

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

**TECHNICAL SUPPORT DOCUMENT**  
**FOR**  
**TITLE V PERMIT TO CONSTRUCT AND OPERATE**  
**#AOP-01-037**

Permit date: May 16, 2011

**Ryegate Associates, Incorporated – East Ryegate, 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:**  
 Ryegate Associates, Incorporated  
 Ryegate Power Station  
 247 Weesner Drive  
 East Ryegate, Vermont 05042

**Facility / Applicant Contact Person:**  
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**1.0 INTRODUCTION**

Ryegate Associates, Incorporated (hereinafter “Permittee”) owns and operates a 20 MW (net) wood fired electrical generating station (also referred to herein as “Facility”).

Administrative Milestones:

| <b>Table 1-1: Administrative Summary</b>               |   |
|--|---|
| <b>Administrative Item</b>                             | <b>Result or Date</b>                           |
| Date Application Received:                             | 9/11/2001                                       |
| Date Administratively Complete:                        | 10/1/2001                                       |
| Date & Location Receipt of Application Noticed:        | 10/4/2001 <i>The Caledonian Record</i>          |
| Date Technically Complete:                             | 08/27/2010                                      |
| Date Draft Decision:                                   | 2/17/2011                                       |
| Date & Location Draft Decision/Comment Period Noticed: | 2/17/2011 <i>The Caledonian Record</i>          |
| Date & Location Public Meeting Noticed:                | None requested                                  |
| Date & Location of Public Meeting:                     | None requested                                  |
| Deadline for Public Comments:                          | 3/21/2011                                       |
| Date Proposed Decision:                                | 3/30/2011                                       |
| Classification of Source Under §5-401:                 | §5-401(3): Electric power generation facilities |
| Classification of Application:                         | Title V Subject Source                          |
| New Source Review Designation of Source:               | Major Stationary Source                         |
| Facility SIC Code(s):                                  | 4911  |
| Facility SIC Code Description(s):                      | Electrical Services                             |

The allowable emissions for the Facility are summarized below:

| <b>Table 1-2: Estimated Air Contaminant Emissions (tons/year)<sup>1</sup></b> |            |            |           |            |                               |                                    |
|---|------------|------------|-----------|------------|-------------------------------|------------------------------------|
| <b>PM/PM10</b>  | <b>SO2</b> | <b>NOx</b> | <b>CO</b> | <b>VOC</b> | <b>Total HAPs<sup>2</sup></b> | <b>CO<sub>2</sub>e<sup>3</sup></b> |
| 22  | 25         | 197        | 394       | 39         | <10/25                        | 280,385                            |

<sup>1</sup> PM/PM10 - particulate matter, SO2 - sulfur dioxide, NOx - oxides of nitrogen, CO - carbon monoxide, HAPs - hazardous air pollutants.

<sup>2</sup> Emissions of individual HAPs each < 10 tpy and emissions of total HAPs combined <25 tpy.

<sup>3</sup> CO<sub>2</sub>e 'at the stack' – includes emissions from biogenic sources. See section 3.3 for details. This is not a facility limit.

## 2.0 FACILITY DESCRIPTION AND LOCATION

### 2.1 Facility Locations and Surrounding Area

The Permittee owns and operates the wood fired electrical generating station located just north of the village of East Ryegate at 247 Weesner Drive, East Ryegate, Vermont. The area surrounding the Facility property is rural and consists of primarily agricultural and residential uses. The Connecticut River borders the property to the East and U.S. Route 5 to the West. The geographical area is complex terrain in all directions surrounding the site.

### 2.2 Facility Description

Operations performed at the Facility are classified within the Standard Industrial Classification Code - 4911 (Electrical Services). The Ryegate Power Station is listed as a stationary source of air contaminants under §5-401(3), Electrical power generation facilities, of the Vermont Air Pollution Control *Regulations* ("*Regulations*").

The Facility is equipped with a wood-fired boiler (hereinafter "Main Boiler"), which is fired with whole tree wood chips delivered in standard chip vans. The fuel is primarily mixed hardwood and softwood, with some lesser amounts of sawdust, mill chips, and bark. The fuel chips are stored in two (2) silos and an uncovered outside storage pile before being mechanically conveyed to the Main Boiler. Wood fuel is fed at a rate of approximately thirty-five (35) tons per hour into a single, high-pressure, boiler designed to burn green fuel. The Facility is operated as a base load plant at or close to 100% capacity at all times, excluding plant outages.

The Main Boiler is fitted with a propane (LPG) auxiliary burner having a maximum rated heat input of 50 million British Thermal Units per hour ("MMBTU/hr"). This burner is used primarily for plant start-up and for supplemental fuel. Steam produced by the Main Boiler is passed through a condensing turbine generator set with extraction steam utilized for feedwater heating. Condenser heat is removed via a open loop circulating water system to a cooling tower structure. The Ryegate Power Station is also equipped with a 430 horsepower ("HP")/300 kilowatt ("kW") propane-fired engine generator set (hereinafter "Emergency Generator") for use during electric power outages, and an auxiliary propane-fired boiler rated at five (5) MMBTU/hr (hereinafter "Auxiliary Boiler"). The Auxiliary Boiler supplies hot water for space heating purposes during plant outages.

On August 4<sup>th</sup>, 1992 the Main Boiler was operated on propane for a brief period to allow the Facility to produce electricity and to synchronize with the Green Mountain Power Corporation grid. The Main Boiler’s initial start up on wood fuel occurred on September 7, 1992.

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.

| <b>TABLE 2-1: Equipment and Stack Information</b>   |  |                                      |                       |                                    |                                      |
|---|--|--------------------------------------|-----------------------|------------------------------------|--------------------------------------|
| <b>DESCRIPTION AND MODEL NUMBER</b>   | <b>SIZE OR CAPACITY (MAX. ALLOWED)</b> | <b>FUEL TYPE(S) OR PROCESS INPUT</b> | <b>DATE INSTALLED</b> | <b>POLLUTION CONTROL EQUIPMENT</b> | <b>STACK HEIGHT (FT Above Grade)</b> |
| Main Boiler:<br>Riley Stoker Corp.  | 300 MMBtu/hr                           | Wood                                 | 1992                  | Multicyclone, ESP, SNCR            | 212                                  |
| Main Boiler:<br>(Auxiliary Burner)<br>Coen Model 230/DAZ-22   | 50 MMBtu/hr                            | LPG<br>(propane)                     | 1992                  | Uncontrolled                       | 212                                  |
| Auxiliary Boiler<br>Manuf: Weil-McLain<br>Boiler Model # 1688R-W<br>Burner Model: WCR3-G-25B                                | 5 MMBtu/hr                             | LPG<br>(propane)                     | 1992                  | Uncontrolled                       | 48                                   |
| Emergency Generator<br>Cummins Engine<br>Model #: GTA-19<br>Marathon Electric<br>Generator Model #:<br>432RSL4015BP-310W rs | 430 bhp<br>(280 kW)                    | LPG<br>(propane)                     | 1992                  | Uncontrolled                       | 48                                   |

| <b>Table 2-2: Existing Air Pollution Control Equipment &amp; Techniques</b> |  |
|---|--|
| Main Boiler – ESP   | Manufacturer: PPC Industries<br>Estimated Collection Efficiency: 99.5%<br>Pressure Drop: 0.5 inch w.c. max<br>Type of Unit: Plate and weighted wire<br>Cleaning Method: Rapping<br>Inlet Temperature: 300 <sup>o</sup> F<br>Collecting surface area: 77,175 ft <sup>2</sup><br>Air Flow Rate: 115,000 acfm |

| <b>Table 2-2: Existing Air Pollution Control Equipment &amp; Techniques</b> |  |
|---|--|
| Main Boiler - SNCR  | Manufacturer: Nalco/Fuel Tech<br>Estimated Collection Efficiency: 30%<br>Pressure Drop: N/A<br>Dimensions: 12 injection nozzles – located approximately 30 feet above the furnace grate.<br>Air Flow Rate: 335,000 lb/hr (flue gas)<br>Other Pertinent Information: Injection of a 15/85 solution of urea and water. |

**2.3 Description of Compliance Monitoring Devices**

The Facility is equipped with continuous emission monitoring devices (CEMS) which measure the emission of NOx, CO, NH3 and either O<sub>2</sub> or CO<sub>2</sub> from the Main Boiler to the ambient air. In addition, the Facility also operates and maintains a continuous opacity monitoring system (COMS) which measures the opacity of the exhaust gas from the Main Boiler.

**2.4 Proposed Modifications to Facility**

There are no proposed modifications to the Facility at this time.

**2.5 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 negligible or exempt sources of air contaminant emissions, and therefore were not considered as emission sources as part of the Permit to Operate renewal review.

On March 4, 2009 the old propane vaporizer (rated at 0.8 MMBTU/hr) was replaced. The new vaporizer is list in Table 2-3.

| <b>Table 2-3: Negligible Sources of Contaminant Emissions</b> |                            |
|---|----------------------------|
| Diesel Fire Pump  | <3 MMBtu/hr No.2 fuel oil  |
| Fuel Yard Maintenance Building Heater                         | <3 MMBtu/hr, No.2 fuel oil |
| Main Maintenance Building Heater                              | <3 MMBtu/hr, Propane       |
| Propane System Vaporizer                                      | 1.825 MMBtu/hr, propane    |

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.

### **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 Emissions of Criteria Pollutants from the Existing Stationary Source**

For the Main Boiler, the calculated potential emissions of NO<sub>x</sub>, PM, CO and VOCs are based on the site specific emission limits and are not affected by the relative amounts of propane or wood fuel used. The potential emissions for HAPs are based on a combination of AP-42 emission factors and some stack testing conducted at the Facility; additional details of this data is available in section 3.2 of this document.

Note that past permits estimated the SO<sub>2</sub> emission rate from the combustion of wood based on AP-42 emission factors. The AP-42 emission factors for wood were updated in September 2003, and the updated factor for SO<sub>2</sub> represents a higher emission rate than the previous factor. Since the Facility carried out stack testing for SO<sub>2</sub> on June 16, 2004, the SO<sub>2</sub> emission rate from this site specific testing will be used to estimate the SO<sub>2</sub> emission rate from the Main Boiler. The estimated hourly emission rate for SO<sub>2</sub> is greater when firing wood fuel, compared to propane so the potential emissions from the Main Boiler are based on firing wood fuel at 300 MMBtu/hr heat input for 8760 hours/year.

| <b>Table 3-1: Main Boiler – Estimated Potential Emissions</b>                                    |                 |                    |                               |   |                     |
|--|-----------------|--------------------|-------------------------------|---|---------------------|
| <b>Wood:</b> Boiler Rating: 300 MMBtu/hr, 35.3 ton/hr of wood with a Btu content of 4,250 Btu/lb |                 |                    |                               |   |                     |
| <b>Propane:</b> Burner rating: 50 MMBtu/hr, annual limit: 20,000,000 cubic feet/yr               |                 |                    |                               |   |                     |
|  |                 | Emission Factor    |                               |   | Estimated Emissions |
|  |                 | Factor             | Units <sup>2</sup>            | Source  | tons per year       |
| SO <sub>2</sub>  | Propane         | 0.09S <sup>1</sup> | lb/1000gal                    | AP-42, Table 1.5-1 (7/98)   | 0.25                |
|  | Wood            | 0.0022             | lb/MMBtu                      | Stack test June 16, 2004  | 2.9                 |
| NO <sub>x</sub>  | Propane or Wood | 0.15<br>45.0       | lb/MMBtu<br>lb/hr             | Permit limit  | 197                 |
| PM   | Propane or Wood | 0.0070<br>5.0      | gr/dscf <sup>3</sup><br>lb/hr | Permit limit  | 21.9                |
| CO   | Propane or Wood | 0.30<br>90.0       | lb/MMBtu<br>lb/hr             | Permit limit  | 394                 |
| VOC  | Propane or Wood | 0.03<br>9.0        | lb/MMBtu<br>lb/hr             | Permit limit  | 39                  |
| HAPs   | Wood            | 0.009              | lb/MMBtu                      | AP-42, Table 1.6-3 and 1.6-4 (9/03) for all HAPs except: acrolein, benzene, formaldehyde and hydrogen chloride for which there was stack testing conducted at the Facility (6/17/2003 & 6/16/2004). Refer to Table 3-5 for further details. | 11.8                |

<sup>1</sup> S represents the grains of sulfur per 100 ft<sup>3</sup> in the propane. The Facility has a sulfur limit of 10 gr/100ft<sup>3</sup> so the emission factor is 0.09 \* 10 = 0.9 lb sulfur/ 10<sup>3</sup> gallons of propane.

<sup>2</sup> lb/MMBtu: pounds of pollutant emitted per million British Thermal Units of energy input to the boiler.

lb/1000 gal: pounds of pollutant emitted per 1000 gallons of fuel input to the boiler.

lb/hr: pounds of pollutant per hour

<sup>3</sup> grain/dscf: grains of particulate matter per dry cubic foot of exhaust gas at 12% CO<sub>2</sub> and at standard temperature (60oF) and pressure (1 atm).

| <b>Table 3-2: Propane Fired Auxiliary Boiler – Estimated Potential Emissions</b>            |                  |                 |  |                     |
|---|------------------|-----------------|--|---------------------|
| Total Fuel input: 5 MMBtu/hr * 720 hr/yr = 3,600 MMBtu/yr                                   |                  |                 |  |                     |
| 3,600 MMBtu/yr * 1000 gallon propane/91.5 MMBtu = 39.3 x 10 <sup>3</sup> gallons/yr propane |                  |                 |  |                     |
|   |                  | Emission Factor |  | Allowable Emissions |
|   |                  | Factor          | Units  | Tons/year           |
| SO <sub>2</sub>   | 0.1 S            | lb/1000 gal     | AP-42, Liquefied Petroleum Gas Combustion, Table 1.5-1, 7/08 | 0.02                |
| NO <sub>x</sub>   | 13               |                 |  | 0.26                |
| PM  | 0.7              |                 |  | 0.014               |
| CO  | 7.5              |                 |  | 0.15                |
| VOC   | 0.8 <sup>1</sup> |                 |  | 0.016               |
| HAPs  | -                |                 |  | Negligible          |

<sup>1</sup> VOC factor based on TOC factor (1.0) - CH<sub>4</sub> (0.2) factor for propane.

| <b>Table 3-3: Propane fueled Generator – Estimated Potential Emissions</b>                                |  |          |   |                              |
|---|--|----------|---|------------------------------|
| Total fuel input: (40 gal/hr)*(720 hr/yr)*(91,500 btu/gal)*(1 MMBtu/10 <sup>6</sup> Btu) = 2,635 MMBtu/yr |  |          |   |                              |
| Emission estimate based on 720 hrs/yr   | Emission Factor                          |          |   | Allowable Emissions, tons/yr |
|   | Factor                                   | Units    | Source  |                              |
| SO <sub>2</sub>   | 0.00059                                  | lb/MMBtu | AP-42 Natural Gas-fired Reciprocating Engines, Table 3.2-1 2-stroke lean-burn engines (07/2000) | 0.001                        |
| PM  | PM10: 0.000077<br>Condensable PM: 0.0099 |          |   | 0.013                        |
| NO <sub>x</sub>   | 4.08                                     |          |   | 5.4                          |
| CO  | 0.317                                    |          |   | 0.42                         |
| VOC   | 0.118                                    |          |   | 0.16                         |

| <b>Table 3-4: Summary of Estimated Air Contaminant Emissions by Source (tons/year)</b> |            |            |                  |            |            |                  |
|--|------------|------------|------------------|------------|------------|------------------|
| Source   | PM/PM10    | SO2        | NOx              | CO         | VOC        | Total HAPs       |
| Main Boiler  | 21.9       | 2.9        | 197              | 394        | 39         | 11.8             |
| Auxiliary Boiler (propane)   | negligible | negligible | negligible       | negligible | negligible | -                |
| Generator (propane)  | negligible | negligible | 5.4 <sup>1</sup> | negligible | negligible | -                |
| <b>Facility Estimated Potential Emissions</b>  | <b>22</b>  | <b>2.9</b> | <b>197</b>       | <b>394</b> | <b>39</b>  | <b>11.8</b>      |
| <b>Facility Allowable Emissions</b>  | <b>22</b>  | <b>25</b>  | <b>197</b>       | <b>394</b> | <b>39</b>  | <b>&lt;10/25</b> |

<sup>1</sup> The emergency generator is not permitted to operate simultaneously with the Main Boiler except for periods of regularly scheduled operation necessary for maintenance and performance testing of the emergency system, so the potential NOx emissions from the generator are not included in the Facility's total potential emission estimate.

As summarized in Table 3-4 above:

- The Facility has allowable emissions of all air contaminants in the aggregate of ten (10) or more tons per year: the Facility is therefore subject to Subchapter X of the *Regulations* and is designated as a Subchapter X Major Source.
- The Facility has allowable emissions of contaminants which classify the source as a "Major Source."
- The Facility has allowable emissions of contaminants which classify the source as a "Title V Subject Source" and therefore is subject to the federal operating permit requirements of 40 C.F.R. Part 70 or 71.



### 3.2 Estimating Actual Emissions of Hazardous Air Contaminants and Hazardous Air Pollutants from the Existing Stationary Source.

#### Benzo(a)pyrene:

Starting on July 11, 1990 with the issuance of Permit to Construct AP-90-029a, this Facility's permits have included an emission limit for benzo(a)pyrene. Initially this was based on the Facility being subject to §5-261 of the *Regulations – Control of Hazardous Air Contaminants*.

As required by the Permit to Construct, on May 18, 1993 the Facility conducted a stack test and the emissions of benzo(a)pyrene were determined to be less than the detection limit of  $1.7 \times 10^{-7}$  lb/MMBtu. Based on the maximum output of the Main Boiler of 300 MMBtu/hr, the potential emission of benzo(a)pyrene was less than 0.000051lb/hr which was considerable lower than the permitted emission rate of 0.012 lb/hr.

On January 20, 1993, this regulation was been amended and some exemptions to the rule were added. §5-261(1)(c)(ii) exempts solid fuel burning equipment installed or constructed prior to January 1, 1993 from the requirements of §5-261. This Facility started operation during 1992, and so it is not subject to the requirements of §5-261.

Based on the change in the applicability of this State of Vermont regulation, the facility specific mass emission rate limit for benzo(a)pyrene has been removed from permit #AOP-01-037. This does not preclude benzo(a)pyrene from being regulated as a Hazardous Air Pollutant.

#### Vermont Hazardous Air Contaminants:

As noted above, since the Main Boiler was installed prior to 1993, it is not subject to §5-261 and the emissions of HACs from the Main Boiler will not be evaluated.

#### Federal Hazardous Air Pollutants:

Shown below is a summary of the estimated emissions of Hazardous Air Pollutants (HAPs) to determine if the Facility is a major source of HAPs and subject to any Federal NESHAPs standards (40 CFR Part 63).

| <b>Table 3-5 Estimated Emission of Hazardous Air Pollutants</b> |                                   |                                |  |
|---|-----------------------------------|--------------------------------|--|
| <b>Hazardous Air Pollutant</b>                                  | <b>Emission Factor (lb/MMBtu)</b> | <b>Emission Factor Source</b>  | <b>Emission Rate (ton/yr) <sup>2</sup></b> |
| Acenaphthene <sup>1</sup>                                       | 9.10E-07                          | AP-42 Table 1.6-3              | 1.20E-03                                   |
| Acenaphthylene <sup>1</sup>                                     | 5.00E-06                          |                                | 6.57E-03                                   |
| Acetaldehyde  | 8.30E-04                          |                                | 1.09E+00                                   |
| Acetophenome  | 3.20E-09                          |                                | 4.20E-06                                   |
| Acrolein  | 3.40E-06                          | Source stack test <sup>3</sup> | 4.47E-03                                   |
| Anthracene <sup>1</sup>   | 3.00E-06                          | AP-42 Table 1.6-3              | 3.94E-03                                   |

| <b>Table 3-5 Estimated Emission of Hazardous Air Pollutants</b> |                                   |                               |  |
|---|-----------------------------------|-------------------------------|--|
| <b>Hazardous Air Pollutant</b>                                  | <b>Emission Factor (lb/MMBtu)</b> | <b>Emission Factor Source</b> | <b>Emission Rate (ton/yr) <sup>2</sup></b> |
| Benz(a)anthracene <sup>1</sup>                                  | 6.50E-08                          |                               | 8.54E-05                                   |
| Benz(a)pyrene <sup>1</sup>                                      | 1.70E-07                          | Source stack test             | 2.23E-04                                   |
| Benzene   | 1.50E-03                          | Source stack test             | 1.97E+00                                   |
| Benzo(b)fluoranthene <sup>1</sup>                               | 1.00E-07                          | AP-42 Table 1.6-3             | 1.31E-04                                   |
| Benzo(e)pyrene <sup>1</sup>                                     | 2.60E-09                          |                               | 3.42E-06                                   |
| Benzo(g,h,i)perylene <sup>1</sup>                               | 9.30E-08                          |                               | 1.22E-04                                   |
| Benzo(j,k)fluoranthene <sup>1</sup>                             | 1.60E-07                          |                               | 2.10E-04                                   |
| bis(2-Ethylehexyl)phthalate                                     | 4.70E-08                          |                               | 6.18E-05                                   |
| Bromomethane  | 1.50E-05                          |                               | 1.97E-02                                   |
| Methyl Ethyl Ketone (2-Butanone)                                | 5.40E-06                          |                               | 7.10E-03                                   |
| Carbon tetrachloride  | 4.50E-05                          |                               | 5.91E-02                                   |
| Chlorine  | 7.90E-04                          |                               | 1.04E+00                                   |
| Chlorobenzene   | 3.30E-05                          |                               | 4.34E-02                                   |
| Chloroform  | 2.80E-05                          |                               | 3.68E-02                                   |
| Chloromethane   | 2.30E-05                          |                               | 3.02E-02                                   |
| Chrysene <sup>1</sup>   | 3.80E-08                          |                               | 4.99E-05                                   |
| Dibenzofurans <sup>1</sup>                                      | 1.88E-09                          |                               | 2.47E-06                                   |
| 1,2-Dichloroethane  | 2.90E-05                          |                               | 3.81E-02                                   |
| Dichloromethane   | 2.90E-04                          |                               | 3.81E-01                                   |
| 1,2-Dichloropropane   | 3.30E-05                          |                               | 4.34E-02                                   |
| 2,4-Dinitrophenol   | 1.80E-07                          |                               | 2.37E-04                                   |
| Ethylbenzene  | 3.10E-05                          |                               | 4.07E-02                                   |
| Flouranthene <sup>1</sup>                                       | 1.60E-06                          |                               | 2.10E-03                                   |
| Flourene a  | 3.40E-06                          | 4.47E-03                      |  |
| Formaldehyde  | 1.70E-04                          | Source stack test             | 2.23E-01                                   |
| Hydrogen Chloride   | 2.30E-04                          | Source stack test             | 3.02E-01                                   |
| Indeno(1,2,3,c,d)pyrene <sup>1</sup>                            | 8.70E-08                          | AP-42 Table 1.6-3             | 1.14E-04                                   |
| Naphthalene   | 9.70E-05                          |                               | 1.27E-01                                   |
| 4-Nitrophenol   | 1.10E-07                          |                               | 1.45E-04                                   |
| Pentachlorophenol   | 5.10E-08                          |                               | 6.70E-05                                   |
| Phenanthrene <sup>1</sup>                                       | 7.00E-06                          |                               | 9.20E-03                                   |
| Phenol  | 5.10E-05                          |                               | 6.70E-02                                   |
| Propionaldehyde   | 6.10E-05                          |                               | 8.02E-02                                   |
| Pyrene <sup>1</sup>   | 3.70E-06                          |                               | 4.86E-03                                   |
| Styrene   | 1.90E-03                          |                               | 2.50E+00                                   |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin                             | 8.60E-12                          |                               | 1.13E-08                                   |
| Tetrachloroethylene   | 3.80E-05                          |                               | 4.99E-02                                   |
| Toluene   | 9.20E-04                          |                               | 1.21E+00                                   |
| 1,1,1-Trichloroethane   | 3.10E-05                          |                               | 4.07E-02                                   |
| 2,4,6-Trichlorophenol   | 2.20E-08                          |                               | 2.89E-05                                   |
| Vinyl Chloride  | 1.80E-05                          |                               | 2.37E-02                                   |
| o-Xylene  | 2.50E-05                          | AP-42 Table 1.6-4             | 3.29E-02                                   |
| Antimony  | 7.90E-06                          |                               | 1.04E-02                                   |
| Arsenic   | 2.20E-05                          |                               | 2.89E-02                                   |
| Beryllium   | 1.10E-06                          |                               | 1.45E-03                                   |
| Cadmium   | 4.10E-06                          |                               | 5.39E-03                                   |
| Chromium (total)  | 2.10E-05                          | 2.76E-02                      |  |

| <b>Table 3-5 Estimated Emission of Hazardous Air Pollutants</b> |                                   |                               |  |
|---|-----------------------------------|-------------------------------|--|
| <b>Hazardous Air Pollutant</b>                                  | <b>Emission Factor (lb/MMBtu)</b> | <b>Emission Factor Source</b> | <b>Emission Rate (ton/yr) <sup>2</sup></b> |
| Cobalt  | 6.50E-06                          |                               | 8.54E-03                                   |
| Lead  | 4.80E-05                          |                               | 6.31E-02                                   |
| Manganese   | 1.60E-03                          |                               | 2.10E+00                                   |
| Mercury   | 3.50E-06                          |                               | 4.60E-03                                   |
| Nickel  | 3.30E-05                          |                               | 4.34E-02                                   |
| Selenium  | 2.80E-06                          |                               | 3.68E-03                                   |
| <b>Total HAPs</b>   |                                   |                               |  |
| <b>Single highest HAP</b>                                       | (styrene)                         |                               | <b>2.5</b>                                 |

<sup>1</sup> HAP because it is a Polycyclic Organic Matter (POM). POM are HAPs as defined by Section 112(b) of CAA.

<sup>2</sup> Annual emission rate based on boiler heat input of 300 MMBtu/hr for 8760 hours/year.

<sup>3</sup> The facility conducted stack testing on 5/18/1993, 6/17/2003 and 6/16/2004.

The SNCR system has emissions of ammonia due to ammonia slip and this emission is subject to §5-261. The SNCR system is required to not exceed 40 ppmv of ammonia. The following is an estimate of the maximum potential ammonia emissions due to the operation of the SNCR system; the actual emissions should be less. Basis:

Flue gas flow rate: 85,000 scfmw (wet)  
 Flue gas moisture content: 21%  
 Ammonia concentration: 40 ppmvd (dry)  
 Hours of operation: 8760 hrs/yr

$$(85,000 \text{ scfmw}) * ((100\% - 21\%) / 100\%) * (40 \text{ scf NH}_3 / 1,000,000 \text{ scf exhaust}) * (14.7 \text{ psia} / ((10.73 \text{ psia-scf/lbmole-}^\circ\text{R}) * (528 \text{ }^\circ\text{R}))) * (17 \text{ lbs NH}_3 / \text{lbmole NH}_3) * 60 \text{ min/hr}) * (8 \text{ hours}) = 57 \text{ lb/8-hr of ammonia emissions.}$$

The emission of Hazardous Air Contaminants from the cooling towers are subject to §5-261. The following table summarizes the estimated emission of ammonia from the SNCR system as well as the HACs from the cooling tower due to the water treatment chemicals released to the atmosphere with the cooling tower drift.

| <b>Table 3-6 Quantification of HAC Emissions</b> |             |                       |   |                                |
|--|-------------|-----------------------|---|--------------------------------|
| <b>Hazardous Air Contaminant</b>                 | <b>CAS#</b> | <b>Toxic Category</b> | <b>Emission Rate (lb/8-hrs)<sup>1</sup></b> | <b>Action Level (lb/8-hrs)</b> |
| sodium bromide                                   | 7647-15-6   | II                    | 0.0536                                      | 11.6                           |
| chlorine   | 7782-50-5   | III                   | 0.00070                                     | 0.01                           |
| methanol   | 110-91-8    | II                    | 0.0438                                      | 97                             |
| ammonia  | 7664-41-7   | II                    | 57  | 8.3                            |

<sup>1</sup> For category III contaminants, emission rate is based on 2000 hours/year of operation. For category I & II contaminants, the emission rate is based on 8760 hours/year.

### 3.3 – Estimating Potential Green House Gas Emissions

**Table 1. Stationary Source Fuel Combustion**

| Source ID | Source Description  | Fuel Combusted      | Potential or Allowable Quantity Combusted | Units   | Reported wood usage (raw tons) | Estimated %MC for raw wood fuel |
|-----------|---------------------|---------------------|---|---------|--------------------------------|---------------------------------|
|           | Main Boiler         | Wood and Wood Waste | 170,333                                   | tons    | 306600                         | 50.0%                           |
|           | Main & Aux. Boilers | Propane             | 587,322                                   | gallons | 0                              | 0.0%                            |
|           | Diesel generator    | Propane             | 28,800                                    | gallons | 0                              | 0.0%                            |

**Table 2. Total Company-Wide Stationary Source Fuel Combustion**

| Fuel Type              | Potential or Allowable Quantity Combusted | Units   |   |
|------------------------|---|---------|---|
| Distillate Fuel Oil #2 | 0   | gallons | For wood - the calculations are based on tons of wood at 10% MC |
| Propane                | 616,122                                   | gallons |   |
| Wood and Wood Waste    | 170,333                                   | tons    |   |

**Table 3. Total Company-wide CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O Emissions from Stationary Source Fuel Combustion**

| Fuel Type   | CO <sub>2</sub> (kg) | CO <sub>2</sub> (lb) | CH <sub>4</sub> (kg) | CH <sub>4</sub> (lb) | N <sub>2</sub> O (kg) | N <sub>2</sub> O (lb) |
|---|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|
| Propane   | 3,445,886            | 7,596,870            | 168.2                | 370.8                | 33.6                  | 74.2                  |
| Total Fossil Fuel Emissions   | 3,445,886            | 7,596,870            | 168.2                | 370.8                | 33.6                  | 74.2                  |
| Wood and Wood Waste   | 245,730,361          | 245,905,123          | 83,831               | 184,816              | 11,003                | 24,257                |
| Total Non-Fossil Fuel Emissions   | 245,730,361          | 245,905,123          | 83,831               | 184,816              | 11,003                | 24,257                |
| Total Emissions for all Fuels   | 249,176,248          | 253,501,993          | 83,999               | 185,187              | 11,036                | 24,331                |
| Global Warming Potential  | CO <sub>2</sub>      | CH <sub>4</sub>      | N <sub>2</sub> O     | CO <sub>2</sub> e    |                       |                       |
|   | 1.0                  | 21.0                 | 310.0                | metric ton           | short ton             |                       |
| Total CO <sub>2</sub> Emissions - Equivalent (Fossil CO <sub>2</sub> e + Biogenic CH <sub>4</sub> & N <sub>2</sub> O)   |                      |                      |                      |                      | 8,631                 | 9,514                 |
| All CO <sub>2</sub> e emissions at stack (Fossil CO <sub>2</sub> e + Biogenic CO <sub>2</sub> e) - for APCD Permit info |                      |                      |                      |                      | 254,362               | 280,385               |

**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 the Main Boiler, the auxiliary boiler and the emergency generator.

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

This emission standard applies to the Main Boiler.

**§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 use of wood fuel and propane the applicant is expected to comply with this regulation.

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

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

- (a)(i) 0.5 pounds per hour per million BTU's of *heat input* in combustion installations where the *heat input* is 10 million BTU's or less per hour.
- (b)(iii) In excess of 0.10 gr/dscf corrected to 12% CO<sub>2</sub> in any combustion installation that has a rated output of 1300 H.P. or greater which commences operation after December 5, 1977.

| <b>Table 4-1: Equipment Subject to §5-231(3)</b> |                      |   |
|--|----------------------|---|
| <b>Equipment ID</b>                              | <b>Size/Capacity</b> | <b>Emission Standard</b>                        |
| Main Boiler                                      | 300 MMBTU/hr         | 0.10 gr/dscf @ 12% CO <sub>2</sub> <sup>1</sup> |
| Auxiliary Boiler                                 | 5 MMBTU/hr           | 0.5 lb/MMBTU                                    |

<sup>1</sup> The Main Boiler is held to a lower emission standard through MSER.

**§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, and the Facility is therefore expected to comply with the fugitive emission limitations of this section.

**§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.

**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 tighter emission standards through MSER.

**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 applies to the Main Boiler. Since the Main Boiler is considered existing boiler under this regulation, it is subject to the work practice standards as well as notification, reporting and recordkeeping requirements established in this rule. The work practice standards include biennial tune-ups and a one-time energy assessment.

**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 permit contains the first approved CAM plan for this Facility. The emissions of PM and NO<sub>x</sub> from the Main Boiler are subject to CAM because:

- the Facility has a Title V Operating Permit;
- the uncontrolled emission rate of these pollutants exceed their respective Title V major source thresholds (100 ton/yr);
- the emissions of PM (NSPS and MSER) and NO<sub>x</sub> (MSER) are subject to an applicable rule;
- the Main Boiler is equipped with emissions control devices for each of these pollutants.

CAM for NO<sub>x</sub>:

The use of a NO<sub>x</sub> Continuous Emissions Monitoring System (CEMS) satisfies the requirements of CAM for NO<sub>x</sub> monitoring.

CAM for PM:

This Facility does not have a direct measurement system for PM, so indirect (parametric) monitoring will be used to provide reasonable assurance that the control equipment is working properly.

For the control of PM emissions the Main Boiler is equipped with mechanical collectors (cyclones) followed by a five (5) field ESP. The ESP uses electric fields by applying a direct-current voltage across a pair of electrodes a discharge electrode and a collection electrode. PM suspended in the exhaust stream is electrically charged by passing through the electric field around each discharge electrode. The negatively charged particles then migrate toward the positively charged collection electrodes. The PM is separated from the gas stream by retention on the collection electrode. Particulate is removed from the collection plates by shaking and rapping the plants clean to collect the PM.

Generally, ESP performance improves as total power input increases. The voltage drops when a malfunction, such as grounded electrodes, occurs in the ESP. When the voltage drops, less particulate is charged and collected. Although this is the general rule, the voltage may remain high but the ESP may fail to perform its function if the collection plates are not cleaned, or rapped, appropriately. If the collection plates are not cleaned, the current drops. Therefore, it is important to monitor both voltage (kilovolts) and current (milliamps).

The Permittee has conducted two sets of stack testing to document the PM emission rate while the potential performance of the ESP is reduced either by taking collection fields off line or operating the ESP at reduced voltage and current in the individual fields.

On June 21, 1995 the Permittee carried out PM stack emission testing with reduced energy to the ESP to determine minimum operational schemes, while still meeting the PM emission limit. This testing was not observed by a representative of Agency. For this testing, if no power is supplied to a field, it is considered to be offline. If 50% of full power is supplied to a field, it is considered to be '½' of a field. The fields that were online were set for full power. During run 4, with only 2 fields in service ("3 fields offline"), the stack test indicated that the PM emission rate was less than the permit limit of 0.0007 gr/dscf @ 12% CO<sub>2</sub>. Table 4-2 summarizes the results of this testing.

| <b>Table 4-2: PM Stack Testing – June 21, 1995</b> |                         |                   |                  |  |
|--|-------------------------|-------------------|------------------|--|
| <b>Run#</b>  | <b>Operating Scheme</b> | <b>Start time</b> | <b>Stop time</b> | <b>PM (gr/dscf @ 12% CO<sub>2</sub>)</b> |
| 1  | 1.5 fields offline      | 8:30              | 10:35            | 0.0004                                   |
| 2  | 2 fields offline        | 11:30             | 13:30            | 0.0005                                   |
| 3  | 2.5 fields offline      | 14:10             | 16:10            | 0.0003                                   |
| 4  | 3 fields offline        | 18:35             | 20:35            | 0.0005                                   |

On July 25, 1995 the Permittee carried out additional PM stack emission testing with reduced energy: reduced kilovolt and milliamp to the individual fields. This testing coincided with the biennial PM compliance testing and was observed by a representative of the Agency. Prior to this testing, their normal operating mode for the ESP was to operate the secondary voltage and amperage near the maximum settings. The design maximum secondary voltage is 55 kV, and the design maximum secondary current is 650 mA.

| <b>Table 4-3: PM Stack Testing – July 25, 1995<br/>ESP Secondary voltage and current operating ranges</b> |  |  |
|---|--|--|
| <b>ESP Field</b>  | <b>Field Secondary Voltage Range (kilovolts)<br/>Min / Avg / Max</b> | <b>Field Secondary Current Range (milliamps)<br/>Min / Avg / Max</b> |
| TR-1  | 38 / 42.5 / 47   | 117 / 246 / 455  |
| TR-2  | 43 / 44.3 / 45   | 390 / 401.5 / 403  |
| TR-3  | 25 / 25 / 25   | 39 / 39 / 39   |
| TR-4  | 20 / 20.7 / 21   | 39 / 43 / 52   |
| TR-5  | 18 / 18 / 18   | 39 / 40.5 / 52   |

During the 7/25/95 testing there were three runs (2 hour sampling times for each run) for typical boiler operation and the PM emission rates were determined to be: 0.0006, 0.0005, and 0.0002 gr/dscf @ 12% CO<sub>2</sub>. There was a 4<sup>th</sup> run that evaluated the PM emission rate for a 2 hour time period that included a soot blow cycle. For a soot blow event, which typically lasts 23 minutes, the Permittee increases the energy in the last 4 fields to near the maximum settings (the first field was already operating at its maximum setting). This energy increase was also carried out during the soot blow event that occurred during the 4<sup>th</sup> run and the PM emission rate, for the entire 2 hour sample time, was 0.0002 gr/dscf @ 12% CO<sub>2</sub>. The increased voltage and current settings for the soot blow sample run were not included in the values shown Table 4-3.

Based on the above testing, the Permittee has recommended the following operating ranges for the ESP’s transformer-rectifier set for the Facility’s PM CAM plan:



| <b>Table 4-4: Electrostatic Precipitator's Transformer-Rectifier Indicator Operating Range</b> |   |   |
|--|---|---|
| <b><i>ESP Field</i></b>  | <b><i>Field Secondary Voltage Range (kilovolts)</i></b> | <b><i>Field Secondary Current Range (milliamps)</i></b> |
| TR-1   | 30 – 50   | 100 – 400   |
| TR-2   | 30 – 50   | 300 – 500   |
| TR-3   | 20 – 25   | 50 – 100  |
| TR-4   | 20 – 25   | 50 – 100  |
| TR-5   | 20 – 25   | 50 – 100  |

The Agency agrees with the Permittee's recommendation that, along with an inspection and maintenance program, the periodic monitoring of secondary voltage and secondary current as indicators represents a good plan for providing reasonable assurance that the Facility is meeting its PM emission limit.

## **5.0 CONTROL TECHNOLOGY REVIEW FOR MAJOR SOURCES AND MAJOR MODIFICATIONS**

The Facility is not undergoing changes subject to new source review; therefore this section is not applicable.

## **6.0 AMBIENT AIR QUALITY IMPACT EVALUATION**

Ambient air quality impact analyses were performed in 1987 as part of the original review for the Facility. The pollutants PM, SO<sub>2</sub>, CO and NO<sub>x</sub> were modeled and it was determined that the proposed impacts would not cause a violation of any National Ambient Air Quality Standard (NAAQS), exceed any PSD increment or significantly contribute to an existing violation of an NAAQS. Refer to permit AOP-01-017 and original technical support document for additional information. The results of this modeling are summarized in Table 6-1.

| Table 6-1: Ambient Air Quality Impact Evaluations  |                 |   |
|--|-----------------|---|
| Date of AQIE/<br>Permit #  | Pollutant(s)    | Summary of Results <sup>1</sup>   |
| Interactive modeling performed on Main Boiler using ISCST model as a screening tool and the EPA VALLEY model nomograph was used to calculate maximum 24-hour concentrations for PM and SO <sub>2</sub> taking into account complex terrain.                                    |                 |   |
| October 1987<br>See original permit's technical support document.  | PM              | Emission Rate: 0.68 grams per second<br>ISCST Results: 24-hr: 88/150, annual: 29/75<br>VALLEY Results: 24-hr: 94/150                |
|  | SO <sub>2</sub> | Emission Rate: 3.51 grams per second<br>ISCST Results: 3-hr: 575/1300, 24-hr 266/365, ann.: 73/80<br>VALLEY Results: 24-hr: 342/365 |
|  | CO              | Emission Rate: 11.6 grams per second<br>ISCST Results: 1-hr: 8924/40000, 8-hr: 4517/10000   |
|  | NO <sub>x</sub> | Emission Rate: 10.4 grams per second<br>ISCST Results: 1-hr: 234/320, annual: 43/100  |
| A re-calculation of the ambient air quality impacts from the Facility was required because some emission rates and building dimensions changed from original application. In Addition, the Agency adopted NO <sub>x</sub> PSD increments since the original permit was issued. |                 |   |
| Technical Analysis for permit #AP-90-029b2<br><br>8/15/1991  | PM              | Emission Rate: 0.64 grams per second<br>ISCST Results: 24-hr: 2.78/150, annual: 0.69/75   |
|  | CO              | Emission Rate: 11.3 grams per second<br>ISCST Results: 8-hr: 6760/10000   |
|  | NO <sub>x</sub> | Emission Rate: 9.45 grams/second<br>ISCST Results: annual: 83/100   |

<sup>1</sup> Results presented as “model output result/Ambient Air Quality Standard”. Each value presented in micrograms per cubic meter and indicates the maximum short-term emission rate.

## 7.0 HAZARDOUS AIR CONTAMINANTS

The emissions of hazardous air contaminants (“HACs”) are regulated under to §5-261 of the *Regulations*. The Owner/Operator of a source must quantify its emissions of HACs regulated by this rule. Any Facility whose emission rate of a HAC exceeds its respective Action Level (“AL”) is subject to the rule for the HAC, and the Owner/Operator must then demonstrate that the emissions of the HAC are minimized to the greatest extent practicable by achieving the Hazardous Most Stringent Emission Rate (“HMSER”) for that HAC.

Solid fuel burning equipment installed or constructed prior to January 1, 1993, and all fuel burning equipment which combusts virgin liquid or gaseous fuel is exempted from review pursuant to §5-261(1)(b)(ii) of the *Regulations*. Based on this exemption, no fuel burning

equipment used at the Facility qualified for review of its HAC emissions.

Other processes at the Facility, including the cooling towers and the SNCR system have emissions of HACs. These emissions have been quantified and compared to their respective ALs in order to determine if review under §5-261 of the *Regulations* was warranted. Emissions of these HACs are summarized above in Table 3-6. No HACs emitted from the cooling towers are anticipated to exceed their respective ALs, However, the emission of ammonia from the SNCR system is estimated to exceed its AL.

The emission of hazardous air pollutants (“HAPs”) may also be regulated separately under to §112 of the Federal Clean Air Act.

This Facility has a permit condition limiting the emissions of HAPs to 10 ton/year of any single HAP and 25 tons/year of all HAPS combined, therefore the Facility is not subject to the federal Major Source HAP standards.

### **7.1 HMSER Selection**

If the emission of any HAC from all regulated sources at the Facility is estimated to exceed its AL, then the Facility is subject to the rule and the emissions must be reduced to achieve HMSER for that HAC.

In Permit AP-90-029a, issued July 11, 1990, HMSER was determined to be an ammonia emission limit of 40 ppm<sub>dv</sub> (parts per million on a volume basis corrected to 12% CO<sub>2</sub>)(one-hour average) when wood is contributing more than thirty (30) % of the BTU input to the Main Boiler. The Agency has determined that this continues to represent HMSER and with the issuance of permit AOP-01-037 is re-establishing this HMSER.