VERMONT AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation
Air Quality & Climate Division

TECHNICAL SUPPORT DOCUMENT FOR

TITLE V AIR POLLUTION CONTROL PERMIT TO CONSTRUCT AND OPERATE AND ACID RAIN PHASE II PERMIT

#AOP-12-005

June 14, 2018

Joseph C. McNeil Electric Generating Station,
Burlington, VT

Prepared By: Steven Snook, Environmental Engineer.
Air Quality & Climate Division

This Technical Support Document details the Agency of Natural Resources, Department of Environmental Conservation, Air Quality & Climate 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:
Joseph C. McNeil
Electric Generating Station
111 Intervale Road
Burlington, VT 05401

Facility / Applicant Contact Person:
David MacDonnell
Burlington Electric Department
585 Pine Street
Burlington, VT 05401-4891
Phone: (802) 865-7476
dmacdonnell@burlingtonelectric.com

1.0 INTRODUCTION

Burlington Electric Department (hereinafter "The Permittee") owns and operates the Joseph C. McNeil Generating Station (also referred to herein as "Facility") at 111 Intervale Road, Burlington, Vermont. This permit application is for the renewal of the existing operating permit (#AOP-07-020a).

Administrative Milestones:

Table 1-1: Administrative Summary

Administrative Item	Result or Date
Date Application Received:	04/20/2012
Date Administratively Complete:	04/22/2012
Date Draft Decision:	3/22/2018
Date & Location Draft Decision/Comment Period Noticed:	3/22/2018 Environmental Notice Bulletin
Date & Location Public Meeting Noticed:	None requested
Date & Location of Public Meeting:	None requested
Deadline for Public Comments:	4/23/2018
Proposed Permit Submitted to EPA for Review:	4/25/2018
Date Final Decision:	6/14/2018
Classification of Source Under §5-401:	§5-401(3): Electric power generation facilities §5-401(6)(b) Fossil fuel-burning equipment §5-401(6)(b) Wood fuel-burning equipment of greater than 90 H.P. rated output.
Classification of Application:	Title V Subject Source
New Source Review Designation of Source:	Major Stationary Source
Facility SIC Code & Description	4911 / Electrical Services /
Facility NAICS Code & Description	221117 / Biomass Electric Power Generation

The allowable emissions for the Facility are summarized below:

Table 1-2: Allowable Air Contaminant Emissions (tons/year)[1]						
$PM/PM_{10}/PM_{2.5}$	SO_2 [2]	NOx	CO	VOC	Total HAPs [3]	CO_2e [4]
46.6	44.6	496	1,469	<50	<10/25	731,139

[1] $PM/PM_{10}/PM_{2.5}$ – total particulate matter, total particulate matter of 10 micrometers in size or smaller and total particulate matter of 2.5 micrometers in size or smaller, respectively. Unless otherwise specified, all PM is assumed to be $PM_{2.5}$; SO_2 - sulfur dioxide; NO_x - oxides of nitrogen measured as NO_2 equivalent; CO - carbon monoxide; VOCs - volatile organic compounds; HAPs - hazardous air pollutants as defined in §112 of the federal Clean Air Act.

[2] The Main Boiler continues to have an SO_2 limit of 39 tons. The potential SO_2 emissions from other equipment at the site have been included in this table

[3] A stationary source with potential emissions of 10 tons per year or greater of any single HAP or 25 tons per year or greater of all HAPs combined is considered a major source of HAPs under §112 of the federal Clean Air Act.

[4] CO_2e '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

Burlington Electric Department operates the multi-fuel power plant located at 111 Intervale Road, Burlington, Vermont. The Facility is bounded to the north by areas used for agricultural activities, and bounded to the east by the Winooski River. The Facility is bounded to the south by residential areas of Burlington, and on the west by a wetland area. The facility is located approximately 148 kilometers from the Lye Brook Wilderness Area outside of Manchester, Vermont and approximately 150 kilometers from the Great Gulf and Dry River Wilderness Areas in New Hampshire.

2.2 Facility Description

The regulated sources of air contaminant emissions at the Facility are the multi-fuel Main Boiler, auxiliary boiler, cooling towers, and used oil furnace.

2.2.1 Description of Existing Equipment

See Table 2-1 for a listing of existing equipment at the Facility.

Table 2-1: Existing Facility Equipment	
Main Boiler: Zurn, 1981 **Total Gas Ports: 6**	Wood: 750 MMBtu/hr (85 ton/hr) Oil Burners (3): 27 gal/min Total Capacity <250MMBtu/hr Natural Gas Burners (6): 660 MMBtu/hr total capacity Low NO_x burners: FGR
Auxiliary Fire Tube Boiler: Cleaver Brooks - 1983	4 MMBtu/hr (Oil 28.6 gph, Natural Gas 3,922 scf/hr)
Cooling Towers, 1981 **(drift eliminators 2009)**	Induced Draft, Counter Flow Design 42,000 gallon/minute recirculation rate 0.001% drift rate

Table 2-2: Stack Data	
Main Stack	Height: 257 ft Diameter: 10 ft Max. Flow Rate: 285,000 acfm (wood) 79,100 acfm (oil) 200,000 acfm (natural gas)
Auxiliary Boiler Stack	Height: 128 ft. Diameter: 12 in. Max. Flow Rate: 1,500 acfm

2.2.2 Description of Existing Air Pollution Control Equipment

See Table 2-3 for a listing of existing equipment at the Facility.

Table 2-3: Existing Air Pollution Control Equipment & Techniques	
Multiclone	Manufacturer: General Electric Environmental Services Model 4X6B56CG37 Pressure Drop: 5” water Inlet Temperature: 315^0F Dimensions: 4.6 sq. ft. inlet area per tube, 56” diameter Number of Cyclones: 18
ESP (9 Field)	Manufacturer: GEESI Model: BA.2X52K4443-6.4 Type of Unit:: Plate and weighted wire Cleaning Method: Rapping Inlet Temperature: 300^0F Collecting surface area: 280,800 ft^2 Air Flow Rate: 300,000 cfm Corona Power: 3,000 w/Kacfm
RSCR	Manufacturer: Babcock Power/Pro-Environmental Inc. Type of Unit: Regenerative Selective Catalytic Reduction Reducing Agent: Aqueous ammonia, 19% Number of Canisters: 6 No. of supplemental burners: 5 Max. burner system Input: 8 MMBtu/hr Catalyst: Cormetech Heat Recovery Media: Ceramic Design Criteria: 236,000 scfm Input Temperature (Max): 315 F Retention Chamber Temperature: 450 F

2.3 Description of Compliance Monitoring Devices

The Facility is equipped with continuous emission monitoring devices (CEMS) which measure the emission of NO_X, CO, NH_3, O_2 and CO_2 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

The Permittee has not proposed any physical changes to the facility. However, they have proposed the following modifications as part of updating the operating permit:

- Remove Condition (11)(f) from the previous permit (AOP-07-020a). Quarterly NOx emissions need to be 0.075 lbs/MMBtu. The Permittee believes this condition is a relic and does not provide useful information anymore. The Agency agrees, and will not carry this condition into permit AOP-12-005.

- Remove the following sentence from Condition (11)(g) in the previous permit. "The Permittee shall comply with the quarterly emission limit starting with the first calendar quarter following 150 calendar days from the initial operation of the main boiler with the RSCR system." The Agency agrees, and will not carry this condition into permit AOP-12-005.

- Reclassify the Used Oil Burner as a negligible source. Emissions from this unit would not be included in future emission inventories. Due to the very low actual emissions from the used oil burner, the Agency will not require reporting the fuel use in this unit as part of the Annual Registration process. The Permittee will need to continue recording the usage of used oil in this unit.

- Remove Condition (29), "The Permittee shall notify the Agency in writing of the date of initial start-up of the selective catalytic reduction system within fifteen (15) days after such date." The Agency agrees, and will not carry this condition into permit AOP-12-005.

- Any other condition, upon further review, that may need to be re-worded or modified to clearly express intent. The Agency will update the wording of other conditions as needed to add clarity.

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 2-4 lists activities at the Facility which were considered negligible or exempt sources of contaminant emissions, and therefore were not considered as emission sources as part of the Permit to Operate renewal review.

Table 2-4: Negligible Sources of Contaminant Emissions	
Used oil burner	0.28 MMBtu/hr burner that has used 600 – 1500 gallons/yr of on-spec used oil.
Distillate Fuel Oil Storage Tank, Fixed Roof, Top Vent, 1983	300,000 gallon capacity
Distillate Fuel Oil Tank	6,000 gallon capacity

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

Table 3-1: Main Boiler: Wood Combustion – Estimated Emissions

750 MMBtu/hr 8760 hrs/yr	Emission Factor			Estimated Emissions (ton/year)
	Factor	Units	Reference	
SO_2	--	--	Facility Cap (Fuel Neutral)	39
NO_x	0.075	lb/MMBtu	RACT – AOP-07-020a	246
PM	9.7	lb/hr	1989 Ambient Air Quality Modeling Study	42
CO	335	lb/hr		1467
VOC	0.0041	lb/MMBtu	Facility emissions testing on July 13, 2005	13.5
HAPs	0.0050	lb/MMBtu	NCASI Technical Bulletin No. 858, AP-42 Wood Residue Combusted in Boilers, Tables 1.6-3 &4(7/01) and Facility emissions testing	16.4

Table 3-2: Main Boiler: Distillate Oil Combustion – Estimated Emissions				
250 MMBtu/hr 0.05 % S Max. Potential fuel usage: 15.6 x 10^6 gal	Emission Factor			Estimated Emissions (ton/year)
	Factor	Units	Source	
SO_2	--		Facility Cap (Fuel Neutral)	39
NO_x	0.23	lb/MMBTU	RACT §5-1010: 4/21/2008	252
PM	2	lbs/1000 gal	AP-42, Fuel Oil Combustion, Table 1.3-1(5/10)	15.6
CO	5	lbs/1000 gal		39
VOC	0.2	lbs/1000 gal	AP-42, Fuel Oil Combustion, Table 1.3-3(5/10)	1.6
HAPs	0.0622	lbs/1000 gal	AP-42, Fuel Oil Combustion, Tables 1.3-8,9,10 &11(5/10)	0.5

Table 3-3: Main Boiler: Natural Gas Combustion – Estimated Emissions				
660 MMBtu/hr Max. Potential Fuel Usage*: 5,668 x 10^6 scf/yr	Emission Factor			Estimated Emissions (ton/year)
	Factor	Units	Source	
SO_2	0.6	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-2(9/98)	1.7
NO_x	0.13	lb/MMBtu	MSER, AP-89-010 9/15/89	376
PM	7.6	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-2(9/98)	21.5
CO	84	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-1(9/98)	238
VOC	5.5	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-2(9/98)	15.6
HAPs	1.89	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-3(9/98)	5.4

* 660 MMBtu/hr x scf/0.0011 MMBtu x 8760 hr/yr = 5256 x 10^6 scf
Worst Case (Wood, Distillate and Natural Gas Fuels)

Table 3-4: Main Boiler Highest Estimated Emissions - tons per year					
SO_2	NO_x	PM	CO	VOC	HAPs
39	376	42	1467	15.6	2.7 / 16.4

The RSCR is equipped with supplemental burners with a total maximum rate heat input of 8 MMBtu/hr. The burners are permitted to burn either natural gas or No. 2 fuel oil.

Maximum annual natural gas usage:

(8 MMBtu/hr) / (0.00102 MMBtu/scf) * (1 MMscf/10^6 scf) * (8760 hr/yr) = 68.7 MMCF/yr

Maximum annual oil usage:

(20 MMBtu/hr) * (0.14 MMBtu/gallon) * (8760 hr/yr) = 500,571 gallons

Table 3-5: RSCR Supplemental Burners: Natural Gas – Estimated Emissions				
Pollutant	Emission Factor			Allowable Emissions (tons/year)
	Factor	Units	Reference	
SO_2	0.6	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-1(9/98)	0.02
NO_x	100		AP-42, Natural Gas Combustion, Table 1.4-1(9/98)	3.4
PM	7.6		AP-42, Natural Gas Combustion, Table 1.4-2(9/98)	0.26
CO	84		AP-42, Natural Gas Combustion, Table 1.4-1(9/98)	2.9
VOC	5.5		AP-42, Natural Gas Combustion, Table 1.4-2(9/98)	0.19
HAPs	1.89		AP-42, Natural Gas Combustion, Tables 1.4-3 & 1.4-4 (9/98)	0.065

Table 3-6: SCR Supplemental Burners: Distillate Oil – Estimated Emissions				
Pollutant	Emission Factor			Allowable Emissions (ton/year)
	Factor	Units	Source	
SO_2	142S	lb/1000 gal	AP-42, Fuel Oil Combustion, Table 1.3-1 (5/10)	1.8
NO_x	20			5.0
PM	2			0.8
CO	5			1.3
VOC	0.2		AP-42, Fuel Oil Combustion, Table 1.3-3 (5/10)	0.09
HAP	0.0622		AP-42 Fuel Oil Combustion, Tables 1.3-8 & 1.3-10 (5/10)	0.016

Table 3-7: SCR Supplemental Burners Estimated Emissions, tons per year Worst Case Emissions: Distillate Fuel Oil and Natural Gas					
SO_2	NO_x	PM	CO	VOC	HAPs
1.8	5.0	0.8	2.9	0.19	0.065

Table 3-8: Auxiliary Boiler: Distillate Oil				
4 MMBtu/hr @ 0.14 MMBtu/gal 8760 hr/yr, 250,286 gal/yr) Sulfur Content: 0.05%max.	Emission Factor			Estimated Emissions (ton/year)
	Factor	Units	Source	
SO_2	142S	lbs/1000 gal	AP-42, Fuel Oil Combustion, Table 1.3-1(5/10)	0.9
NO_x	20	lbs/1000 gal		2.5
PM	3.3	lbs/1000 gal		0.4
CO	5	lbs/1000 gal		0.63
VOC	0.34	lbs/1000 gal	AP-42, Fuel Oil Combustion, Table 1.3-3(5/10)	0.04
HAPs	0.0622	lbs/1000 gal	AP-42, Fuel Oil Combustion, Tables 1.3-8,9,10 &11(5/10)	0.008

Table 3-9: Auxiliary Boiler: Natural Gas				
4 MMBtu/hr @ 0.00102 MMBtu/scf, 8760 hr/yr, 3.43 x 10^6 scf/yr)	Emission Factor			Estimated Emissions (ton/year)
	Factor	Units	Source	
SO_2	0.6	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-1(7/98)	0.01
NO_x	100	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-1(7/98)	1.7
PM	7.6	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-2(7/98)	0.13
CO	84	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-1(7/98)	1.4
VOC	5.5	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-2(7/98)	0.09
HAPs	1.89	lb/10^6 scf	AP-42, Natural Gas Combustion, Table 1.4-3 &4 (7/98)	0.03

Table 3-10: Auxiliary Boiler Allowable Emissions, tons per year Worst Case Emissions: Auxiliary Boiler: Distillate Fuel Oil and Natural Gas					
SO_2	NO_x	PM	CO	VOC	HAPs
0.9	2.5	0.4	1.4	0.09	0.03

Table 3-11: Used Oil Furnace				
0.28 MMBtu/hr fuel usage: 1,600 [1] gal/yr Max. Sulfur: 0.5%	Emission Factor			Allowable Emissions (ton/year)
	Factor	Units	Source	
SO_2	107S	lb/1000 gal	AP-42, Waste Oil Combustion, Tables 1.11-1 & 2 (10/96)	0.04
NO_x	16	lb/1000 gal		0.013
PM	172.9	lb/1000 gal		0.14
CO	2.1	lb/1000 gal		0.0017
VOC	1.0	lb/1000 gal	AP-42, Waste Oil Combustion, Table 1.11-3 (10/96)	0.0008
HAPs	0.47	lb/1000 gal	AP-42, Waste Oil Combustion, Tables 1.11-4 & 5 (10/96)	0.0004

[1] 1,600 is not a facility limit.

<u>Cooling Tower:</u> Emissions of particulate matter from cooling tower drift were not estimated or included in previous permits, being identified as "negligible". For the current permit review, these PM emissions were estimated using procedures described in *AP-42, Chapter 13, Miscellaneous Sources, Section 13.4 - Wet Cooling Towers (January 1995)*. Emissions from the cooling tower were based on information provided by the Permittee in the original application, including a cooling tower flowrate of 42,000 gallons per minute, a drift loss of 0.001%. The total dissolved solids contained in the circulating water in the cooling tower was assumed to be 4,500 ppm. The estimated PM emissions from the cooling towers do not represent an emission increase for the Facility, but rather represent a quantification of emissions that have always been present at the Facility.

Table 3-12: Estimated Cooling Tower Drift Emissions				
Pollutant	Cooling Tower Flow Rate (gallons/minute)	Circulating Water Lost as Drift %	Total Dissolved Solids Concentration of Cooling Water (parts per million)	Estimated PM Emissions (tons/yr)
PM	42,000	0.001	4,500	4.1

Table 3-13: Total Facility Emissions, tons per year						
Source	SO_2	NO_x	PM	CO	VOC	HAPs
Main Boiler	39	376	42	1,467	15.6	2.7/15.8
RSCR	1.8	5.0	0.8	2.9	0.19	0.065
Auxiliary Boiler	0.9	2.5	0.4	1.4	0.09	0.03
Cooling Tower	-	-	4.1	-	-	-
Used Oil Furnace	0.04	0.01	0.1	negligible	negligible	negligible
Estimated Potential Emissions	41.7	383	47.9	1,472	15.7	2.7 / 16.4
Allowable Emissions	39	496	47	1469	<50	<10/25

As summarized in Table 3-9 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 also has allowable emissions of at least one contaminant of fifty (50) or more tons per year which classifies 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 Estimated Emissions of Hazardous Air Contaminants (HACs) and Hazardous Air Pollutants (HAPs) from the Existing Stationary Source.

The equipment at the Facility that was evaluated for emissions of HACs and HAPs includes the following:

- Main Boiler combustion emissions
- Main Boiler pollution control emissions.
- Auxiliary Boiler combustion emissions (ammonia)
- Cooling Tower drift

<u>Vermont Hazardous Air Contaminants (HACs):</u>

Pursuant to §5-261(1)(b)(ii) of the *Regulations*, all fuel burning equipment which combusts virgin liquid or gaseous fuel and wood boilers constructed before January 1, 1993 are exempt from this section. Therefore, the Main Boiler combustion emissions and the Auxiliary Boiler combustion emissions are not subject to §5-261 of the *Regulations* at this time. However, combustion emissions from these sources are included in the discussion of Federal Hazardous Air Pollutants (HAPs) in this section.

Water circulated through the cooling towers contains various anti-microbial and anti-corrosion agents, which are emitted to the ambient air as the water droplets from the cooling tower evaporate. These emissions and known as “drift”, and HACs in Cooling Tower drift are subject to §5-261. The following table summarizes estimated potential HAC emissions from the Cooling Tower as a result of “drift”.

Table 3-14 Quantification of Cooling Tower HAC Emissions

Hazardous Air Contaminant	CAS#	Toxic Category	Emission Rate (lb/8-hrs)	Action Level (lb/8-hrs)
Sodium Hydroxide	1310-73-2	3	0.0013	0.35
Chlorine	7782-50-5	3	0.0050	0.01

The estimated HAC emissions from the cooling towers do not exceed their respective Action Levels, and accordingly, cooling tower emissions were not evaluated further under §5-261 of the *Regulations*.

The RSCR system has emissions of ammonia due to ammonia slip. The RSCR system is required to not exceed 20 ppmv of ammonia. The following is an estimate of the maximum potential ammonia emissions due to the operation of the RSCR system; the actual emissions should be less.

Basis:
Flue gas flow rate: 240,000 scfmw (wet)
Flue gas moisture content: 21%
Ammonia concentration: 20 ppmvd (dry)
Hours of operation: 8,760 hrs/yr

(240,000 scfmw) * ((100%-21%)/100%) * (20 scf NH_3/1,000,000 scf exhaust) * (14.7 psia/((10.73 psia-scf/lbmole-^oR)*(528 ^oR)) * (17 lbs NH_3/lbmole NH_3) * 60 min/hr) * (8 hours)

= 80.2 lb/8-hr of ammonia emissions.

The Action Level for ammonia from Appendix C of the Regulations is 8.3 lbs/8-hr, so the estimated maximum potential ammonia emissions due to the operation of the RSCR system exceed the Action Level. Emissions during actual operation of the RSCR system are anticipated to be less than this estimate.

Table 3-15 summarizes the estimated emissions of HACs subject to HMSER:

Table 3-15 Quantification of HAC Emissions from RSCR				
Hazardous Air Contaminant	**CAS#**	**Toxic Category**	**Emission Rate (lb/8-hrs)**	**Action Level (lb/8-hrs)**
Ammonia	7664-41-7	2	80.2	8.3

Federal Hazardous Air Pollutants:

The emissions of HAPs are quantified to determine if the Facility is a major source of HAPs and subject to any Federal NESHAPs standards (40 *CFR.* Part 63). HAP emissions from the Facility were estimated based on AP-42 emission factors for combustion of No.2 fuel oil and natural gas, using emission factors available from *AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources* (AP-42).

For estimating HAP emissions from wood combustion, a combination of emission factors from AP-42, National Counsel for Air and Stream Improvement (NCASI) Technical Bulletin No. 858 and from limited emissions testing performed on the Main Boiler at the Facility. On site emissions tests were conducted on July 15-16, 2004 and July 13, 2005 and specific HAPs that were evaluated during these stack tests included the following:

- Acrolein
- Benzene
- Formaldehyde
- Hydrogen chloride
- Styrene
- Manganese

Emissions of HAPs from the cooling tower were estimated as part of the HAC evaluation presented above. Estimation of individual HAPs from operation of the Auxiliary Boiler was not tabulated. Rather, the overall HAP emissions from the Auxiliary Boiler were estimated using emission factors from AP-42. The total potential to emit for HAPs from these two activities were estimated to be less than 0.04 tons per year.

Most of the Facility HAP emissions are from wood combustion in the Main Boiler. Table 3-16 presents a summary of the estimated HAP emissions from wood combustion in the Main Boiler at the Facility. These emission factors differ from those used in previous permits. The Agency has reviewed HAP emission factors for wood combustion based on site-specific testing, emission factors from the National Counsel for Air and Stream Improvement (NCASI) and AP-42, and has developed this revised table of HAP emission factors. Note that the Agency prefers the emission factors listed in TB No. 858, over AP-42, because NCASI screened data such that only data from boilers firing unadulterated wood were included in the report. As stated on Page 93 of the report: “For the current data summary, the data for only those boilers in the AP-42 background document were considered that were deemed relevant to the burning of wood residues in forest products industry boilers. Thus, emissions data corresponding to wood combustion in furniture industry boilers and combustion of biomass other than virgin wood residues (e.g., agricultural waste, treated wood, etc.) were not included in the current summary."

This Facility has permit conditions that define the methods to be used for estimating HAP emissions on a 12-month rolling average basis. The Permit also limits HAP emissions from the Facility to less than 10 ton/year of any single HAP and less than 25 tons/year of all HAPS combined. With these limitations, the Facility is not subject to the federal Major Source HAP standards.

This Permit also requires periodic emissions testing for certain HAPs that are anticipated to have the greatest emission factors. This testing will provide an ongoing review for the validity of the HAP emission estimates. Periodic testing will be required for the following HAPs (with chemical abstract numbers):

- Acetaldehyde (75-07-0)
- Benzene (71-43-2)
- Chlorine (7782-50-5)
- Dichloromethane (methylene chloride) (75-09-2)
- Formaldehyde (50-00-0)
- Hexane (110-54-3)
- Methanol (67-56-1)

Based on the available data, the emissions of the above-listed HAPs are estimated to account for approximately 78% of the total HAP emissions from the Facility.

Table 3-16
Estimated Emission of Hazardous Air Pollutants
Main Boiler Wood Combustion

Pollutant	CAS #	Proposed Emission Factor (lb/MMBtu)	Reference [1]	Estimated Annual Emissions [2] (lbs)
1,2,4-trichlorobenzene	120821	5.50E-05	NCASI	361.4
1,2-Dichloroethane (ethylene dichloride)	107062	2.90E-05	NCASI	190.5
1,2-Dichloropropane (propylene dichloride)	78875	3.30E-05	NCASI	216.8
2,4,6-Trichlorophenol	88062	2.20E-07	NCASI	1.4
2,4-Dinitrophenol	51285	4.80E-07	NCASI	3.2
4-Nitrophenol	100027	3.30E-07	NCASI	2.2
Acetaldehyde	75070	1.90E-04	NCASI	1248.3
Acetophenone	98862	2.70E-07	NCASI	1.8
Acrolein	107028	1.00E-05	McNeil Test	65.7
Antimony		4.20E-07	NCASI	2.8
Arsenic		1.00E-06	NCASI	6.6
Benzene	71432	7.80E-04	McNeil Test	5124.6

Table 3-16
Estimated Emission of Hazardous Air Pollutants
Main Boiler Wood Combustion

Pollutant	CAS #	Proposed Emission Factor (lb/MMBtu)	Reference [1]	Estimated Annual Emissions [2] (lbs)
Beryllium		1.90E-06	NCASI	12.5
bis(2-Ethylhexyl) phthalate	117817	4.70E-08	AP-42	0.3
Bromomethane (methyl bromide)	74839	1.50E-05	NCASI	98.6
Cadmium		1.90E-06	NCASI	12.5
Carbon disulfide	75150	1.30E-04	NCASI	854.1
Carbon tetrachloride	56235	8.90E-07	NCASI	5.8
Chlorine	7782505	7.90E-04	NCASI	5190.3
Chlorobenzene	108907	1.70E-05	NCASI	111.7
Chloroform	67663	3.10E-05	NCASI	203.7
Chloromethane (methyl chloride)	74873	4.00E-05	NCASI	262.8
Chromium (total)		6.00E-07	NCASI	3.9
Cobalt		1.90E-07	NCASI	1.2
Cumene	98828	1.80E-05	NCASI	118.3
Di-butyl phthalate	84742	3.30E-05	NCASI	216.8
Dichloromethane (methylene chloride)	75092	5.40E-04	NCASI	3547.8
dinitrotoluene-2,4	121142	9.40E-07	NCASI	6.2
Ethylbenzene	100414	6.80E-06	NCASI	44.7
Formaldehyde	50000	4.60E-04	McNeil Test	3022.2
Hexachlorobenzene	118741	1.00E-06	NCASI	6.6
Hexane	110543	2.90E-04	NCASI	1905.3
Hydrogen Chloride	7647010	1.20E-04	McNeil Test	788.4
Lead compounds		5.80E-06	AP-42	38.1
Manganese		7.70E-06	McNeil Test	50.6
Mercury		9.90E-07	NCASI	6.5
Methanol	67561	8.30E-04	NCASI	5453.1
Methyl Isobutyl Ketone	108101	2.30E-05	NCASI	151.1
Naphthalene	91203	1.60E-04	NCASI	1051.2
Nickel compounds		2.90E-06	NCASI	19.1
Pentachlorophenol	87865	4.60E-08	AP-42	0.3
Phenol	108952	1.40E-05	NCASI	92.0
Phosphorous	7723140	9.90E-05	NCASI	650.4
Polycyclic organic matter (POM)	-	2.98E-05	AP-42	195.6
Propionaldehyde (propanal)	123386	6.10E-05	NCASI	400.8
Selenium		3.00E-06	NCASI	19.7
Styrene	100425	1.47E-06	McNeil Test	9.7

Table 3-16 Estimated Emission of Hazardous Air Pollutants Main Boiler Wood Combustion				
Pollutant	**CAS #**	**Proposed Emission Factor (lb/MMBtu)**	**Reference [1]**	**Estimated Annual Emissions [2] (lbs)**
Tetrachloroethylene (perchloroethylene)	127184	5.20E-05	NCASI	341.6
Toluene	108883	2.90E-05	NCASI	190.5
Trichloroethylene	79016	NCASI	AP-42	184.0
Vinyl Chloride	75014	1.80E-05	NCASI	118.3
Xylenes (incl. o, m & p)	-	2.80E-05	NCASI	184.0
			Total HAPs (tons)	**16.4**
			Largest Emissions of a Single HAP (methanol) (tons)	**2.7**

[1] AP-42 factors: 1.6 Wood Residue Combustion in Boilers. NCASI: National Council for Air and Stream Improvement (NCASI) "Compilation of 'Air Toxic' and Total Hydrocarbon Emissions Data for Sources at Kraft, Sulfite and Non-Chemical Pulp Mills – An Update" Technical Bulletin No. 858 = February 2003. McNeil Test: Testing conducted on the Main Boiler during July 15 & 16, 2004 and July 13, 2005.

[2] Annual emission rate based on the Main Boiler firing wood at the maximum boiler heat input of 750 MMBtu/hr for 8,760 hours/year.

3.3 – Estimating Potential Green House Gas Emissions

Section 3.3 Estimation of CO_2e Emissions

Facility:	Burlington Electric - McNeil Station		Permit #:	AOP-12-005		
Source ID	**Source Description**	**Fuel Combusted**	**Potential/ Allowable Quantity Combusted**	**Units**	**Estimated wood usage (raw tons)**	**Estimated %MC for raw wood fuel**
	Main Boiler - wood	Wood and Wood Waste	446,111	tons	730000	45.0%
	Main Boiler - distillate	Distillate Fuel Oil #2	0	gallons	0	0.0%
	Main Boiler - gas	Natural Gas	0	scf	0	0.0%
	Emergency engines	Distillate Fuel Oil #2	0	gallons	0	0.0%
	Auxilliary boiler	Natural Gas	34,352,941	scf	0	0.0%
	RSCR Supp Burners	Natural Gas	68,705,882	scf	0	0.0%

The wood fuel emission factors are based on wood with 10% moisture content, so 730,000 tons @ 45% MC is converted to 446,111 tons @ 10% MC

Table 2. Total Company-Wide Stationary Source Fuel Combustion

Fuel Type	Quantity Combusted	Units
Distillate Fuel Oil #2	0	gallons
Natural Gas	103,058,824	scf
Wood and Wood Waste	446,111	tons

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

Fuel Type	CO_2 (kg)	CO_2 (lb)	CH_4 (kg)	CH_4 (lb)	N_2O (kg)	N_2O (lb)
Distillate Fuel Oil #2	0	0	0.0	0.0	0.0	0.0
Total Fossil Fuel Emissions	5,617,176	12,383,738	105.9	233.6	10.6	23.4
Wood and Wood Waste	643,579,518	1,418,848,276	219,558	484,042	28,817	63,531
Total Non-Fossil Fuel Emissions	643,579,518	1,418,848,276	219,558	484,042	28,817	63,531
Total Emissions for all Fuels	649,196,694	1,431,232,015	219,664	484,276	28,828	63,554

	CO_2	CH_4	N_2O	CO_2e	
Global Warming Potential	1.0	25.0	298.0	**metric ton**	**short ton**
Total CO_2 Emissions - Equivalent (Fossil CO2e + Biogenic CH4 & N2O)				**19,699**	**21,715**
All CO2e emissions at stack (Fossil CO2e + Biogenic CO2e) - for APCD Permit info				**663,279**	**731,139**

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 stacks and vents at the facility.

§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 including the Main Boiler, Auxiliary Boiler and Used Oil Furnace. Based on the application submittal, the applicant is expected to comply with this regulation based on the use of natural gas and distillate oil. Natural gas and distillate oil, by their official fuel specification definition, comply with this requirement.

§5-221(2) - Prohibition of Potentially Polluting Materials in Fuel; Used Oil
The use of used oil as a fuel is prohibited except in conformance with the requirements of this section. Based on the application submittal and information available to the Agency, the Facility does burn used oil in a 0.28 MMBtu/hr used oil furnace and is therefore currently subject to this regulation.

§5-231(3)(a) - 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 are shown in Table 4-1.

Table 4-1: Equipment Subject to §5-231(3)

Equipment ID	*Rating MMBtu/hr*	*Emission Standard lbs/MMBtu*	*Allowable Emissions (lb/hr)*
Auxiliary Boiler	4	0.5	2.0
Used Oil Furnace	0.28	0.5	0.14

§5-231(3)(b) - 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. However, the combustion of wood chips in the Main Boiler is subject to the more stringent MSER emission rate of 0.007 gr/dscf corrected to 12% CO_2.

§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.

§5-251 - Control of Nitrogen Oxide Emissions
Based on the application submittal and information available to the Agency, this Facility is subject to this regulation. However the MSER emission rate is more stringent.

§5-252 - Control of Sulfur Dioxide Emissions. Based on the application submittal and information available to the Agency, this Facility currently has no applicable fuel burning equipment subject to this regulation.

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

§5-502(3) - Most Stringent Emission Rate. As part of obtaining approval for the original installation of the main boiler and the major modification involving the addition of natural gas burners in 1989, the Agency required the Permittee to achieve the MSER pursuant to §5-502(3) of the *Regulations*.

4.2 Federal Air Pollution Control Regulations and the Clean Air Act

Section 111 of the Clean Air Act establishes New Source Performance Standards (NSPS). NSPSs apply to new sources, and are promulgated under 40 CFR, Part 60. Section 112 of the Clean Air Act establishes National Emission Standards for Hazardous Air Pollutants (NESHAPs). NESHAPs are promulgated under 40 C.F.R. Part 61 and Part 63, and may apply to new or existing sources.

Potentially applicable NSPSs and NESHAPs, and other potentially applicable Federal air pollution control regulations are summarized in Section (f)(a)(iv) of permit AOP-12-005.

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

An ambient air quality impact evaluation was performed for Air Pollution Control Permit to Construct #AP-89-010, issued on September 15, 1989. The objective of this ambient air quality impact evaluation was to demonstrate compliance with the Vermont and National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments. Since the facility change in 1989 was a Major Modification, the Facility was allowed only 25% of the remaining annual PSD increment.

MODEL RESULTS - Refined Modeling: Ambient Air Quality Standards - The applicant used the Industrial Source Complex Short Term (ISCST) model to estimate the impact of SO_2, NO_2, and PM due to the proposed project. The results of the air quality impact evaluation are shown in Table 6-1. Model results demonstrated that emissions from the modifications will not exceed National Ambient Air Quality Standard.

Table 6-1: ISCST Maximum Concentration Results Compared to AAQS

Pollutant	Averaging Time	Modeled Emission Rate (g/s) [1]	Maximum Concentration (μg/m^3) [2]	Background Concentration (μg/m^3) [2]	Total Concentration (μg/m^3) [2]	Standard (μg/m^3) [2]
SO_2	Annual	1.9	0.5	17	17	80
	24- hour	12.6	63.1	68	131	365
	3-hour		141.9	141	283	1,300
CO	8-hour	42.2	184.1	6,954	7,138	10,000
	1-hour		263	13,566	13,829	40,000
NO_2	Annual	17.2	4.5	36	41	100
	1-hour	18.2	113.4	141	254	320
PM_{10}	Annual	1.2	0.3	30	30	50
	24- hour		3.0	52	55	150
PM (TSP)	Annual		0.3	67	67	75
	24- hour		3.0 [3]	161	182	150

[1] g/s: emission rate of the pollutant in terms of grams of pollutant per second.

[2] μg/m^3: micrograms of pollutant per cubic meter of air.

[3] At the time this modeling was conducted, the existing 24-hour TSP background level of 161 μg/m^3 exceeded the secondary standard of 150 μg/m^3. The maximum impact from the Facility of 3.0 μg/m^3 (24-hour) was less than the significant impact level of 5.0 μg/m^3 (24-hour).

Prevention of Significant Deterioration - The results of the air quality impact evaluation performed using ISCST are shown in Table 6-2. The results of this modeling indicated compliance with the PSD increments.

Table 6-2: ISCST Predicted PSD Increment Consumption April, 1989

Pollutant	PSD Increment Consumed ($\mu g/m^3$)	PSD Increment Available ($\mu g/m^3$)
SO_2	0.3	5.0
NO_2	3.5	6.3
PM	0.2	4.7

7.0 HAZARDOUS AIR CONTAMINANTS & HAZARDOUS AIR POLLUTANTS

Pursuant to §5-261 of the *Regulations*, any stationary source subject to the rule[1] with current or proposed actual emissions of a hazardous air contaminant (HAC) equal to or greater than the respective Action Level (found in Appendix C of the *Regulations*) shall be subject to the Regulation and shall achieve the Hazardous Most Stringent Emission Rate (HMSER) for the respective HAC.

HMSER is defined as a rate of emissions which the Secretary, on a case-by-case basis, determines is achievable for a stationary source based on the lowest emission rate achieved in practice by such a category of source and considering economic impact and cost. HMSER may be achieved through application of pollution control equipment, production processes or techniques, equipment design, work practices, chemical substitution, or innovative pollution control techniques. If the emission rate of any HAC after achieving HMSER is still estimated to exceed its action level after achieving HMSER, an air quality impact evaluation may be required to further assess the ambient impacts for compliance with the Hazardous Ambient Air Standard (“HAAS”) or Stationary Source Hazardous Air Impact Standard (“SSHAIS”).

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 HAP standards. Note that ammonia is a Vermont HAC, but is not listed as a HAP by the US EPA.

As shown in Section 3, if the RSCR system has estimated emissions of ammonia which exceeds the Action Level of 8.3 lb/8hrs and is therefore subject to §5-261.

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.

[1] APCR §5-261(1)(c)(ii) provides that solid fuel burning equipment (not including incinerators) installed or constructed prior to January 1, 1993, and all fuel burning equipment which combust virgin liquid or gaseous fuel shall not be subjects to the requirements of §5-261.

HMSER has been determined to be an ammonia emission limit of 20 ppmdv @ 6% O_2 based on an 8-hr rolling average and the operation of an ammonia continuous emission monitor (CEM).

As part of the Permittee's Act 248j petition, the Permittee assessed the potential concentration of ammonia in the ambient air. The US EPA's SCREEN3 model was used as well as scaling prior refined modeling results that were conducted for the facility. The modeling results projected the maximum impact concentration of ammonia to be two orders of magnitude lower than the Hazardous Ambient Air Standard. The Agency did not review this modeling analysis.

8.0 REASONABLY AVAILABLE CONTROL TECHNOLOGY

§5-1010 of the *Regulations* requires sources to install, maintain and use Reasonably Available Control Technology (RACT). RACT is defined in the *Regulations* as "devices, systems, process modifications or other apparatus or techniques designed to prevent or control emissions that are reasonably available, taking into account the social, environmental and economic impact of such controls, and alternative means of emission control". A RACT analysis typically reviews a range of emission reduction options, from the greatest reduction to the least (Top Down). RACT exists within a hierarchy of emission reduction acronyms. In descending order of emission reduction, these are: LAER, MSER, BACT, NSPS, RACT.

<u>Previous RACT Reviews:</u>

Permit #AOP-01-057, issued on August 28, 2003:

The Agency determined that RACT for NO_x was a short-term NO_x emission rate for wood and oil combustion of 0.23 lb/MMBtu. The Agency also required the Permittee to report all NO_x emission that exceed 0.21 lbs/MMBtu on a quarterly basis. The limit was based on optimized operation of the boiler in its current configuration.

The long-term NO_x emission rate was also modified to more closely reflect the baseline emissions of the facility. The long-term NOx RACT was set at an annual average of 0.15 lb/MMBtu. The Agency extrapolated the baseline emission rate of 0.15 lb/MMBtu for the Main Boiler heat input rating of 750 MMBtu/hr for 8760 hours per year resulting in a NO_x emission limit of 493 tons per rolling twelve month.

RACT for CO was reviewed and the Agency concluded no changes in the Facility's current operation were required. The Facility's CO limit was based on an MSER review for permit AP-89-010 issued on 9/15/1989: the modern combustion design of the Main Boiler and a CO limit of 1500 ppmv (1-hour average).

Permit #AOP-07-020, issued April 21, 2008:

The Permittee proposed to install and operate a Regenerative Selective Catalytic Reduction (RSCR) device to reduce the emission of NOx. The use of the RSCR system would help the Facility to qualify for the Class 1 Renewable Energy Credit market in Connecticut and/or Massachusetts. The NOx emission limit to qualify for these particular

RECs is 0.075 lb/MMBtu based on a quarterly average. A strong REC market impacts the economics of NO_X RACT. Accordingly, the Agency determined that with successful installation and operation of the RSCR system, and with qualifying for the Massachusetts and/or Connecticut REC markets, RACT for the main boiler at the Facility was the operation of the NO_X RSCR system to achieve a NO_X emission limit of 0.075 lb/MMBtu based on a quarterly average.

RACT for CO was reviewed and continued to be good combustion practices and a CO limit of 1500 ppmv (1-hour average).

RACT Review for permit AOP-12-005:

The Agency has determined that RACT for NOx continues to be the operation of the RSCR and achieving a NOx emission limit of 0.075 lb/MMBtu based on a quarterly average.

This RACT determination shall be reviewed as part of the review of the next operating permit application for this Facility.

If the REC market incentives are no longer available, or if the Permittee elects to no longer participate in the REC market and wants to stop operating the RSCR, they will be required to file an amendment application for reconsideration of this NO_X RACT determination. The Permittee would be required to demonstrate that the continued operation and maintenance cost, but not the initial capital costs are excessive for RACT.