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

TECHNICAL SUPPORT DOCUMENT

FOR

PERMIT TO CONSTRUCT AND OPERATE

AOP-10-038

Date: November 12, 2014

Rock-Tenn Company – Missisquoi Mill
Sheldon Springs, Vermont

Prepared By: Marty Gildea

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 & Operate 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:
Rock-Tenn Company – Missisquoi Mill
PO Box 98
369 Mill Street
Sheldon Springs, Vermont 05485

Facility/Applicant
Rock-Tenn Converting Company
P.O. Box 4098
Norcross, GA 30091

Contact Person:
Roger Thieken, Technical Director
Phone: (802) 933-7733, ext. 247
FAX: (802) 933-5326

1.0 INTRODUCTION

Rock-Tenn Converting Company Inc. (hereinafter "The Permittee," and also referred to herein as "Owner/Operator") owns and operates a paperboard manufacturing facility (also referred to herein as "Facility") on Mill Street in Sheldon Springs, Vermont.

The Facility will maintain the current fuel cap of 1,024,800 gallons of 2.0% sulfur content No. 6 fuel oil per year as specified in the Operating Permit. Since the 27 MMBtu/hr Cleaver Brooks boiler is over 10 MMBtu/hr, the facility is subject to the federal regulation NSPS Subpart Dc. The 27.0 MMBtu/hr (700 hp) Cleaver-Brooks Boiler #2, itself requires a fuel cap of 946,354 gallons of No. 6 fuel oil per year at 0.5% sulfur content to remain below the current thresholds for a major modification, thus subject to a MSER review.

The allowable emissions for the Facility are summarized below:

Table 1-1: Allowable Air Contaminant Emissions (tons/year)[1]

PM/PM_{10}	SO_2	NO_X	CO	VOC	Total Criteria	Total HAPs
17.7	162.3	<100	63.3	<50	>10	<10/25

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

2.0 FACILITY DESCRIPTION AND LOCATION

2.1 Facility Locations and Surrounding Area

The Facility is located in the village of Sheldon Springs, Vermont. It is located near the center of Sheldon Springs and is near several residential areas. The location of the Facility and relative surrounding area may be found in Appendix A of this document.

2.2 Facility Description and Explanation of Process

The Facility is a "Title V Subject Source" listed under the Standard Industrial Classification ("SIC") Code 2631, paperboard mills. The regulated sources of air contaminant emissions at the Facility are the three coating dryers, the four boilers, the emergency generator, and the process emissions.

2.3 Description of Equipment

2.2.1 Description of Existing Equipment

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

Table 2-1: Equipment Specifications
Combustion

Equipment/Make/Model	Capacity/Size MMBtu/hr[1] (hp) [2]	Fuel Type	Date of Manufacture (installation)
Wickes Boiler #1	89 MMBtu/hr 80 MMBtu/hr	Natural Gas No. 6 Fuel Oil	1950
Cleaver-Brooks Boiler #2, Model CBLE400-700-250ST with 4 Pass Wet and Dry Back	27.2 MMBtu/hr 27.0 MMBtu/hr (700 hp)	Natural Gas No. 6 Fuel Oil	2007
B&W Boiler #3	33 MMBtu/hr 33 MMBtu/hr	Natural Gas No. 6 Fuel Oil	1950
B&W Boiler #4	31 MMBtu/hr 31 MMBtu/hr	Natural Gas No. 6 Fuel Oil	1950
Paperboard Machine #1	5 MMBtu/hr	Natural Gas	1969
Paperboard Machine #1b	2.98 MMBtu/hr	Natural Gas	2001
Paperboard Machine #2	Steam supplied from Boilers		1969
Paperboard Machine #2b	3.264 MMBtu/hr	Natural Gas	1998
	1.67 MMBtu/hr	Natural Gas	2001
Equipment/Make/Model	**Capacity/Size**	**Fuel Type**	**Date of Manufacture (installation)**
Emergency Diesel Generator	16 MMBtu/hr	No. 2	1950

[1] MMBtu/hr - Million British Thermal Units per hour maximum rated heat input.
[2] hp. – Rated engine horsepower output as specified by the manufacturer.

2.2.2 Identification of Negligible Activities

Table 2-2 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 Operating/Construction Permit.

Table 2-2: Negligible Sources of Contaminant Emissions	
Space Heater	1 Compactor shed space heater, rated at 40,000 Btu/hr (Propane)
Diesel Fire Pump	1 Detroit Diesel Fire Pump
Maintenance Shop	Repair and maintenance shop activities
Welding Equipment	Soldering and welding equipment
Ventilation Units	Ventilation units used for human comfort
Propane Tanks	Propane Storage Tanks
Fuel Oil Tank	No. 6 Fuel oil storage tank, capacity: 110,000 gallons
Lab	Paper testing lab
Construction	Intermittent construction activities
Space Heaters	Five Salamander space heaters.
Forklifts	25 Propane forklifts and 4 battery operated fork lifts
Front End Loaders	Two diesel-powered front end loaders.
Utility Truck	One gasoline engine ½ ton utility truck

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

2.2.3 Proposed Limitations

2.2.3.1 The proposed limitations have not changed from the previous permit (AOP-05-018b) with the exception of VOC emissions. For the purpose of completeness, these limitations are presented below.

In order to maintain SO_2 emissions to less than 162.3 tons per year the Permittee has proposed the following fuel limit:

The Facility shall not burn more than 1,024,800 gallons of residual fuel oil with a sulfur content of 2.0 percent by weight in all boilers combined based on a rolling twelve (12) consecutive calendar month period. Should the Facility choose to burn fuel oil with a sulfur content less than 2.0 percent by weight, then the quantity of fuel oil shall be limited by the following formula based on a rolling twelve (12) consecutive calendar month period commencing with the issuance of this permit:

$$[(GPY_{\text{fuel oil burned in the boilers}}) * (\%S)] < 2{,}049{,}600$$

Where "GPY" means gallons of fuel oil burned in the boiler, "%S" means the weighted average sulfur content of the fuel expressed as percent by weight.

2.2.3.2 The 27.0 MMBtu/hr (700 hp) Cleaver-Brooks Boiler #2 will require a fuel cap of 946,354 gallons of No. 6 fuel oil per year at 0.5% sulfur content to remain below the current thresholds for a major source review.

2.2.3.3 The facility must maintain NOx emission to less than 100 tons per year.

NO_x Tons = {[Residual oil used (gal) x 55.0 lbs/10^3 gal] + [Distillate oil used (gal) x 20.0 lbs/10^3 gal] + [Natural gas used (ft^3) x 100.0 lbs/10^6 ft^3] }/(2000.0 lbs/ton)

VOC emissions are estimated as follows:

The process chemical portion of estimated VOC emissions has been averaging about 28 tons/ year (as of July, 2014, which includes about 11 tpy from the coating materials, and 17 tpy from other process materials. Most of the "other" process materials are utilized based on facility productivity in tons per day. It would require a significant change to the Permitee's process, or the types of chemicals used, to impact the potential emissions from these materials. Coating materials are added to the surface of the paperboard on a square foot basis. Therefore, a potential change in the grade mix to a lighter basis weight product (more square feet per pound) could require significantly more coating without really changing the production rate in tons/ day. One could estimate a potential for the coating materials by assuming maximum reasonable coating weights of the current formulations are applied while running our maximum line speeds on the two paper machines.

Table 1. Calculated results below are extracted from an Excel Spreadsheet entitled: Est Coating VOC.xlsx located in the appropriate project folder.

Current Coating Formula est. VOC (#VOC per dry# coating basis)		
Air Knife Top Coating	0.102559	% VOC
Rod Pre-Coating	0.113098	% VOC
Current Coating Use Estimates		
Average Basis Weight	82	#/msf
Production Rate	110,000	tons/year
Ave. AK Coating Applied	3.9	#/msf
Ave PC Coating Applied	3.6	#/msf
	10.8	est. tpy
Potential Coating Use Estimate		
PM1 Max. Speed	450	fpm
PM2 Max. Speed	620	fpm
PM1/2 Max. Web Width	88	inches
Est. Max. AK Applied	4.5	#/msf
Est. Max. PC Applied	4.0	#/msf
	18.8	est. tpy
Potential VOC Estimates		
Combustion	9	tpy
Coating	19	tpy

Other Process	20	tpy
est. potential	48	tpy

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 Vermont Air Pollution *Regulations* ("*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 Designation of the Facility for the Permit to Operate

The designation of the Facility for the Permit to Operate is determined by its allowable emissions following issuance of the permit, taking into account any limitations contained in the permit that restrict the Facility's allowable emissions.

The calculated allowable emissions for the Facility involved allotting one-hundred (100) percent of allowable fuel oil No. 6 at two (2) percent sulfur content to the 89 MMBtu/hr Wickes Boiler #1. The 1,024,800 gallon fuel cap is consumed in it's entirety by the 89 MMBtu/hr Wickes Boiler #1. The remaining three boilers were analyzed assuming that the boilers burned natural gas for the entire year. The allotted fuel use and hours of operation for each piece of equipment is summarized in Table 3-1. Note that the fuel allotment used for calculating the Facilities' allowable emissions does not represent a fuel limit for an individual boiler. Table 3-2 shows the potential emissions from the Facility's coating dryers, boilers, and 200 hours of operation from the emergency diesel generator. Emissions factors for different types of fuel and their sources can be found in Appendix B.

Table 3-1: Fuel Use Per Equipment

Unit	Fuel	Capacity (MMBtu/hr)	Fuel Consumption	Hours
Wickes Boiler #1	No. 6 Fuel Oil	89	1,024,800.0 gallons per year	1727.3
	Natural Gas	80	535.8 MMscf [1]per year	7,032.7
Cleaver-Brooks Boiler #2,	No. 6 Fuel Oil	27.0	0.0	0.0
	Natural Gas	27.2	227 MMscf	8760
B&W #3	No. 6 Fuel Oil	33	0.0 gallons	0.0
	Natural Gas		275.3 MMscf	8760

Table 3-1: Fuel Use Per Equipment				
Unit	Fuel	Capacity (MMBtu/hr)	Fuel Consumption	Hours
B&W Boiler #4	No. 6 Fuel Oil	31	0.0 gallons	0.0
	Natural Gas		258.6 MMscf	8760
Emergency Generator	No. 2 / Diesel	16	22,857 gallons	200

[1] Fuel consumption in Million Standard Cubic Feet of natural gas and gallons of fuel oil.

Based upon the above chart the fuel use per year is:

- 1,024,800 gallons of No. 6 fuel oil @ 2% sulfur content.
- 22,857 gallons of No. 2 / Diesel.
- 1296.7 Million Standard Cubic Feet of natural gas.

Table 3-2 shows the potential emissions from the Facility's coating dryers, boilers, and 200 hours of operation from the emergency diesel generator.

Table 3-2: Potential Emissions From Coating Dryers, Boilers, and Emergency Generator						
	Emission					
	PM_{10}	SO_2	NO_X	CO	VOC	HAP
No.6 Fuel Oil	11.8	160.9	28.2	2.6	0.1	0.10
No. 2 Fuel Oil	0.5	0.9	7.1	1.5	0.6	0.01
Natural Gas	4.9	0.5	70.4	54.5	3.9	1.3
Total	17.2	162.2	105.7	58.6	4.6	1.4

Process lines #1 and #2 have a maximum running speed 350 ft/min and 600 ft/min respectively. The maximum width of the boxboard produced is 7.33 feet. This means the Facility has the potential to produce 417,810 ft^2/hr.

$$\left(950\frac{ft}{\min}\right)(7.33\,ft)\left(60\frac{\min}{hr}\right)=417810\frac{ft^2}{hr}$$

At most, 9.0 pounds of dry coating is applied per 1000 square feet of boxboard. Currently 2371 pounds of dry products are used per batch of boxboard coating. These consist of binders, pigments and small quantity of additives.

$$\left(417810\frac{ft^2}{hr}\right)\left(9.0\frac{lb-dry}{1000-ft^2}\right)=3760.29\frac{lb-dry}{hr}$$

Typically the boxboard coating contains 4.35 pounds of VOC emission's per batch of coating.

$$\left(3760.29\frac{lb-dry}{hr}\right)\left(\frac{1}{2371}\frac{batch}{lb-dry}\right)=1.59\frac{batch}{hr}$$

Therefore the maximum VOC emissions from the boxboard coating is 30.3 tons per year.

$$\left(4.35\frac{lb-VOC}{batch}\right)\left(1.59\frac{batch}{hr}\right)\left(8760\frac{hr}{yr}\right)\left(\frac{1}{2000}\frac{ton}{lb}\right)=30.3\frac{ton-VOC}{yr}$$

The Facility uses a variety of chemicals in the process lines. It is estimated that the process lines run on average 2000 hours/year. Table 3-3 shows the Facility's actual average use of chemicals as reported from 2012 are classified as Hazardous Air Contaminants, the average pounds per eight hour emitted, and whether or not it exceeds the action level.

Table 3-3: Hazardous Air Contaminants

Chemical Name	CAS	Toxic[1] Category	lb/year	lb / 8-hour	Action Level (lb / 8-hour)	% Action Level
Vinyl Acetate	108-05-4	1B	1524.26	1.4	1.7	81.9
Triethanolamine	102-71-6	2A	362.4	0.3	1.4	23.6
Acetaldehyde	75-07-0	1B	993.83	0.9	0.038	2388.4
Ammonia	7664-41-7	2A	4287.5	3.9	8.3	47.2

[1] For category 3 contaminants, emission rate is based on 2000 hours/year of actual operation. For category 1 & 2 contaminants, the emission rate is based on 8760 hours/year of unrestricted operation.

The total Facility's allowable emissions are summarized in Table 3-4:

Table 3-4: Allowable Emissions (Tons Per Year)

	PM_{10}	SO_2	NO_X	CO	VOC	HAPs
Fuel Emissions	17.2	162.2	<100	63.2	5.0	1.60
Process Emissions	0	0	0	0	30.3	3.6
Total	17.2	162.2	<100	63.2	35.3	5.2

4.0 APPLICABLE REQUIREMENTS

The compliance analyses and determinations in this technical analysis rely on data and representations provided by the Owner/Operator. Any statements and conclusions regarding the compliance status contained herein are not binding against the state of Vermont in any future legal or administrative proceedings.

4.1 Vermont Air Pollution Control Regulations and Statutes

§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.

(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.

(ii) For combustion installations where the *heat input* is greater than 10 million BTU's per hour, but where the *heat input* is equal to or less than 250 million BTU's per hour, the applicable limit is determined by using the following formula:

(iii)

$$E_{PM} = 10^{[-0.47039(\log_{10} HI)+0.16936)}$$

where:

E_{PM} - is the *particulate matter emission* limit, expressed to the nearest hundredth pound per hour per million BTU's; and

HI - is the *heat input* in millions of BTU's per hour.

For the Wickes Boiler #1, B&W Boiler #3, #4, and the Cleaver-Brooks Boiler #2 when firing oil:

The allowable particulate emissions from the subject equipment are shown in Table 4-1.

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

Equipment ID	***Size/Capacity***	***Emission Standard, lbs/MMBtu***	***Allowable Emissions, lbs/hr***
Wickes Boiler #1	89	0.18	16.0
Cleaver-Brooks Boiler #2	27.2	0.30	8.85
B&W Boiler #3	33	0.29	9.6
B&W Boiler #4	31	0.29	9.0

5.0 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. 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").

The Agency has determined that the Facility will have regulated emissions of acetaldehyde and vinyl acetate in excess of their respective Action Level. The Agency has determined the HMSER to be an acetaldehyde content limit of 350 ppm and a vinyl acetate content limit of 450 ppm for all coating components used in the paperboard manufacturing process. This HMSER evaluation shall be subject to re-evaluation five (5) years from the date of its determination and shall remain in effect until revised by the Agency.

The coating manufacturer for POLYCO 3103 indicated accurate acetaldehyde concentrations could not be established below 15 ppm. While some residual acetaldehyde may remain within the mixture, a more

conservative content limit for acetaldehyde for both VOC and HAPs assumes 100 percent of the acetaldehyde is emitted. Permit AOP-05-018b set an average HMSER acetaldehyde limit of 350 ppm for the coatings used. The Facility has provided annual test results from Rohm and Haas, which indicate a more accurate average concentration of 206.51 ppm (average concentration for CY 2012). The concentration of acetaldehyde in the coatings shall be provided once a year for HMSER compliance certification.

In addition to Acetaldehyde, POLYCO 3130 contains Vinyl Acetate at concentrations of concern. Assuming 100% emissions as defined above, emissions are estimated to be 82% of the action limits. Test results from Rohm & Haas show average concentrations for CY 2012 of 316.73 ppm, well below the previously defined HMSER.

The Facility has considered using a different formula especially noting styrene. The other formulations still produced HAC's over the Action Level. (ie Rhoplex P-308 was over for Acrylonitrile and Styrene and SBA was over for both Acrylonitrile and 1,3-Butadiene). These latex coatings are more expensive, did not provide the same coverage, or printability.

- Future Emission rate emissions based on 2012's usage of wet coating:Acetaldehyde:(ppm HMSER limit) * (amount of wet Polyco 3103 NP) / 106
- (350 ppm) * (4,812,504) / 106 = 1,684 lbs per year or 0.84 tons per year.

Vinyl Chloride:

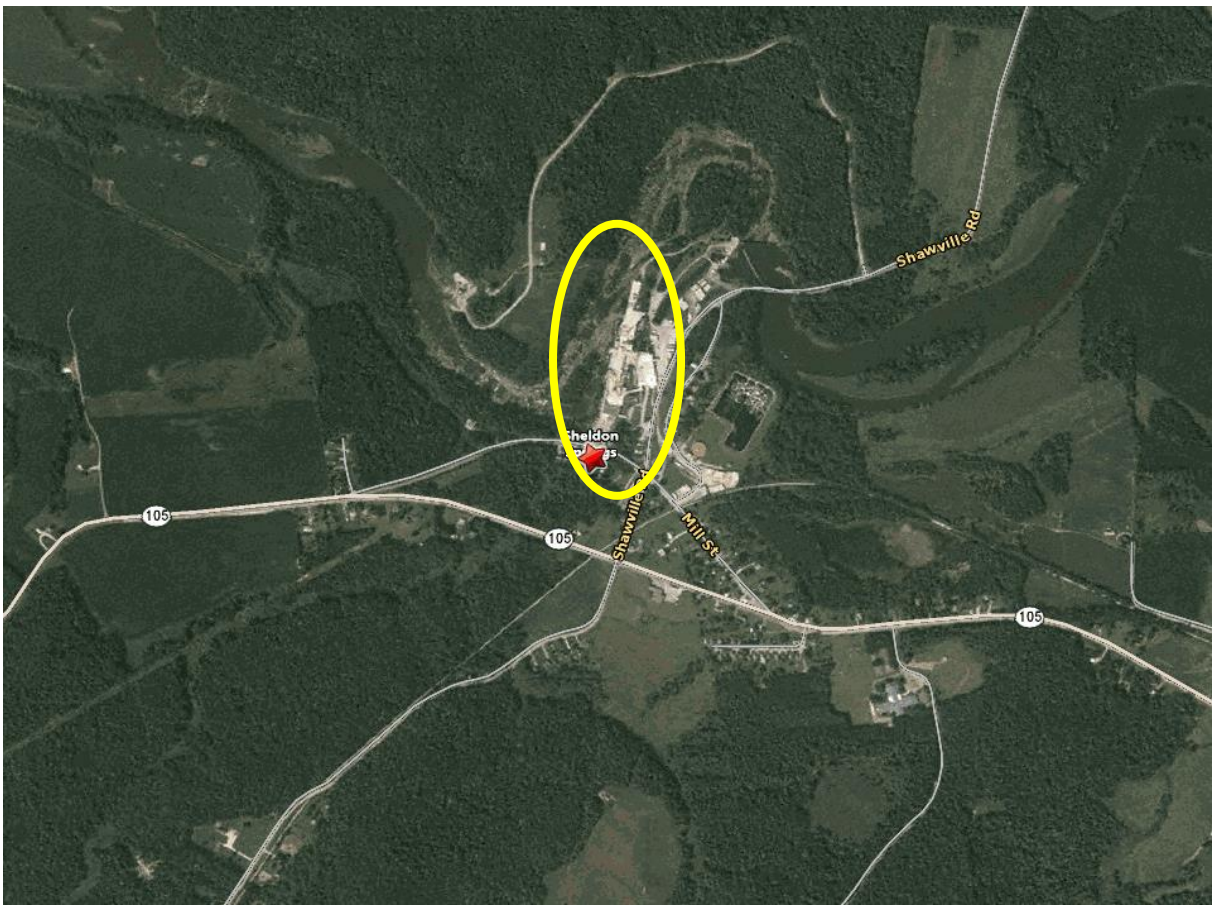
- (ppm HMSER limit) * (amount of wet Polyco 3103 NP) / 10^6
- (450 ppm) * (4,812,504 gal.) / 10^6 = 2165 lbs per year or 1.08 tons per year.

APPENDICES

APPENDIX A – Map of Location

APPENDIX B – Emission Calculations

APPENDIX A – Map of Location



APPENDIX B - Emission Calculations

Coating Dryers

AP – 42 Emission Factors

• PM_{10}	7.6 lb/10^6 cu ft	Section 1.4	Tables 1.4-2	(7/98)
• SO_2	0.6 lb/10^6 cu ft	Section 1.4	Tables 1.4-1	(7/98)
• NO_X	100 lb/10^6 cu ft	Section 1.4	Tables 1.4-1	(7/98)
• CO	84.0 lb/10^6 cu ft	Section 1.4	Tables 1.4-2	(7/98)
• VOC	5.5 lb/10^6 cu ft	Section 1.4	Tables 1.4-2	(7/98)
• HAP	1.89 lb/10^6 cu ft	Section 1.4	Tables 1.4-3 and 1.4-4	(7/98)

Natural gas MMscf for coating dryers

$$MMscf = 5\frac{MMBtu}{hr} \div 0.001050\frac{MMBtu}{MMscf} = 41.7MMscf$$

$$MMscf = 3.264\frac{MMBtu}{hr} \div 0.001050\frac{MMBtu}{MMscf} = 27.2MMscf$$

Total amount of natural gas used:

$$MMscf = 41.7(MMscf) + 41.7(MMscf) + 27.2(MMscf) = 110.6$$

$$Formula\_Emissoins\_from\_Natural\_Gas = 110.6\frac{MMscf}{year} \cdot Emission\_Factor\ \frac{lb}{MMscf} \cdot \frac{1}{2000}\frac{ton}{lb} = \frac{ton}{year}$$

Table B-1: Potential Emissions from Coating Dryers

Pollutant	Emission Factor *lb/MMscf*	Amount of Pollutant *tons per year*
PM	7.6	0.4
SO2	0.6	0.03
NOX	100	5.5
CO	84.0	4.7
VOC	5.5	0.3
HAP	1.89	0.1

Boiler Emissions

Wickes Boiler #1 – 89.0 MMBtu/hr

Limitations – 1,024,800 gallons per year gallons fuel oil per year of No. 6 Fuel Oil
Maximum Sulfur Content by weight: 2.0%

AP – 42 Emission Factors

• PM_{10}	23.1 lb/1000 gal	Section 1.3	Tables 1.3-1 & 1.3-2	(9/98)
• SO_2	314 lb/1000 gal	Section 1.3	Table 1.3-1	(9/98)
• NO_X	55 lb/1000 gal	Section 1.3	Table 1.3-1	(9/98)
• CO	5 lb/1000 gal	Section 1.3	Table 1.3-1	(9/98)
• VOC	0.28 lb/1000 gal	Section 1.3	Table 1.3-3	(9/98)
• HAP	0.155 lb/1000gal	Section 1.3	Table 1.3-9 & 1.3-11	(9/98)

Formulas for emission factors:

$$SO_2 = 157 \cdot S \frac{lb}{1000 gal} = 314 \frac{lb}{1000 gal}$$

Where S=the percent sulfur content(S=2)

$$NO_x = 20.54 + 104.39 \cdot N \frac{lb}{1000 gal} = 72.735 \frac{lb}{1000 gal}$$

Where N = Nitrogen content in fuel. (In this case N = 0.5)

$$PM_{10} = 9.19 \cdot S + 3.22 \frac{lb}{1000 gal} + CPM = 23.1 \frac{lb}{1000 gal}$$

Where CPM = Condensable Particulate Matter. (In this care CPM = 1.5)

Emissions Calculations for the Wickes Boiler No. 6 Fuel Oil:

$$Formula\_Fuel\_Oil\_No.6 = 1{,}024{,}800 \frac{gal}{year} \cdot Emissions\_Factor \cdot \frac{lb}{1000 gal} \cdot \frac{1}{2000} \frac{ton}{lb} = \frac{tons}{year}$$

The Facility is held to a limit of 1,024,800 gallons per year in accordance with AOP-05-018a. The emissions calculation assumes the worst case such that the entire fuel limit is consumed by the Wicks Boiler #1. Additional operating hours up to 8760 hours are based on natural gas consumption.

Table B-2: Wickes Boiler #1 - No. 6 Fuel Oil

	Emission Factor lb/1000 gal	**Amount of Pollutant** *tons per year*
PM	23.1	11.8
SO2	314	160.9
NOX	55	28.2
CO	5	2.6
VOC	0.28	0.1
HAP	0.155	0.1

Emissions Calculations for the Wickes Boiler Natural Gas:

$$\frac{gal}{hour} = 89\frac{MMBtu}{hr} \div 0.15\frac{MMBtu}{gal} = 593.3\frac{gal}{hour}$$

$$hours\_of\_operation\_from\_fuel = 1{,}024{,}800(gal) \div 593.3\frac{gal}{hour} = 1{,}727.3(hours)$$

$$hours\_of\_operation\_from\_NaturalGas = 8760(hours) - 1{,}727.3(hours) = 7{,}032.7(hours)$$

$$MMscf = 80\frac{MMBtu}{hr} \div 0.00105\frac{MMBtu}{scf} \cdot \frac{1}{10^6}\frac{MMscf}{scf} \cdot 7{,}032.7(hours) = 535.8MMscf$$

$$Formula\_Natural\_Gas = 535.8\frac{MMscf}{year} \cdot Emission\_Factor\frac{lb}{MMscf} \cdot \frac{1}{2000}\frac{ton}{lb} = \frac{ton}{year}$$

Table B-3: Wickes Boiler #1 - Natural Gas

	Emission Factor (lb/MMscf)	**Amount of Pollutant** *tons per year*
PM	5.5	1.5
SO2	0.6	0.2
NOX	100	26.8
CO	84	22.5
VOC	5.5	1.5
HAP	1.89	0.5

Four Pass Wet-Back Scotch Boiler, B&W #3, and B&W Boiler #4
Boiler consumption is based on 8760 hours per year of natural gas consumption.

$$Formual\_MMscf = Boiler\_Capacity \frac{MMBtu}{hr} \div \frac{1}{1050}\frac{MMscf}{MMBtu} * 8760 \frac{hours}{year} = \frac{MMscf}{year}$$

$$Formula\_Natural\_Gas = X \frac{MMscf}{year} \cdot Emission\_Factor \frac{lb}{MMscf} \cdot \frac{1}{2000}\frac{ton}{lb} = \frac{ton}{year}$$

Table B-4: Potential Emissions from the Hurst, and B&W Boilers #3 and #4

Cleaver-Brooks Boiler #2			33 MMBtu/hr B&W #3 Boiler Natural Gas			31 MMBtu/hr B&W #4 Boiler Natural Gas		
	Emission Factor (lb/MMscf)	**Amount of Pollutant** *tons per year*		Emission Factor (lb/MMscf)	**Amount of Pollutant** *tons per year*		Emission Factor (lb/MMscf)	**Amount of Pollutant** *tons per year*
PM	5.5	0.9	PM	5.5	1.1	PM	5.5	1.0
SO2	0.6	0.1	SO2	0.6	0.1	SO2	0.6	0.1
NOX	100	11.4	NOX	100	13.8	NOX	100	12.9
CO	84	9.5	CO	84	11.6	CO	84	10.9
VOC	5.5	0.6	VOC	5.5	0.8	VOC	5.5	0.7
HAP	1.89	0.2	HAP	1.89	0.3	HAP	1.89	0.2

Table B-5: Potential Natural Gas Consumption from the Wickes #1 Boiler, Hurst Boiler, and B&W Boilers #3 and #4

Boiler Name	**Capacity** *MMBtu/hr*	**Estimated Amount of Natural Gas** *MMscf per year*
Wickes Boiler #1	80	535.8
Cleaver-Brooks Boiler #2	27.2	227.0
B&W #3	33.0	275.3
B&W Boiler #4	31.0	258.6

Total Fuel consumption MMscf per year: 1,297

Emergency Diesel Generator

Limitations – 200 hours of operation per year,
No. 2 Fuel Oil with a maximum sulfur content by weight of 0.5%
Fuel Consumption of 22,857 gallons per year, 16 MMBtu/hr

AP – 42 Emission Factors

• PM_{10}	0.31 lb/MMBtu	Section 3.3	Table 3.3-1	(10/96)
• SO_2	0.50 lb/MMBtu	Section 1.3	Table 1.3-1	(09/98)
• NO_X	4.41 lb/MMBtu	Section 3.3	Table 3.3-1	(10/96)
• CO	0.95 lb/MMBtu	Section 3.3	Table 3.3-1	(10/96)
• VOC	0.36 lb/MMBtu	Section 3.3	Table 3.3-1	(10/96)
• HAP	0.000168 lb/MMBtu	Section 3.3	Table 3.3-1	(10/96)

$$formula\_gallons\_per\_year = 16\frac{MMBtu}{hr} \div 0.14\frac{MMBtu}{gal} \cdot 200(hours) = 22{,}857.1(gallons\_per\_year)$$

Sulfur Emission limit based on .5% sulfur content by weight

$$SO_2 = (7.05\frac{lb}{gal} \cdot (0.5/100) \cdot 64/32) / 0.14\frac{MMBTU}{gal} = 0.50\frac{lb}{MMBTU}$$

Calculations

$$22{,}857.1\frac{gal}{year} \cdot 0.14\frac{MMBTU}{gal} \cdot Emissions\_Rate\frac{lb}{MMBTU} \cdot \frac{1}{2000}\frac{ton}{lb} = \frac{tons}{year}$$

Table B-3: Potential Emissions from Emergency Diesel Generator		
Pollutant	**Emission Factor** *lb/MMBtu*	**Amount of Pollutant** *tons per year*
PM	0.31	0.5
SO2	0.50	0.9
NOX	4.41	7.1
CO	0.95	1.5
VOC	0.36	0.6
HAP	.000168	~0

Summary

Table B-4: Potential Emissions from Dryers, Boilers, and the Emergency Diesel Generator							
	PM ton/yr	SO2 ton/yr	NOX ton/yr	CO ton/yr	VOC ton/yr	HAP ton/yr	Total ton/yr
Coating Dryers	0.4	0	5.5	4.7	0.3	0.1	11.0
Wickes Boiler #1 - No. 6 Fuel Oil	11.8	160.9	28.2	2.6	0.1	0.1	203.7
Wickes Boiler #1 - Natural Gas	2.0	0.2	26.8	22.5	1.5	0.5	53.5
Cleaver-Brooks Boiler #2 – Natural Gas	0.9	0.1	11.4	9.5	0.6	0.2	22.7
B&W #3 Boiler - Natural Gas	1.1	0.1	13.8	11.6	0.8	0.3	27.7
B&W #4 Boiler - Natural Gas	1.0	0.1	12.9	10.9	0.7	0.2	25.8
Emergency Diesel Generator - Fuel Oil No.2	0.5	0.9	7.1	1.5	0.6	0.0	10.6
Total tons per year	17.7	162.3	105.7	63.3	4.6	1.4	355.0

Table B-5: Fuel Use Per Equipment				
Unit	**Fuel**	**Capacity** (MMBtu/hr)	**Fuel Consumption**	**Hours**
Wickes Boiler #1	No. 6 Fuel Oil	89	1,024,800.0 gallons per year	1727.3
	Natural Gas	80	535.8 MMscf per year	7,032.7
Cleaver-Brooks Boiler #2	No. 6 Fuel Oil	27.0	0.0	0.0
	Natural Gas	27.2	227.0 MMscf	8760
B&W #3	No. 6 Fuel Oil	33	0.0 gallons	0.0
	Natural Gas		275.3 MMscf	8760
B&W Boiler #4	No. 6 Fuel Oil	31	0.0 gallons	0.0
	Natural Gas		258.6 MMscf	8760
Emergency Generator	No. 2 / Diesel	16	22,857 gallons	200

JT
A2 file – Rock-Tenn Converting Company(Missisquoi Mill) – Sheldon Springs