Existing Line #006 (Overhead Line)
Major Modification Air Permit Application

LEGACY CABINETS, INC.
100 Legacy Blvd.
Eastaboga, Alabama 36260

RECEIVED
OCT 21 2021
ADEM AIR DIVISION

September 2021

Prepared By:

LAYTON
ENVIRONMENTAL ENGINEERING, LLC

1900 Crestwood Blvd., Suite 114
Birmingham, Alabama 35210

Phone (205)951-3700 • Fax (205)951-5544

Table of Contents

1.

Facility ID Form

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (AIR DIVISION)

Do not Write in This Space

Facility Number | | | | - | | | | |

CONSTRUCTION/OPERATING PERMIT APPLICATION
FACILITY IDENTIFICATION FORM

1. **Name of Facility, Firm, or Institution:** LEGACY CABINETS, INC.

Facility Physical Location Address

Street & Number: 100 LEGACY BOULEVARD

City: EASTABOGA **County:** TALLADEGA **Zip:** 36260

Facility Mailing Address (If different from above)

Address or PO Box: P.O. BOX 730

City: EASTABOGA **State:** ALABAMA **Zip:** 36260

Owner's Business Mailing Address

2. **Owner:** LEGACY CABINETS, INC.

Street & Number: 100 LEGACY BOULEVARD **City:** EASTABOGA

State: ALABAMA **Zip:** 36260 **Telephone:** 256-631-4888

Responsible Official's Business Mailing Address

3. **Responsible Official:** JOE GROGAN **Title:** VICE-PRESIDENT

Street & Number: 100 LEGACY BOULEVARD

City: EASTABOGA **State:** ALABAMA **Zip:** 36260

Telephone Number: 256-831-4888 **E-mail Address:** jgrogan@legacycabinetsllc.com

Plant Contact Information

4. **Plant Contact:** JOE GROGAN **Title:** VICE-PRESIDENT

Telephone Number: 256-831-4888 **E-mail Address:** jgrogan@legacycabinetsllc.com

5. **Location Coordinates:**

UTM 3715.21 **E-W** 589.06 **N-S**

Latitude/Longitude _____ **LAT** _____ **LONG**

6. **Permit application is made for:**

- [ ] Existing source (initial application)
- [x] Modification
- [ ] New source (to be constructed)
- [ ] Change of ownership
- [ ] Change of location
- [ ] Other (specify) _____

Existing source (permit renewal)

If application is being made to construct or modify, please provide the name and address of installer or contractor

LEGACY CABINETS, LLC

_____

_____ **Telephone** _____

Date construction/modification to begin _____ **to be completed** _____

7. **Permit application is being made to obtain the following type permit:**

- [x] Air permit
- [ ] Major source operating permit
- [ ] Synthetic minor source operating permit
- [ ] General permit

8. **Indicate the number of each of the following forms attached and made a part of this application: (if a form does not apply to your operation indicate "N/A" in the space opposite the form). Multiple forms may be used as required.**

N/A	**ADEM 104 - INDIRECT HEATING EQUIPMENT**
N/A	**ADEM 105 - MANUFACTURING OR PROCESSING OPERATION**
N/A	**ADEM 106 - REFUSE HANDLING, DISPOSAL, AND INCINERATION**
N/A	**ADEM 107 - STATIONARY INTERNAL COMBUSTION ENGINES**
N/A	**ADEM 108 - LOADING, STORAGE & DISPENSING LIQUID & GASEOUS ORGANIC COMPOUNDS**
1	**ADEM 109 - VOLATILE ORGANIC COMPOUND SURFACE COATING EMISSION SOURCES**
N/A	**ADEM 110 - AIR POLLUTION CONTROL DEVICE**
N/A	**ADEM 112 - SOLVENT METAL CLEANING**
N/A	**ADEM 438 - CONTINUOUS EMISSION MONITORS**
N/A	**ADEM 437 - COMPLIANCE SCHEDULE**

9. **General nature of business: (describe and list appropriate standard industrial classification (SIC) and North American Industry Classification System (NAICS) (www.naics.com) code(s)):**

SIC CODE #2511 - MANUFACTURING OF WOODEN CABINETS

NAICS CODE #337110

10. <u>For those making application for a synthetic minor or major source operating permit</u>, please summarize each pollutant emitted and the emission rate for the pollutant. Indicate those pollutants for which the facility is major.

Regulated pollutant	Potential Emissions* (tons/year)	Major source? yes/no
N/A		

*Potential emissions are either the maximum allowed by the regulations or by permit, or, if there is no regulatory limit, it is the emissions that occur from continuous operation at maximum capacity.

11. For those applying for a major source operating permit, indicate the compliance status by program for each emission unit or source and the method used to determine compliance. Also cite the specific applicable requirement.

Emission unit or source: N/A
(description)

Emission Point No.	Pollutant[4]	Standard	Program[1]	Method used to determine compliance	Compliance Status	
					IN[2]	OUT[3]
N/A						

[1]PSD, non-attainment NSR, NSPS, NESHAP (40 CFR Part 61), NESHAP (40 CFR Part 63), accidental release (112(r)),SIP regulation, Title IV, Enhanced Monitoring, Title VI, Other (specify)

[2]Attach compliance plan

[3]Attach compliance schedule (ADEM Form-437)

[4]Fugitive emissions must be included as separate entries

12. **List all insignificant activities and the basis for listing them as such (i.e., less than the insignificant activity thresholds or on the list of insignificant activities). Attach any documentation needed, such as calculations. No unit subject to an NSPS, NESHAP or MACT standard can be listed as insignificant.**

Insignificant Activity	Basis
0.75 MMBTU/HR NATURAL GAS FUEL CURING OVEN	T&I ACTIVITIES LIST

13. List and explain any exemptions from applicable requirements the facility is claiming:

a. N/A

b.

c.

d.

e.

f.

g.

h.

i.

14. List below other attachments that are a part of this application(all supporting engineering calculations must be appended):

a. N/A

b.

c.

d.

e.

f.

g.

h.

i.

I CERTIFY UNDER PENALTY OF LAW THAT, BASED ON INFORMATION AND BELIEF FORMED AFTER REASONABLE INQUIRY, THE STATEMENTS AND INFORMATION CONTAINED IN THIS APPLICATION ARE TRUE, ACCURATE AND COMPLETE.

I ALSO CERTIFY THAT THE SOURCE WILL CONTINUE TO COMPLY WITH APPLICABLE REQUIREMENTS FOR WHICH IT IS IN COMPLIANCE, AND THAT THE SOURCE WILL, IN A TIMELY MANNER, MEET ALL APPLICABLE REQUIREMENTS THAT WILL BECOME EFFECTIVE DURING THE PERMIT TERM AND SUBMIT A DETAILED SCHEDULE, IF NEEDED FOR MEETING THE REQUIREMENTS.

V.P. [illegible] 10-11-21

SIGNATURE OF RESPONSIBLE OFFICIAL **TITLE** **DATE**

RECEIVED
OCT 21 2021
ADEM AIR DIVISION

2.

Process Description

2.1 Background

On 04/30/15 Legacy Cabinets was issued a permit to install Line #6 which consisted of four (4) stain booths, wipe station, two (2) sealer booths, sanding station, four (4) topcoat booths and a curing oven. VOC emission were limited to 39.5 tpy. In 2017 the facility submitted a PSD Permit Application to ADEM requesting that the Annual VOC limit be increased to 110.0 tpy. The request also contained the following PSD BACT limitations on coating.

Coating	lbs VOC/gallon coating (weighed average)
Stains	1.58
Sealers	0.62
Topcoats	2.30
Catalyst	1.55

The permit for the above increase was issued on October 18, 2017.

2.2 Proposed Modification

Consumer demands have required the facility to modify their existing coating formulations. To allow flexibility Legacy requests the following changes to Line #6.

1. Decrease allowable VOC emissions from 110 tpy to 63 tpy.
2. Increase the weighted average lbs VOC/gallon coating to the following:

Coating	lbs VOC/gallon coating (weighed average)*
Basecoats (stains)	1.80
Topcoats	3.10

*lbs VOC/gallon limits for sealers and catalyst will not change.

2.3 VOC Change Due to VOC lbs/ Gallon Increase.

The increase in VOC emissions based upon the increase in lbs VOC/gallon values and projected maximum coating usage limits is for the Basecoats and Topcoats are as follows:

a. Annual VOC emissions based upon existing coating lbs VOC/gallon limit and future worst case coating usage

Coating	VOC (lbs/gallon)	Gallons/Yr	VOC (tpy)
Basecoats (stains)	1.58	17,500	13.825
Sealers	0.62	N/A	
Topcoats	2.30	30,000	34.50
Catalyst	1.55	N/A	
Total			48.325

b. Annual VOC emission based upon future (proposed) coating lbs VOC/gallon limit at future worst case coating usage. (Basecoats and Topcoats)

Coating	VOC (lbs/gallon)	Gallon/Yr	VOC (tpy)
Basecoats (stains)	1.80	17,500	15.75
Sealers	N/A	N/A	
Topcoats	3.10	30,000	46.50
Catalyst	N/A	N/A	
Total			62.25

c. Annual tons of VOC/yr change due to modification

	VOC (tpy)		
Coating	Post-Modification	Pre-modification	Change
Basecoats (stains)	15.75	13.825	1.925
Sealers	N/A	N/A	
Topcoats	46.50	34.50	12.00
Catalyst	N/A	N/A	
Total			13.925

All of the above is based upon 5,000 hours of operation per year.

2.4 Summary

Legacy Cabinets LLC requests the following modification to Surface Coating Line #006:

1. The line be limited to spraying only basecoat (stains) and topcoats.

2. The weighed VOC/gallon limit for basecoats be increased from the current permit limit of 1.58 lbs/gallon to 1.80 lbs/gallon.

3. The weighed VOC/gallon limit for topcoats be increased from the current permit limit of 2.30 lbs/gallon to 3.10 lbs/gallon.

The modifications will result in a Line #6 VOC emission reduction of 43%.

% Reduction = [(110 tpy-63 tpy) / (110 tpy)] (100)

= 43

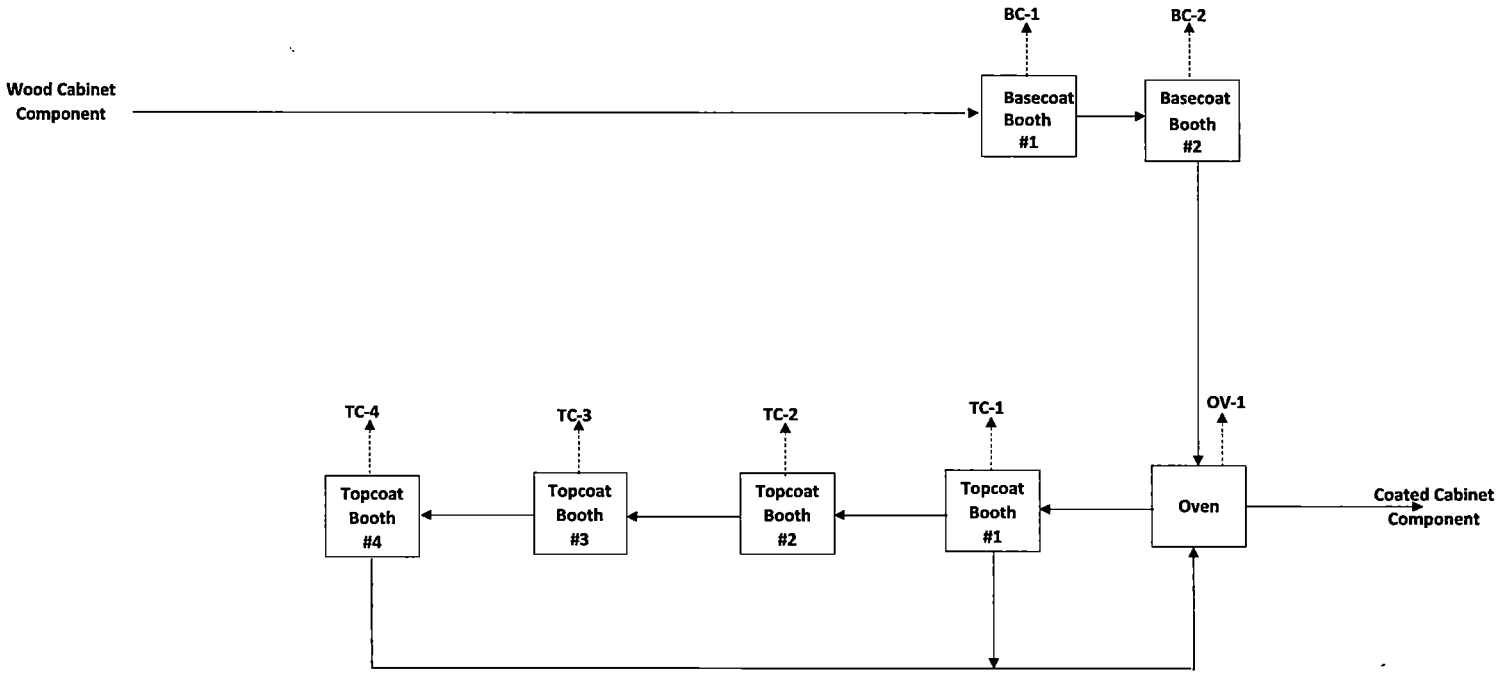
The proposed basecoat (stains) weighted limit of 6.60 lbs VOC/gallon (minus water and exempt solvents) limit meets the most stringent limit identified in the BACT Clearinghouse.

The proposed topcoat weighed limit of 1.80 lbs VOC/lbs solids meets the most stringent limit identified in the clearinghouse.

Legacy Cabinets LLC performed a BACT analysis on add-on control devices to determine if any options are cost effective in further reducing VOC emissions. The analysis was conducted assuming that line #6 had not been permitted. The results show that installation of add-on controls is not cost effective.

3.

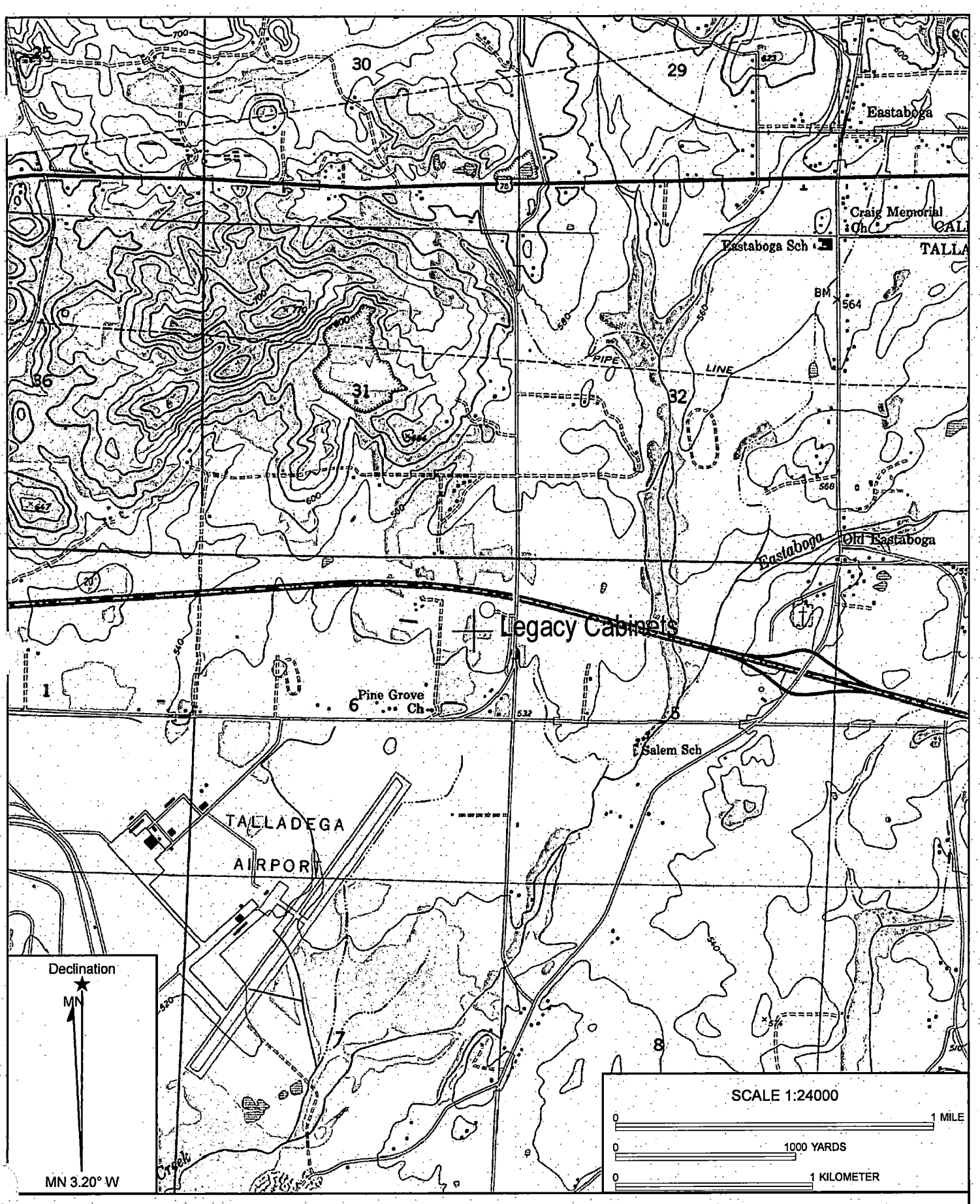
Flow Diagram



FLOW DIAGRAM

4.

Facility Location



Name: EASTABOGA (AL)
Date: 03/20/20
Scale: 1 inch = 2,000 ft.

Location: 033° 35' 03.77" N 086° 02' 27.15" W

5.

BACT Analysis

5.1

BACT Methodology

5.1 BACT Methodology

5.1.1 General

Table 1.1

Key Steps in the "Top-Down" BACT Process

STEP 1:	**IDENTIFY ALL CONTROL TECHNOLOGIES** - LIST is comprehensive
STEP 2:	**ELIMINATE TECHNICALLY INFEASIBLE OPTIONS** - A demonstration of technical infeasibility should be clearly documented and show, based on physical, chemical, and engineering principles, that technical difficulties would preclude the successful use of the control option on the emission unit under review.
STEP 3:	**RANK REMAINING CONTROL TECHNOLOGIES BY CONTROL EFFECTIVENESS** - control effectiveness (percent pollutant removed) - expected emission rate (tons per year) - expected emission reduction (tons per year) - energy impacts (BTU, kwhr) - environmental impacts (other media and the emissions of toxic and hazardous air emissions) - economic impacts (total cost effectiveness, incremental cost effectiveness)
STEP 4:	**EVALUATE MOST EFFECTIVE CONTROLS AND DOCUMENT RESULTS** - case-by-case consideration of energy, environmental, and economic impacts - if top option is not selected as BACT, evaluate next most effective control option
STEP 5:	**SELECT BACT** - most effective option not reject is BACT

5.1.2 Eliminate Technically Infeasible Options

In this step, the technical feasibility of the control options identified is evaluated with respect to the source-specific (or emissions unit-specific) factors. A demonstration of technical infeasibility should be clearly documented and should show, based on physical, chemical, and engineering principles, that technical difficulties would preclude the successful use of the control option on the emission unit under review. Technically

infeasible control options are then eliminated from further consideration in the BACT analysis.

5.1.3 Rank Remaining Control Technologies by Control Effectiveness

All remaining control alternatives not eliminated in are ranked and then listed in order of overall control effectiveness for the pollutant under review, with the most effective control alternative at the top. A list should be prepared for each pollutant and for each emissions unit (or grouping of similar units) subject to the BACT analysis. The list should present the array of control technology alternatives and should include the following types of information:

- control efficiencies (percent pollutant removed);
- expected emission rate (tons per year, pounds per hour);
- expected emissions reduction (tons per year);
- environmental impact [includes any significant or unusual other media impacts (e.g., water or solid waste), and , at a minimum, the impact of each control alternative on emissions of toxic or hazardous air contaminants];
- energy impacts.

5.1.4 Evaluate Most Effective Controls and Document Results

After the identification of available and technically feasible control technology options, the energy, environmental, and economic impacts are considered to arrive at the final level of control. At this point, the analysis presents the associated impacts of the control option in the listing. For each option, the applicant is responsible for presenting an objective evaluation of each impact. Both beneficial and adverse impacts should be discussed and, where possible, quantified. In general, the BACT analysis should focus on the direct impact of the control alternative.

5.1.5 Select BACT

The most effective control option not eliminated is proposed as BACT for the pollutant and emission unit under review.

5.2

Potential BACT Options

5.2 POTENTIAL BACT OPTIONS

Potentially applicable control alternatives can be categorized in three ways:

- **Inherently Lower-Emitting Processes/Practices**, including the use of materials and production processes and work practices that **prevent** emissions and result in lower "production-specific" emissions:

- **Add-on Controls,** such as carbon adsorbents, thermal oxidizers and other devices that **control** and **reduce** emissions after they are produced; and

- **Combination of Inherently Lower Emitting Processes and Add-On Controls**

In an effort to determine potentially applicable control technology alternatives, the following information sources were consulted:

- EPA's BACT/LAER Clearinghouse and Control Technology Center;
- Control Technology vendors;
- Technical journals, reports and newsletters;
- EPA's New Source Review (NSR) bulletin board;
- ENSR Consulting and Engineering; and
- Emission Standard Division, EPA Research Triangle Park

The BACT/LAER Clearinghouse documented only a handful for BACT/LAER determinations for facilities within the wooden furniture-kitchen cabinet category.

5.2.1 Inherently Lower Emitting Processes/Practices

5.2.1.1 Coating Reformulation

- **Waterborne Coatings**

There are two basic types of waterborne systems: full and hybrid. In a full waterborne system, all the coatings are reformulated with water; in a hybrid system, only selected coatings are reformulated, generally the clear coats.

- **Other Low VOC Coatings**
  Other types of low VOC coatings are high solids polyester and high solids polyurethane (pe/pu) two component catalyzed coating systems. Both of these coatings are similar; they are nearly 100 percent solids with negligible VOC contents.

5.2.1.3 **Spray Booth Design and Operation**

- **Reciprocating Spray Machines (Automated Spray Booths)**
  Reciprocating spray machines have become quite popular in recent years for coating flow pieces having similar dimensions.

5.2.1.3 **Increased Transfer Efficiency**

VOC emissions may also be reduced by increasing the transfer efficiency of the applicator. Four types of alternative spray guns are discussed

- **Airless Spraying**
  Airless spraying is similar to conventional compressed air spraying except that instead of using a compressed air stream to atomize the paint, hydraulic impingement of the paint stream at pressures of 1,000 to 3,000 pounds per square inch (psi) is used.
- **Air Assisted Airless Spraying**
  Air assisted airless spraying is a combination of the combination of the compressed air and airless systems. Paint is forced through the nozzle under pressure (300 to

500 psi) and a lower pressure air stream (15 to 20 psi) completes the atomization.

- **High Volume Low Pressure Spraying (Turbine Spraying)**
  High volume low pressure (HVLP) spraying systems are low pressure systems that do not require compressed air for operation. This system uses a relatively high volume of air at low pressure (7 psi) instead of low volumes at high pressure (30-60 psi) as in compressed air spraying.
- **Airless Electrostatic**
  Electrostatic spray utilizes the attractive forces between materials of opposite electrical charge as an aid in supplying a uniform coating to various surfaces. The method reduces overspray and waste and thereby increases the coating's application efficiency over conventional spray coating processes.
- **Air Electrostatic**
  Air electrostatic spraying is a combination of the conventional air atomization system and electrostatics. It enhances the versatility and simplicity of conventional application with the attraction of electrically charged paint to a grounded surface.

5.2.1.4 Coating Usage Limitation w/ Coating Reformulation

This option involves reducing the quantity of coatings used in the process and coating reformulation.

5.2.2 Add-on Controls

In addition to reformulating the coatings and increasing transfer efficiency another available BACT control option is add-on controls. Add-on controls are installed downstream of the VOC source and either destroy or recover the VOC vapors. Seven different add-on control technologies are possible BACT

alternatives for this industry. They include four thermal oxidation technologies (recuperative thermal oxidizers, regenerative thermal incinerators, fixed bed catalytic oxidizers, and fluidized bed catalytic oxidizers); carbon adsorption; combination techniques (thermal oxidation and adsorption) ultraviolet/activated ozone oxidation (UV/AO) and biofiltration.

5.2.2.1 Recuperative Thermal Incineration

The first potentially feasible add-on technology described for the control of VOC emissions in the wood finishing industry is recuperative thermal oxidation. An efficient thermal oxidizer design must provide adequate dwell or residence time for complete combustion, sufficiently high temperatures for VOC destruction, and adequate velocities to ensure proper mixing without quenching combustion. The type of burners and their arrangement affect combustion rates and resident time, that is, the more thorough the contact between the flame and VOC, the shorter the time required for complete combustion. To achieve maximum efficiency, all combustible matter should be passed through the burner.

5.2.2.2 Regenerative Thermal Incineration

The second potentially feasible add-on control technology described for controlling VOC emissions from wood finishing industry is regenerative thermal oxidation. Regenerative thermal oxidizers provide a high degree of thermal heat recovery (up to 95 percent). This is useful for situations where the air flow rate is high and VOC concentration is low. These cases would require a significant amount of heat recovery to minimize overall system operating costs. For this reason, a regenerative thermal oxidation system, which maintains a very high thermal efficiency with respect to traditional thermal oxidation designs, is evaluated.

5.2.2.3 Fixed Bed Catalytic Incineration

The third add-on technology described for the control of VOC emissions from the wood finishing industry is catalytic thermal oxidation. In a catalytic thermal oxidizer, a catalyst is used to lower the activation energy needed for oxidation. When a preheated gas stream is passed through a

catalytic thermal oxidizer, the catalytic bed initiates and promotes the oxidation of the VOC without being permanently altered itself. In catalytic thermal oxidation, combustion occurs at significantly lower temperatures than in thermal oxidation; however, care must be taken to ensure complete combustion. As with recuperative thermal incineration, the maximum heat recover available for this technology, 70 percent, is used to minimize annual operation costs.

5.2.2.4 Fluidized Bed Catalyst Incineration

The fourth potentially feasible add-on technology described for control of VOC emissions is fluidized bed catalyst thermal oxidation.

5.2.2.5 Carbon Adsorption

The fifth potentially feasible add-on technology described for control of VOC emissions is carbon adsorption. Vapor phase carbon adsorption has been shown to be an effective means of recovering solvents from atmospheric discharges. The technique is preferred for applications where alternative systems are unable to produce the required low outlet concentration at a reasonable cost.

5.2.2.6 Combination Technologies

Recently, vendors have begun offering a system that utilizes aspects of zeolite or carbon adsorption followed by catalytic or thermal oxidation in the same control unit. This series achieves high VOC removals (90+ percent) without the generation of a liquid waste stream (as is the case with steam desorption). In addition, by concentrating the VOC in the gas stream, the fuel costs for incineration are markedly reduced.

5.2.2.7 Ultraviolet/Activated Oxygen (UV/AO) Oxidation

This process uses ultraviolet (UV) light and activated oxygen/ozone to destroy VOCs.

5.2.2.8 Biofiltration

In biofiltration, gases containing biodegradable organic compounds are vented through a biologically active material. The biofilm contains a population of microorganisms on a porous filter material. As gases pass

through the biofilter, the organics partition from the gaseous phase to the liquid phase of the biofilm. From the liquid phase, the contaminants are available for the oxidation process through the microorganism on the biofilm. Control efficiency vary on several things to include water solubility of the VOC and can range from 10%-90%

5.3

Technical Feasibility of Potential BACT Options for the Wooden Furniture Industry

5.3 TECHNICAL FEASIBLITY OF POTENTIAL BACT OPTIONS FOR THE WOODEN CABINET INDUSTRY

The technical feasibility for each control technology was developed based on commercial availability of the control technology, the demonstrated use of the technology in various segments of the wood cabinet industry, and the input from equipment vendors, coating suppliers, and other industry experts. Most of this information was obtained directly from vendors, the ENSR Consulting and Engineering, and National Economic Research Associates, Inc. Report mentioned in Chapter 6, and the EPA document entitle "Control of VOC Emissions from Wood Furniture Coating Operations – Draft".

In general, for a control technology to be considered feasible, for application as BACT, it must be commercially available, and demonstrated in several wood finishing industry installations. The only exception would be add-on controls, which have a history of being used for a wide range of different industries and VOC sources.

Table VIII.C.1 presents a summary of the technical feasibility determination for the kitchen cabinet industry. Technologies which were not determined to be feasible for the industry are not included in this table.

Table VIII.C.1

Technical Feasibility of Alternative VOC Control Technologies

Airless or Air Assisted Spraying	HVLP Guns	Add-On Controls	Waterborne Coatings	Coating Reformulation	UV Curing	Reciprocating Spray Machines	Coating usage Limitation's w/ Coating Reformulation
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

5.4

Technical Feasibility for Potential BACT Options at Legacy Cabinets Inc.

5.4 TECHNICAL FEASBILITY OF POTENTIAL BACT OPTIONS AT LEGACY CABINETS

The technical feasibility of those options identified in the preceding chapter with regards to Legacy Cabinets, Inc. is discussed in the following sections:

5.4.1 HVLP Guns/Air Assisted Airless

At Legacy Cabinets, Inc. HVLP and air assisted airless spraying techniques are currently being used.

5.4.2 Add-on Controls

There is extensive operating experience in the industry with various add-on controls for reducing VOC emissions. Among these are regenerative and recuperative thermal oxidation, catalytic thermal oxidation, carbon adsorption, etc. According to industry experts there are only two add-on controls that are economically feasible for the kitchen cabinet industry: Regenerative Thermal Oxidizer and Zeolite Rotor Concentrator.

5.4.3 Waterborne Coatings

At the present time, Legacy Cabinets Inc. is using hybrid waterborne coatings and is continually working with coating supplier to reduce the VOC content in the coatings. Waterborne coatings are not feasible for this line.

5.4.4 UV Curing

UV curable coatings are feasible for sealer and topcoat applications on flat lines and are not feasible for overhead lines.

5.4.5 Reciprocating Spray Machines

Reciprocating spray machines are not feasible for overhead lines.

5.4.6 Coating Usage Limitation w/ Coating Reformulation

Coating usage/limitations w/ coating reformulation is feasible.

5.4.7 Coating Reformulation

Legacy Cabinets, Inc. is continually working with vendors to develop coatings that have a lower VOC content. During the past several years, the company has been successful in achieving their goal of reducing the VOC content of many of the coatings. However, coating reformulation to lower VOC content is not feasible for this project.

5.4.8 Summary

The technical feasibility of the above options for installation on the proposed surface coatings line at Legacy Cabinets, Inc. are summarized below.

Airless or Air Assisted Spraying	HVLP Guns	Add-On Controls	Waterborne	Coating Reformulation	UV Curing	Reciprocating Spray Machines	Coating Usage Limitations w/ Coating Reformulation
Yes Existing (sealers and topcoats)	Yes Existing (stains)	Yes	No	No	No	No	Yes

5.5

RACT/BACT/LAER Clearinghouse

5.5.1 General

For the period of 01/01/11 to 09/15/21 the RACT/BACT/LAER Clearinghouse identified three (3) facilities in the Wood Products/Furniture Surface Coating Category.

The three facilities are shown below:

ID	Facility
AL	Legacy Cabinets, Inc.
IL-0122	Masterbrands Cabinets, Inc.
IN-0280	Masterbrands Cabinets, Inc.

5.5.2 Feasibility of Applying BACT at the Identified Three (3) Facilities to Legacy Cabinets, Inc.

5.5.2.1 Legacy Cabinets (AL-0314)

Coating reformulation was considered BACT, however it is not applicable for this project.

5.5.2.2 Masterbrand Cabinets, Inc. (IL-0122)

This process addressed the following uncontrolled operations: Main 1 (West) : Pre-seal, Sealer and topcoat Main 2 (East): Pre-Seal, Sealer and topcoat Trim UV (Flat Molding) Fiberboard Limits: i. stains, toners and glazes (less water and exempt compounds) : Opaque Stain- 4.7 lb/gal, Non-topcoat pigmented coat-5.0 lb/gal, Repair coat- 5.6 lb/gal, Semi-transparent stain 6.6 lb/gal, Washcoat-6.1 lb/gal ii. Sealers (including pre-seals): Acid-cured alkyd amino vinyl sealer-2.3 lb VOM/lb solids, All other sealers-1.9 lb VOM/lb solids iii. Topcoats: Acid-cured alkyd amino conversion varnish topcoats-2.0 lb VOM/lb solids, All other topcoats-1/8 lb VOM/lb solids

Some of the above are applicable for this project.

5.5.2.3 Masterbrand Cabinets, Inc. (IN-0280)

BACT was determined to be 5.30 lbs VOC/gallon applied in topcoat/opaque spray booths. The above is not applicable for this project.

5.6

BACT Selection Process

5.6.1 METHODOLOGY

After identifying and listing the available control technology, the next step is the determination of the energy, economic and environmental impacts of each option, and the ultimate selection of the final level of control.

Total capital and annual costs presented in this section were obtained from the following sources.

1. EPA OAQPS Control Cost Manual, January 2002.
2. An Evaluation of VOC Emission Control Technology for the Wood Furniture and Cabinet Industries
3. EPA Guidelines Series – Control of VOC Emissions from Wood Furniture and Coating Operations
4. EPA Handbook – Control Technology for Hazardous Air Pollutants
5. EPA Document – Control of Air Emissions from Superfund Sites
6. Vendor Information

The feasibility analysis conducted in Section VIII showed that the following add-on controls warrant further consideration.

1. Regenerative Thermal Oxidizer (RTO)
2. Zeolite Rotor Concentrator / RTO

5.6.2 POTENTIAL BACT OPTIONS

5.6.2.1 Baseline Calculations

Potential VOC emissions are based upon the following:

a. 5,000 hrs/year operation

b. Installation of one (1) existing surface coating line consisting of six (6) spray booths and one (1) oven.

c. Emissions from the Line #6 are uncontrolled

Coating	Usage Potential (Gallons)	VOC Emission Rate (lbs/gallon)	VOC Emissions (Total) Potential
A. Stain (basecoat)	17,500	1.80	15.75
B. Topcoat	30,000	3.10	46.50
TOTAL	47,500		62.25

Baseline assumption and calculations are further detailed

5.6.2.1 Coating Usage Limitation w/ Coating Reformulation (option CUL)

The reformulated basecoats and topcoats will meet the most stringent limits identified in the BACT clearinghouse for the wooden kitchen cabinet industry. Legacy Cabinets requests a basecoat (stain) limit of 6.60 lbs VOC/gallon (minus water and exempts) and a topcoat limit of 1.80 lbs VOC/ solid.

5.6.2.2 Add-on Control Device

Add-on controls considered for controlling VOC emissions from the baseline option include the following:

1. Regenerative Thermal Oxidation
2. Zeolite Rotor Concentrator/RTO

According to Mr. Scott Bayon, Director of Sales at Anguil, a major supplier of air pollution equipment for the wood products industry, Zeolite Rotor

Concentrator/RTO and the Regenerative Thermal Oxidation are only viable technologies when considering both capital and operating costs for a large system.

Add-on controls will be evaluated for the following operating scenarios:

1. **Option A** – Control device will treat emissions from all coating booths and the curing oven using an RTO.
2. **Option B** – Control device will treat emissions from all coating booths using a Zeolite Rotor Concentrator/RTO.

Options to be evaluated include the following:

1. Regenerative Thermal Oxidizer (A-1)
2. Zeolite Rotor Concentrator/RTO (A-2)

Cost Calculations for add-on controls are enclosed as Appendix B.

5.6.3 Evaluation of Options

5.6.3.1 Evaluation of Controls

The economic impact and environmental impact analysis will be used to determine BACT.

5.6.3.2 Economic Impact

The average cost effectiveness of each technology option is summarized in Table 5.1.

Table 5.1

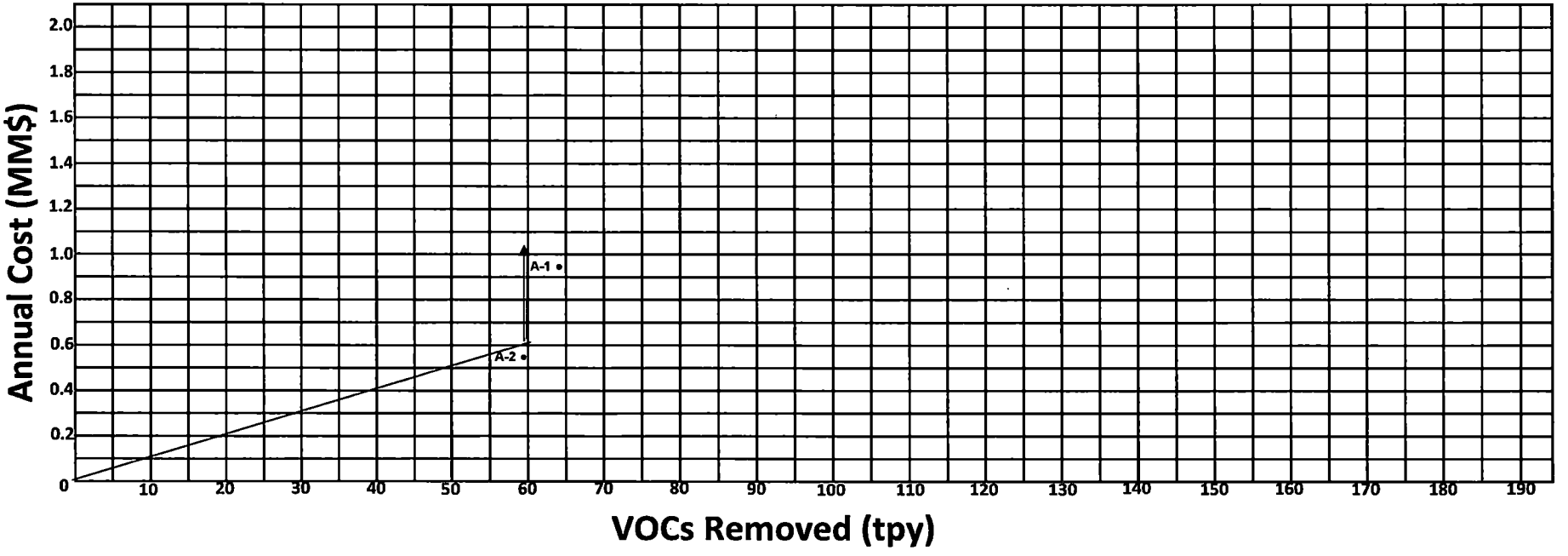
Average Cost Effectiveness

Technology Option	Baseline Emission Rate (tpy)	Capital Cost ($)	Annual Cost ($)	Total Emission Reduction (tpy)	Cost Effectiveness ($/T)
Coating Usage Limitation w/ Coating Reformulation (CUL)	N/A	N/A	N/A	N/A	N/A
A-1	62.25	3,707,576	1,059,864	59.14	17,821
A-2	62.25	3,708,367	805,682	59.14	13,623

In addition to the average cost effectiveness of an option, incremental cost effectiveness between dominant control options was also calculated. The incremental cost effectiveness was examined in combination with the average cost effectiveness in order to justify elimination of options. The incremental cost effectiveness calculation compares the cost and emissions performance level of an option to those of the next most stringent option.

The incremental cost-effectiveness comparisons focused on annualized cost and emission reduction differences between **dominant** options. Dominant set of options are determined by generating the envelope of least-cost options. This is a graphical plot of total annualized costs for a total emissions reduction for all options identified in the BACT analysis (see Figure 5.1).

FIGURE 5.1


Annual Cost (MM$)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
A-1
A-2
VOCs Removed (tpy)

Based on the information presented in Figure 3.1, it appears that the option having the highest incremental cost effectiveness between dominant options is Option CUL (Coating Usage Limitation w/ Coating Reformulations). The incremental costs are shown in Table 5.2.

Table 5.2
Incremental Cost Effectiveness

Technology Option	Incremental Annualized Cost ($)	Emission Reduction (tons/yr)	Incremental Cost Effectiveness ($/ton)
Zeolite Rotor Concentrator /RTO (A-2)	805,682	59.14	13,623
Coating Usage Limitations w/ Coating Reformulation (CUL)	N/A	N/A	N/A

5.6.3.3 ENERGY AND ENVIRONMENTAL IMPACTS

The environmental impacts associated with each of the technology options are shown in Table 5.3.

Based on the information in Table 5.3, it appears that all of the technology options have a minimal adverse impact upon the environment.

Table 5.3

Energy and Environmental Impacts

Technology Option	Electric Usage KW-hr/yr	Fuel Usage MMBTU/yr	Steam Usage lbs/yr	Liquid Waste gal/yr	Solid Waste lbs/yr	Secondary Air Emissions tons/yr
Regenerative Thermal Oxidizer (A-1)	1,595,000	50,035	N/A	N/A	N/A	4.93
Zeolite Rotor Concentrator /RTO (A-2)	605,000	13,885	N/A	N/A	N/A	1.41
Coating Usage Limitation w/ Coating Reformulation (CUL)	N/A	N/A	N/A	N/A	N/A	N/A

5.6.4 BACT SELECTION

Legacy Cabinets, Inc. has determined that coating reformulation constitutes BACT. The next dominant option (A-2) would reduce VOC emissions from 62.25 tpy to 3.12 tpy at an incremented cost of $13,623/ton. Legacy Cabinets considers this cost to be too excessive and proposes the following BACT limits:

1. VOC emissions from Line #006 be limited to 62.25 tpy
2. Legacy Cabinets on a rolling twelve-month basis will not exceed the VOC limits set forth in Table 4.1 for Line #006.

Table 4.1

LBS VOC/gallon (average)

Coating	Existing	Proposed		
	lbs VOC/gallon	lbs VOC lbs solid	lbs VOC/gallon minus water and exempts	lbs VOC/gallon
Basecoat (stains)	1.58	N/A	6.60	1.80
Topcoat	2.30	1.80	N/A	3.10

3. Facility-wide HAP emissions will not exceed 0.70 lbs HAP/lb Solids based upon a rolling 12-month total. This is below the Subpart JJ Standard of 0.8 lbs HAP/lb Solids for new facilities.
4. Line #006 HAP emissions will not exceed 0.30 lb HAP/lbs Solids based upon a rolling 12-month total.

The proposed BACT limits were compared to data from the RACT/BACT/LAER Clearinghouse. The limits meet those established in the clearinghouse.
As discussed earlier, installation of add-on controls has been eliminated because of disproportionately high average and incremental cost, and capital cost.

6.

Applications

Overhead Line (Line #006)

Note:

Application assumes worst case conditions were only Basecoats and Topcoats are being sprayed. These two coating categories have the highest VOC lb/gallon emission rate.

PERMIT APPLICATION
FOR
VOLATILE ORGANIC COMPOUND (VOC)
SURFACE COATING EMISSION SOURCES

☐☐☐ - ☐☐☐☐ - ☐☐☐☐
Do not write in this space

1. **Name of firm or organization:** LEGACY CABINETS, INC.

2. **Identification Name or Number given to this process:** OVERHEAD COATING LINE #006

3. **Type of surface coating process:**

- ☐ **Can coating**
- ☐ **Coil coating**
- ☐ **Metal furniture coating**
- ☐ **Surface coating of large appliances**
- ☐ **Misc. metal parts & products**
- ☐ **Flatwood paneling coating**
- ☐ **Paper, fabric and vinyl coating**
- ☐ **Magnet wire coating**
- ☐ **Automobile and light duty truck manufacturing**
- ☑ **Other (specify):** SURFACE COATING OF WOODEN CABINETS

4. **Briefly describe the operation of this surface coating process in your facility:**

OVERHEAD LINE (LINE #006)

LEGACY CABINETS INC. OPERATES A OVERHEAD SURFACE COATING LINE (LINE #006) AT THEIR EASTABOGA, ALABAMA FACILITY. THE LINE CONSISTS OF TWO (2) BASECOAT (STAIN) BOOTHS. FOUR (4) TOPCOAT BOOTHS AND A CURING OVEN.

EMISSIONS WILL BE LIMITED TO 62.50 TONS OF VOC PER YEAR BASED UPON A ROLLING TWELEVE-MONTH TOTAL.

HOURS OF OPERATION SHALL BE LIMITED TO 5,000 HOUR PER YEAR.

5. **Normal operating schedule:**

Hours/ day: 20 **Days/ week:** 5 **Weeks/ year:** 50

Peak production season (if any): N/A

6. **Coating material used in unit or process (as applied). Do not include diluents added to coatings (see item 7).**

Coating Material	Coating Method	Max. gal/hr	Total gal/yr.	Density lbs/gal	% wt Solid	% wt Water	% wt VOC	VOC's applied lbs/year
VARIOUS BASECOAT (STAINS)	SPRAY	3.50	17,500	7.1686	11.95	1.00	25.10	31,500
TOPCOAT	SPRAY	6.00	30,000	8.83	38.06	0.00	35.10	93,000
SEALER	SPRAY	N/A	N/A	8.37	32.02	0.00	7.41	N/A

Total (lbs/year)	124,500
Total (tons/year)	62.25

7. **Description of organic liquid diluents (coating thinners & additives) added to the surface coatings:**

Diluents	Amt. added per gallon	Coating material	Total gal/yr.	Density lbs/gal	% wt Water	% wt VOC	VOC's lbs/year
CATALYST	VARIES	N/A	N/A	8.35	0.00	18.56	N/A
					Total (pounds/year)		N/A
					Total (tons/year)		N/A

8. **Description of all organic liquid solvents used for wash or clean up:**

Solvents	Total gal/yr.	Density lbs/gal	% wt Water	% wt VOC	VOC's lbs/year
RO42	VARIES	6.67	0.00	64.70	N/A
			Total (pounds/year)		N/A
			Total (tons/year)		N/A

9. After coating, materials are: ☑Oven dried ☐Air dried ☐Warm air tunnel dried

If oven or warm air tunnel dried, the total fuel heat input is (exclude fuels used by indirect heating equipment previously described on ADEM Form 104.): 0.75 MMBtu/hr

Fuel	Heat Content	Units	Max. % Sulfur	Max. % Ash	Grade No. [fuel oil only]	Supplier [used oil only]
Coal		Btu/lb				
Fuel Oil		Btu/gal				
Natural Gas	1,000	Btu/ft³	N/A	N/A	N/A	N/A
L. P. Gas		Btu/ft³				
Wood		Btu/lb				
Other (specify)						

10. Air contaminant emission points: (each point of emission should be listed separately and numbered so that it can be located on the attached flow diagram):

Emission Point	Stack							
	UTM Coordinates		Height Above Grade (Ft)	Base Elevation (Ft)	Diameter (Ft)	Gas Exit Velocity (Ft/Sec)	Volume of Gas Discharge d (ACFM)	Exit Temperature (°F)
	E-W (km)	N-S (km)						
BC-1	589.050	3761.408	20	540	3.0	28.29	16,000	68
BC-2	589.055	3761.405	20	540	3.0	28.29	16,000	68
TC-1	589.064	3761.406	20	540	3.0	28.29	16,000	68
TC-2	589.702	3761.403	20	540	3.0	28.29	16,000	68

* std temperature is 68°F - std pressure is 29.92" in hg.

CONTINUED

9. After coating, materials are: ☐ Oven dried ☐ Air dried ☐ Warm air tunnel dried

If oven or warm air tunnel dried, the total fuel heat input is (exclude fuels used by indirect heating equipment previously described on ADEM Form 104.): _____ MMBtu/hr

Fuel	Heat Content	Units	Max. % Sulfur	Max. % Ash	Grade No. [fuel oil only]	Supplier [used oil only]
Coal		Btu/lb				
Fuel Oil		Btu/gal				
Natural Gas		Btu/ft³				
L. P. Gas		Btu/ft³				
Wood		Btu/lb				
Other (specify)						

10. Air contaminant emission points: (each point of emission should be listed separately and numbered so that it can be located on the attached flow diagram):

Emission Point	Stack							
	UTM Coordinates		Height Above Grade (Ft)	Base Elevation (Ft)	Diameter (Ft)	Gas Exit Velocity (Ft/Sec)	Volume of Gas Discharge d (ACFM)	Exit Temperature (°F)
	E-W (km)	N-S (km)						
TC-3	589.052	3761.428	20	540	3.0	28.29	16,000	68
TC-4	589.052	3761.434	20	540	3.0	28.29	16,000	68
OV-1	589.082	3761.427	20	540	1.0	53.05	10,000	100

* std temperature is 68°F - std pressure is 29.92" in hg.

11. **Air contaminants emitted: basis of estimate (material balance, stack test, emission factor, etc.) must be clearly indicated on calculations appended to this form. Fugitive emissions must be included and calculations must be appended.**

Emission Point	Pollutants	Potential Emissions (lb/hr)	Potential Emissions (Tons/yr)	Basis of Calculation	Regulatory Emission Limit (lb/hr)	Regulatory Emission Limit (units of standard)
BC-1	A. VOC	2.835	7.088	MASS BALANCE	N/A	N/A
	B. HAPs	0.45	1.13	MASS BALANCE	N/A	N/A
	1. XYLENE	0.034	0.085	MASS BALANCE	N/A	N/A
	2. MIBK	0.010	0.026	MASS BALANCE	N/A	N/A
	3. METHANOL	0.395	0.988	MASS BALANCE	N/A	N/A
	4. ETHYLBENZENE	0.010	0.024	MASS BALANCE	N/A	N/A
	5. FORMALDEHYDE	0.002	0.005	MASS BALANCE	N/A	N/A
	C. PM	0.015	0.038	MASS BALANCE	N/A	N/A

12. **Is there any emission control equipment on this unit or process?**

☐yes ☑no **(if "yes", complete ADEM Form 110)**

13. **Does this process have particulate filters?**

☑yes ☐no

14. **For each regulated pollutant, describe any limitations on source operation which affects emissions or any work practice standard (attach additional pages if necessary):**

N/A

15. **Is this surface coating process in compliance with all applicable air pollution rules and regulations?**

☑yes ☐no **(if "no", complete ADEM Form 437)**

16. **For existing sources only, include a chronological history of the process, including original installation date, modification date(s), and detailed description of the modification(s).**

Name of person preparing application KENNETH M. LAYTON

Signature: Kenneth M. Layton **Date:** 09/29/21

11. **Air contaminants emitted: basis of estimate (material balance, stack test, emission factor, etc.) must be clearly indicated on calculations appended to this form. Fugitive emissions must be included and calculations must be appended.**

Emission Point	Pollutants	Potential Emissions (lb/hr)	Potential Emissions (Tons/yr)	Basis of Calculation	Regulatory Emission Limit (lb/hr)	Regulatory Emission Limit (units of standard)
BC-2	A. VOC	2.835	7.088	MASS BALANCE	N/A	N/A
	B. HAPs	0.45	1.13	MASS BALANCE	N/A	N/A
	1. XYLENE	0.034	0.085	MASS BALANCE	N/A	N/A
	2. MIBK	0.010	0.026	MASS BALANCE	N/A	N/A
	3. METHANOL	0.395	0.988	MASS BALANCE	N/A	N/A
	4. ETHYLBENZENE	0.010	0.024	MASS BALANCE	N/A	N/A
	5. FORMALDEHYDE	0.002	0.005	MASS BALANCE	N/A	N/A
	C. PM	0.015	0.038	MASS BALANCE	N/A	N/A

12. **Is there any emission control equipment on this unit or process?**

☐yes ☑no **(if "yes", complete ADEM Form 110)**

13. **Does this process have particulate filters?**

☑yes ☐no

14. **For each regulated pollutant, describe any limitations on source operation which affects emissions or any work practice standard (attach additional pages if necessary):**

N/A

15. **Is this surface coating process in compliance with all applicable air pollution rules and regulations?**

☑yes ☐no **(if "no", complete ADEM Form 437)**

16. **For existing sources only, include a chronological history of the process, including original installation date, modification date(s), and detailed description of the modification(s).**

Name of person preparing application KENNETH M. LAYTON

Signature: Kenneth M. Layton **Date:** 09/29/21

11. **Air contaminants emitted: basis of estimate (material balance, stack test, emission factor, etc.) must be clearly indicated on calculations appended to this form. Fugitive emissions must be included and calculations must be appended.**

Emission Point	Pollutants	Potential Emissions (lb/hr)	Potential Emissions (Tons/yr)	Basis of Calculation	Regulatory Emission Limit (lb/hr)	Regulatory Emission Limit (units of standard)
TC-1	A. VOC	4.185	10.46	MASS BALANCE	N/A	N/A
	B. HAPs	0.177	0.442	MASS BALANCE	N/A	N/A
	1. METHANOL	0.006	0.015	MASS BALANCE	N/A	N/A
	2. XYLENE	0.155	0.387	MASS BALANCE	N/A	N/A
	3. ETHYLBENZENE	0.014	0.036	MASS BALANCE	N/A	N/A
	4. FORMALDEHYDE	0.0006	0.0016	MASS BALANCE	N/A	N/A
	5. TOLUENE	0.0004	0.0009	MASS BALANCE	N/A	N/A
	6. CUMENE	0.0004	0.001	MASS BALANCE	N/A	N/A
	C. PM	0.0504	0.126	MASS BALANCE	N/A	N/A

12. **Is there any emission control equipment on this unit or process?**

☐yes ☑no **(if "yes", complete ADEM Form 110)**

13. **Does this process have particulate filters?**

☑yes ☐no

14. **For each regulated pollutant, describe any limitations on source operation which affects emissions or any work practice standard (attach additional pages if necessary):**

N/A

15. **Is this surface coating process in compliance with all applicable air pollution rules and regulations?**

☑yes ☐no **(if "no", complete ADEM Form 437)**

16. **For existing sources only, include a chronological history of the process, including original installation date, modification date(s), and detailed description of the modification(s).**

Name of person preparing application KENNETH M. LAYTON

Signature: Kenneth M. Layton **Date:** 09/29/21

11. **Air contaminants emitted: basis of estimate (material balance, stack test, emission factor, etc.) must be clearly indicated on calculations appended to this form. Fugitive emissions must be included and calculations must be appended.**

Emission Point	Pollutants	Potential Emissions (lb/hr)	Potential Emissions (Tons/yr)	Basis of Calculation	Regulatory Emission Limit (lb/hr)	Regulatory Emission Limit (units of standard)
TC-2	A. VOC	4.185	10.46	MASS BALANCE	N/A	N/A
	B. HAPs	0.177	0.442	MASS BALANCE	N/A	N/A
	1. METHANOL	0.006	0.015	MASS BALANCE	N/A	N/A
	2. XYLENE	0.155	0.387	MASS BALANCE	N/A	N/A
	3. ETHYLBENZENE	0.014	0.036	MASS BALANCE	N/A	N/A
	4. FORMALDEHYDE	0.0006	0.0016	MASS BALANCE	N/A	N/A
	5. TOLUENE	0.0004	0.0009	MASS BALANCE	N/A	N/A
	6. CUMENE	0.0004	0.001	MASS BALANCE	N/A	N/A
	C. PM	0.0504	0.126	MASS BALANCE	N/A	N/A

12. **Is there any emission control equipment on this unit or process?**

☐yes ☑no **(if "yes", complete ADEM Form 110)**

13. **Does this process have particulate filters?**

☑yes ☐no

14. **For each regulated pollutant, describe any limitations on source operation which affects emissions or any work practice standard (attach additional pages if necessary):**

N/A

15. **Is this surface coating process in compliance with all applicable air pollution rules and regulations?**

☑yes ☐no **(if "no", complete ADEM Form 437)**

16. **For existing sources only, include a chronological history of the process, including original installation date, modification date(s), and detailed description of the modification(s).**

Name of person preparing application KENNETH M. LAYTON

Signature: Kenneth M. Layton **Date:** 09/29/21

11. **Air contaminants emitted: basis of estimate (material balance, stack test, emission factor, etc.) must be clearly indicated on calculations appended to this form. Fugitive emissions must be included and calculations must be appended.**

Emission Point	Pollutants	Potential Emissions (lb/hr)	Potential Emissions (Tons/yr)	Basis of Calculation	Regulatory Emission Limit (lb/hr)	Regulatory Emission Limit (units of standard)
TC-3	A. VOC	4.185	10.46	MASS BALANCE	N/A	N/A
	B. HAPs	0.177	0.442	MASS BALANCE	N/A	N/A
	1. METHANOL	0.006	0.015	MASS BALANCE	N/A	N/A
	2. XYLENE	0.155	0.387	MASS BALANCE	N/A	N/A
	3. ETHYLBENZENE	0.014	0.036	MASS BALANCE	N/A	N/A
	4. FORMALDEHYDE	0.0006	0.0016	MASS BALANCE	N/A	N/A
	5. TOLUENE	0.0004	0.0009	MASS BALANCE	N/A	N/A
	6. CUMENE	0.0004	0.001	MASS BALANCE	N/A	N/A
	C. PM	0.0504	0.126	MASS BALANCE	N/A	N/A

12. **Is there any emission control equipment on this unit or process?**

☐yes ☑no **(if "yes", complete ADEM Form 110)**

13. **Does this process have particulate filters?**

☑yes ☐no

14. **For each regulated pollutant, describe any limitations on source operation which affects emissions or any work practice standard (attach additional pages if necessary):**

N/A

15. **Is this surface coating process in compliance with all applicable air pollution rules and regulations?**

☑yes ☐no **(if "no", complete ADEM Form 437)**

16. **For existing sources only, include a chronological history of the process, including original installation date, modification date(s), and detailed description of the modification(s).**

Name of person preparing application KENNETH M. LAYTON

Signature: Kenneth M. Layton **Date:** 09/29/21

11. **Air contaminants emitted: basis of estimate (material balance, stack test, emission factor, etc.) must be clearly indicated on calculations appended to this form. Fugitive emissions must be included and calculations must be appended.**

Emission Point	Pollutants	Potential Emissions (lb/hr)	Potential Emissions (Tons/yr)	Basis of Calculation	Regulatory Emission Limit (lb/hr)	Regulatory Emission Limit (units of standard)
TC-4	A. VOC	4.185	10.46	MASS BALANCE	N/A	N/A
	B. HAPs	0.177	0.442	MASS BALANCE	N/A	N/A
	1. METHANOL	0.006	0.015	MASS BALANCE	N/A	N/A
	2. XYLENE	0.155	0.387	MASS BALANCE	N/A	N/A
	3. ETHYLBENZENE	0.014	0.036	MASS BALANCE	N/A	N/A
	4. FORMALDEHYDE	0.0006	0.0016	MASS BALANCE	N/A	N/A
	5. TOLUENE	0.0004	0.0009	MASS BALANCE	N/A	N/A
	6. CUMENE	0.0004	0.001	MASS BALANCE	N/A	N/A
	C. PM	0.0504	0.126	MASS BALANCE	N/A	N/A

12. **Is there any emission control equipment on this unit or process?**

☐yes ☑no **(if "yes", complete ADEM Form 110)**

13. **Does this process have particulate filters?**

☑yes ☐no

14. **For each regulated pollutant, describe any limitations on source operation which affects emissions or any work practice standard (attach additional pages if necessary):**

N/A

15. **Is this surface coating process in compliance with all applicable air pollution rules and regulations?**

☑yes ☐no **(if "no", complete ADEM Form 437)**

16. **For existing sources only, include a chronological history of the process, including original installation date, modification date(s), and detailed description of the modification(s).**

Name of person preparing application KENNETH M. LAYTON

Signature: Kenneth M. Layton **Date:** 09/29/21

11. **Air contaminants emitted: basis of estimate (material balance, stack test, emission factor, etc.) must be clearly indicated on calculations appended to this form. Fugitive emissions must be included and calculations must be appended.**

Emission Point	Pollutants	Potential Emissions (lb/hr)	Potential Emissions (Tons/yr)	Basis of Calculation	Regulatory Emission Limit (lb/hr)	Regulatory Emission Limit (units of standard)
OV-1	A. VOC	2.49	6.225	MASS BALANCE	N/A	N/A
	B. HAPs	0.179	0.447	MASS BALANCE	N/A	N/A
	1. METHANOL	0.0905	0.226	MASS BALANCE	N/A	N/A
	2. XYLENE	0.076	0.191	MASS BALANCE	N/A	N/A
	3. ETHYLBENZENE	0.0085	0.021	MASS BALANCE	N/A	N/A
	4. FORMALDEHYDE	0.0007	0.002	MASS BALANCE	N/A	N/A
	5. MIBK	0.0023	0.006	MASS BALANCE	N/A	N/A
	6. TOLUENE	0.0002	0.0004	MASS BALANCE	N/A	N/A
	7. CUMENE	0.0002	0.0005	MASS BALANCE	N/A	N/A

12. **Is there any emission control equipment on this unit or process?**

☐yes ☑no **(if "yes", complete ADEM Form 110)**

13. **Does this process have particulate filters?**

☑yes ☐no

14. **For each regulated pollutant, describe any limitations on source operation which affects emissions or any work practice standard (attach additional pages if necessary):**

N/A

15. **Is this surface coating process in compliance with all applicable air pollution rules and regulations?**

☑yes ☐no **(if "no", complete ADEM Form 437)**

16. **For existing sources only, include a chronological history of the process, including original installation date, modification date(s), and detailed description of the modification(s).**

Name of person preparing application KENNETH M. LAYTON

Signature: Kenneth M. Layton **Date:** 09/29/21

11. **Air contaminants emitted: basis of estimate (material balance, stack test, emission factor, etc.) must be clearly indicated on calculations appended to this form. Fugitive emissions must be included and calculations must be appended.**

Emission Point	Pollutants	Potential Emissions (lb/hr)	Potential Emissions (Tons/yr)	Basis of Calculation	Regulatory Emission Limit (lb/hr)	Regulatory Emission Limit (units of standard)
TOTAL	A. VOC	24.90	62.25	MASS BALANCE	N/A	N/A
	B. HAPs	1.787	4.468	MASS BALANCE	N/A	N/A
	1. XYLENE	0.764	1.91	MASS BALANCE	N/A	N/A
	2. TOLUENE	0.002	0.004	MASS BALANCE	N/A	N/A
	3. METHANOL	0.905	2.262	MASS BALANCE	N/A	N/A
	4. ETHYLBENZENE	0.085	0.212	MASS BALANCE	N/A	N/A
	5. FORMALDEHYDE	0.007	0.018	MASS BALANCE	N/A	N/A
	6. MIBK	0.023	0.058	MASS BALANCE	N/A	N/A
	7. CUMENE	0.002	0.005	MASS BALANCE	N/A	N/A
	C. PM	0.232	0.58	MASS BALANCE	N/A	N/A

12. **Is there any emission control equipment on this unit or process?**

☐yes ☑no **(if "yes", complete ADEM Form 110)**

13. **Does this process have particulate filters?**

☑yes ☐no

14. **For each regulated pollutant, describe any limitations on source operation which affects emissions or any work practice standard (attach additional pages if necessary):**

N/A

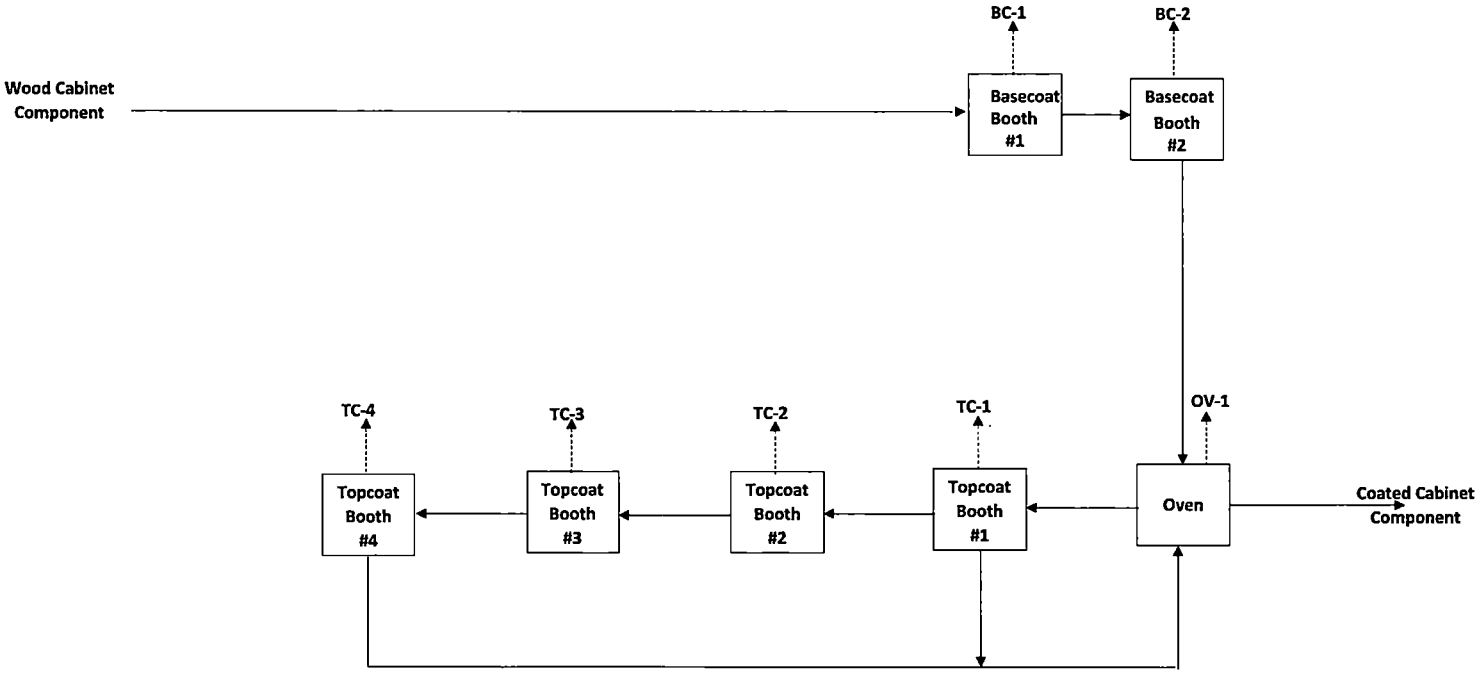
15. **Is this surface coating process in compliance with all applicable air pollution rules and regulations?**

☑yes ☐no **(if "no", complete ADEM Form 437)**

16. **For existing sources only, include a chronological history of the process, including original installation date, modification date(s), and detailed description of the modification(s).**

Name of person preparing application KENNETH M. LAYTON

Signature: Kenneth M. Layton **Date:** 09/29/21



FLOW DIAGRAM

7.

Emission Calculations

7.1

TOTALS

VOC EMISSIONS				
Coating	**Gallons Per Year**	**Density (lbs/gallon)**	**VOC Fraction**	**VOC (lbs/year)**
Topcoat	30,000	8.83	0.351	93,000
Basecoat (stains)	17,500	7.1686	0.251	31,500
Total	47,500			124,500
Tons/Year				62.25
LBS/HR				24.9
(based upon 5,000 hours/yr)				

HAP EMISSIONS																		
			XYLENE		ETHYLBENZENE		FORMALDEHYDE		MIBK		TOLUENE		METHANOL		CUMENE		TOTAL HAPs	
COATING	GALLONS PER YEAR	DENSITY (lbs/gallon)	wt. fraction	lbs/yr	wt. fraction	lbs/yr	wt. fraction	lbs/yr	wt. fraction	lbs/yr	wt. fraction	lbs/yr	wt. fraction	lbs/yr	wt. fraction	lbs/yr	wt. fraction	lbs/yr
TOPCOATS	30,000	8.83	0.013	3444	0.0012	318	0.000053	14	0.00	0	0.00003	8	0.0005	132	0.0004	10	0.014823	3927
BASECOATS (stains)	17,500	7.1686	0.003	376	0.00084	106	0.00017	21	0.00092	115	0.00	0.00	0.035	4391	0.00	0.00		5009
TOTAL	47,500			3820		424		35		115		8		4523		10		8936
TONS/YEAR				1.91		0.212		0.018		0.058		0.004		2.262		0.005		4.468
LBS/HR				0.764		0.085		0.007		0.023		0.002		0.905		0.002		1.787
(5000 hrs/yr)																		

PM EMISSIONS							
COATING	GALLONS PER YEAR	DENSITY (lbs/gallon)	SOLIDS FRACTION	SOLIDS (lbs/yr)	SPRAY EFFICIENCY	CONTROL EFFICIENCY	PM (lbs/yr)
TOPCOATS	30,000	8.83	0.38055	100,808	0.5	0.98	1008
BASECOATS (Stains)	17,500	7.1686	0.1195	14,991	0.5	0.98	150
Total	47,500			115,799			1158
TONS/YR							0.58
LBS/HR							0.232

(based upon 5,000 hours a year)

7.2

Emission Point

			EMISSION RATE (LBS/HR)							
EMISSION POINT		VOC	XYLENE	ETHYLBENZENE	FORMALDEHYDE	MIBK	TOLUENE	METHANOL	CUMENE	TOTAL HAPS
BC-1	*	2.835	0.03384	0.00954	0.00189	0.01035	0	0.39519	0	0.45081
BC-2	*	2.835	0.03384	0.00954	0.00189	0.01035	0	0.39519	0	0.45081
TC-1	**	4.185	0.15498	0.01431	0.00063	0	0.00036	0.00594	0.00045	0.176715
TC-2	**	4.185	0.15498	0.01431	0.00063	0	0.00036	0.00594	0.00045	0.176715
TC-3	**	4.185	0.15498	0.01431	0.00063	0	0.00036	0.00594	0.00045	0.176715
TC-4	**	4.185	0.15498	0.01431	0.00063	0	0.00036	0.00594	0.00045	0.176715
OV-1	***	2.49	0.0764	0.00848	0.0007	0.0023	0.00016	0.09046	0.0002	0.17872
	TOTAL	24.90	0.764	0.085	0.007	0.023	0.002	0.905	0.002	1.787

*Assume 42.50% of Basecoat is Emitted

**Assume 21.25% of Topcoat is Emitted

***Assume 15% of Basecoat and 15% of Topcoat is Emitted

			EMISSION RATE (TONS/YR)							
EMISSION POINT		VOC	XYLENE	ETHYLBENZENE	FORMALDEHYDE	MIBK	TOLUENE	METHANOL	CUMENE	TOTAL HAPS
BC-1	*	7.0875	0.0846	0.02385	0.004725	0.025875	0	0.987975	0	1.127025
BC-2	*	7.0875	0.0846	0.02385	0.004725	0.025875	0	0.987975	0	1.127025
TC-1	**	10.4625	0.38745	0.035775	0.001575	0	0.0009	0.01485	0.001125	0.4417875
TC-2	**	10.4625	0.38745	0.035775	0.001575	0	0.0009	0.01485	0.001125	0.4417875
TC-3	**	10.4625	0.38745	0.035775	0.001575	0	0.0009	0.01485	0.001125	0.4417875
TC-4	**	10.4625	0.38745	0.035775	0.001575	0	0.0009	0.01485	0.001125	0.4417875
OV-1	***	6.225	0.191	0.0212	0.00175	0.00575	0.0004	0.22615	0.0005	0.4468
TOTAL		62.25	1.91	0.212	0.018	0.058	0.004	2.2615	0.005	4.468

*Assume 42.50% of Basecoat is Emitted

**Assume 21.25% of Topcoat is Emitted

***Assume 15% of Basecoat and 15% of Topcoat is Emitted

EMISSION RATE (LBS/HR)

EMISSION POINT	PM
BC-1 *	0.015
BC-2 *	0.015
TC-1 **	0.0504
TC-2 **	0.0504
TC-3 **	0.0504
TC-4 **	0.0504
TOTAL	0.2316
TONS/YR	0.58
LBS/HR	0.232

*Assume 50% of Basecoat is Emitted

**Assume 25% of Topcoat is Emitted

EMISSION RATE (TONS/HR)

EMISSION POINT		PM
BC-1	*	0.0375
BC-2	*	0.0375
TC-1	**	0.126
TC-2	**	0.126
TC-3	**	0.126
TC-4	**	0.126
	TOTAL	0.579

*Assume 50% of Basecoat is Emitted

**Assume 25% of Topcoat is Emitted

7.3

Compliance with BACT

COMPLIANCE WITH BACT

COATING	QUANTITY (gallon)	VOC (lbs/gallon)	VOC * (lbs)	GALLONS (minus H2O & exempts)	lbs VOC Gallon minus H2O & exempts	SOLIDS (lbs/gallon)	SOLIDS (lbs)	lbs VOC/lb solids
A. BASECOATS								
1. R4002-81	2,653	4,927	13,072	2,653				
2. R4005-3	4,024	0.67	2,696	414.47				
3. R4012-29	1193	0.02	80	3.58				
4. R4016-5	2012	1.31	2636	408.44				
5. R4024-4	7618	0.91	6932	1081.76				
Total	17,500		25,416	4561.25	5.57			
B. TOPCOATS								
1. TOTAL	30000	3.1	93,000			3.36	100,774	0.923

*based upon actual coating formulations. Does not include VOC safety factor of 1.18 to meet 6.60 lbs VOC/gallon (minus water and exempt solvents) limit

7.4

Curing Oven Products of Combustion

LEGACY CABINETS

0.75 MM BTU/hr Natural Gas Fired Curing Oven

Pollutant	CAS #	Actual Quantity of Natural Gas Consumed		Hours of Operation/year		Heating Value of Natural Gas	Maximum Natural Gas Firing Rate	Maximum Natural Gas Firing Rate	Emission Factor	Emission Rates			
										lbs/hr		tons/year	
		MMCF/hr	MMCF/year	(Actual)	(Potential)	(BTU/cf)	(MMBTU/hr)	(MMCF/hr)	(lbs/MMCF)	(Actual)	(Potential)	(Actual)	(Potential)
A. PM		0.000075	3	4000	8760	1000	0.75	0.000075	7.6	0.00057	0.00057	0.00114	0.002497
B. PM_{10}		0.000075	3	4000	8760	1000	0.75	0.000075	7.6	0.00057	0.00057	0.00114	0.002497
C. SO_2		0.000075	3	4000	8760	1000	0.75	0.000075	0.6	0.000045	0.000045	0.00009	0.000197
D. NO_x		0.000075	3	4000	8760	1000	0.75	0.000075	100	0.0075	0.0075	0.015	0.03285
E. CO		0.000075	3	4000	8760	1000	0.75	0.000075	84	0.0063	0.0063	0.0126	0.027594
F. VOC		0.000075	3	4000	8760	1000	0.75	0.000075	5.5	0.000413	0.000413	0.000825	0.001807
G. HAPs													
1. Volatiles													
a. POM													
2-Methylnaphthalene	91-57-6	0.000075	3	4000	8760	1000	0.75	0.000075	0.000024	1.8E-09	1.8E-09	3.6E-09	7.88E-09
3-Methylchloroanthene	56-49-5	0.000075	3	4000	8760	1000	0.75	0.000075	1.80E-06	1.35E-10	1.35E-10	2.7E-10	5.91E-10
7,12-Dimethylbenzyl(a)anthrancene		0.000075	3	4000	8760	1000	0.75	0.000075	0.000016	1.2E-09	1.2E-09	2.4E-09	5.26E-09
Acenaphthene	83-32-9	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000018	1.35E-10	1.35E-10	2.7E-10	5.91E-10
Acenaphthylene	203-96-8	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000018	1.35E-10	1.35E-10	2.7E-10	5.91E-10
Anthracene	120-12-7	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000024	1.8E-10	1.8E-10	3.6E-10	7.88E-10
Benzo(a)anthracene	56-55-3	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000018	1.35E-10	1.35E-10	2.7E-10	5.91E-10
Benzo(a)pyrene	50-32-8	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000012	9E-11	9E-11	1.8E-10	3.94E-10
Benzo(b)fluorathene	205-99-2	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000018	1.35E-10	1.35E-10	2.7E-10	5.91E-10
Benzo(g,h,i)perylene	191-24-2	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000012	9E-11	9E-11	1.8E-10	3.94E-10
Benzo(k)fluoranthene	205-82-3	0.000075	3	4000	8760	1000	0.75	0.000075	1.80E-06	1.35E-10	1.35E-10	2.7E-10	5.91E-10
Crysene	218-01-9	0.000075	3	4000	8760	1000	0.75	0.000075	1.80E-06	1.35E-10	1.35E-10	2.7E-10	5.91E-10
Dibenzo(a,h)anthracene	53-70-3	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000012	9E-11	9E-11	1.8E-10	3.94E-10
Fluoranthene	206-44-0	0.000075	3	4000	8760	1000	0.75	0.000075	0.000003	2.25E-10	2.25E-10	4.5E-10	9.86E-10
Fluorene	86-73-7	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000028	2.1E-10	2.1E-10	4.2E-10	9.2E-10
Indeno(1,2,3-cd)pyrene	193-39-5	0.000075	3	4000	8760	1000	0.75	0.000075	0.0000018	1.35E-10	1.35E-10	2.7E-10	5.91E-10
Phenathrene	85-01-8	0.000075	3	4000	8760	1000	0.75	0.000075	0.000017	1.28E-09	1.28E-09	2.55E-09	5.58E-09
Pyrene	129-00-0	0.000075	3	4000	8760	1000	0.75	0.000075	0.000005	3.75E-10	3.75E-10	7.5E-10	1.64E-09
Total POMs									8.82E-05	6.62E-09	6.62E-09	1.32E-08	2.90E-08
b. Benzene	71-43-2	0.000075	3	4000	8760	1000	0.75	0.000075	0.0021	1.58E-07	1.58E-07	3.15E-07	6.9E-07
c. Dichlorobenzene	25321-22-6	0.000075	3	4000	8760	1000	0.75	0.000075	0.0012	9E-08	9E-08	1.8E-07	3.94E-07
d. Formaldehyde	50-00-0	0.000075	3	4000	8760	1000	0.75	0.000075	0.075	5.63E-06	5.63E-06	1.13E-05	2.46E-05
e. Hexane	110-54-3	0.000075	3	4000	8760	1000	0.75	0.000075	1.8	0.000135	0.000135	0.00027	0.000591
f. Naphthalene	91-20-3	0.000075	3	4000	8760	1000	0.75	0.000075	0.00061	4.58E-08	4.58E-08	9.15E-08	2E-07
g. Toluene	108-88-3	0.000075	3	4000	8760	1000	0.75	0.000075	0.0034	2.55E-07	2.55E-07	5.1E-07	1.12E-06
Volatile Totals									1.88E+00	1.41E-04	1.41E-04	2.82E-04	6.18E-04
2. Particulates													
a. Arsenic	7440-38-2	0.000075	3	4000	8760	1000	0.75	0.000075	0.0002	1.5E-08	1.5E-08	3E-08	6.57E-08
b. Beryllium	7440-41-7	0.000075	3	4000	8760	1000	0.75	0.000075	0.000012	9E-10	9E-10	1.8E-09	3.94E-09
c. Cadmium	7440-43-9	0.000075	3	4000	8760	1000	0.75	0.000075	0.0011	8.25E-08	8.25E-08	1.65E-07	3.61E-07
d. Chromium	7440-47-3	0.000075	3	4000	8760	1000	0.75	0.000075	0.0014	1.05E-07	1.05E-07	2.1E-07	4.6E-07
e. Cobalt	7440-48-4	0.000075	3	4000	8760	1000	0.75	0.000075	0.000084	6.3E-09	6.3E-09	1.26E-08	2.76E-08
f. Manganese	7439-96-5	0.000075	3	4000	8760	1000	0.75	0.000075	0.00038	2.85E-08	2.85E-08	5.7E-08	1.25E-07
g. Mercury	7439-97-6	0.000075	3	4000	8760	1000	0.75	0.000075	0.00026	1.95E-08	1.95E-08	3.9E-08	8.54E-08
h. Nickel	7440-02-0	0.000075	3	4000	8760	1000	0.75	0.000075	0.0021	1.58E-07	1.58E-07	3.15E-07	6.9E-07
i. Selenium	7782-49-2	0.000075	3	4000	8760	1000	0.75	0.000075	0.000024	1.8E-09	1.8E-09	3.6E-09	7.88E-09
j. Lead	7439-92-1	0.000075	3	4000	8760	1000	0.75	0.000075	0.0005	3.75E-08	3.75E-08	7.5E-08	1.64E-07
Total Particulates									0.00606	4.55E-07	4.55E-07	9.09E-07	1.99E-06
3. Total HAPs									**1.89E+00**	**1.42E-04**	**1.42E-04**	**2.83E-04**	**6.20E-04**

8.0

Monitoring/Regulatory Summary

MONITORING/REGULATORY SUMMARY Line #006

A. Applicable Regulations

This unit is subject to the following regulations:

1. Applicable requirements of ADEM Admin. Code R. 335-3-16-.03, "Major Source Operating Permits".

2. Applicable requirements of ADEM Admin. Code R. 335-3-11-.06(35), "National Emission Standards for Wooden Furniture Manufacturing Operations" as an "Existing Source". This source is also subject to the General Provisions as listed in Table 1 of Subpart JJ in 40 CFR Part 63.

B. Emission Standards

This unit is subject to the following standards:

1. Applicable emission standards of 40 CFR Part 632 Subpart JJ §63.802 "National Emission Standards for Wooden Furniture Manufacturing Operations" to include §63.802(a)(1) through (a)(3).

2. Shall not emit greater than 0.70 pounds of VHAPs per pound of solids as delivered to applicator for all coatings as determined by a monthly average among other requirements.

3. Emission of Volatile Organic Compounds (VOCs) from surface coating operations including, but not limited to coating, storage, cleanup, etc., shall not exceed 62.50 tons per year (TPY) of any consecutive rolling 12-month period based on the premise that all VOCs applied are emitted.

4. Applicable work practice standards of 40 CFR Part 63 Subpart JJ §63.803 "National Emission Standards for Wood Furniture Manufacturing Operations" to include §63.803(a) through (l).

5. Hours of operation at Line #006 shall be limited to 5,000 hours per year based upon a rolling 12-month total.

6. Basecoats (stains) and Topcoats used at this line shall not exceed the following during any rolling 12-month period.

Coating	LBS VOC/Gallon	LBS VOC/Gallon (minus H_2O and exempts)	LBS VOC/ LBS Solids
Basecoat (stains)	1.80	6.60	N/A
Topcoat	3.10	N/A	1.80
Sealers	0.62	N/A	N/A
Catalyst	1.55	N/A	N/A

C. Monitoring/Testing

This unit is subject to the following monitoring requirements:

1. Accurate and understandable records of consumption, which record at least the last five years of data, will be maintained in a permanent form suitable for inspection and be available immediately upon request. This facility shall provide a copy of records and supporting background documents upon request that pertain to this air permit. These records shall contain the following:

   a. The type, quantity in gallons, and weight in pounds of each VOC or HAP containing material used during each calendar month.

   b. The percent by weight of VOCs, water, solids, VHAPs, and exempt VOC compounds content of each VOC containing material used each calendar month.

   d. Compliance with VOC and VHAP limits shall be based upon monthly material use inventories. Emissions may be adjusted for VOC and VHAP content of material and removed from the plant as waste or returns if the recordkeeping and details surrounding the materials are approved in advance.

   e. Complete inventories of the VOC and HAP containing material (their usage, VOC content and VHAP content) shall be made at the end of each calendar month.

   f. The amount of VOCs emitted per calendar month from the coating and cleaning operations in units of pounds and tons.

   g. The rolling 12-month total of VOCs emitted from the coating and cleaning operations in units of pounds and tons.

D. Recordkeeping/Reporting

This unit is subject to the following recordkeeping and reporting requirements:

1. Applicable recordkeeping requirements of 40 CFR Part 63 Subpart JJ §63.806, "National Emission Standards for Wood Furniture Manufacturing Operations" to include §63.806(a) through (e), and (h) through (j).

2. Applicable reporting requirements of 40 CFR Part 63 Subpart JJ §63.807, "National Emission Standards for Wood Furniture Manufacturing Operations" to include §63.807(a) through (c), and (e).

3. A report summarizing the information in proviso 5.1 shall be submitted each calendar quarter by the 15th day of the month following the end of the quarter, in a format approved by the Department in advance.

4. Facility shall record the hours of operation at Line #006 on a daily and monthly basis.

5. Facility shall calculate the Line #006 hours of operation on a rolling 12-month basis.

9.

Appendix A

Baseline Data

9. BASELINE DATA

9.1. ASSUMPTIONS

The overhead line consists of two (2) basecoat (stain) booths, four (4) topcoat booths and a curing oven. Legacy Cabinets Inc. proposes to use coatings having the following characteristics:

Category	Density	Wt. Fraction VOC	VOC (lbs/gallon)
Basecoat	7.1686	0.251	1.80
Topcoat	8.83	0.351	3.10

9.2 EMISSIONS

a. tons/yr

tons/yr= [(30,000 gallon topcoat/yr) (3.10 lbs VOC/gallon) + (17,500 gallon basecoat/yr) (1.80lbs VOC/gallon)] / (2000 lbs/hr)

= 62.25

b. lbs/hr

lbs/hr = (62.25 tons VOC/yr) (2000 lbs/hr) / (5000 lbs/hr)

= 24.90

9.3 VOC (lbs/hr) and Flowrate

Volume flow rates and VOC emission rates for the base line option are as follows:

Emission Point	Flowrate (acfm)	VOC Emissions	
		lbs/hr	tpy
BC-1	16,000	2.835	7.0875
BC-2	16,000	2.835	7.0875
TC-1	16,000	4.185	10.4625
TC-2	16,000	4.185	10.4625
TC-3	25,000	4.185	10.4625

TC-4	16,000	4.185	10.4625
OV-1	10,000	2.490	6.225
Total	106,000	24.90	62.50

10.

Appendix B

Add-On Control Cost Calculations

10.1 Option A-1

10.2 Option A-2

10.1 Option A-1

(Regenerative Thermal Oxidizer)

a. Assumptions

b. Calculations

c. Cost Per Ton Removed

a.

Assumptions

Thermal Regenerative Assumptions

1. Control Efficiency

   95%

2. Flow Rate

   Q = 106,000 cfm

3. VOC Concentration

   VOC Concentration: Molecular weight of 100 lbs/mole

4. Inlet VOC Concentration (BC-1, BC-2, TC-1, TC-2, TC-3, TC-4, OV-1)

   lbs/hr = (62.25 tpy)(2000 lbs/hr)/(5000 hrs/yr)

   = 24.90

5. Outlet VOC Concentration

   lbs/hr = (24.90 lbs/hr)(1-0.95)

   = 1.245

6. VOCs Removed

   tpy = (24.90 lbs/hr – 1.25 lbs/hr)(5000 hrs/yr)/(2000 lbs/hr)

   = 59.14

7. Heat Recovery Regenerative – 95%

8. Basic Equipment Cost (EC)

   EC = $ 1,600,000 (from vendor)

9. Auxiliary Equipment Cost

   Assume 5% of EC

10. Auxiliary Fan Cost (FC)

$FC = (90.99)(Q_T)^{0.5612}$

11. Annual Electricity Cost

Cost = (hrs)($0.06/kW-hr)(288kW)

12. Labor

Operating	=	0.5 hrs/shift, $30/hr
Supervisory	=	15% of operating labor
Maintenance	=	0.5 hrs/shift, $30/hr

13. Auxiliary Fuel Required

$$Q_f = \frac{D_e Q_e [Cp_{air} (1.1\ T_c - T_{he} - 0.1\ T_r) - h_e]}{D_f [h_f - 1.1\ Cp_{air} (T_c - T_r)]}$$

where

Q_f	=	natural gas flow rate, scfm
D_e	=	density of flue gas stream, lb/scf (usually 0.0739 lb/scf)
D_f	=	density of fuel gas, 0.0408 lb/scf for methane
Q_e	=	emission stream flow rate, scfm
Cp_{air}	=	mean heat capacity of air between T_c and T_rBTU/lb - °F
	=	0.253
T_c	=	combustion temperature, °F = 1500
T_{he}	=	emission stream temperature after heat recover, °F
	=	1425
T_r	=	reference temperature, 77°F
h_f	=	lower heating value of natural gas = 21,600 BTU/lb
h_e	=	heat content of flue gas = 3.0 BTU/lb
Q_f	=	0.0016

14. Auxiliary Fuel Cost

Cost = ($0.006/ft^3)($Q_f$)(60)(HRS)

15. Capital Recovery

10 year life of equipment

7% interest rate

16. Capital Recovery Cost Factor

0.14238

17. Capital Recovery Cost

CRC = (0.14238)(total capital investment)

18. $Q_T = Q_e + Q_f$

b.

Calculations

CALCULATIONS

1. Basic Equipment Cost

   EC = $ 1,600,000

2. Auxiliary Equipment Cost

   AEC = (0.05)($1,600,000)

   = $ 80,000

3. Auxiliary Fan Cost

   FC = $(90.99)(106,154)^{0.5612}$

   = $ 60,193

4. Annual Electricity Cost

   Cost = (319 KW)($ 0.06 / kW-hr)(5,000 hr/yr)

   = $ 95,700

5. Auxiliary Fuel Cost

   Cost = (10,007 cf/hr) ($0.005 /cf)(5000 hrs/yr)

   = $ 250,175

6. Capital Recovery Cost

   CRC = (0.14238)($3,707,576)

   = $ 525,885

7. Q_T = $Q_E + Q_F$

   = 106,000 + 1,667

   = 107,667 cfm

8. Tons VOC Removed/yr = 59.14

C.

Cost Per Ton Removed

A. TOTAL CAPITAL INVESTMENT

I. TOTAL EQUIPMENT COST (TPE)

A.	Equipment Cost	$1,600,000
B.	Auxiliary Equipment (5% of A)	$80,000
C.	Auxiliary Fan	$60,193
D.	Instrumentation (10% of A + B + C)	$173,694
E.	Sales Tax (3% of A + B + C)	$52,108
F.	Freight (5% of A + B + C)	$86,847
G.	Building/Site Preparation	$250,000
	TOTAL	$2,302,842

II. DIRECT INSTALLATION COST (DIC)

A. Includes foundation and supports, handling and erection, electrical, piping, insulation for ductwork and painting (assumed to be 30% of TPE) $690,853

III. INDIRECT INSTALLATION COST (IIC)

A. Includes engineering, construction, start-up, performance tests, contractors fee, contingencies, etc. (assumed to be 31% of TPE) $713,881

IV. TOTAL CAPITAL INVESTMENT (TCI)

A. Sum of TPE, DIC, and IIC $3,707,576

B. TOTAL ANNUAL COST

I. DIRECT ANNUAL COST (DAC)

A.	Fuel Cost	$250,000
B.	Electrical Cost	$95,700
C.	Operating Labor Cost ($30/hr)(250 hrs/yr)	$7,500
D.	Supervisory Cost (15% of C)	$1,125
E.	Maintenance Labor Cost ($30/hr)(250 hrs/yr)	$7,500
F.	Maintenance Material (100% of E)	$7,500
	TOTAL	$369,500

II. INDIRECT ANNUAL COST (IAC)

A.	Overhead (60% of labor and maintenance)	$14,175
B.	Administration (2% of TCI)	$74,152
C.	Property Tax (1% of TCI)	$37,076
D.	Insurance (1% of TCI)	$37,076
E.	Capital Recovery	$527,885*
	TOTAL	$690,364

*TCI (Capital Recovery Cost Factor)

III. TOTAL ANNUAL COST

A. Sum of DAC and IAC $1,059,864

IV. COST PER ON VOC REMOVED

A. Cost = $1,059,864/59.14

= $17,921

10.2 Option A-2

(Zeolite Rotor Concentrator/RTO)

a. Assumptions

b. Calculations

c. Cost Per Ton Removed

a.

Assumptions

Zeolite Rotor Concentrator Assumptions

1. Control Efficiency

   95%

2. Flow Rate

   Q = 106,000 cfm

3. VOC Concentration

   VOC Concentration: Molecular weight of 100 lbs/mole

4. Inlet VOC Concentration (BC-1, BC-2, TC-1, TC-2, TC-3, TC-4, OV-1)

   lbs/hr = (62.25 tpy)(2000 lbs/hr)/(5000 hrs/yr)

   = 24.90

5. Outlet VOC Concentration

   lbs/hr = (24.90 lbs/hr)(1-0.95)

   = 1.25

6. VOCs Removed

   tpy = (24.90 lbs/hr – 1.25 lbs/hr)(5000 hrs/yr)/(2000 lbs/hr)

   = 59.14

7. Auxiliary Fuel Required

   Q_{AF} = Q operation + Q startup

8. Basic Equipment Cost (EC)

   $ 1,046,595 (from vendor)

9. Auxiliary Equipment Cost

   Assume 5% of EC

10. Auxiliary Fan Cost (FC)

FC = $(90.99)(Q_T)^{0.5612}$

11. Electrical Cost

Cost = (kw)(hrs)($0.06/kw-hr)

12. Auxiliary Fuel Cost

Cost = ($0.005/ft^3)(ft^3)(hrs)

13. Labor Costs

Operating = 0.5 hrs/shift, $30/hr

Supervisory = 15% of operating labor

Maintenance = 0.5 hrs/shift, $30/hr

14. Capital Recovery

10 year life of equipment

7% interest rate

15. Capital Recovery Cost Factor

0.14238

16. Capital Recovery Cost

CRC = (0.14238)(total capital investment)

b.

Calculations

CALCULATIONS

1. Basic Equipment Cost

   $1,600,000

2. Auxiliary Equipment Cost

   AEC = (0.05)(1,600,00)

   = $ 80,000

3. Auxiliary Fan Cost

   FC = $(90.99)(106,000)^{0.5612}$

   = $ 60,114

4. Electrical Cost

   Cost = (121 kw)($0.06)(5000 hr/yr)

   = $ 36,300

5. Auxiliary Fuel Cost

   Cost = ($0.005/$ft^3$)(2,777 ft^3/hr)(5000 hrs/yr)

   = $69,425

6. Capital Recovery Cost

   CRC = (0.14238)[(3,708,367)]

   = $527,997

7. Tons VOC Removed/yr = 59.14

C.

Cost Per Ton Removed

A. TOTAL CAPITAL INVESTMENT

I. TOTAL EQUIPMENT COST (TPE)

A.	Equipment Cost	$ 1,600,000
B.	Auxiliary Equipment (5% of A)	$80,000
C.	Auxiliary Fan	$60,114
D.	Instrumentation (10% of A + B + C)	$174,011
E.	Sales Tax (3% of A + B + C)	$52,203
F.	Freight (5% of A + B + C)	$87,006
G.	Building/Site Preparation	$250,000
	TOTAL	$2,303,334

II. DIRECT INSTALLATION COST (DIC)

A. Includes foundation and supports, handling and erection, electrical, piping, insulation for ductwork and painting (assumed to be 30% of TPE) ..... $ 691,000

III. INDIRECT INSTALLATION COST (IIC)

A. Includes engineering, construction, start-up, performance tests, contractors fee, contingencies, etc. (assumed to be 31% of TPE)) $714,033

IV. TOTAL CAPITAL INVESTMENT (TCI)

A. Sum of TPE, DIC, and IIC $3,708,367

B. TOTAL ANNUAL COST

I. DIRECT ANNUAL COST (DAC)

A.	Fuel Cost.....	$69,425
B.	Electrical Cost.....	$36,300
C.	Operating Labor Cost ($30/hr)(250 hrs/yr).....	$7,500
D.	Supervisory Cost (15% of C).....	$1,125
E.	Maintenance Labor Cost ($30/hr)(250 hrs/yr).....	$7,500
F.	Maintenance Material (100% of E).....	$7,500
	TOTAL	$129,350

II. INDIRECT ANNUAL COST (IAC)

A.	Overhead (60% of labor and maintenance).....	$14,175
B.	Administration (2% of TCI).....	$74,167
C.	Property Tax (1% of TCI).....	$37,084
D.	Insurance (1% of TCI).....	$37,084
E.	Capital Recovery.....	$527,997
	TOTAL	$676,332

III. TOTAL ANNUAL COST

A.	Sum of DAC and IAC.....	$805,682

IV. COST PER ON VOC REMOVED

A. Cost = $805,682/ 59.14

= $13,623