ORIGINAL

TECHNICAL DOCUMENT IN SUPPORT OF A PETITION BY CROWNLINE BOATS, INC. FOR AN ADJUSTED STANDARD

December 2003

Prepared for:

Crownline Boats, Inc.
West Frankfort, Illinois

Prepared by:

Advance Environmental Associates, L.L.C.
300 S. Second Street
St. Charles, Missouri 63301

Table of Contents

DRAFT

1.0 BACKGROUND

1.1 Business History of Crownline Boats, Inc.

Crownline Boats, Inc. (Crownline) owns and operates a fiberglass boat manufacturing facility under primary SIC code of 3732. Crownline's first boat rolled off the line on March 25, 1991. At that time Crownline employed less than 25 people. By 1991, Crownline had grown out of its Whittington location and moved into a larger facility. By December 1994, Crownline's new state-of-the-art boat manufacturing plant was completed. All of Crownline's operations have been at this new location since then. The current facility is located approximately 1.5 miles south of the town of West Frankfort, Illinois along Illinois State Route 37 in an area that consists of residential and rural properties. In addition to making an impact on the marine industry, Crownline has also positively affected the local economy, and with 500-600 full-time personnel, is one of the largest employers in Southern Illinois.

More specific information about Crownline's operations is presented in Section 2.0. Also, more history and photographs of some of Crownline's key production operations and products are located, in **Appendices 1 and 2** to this document.

1.2 Crownline's Compliance History

Crownline has always strived to comply with environmental, safety and health regulations. In the mid-1990's, they responded to odor complaints in the vicinity of the plant by installing an odor reduction system. In addition, in order to meet OSHA worker styrene exposure limits, Crownline installed a new ventilation system for worker protection and, as part of this installation, designed the system to disperse air vented from the plant in order to reduce odors.

It continues to be Crownline's goal to comply with environmental regulations including 35 IAC §215.301 "Use of Organic Material" (the "8 lb/hr Rule"). A complete history of developments related to Crownline's compliance with the 8 lb/hr Rule is presented in the following section of this report.

1.3 Background Leading to the 8 lb/hr VOM Rule Compliance Issue

In March, 2000, Crownline received a letter from IEPA informing them that the method for calculating emissions for polyester resin product manufacturing processes had changed (see **Appendix 3**). The IEPA had indicated that the previous USEPA polyester resin product manufacturing process emission factors underestimate emissions and, therefore, should not be used. However, IEPA agreed with the USEPA in that the new factors, developed by the National Marine Manufacturer's Association (NMMA) for fiberglass boat manufacturing, more accurately represent emissions of styrene and other hazardous volatile organic air pollutants. Accordingly, these new factors should be used to estimate VOM emissions. The letter also stated that "users must evaluate these new factors for applicability to their own operations in order to determine which are the most appropriate for accurately estimating emissions".

Due to the complexity of the new factors and their desire to properly evaluate the new emission factors for applicability to their boat manufacturing processes, Crownline contracted with a consultant, Advance Environmental Associates, L.L.C. (AEA), to perform the necessary analyses. Specifically, AEA evaluated the methodology for calculating Crownline's boat manufacturing emissions and, using the new emission factors, re-calculate emissions associated with the gelcoating, resin lamination, and other boat production processes at the West Frankfort plant that use VOM-containing materials. Coincident with the re-computing of VOM emissions using the new emission factors, AEA also reviewed Crownline's Preliminary Draft Title V Operating permit. A review of Crownline's draft Title V operating permit identified that it did not define the method by which Crownline will be expected to demonstrate compliance with the 8 lb/hr Rule.

Using the new emission factors that were developed from a 1997 study by the NMMA and accepted by IEPA and USEPA (See **Appendix 4** for a copy of the 1997 study titled, "Baseline Characterization of Emissions From Fiberglass Boat Manufacturing For National Marine Manufacturers Association), the hourly emissions from certain of Crownline's operations (application of gelcoat, resin, caulk, adhesive, and lacquer to boat hulls, decks, and small parts) have been computed. The results of these computations show that hourly emissions for certain parts of Crownline's operations would exceed the 8 lb/hr limit on a strict hourly basis.

In the event emissions calculations showed that Crownline could not demonstrate compliance with the 8 lb/hr Rule on a strict hourly basis, Crownline decided to determine if any viable methods for reducing VOM emissions from their operations exist and could be practically employed at their facility. Accordingly, with AEA's assistance, Crownline embarked on identifying and evaluating available methods. This analysis carefully examined both the technical and economic feasibility of possible process changes and the application of available and proven add-on air pollution controls.

While AEA conducted this analysis, Crownline simultaneously agreed to begin the process for petitioning the Illinois Pollution Control Board ("the Board") for an adjusted standard. In discussions with IEPA, Crownline decided that pursuing an adjusted standard would be a viable option. IEPA concurred with this approach.

2.0 DISCUSSION OF THE BOAT MANUFACTURING INDUSTRY

This section discusses the boat manufacturing industry in general and the various methods for making boats. It also discusses the specific boat manufacturing technology used at Crownline and the newly promulgated MACT Standard for the boat manufacturing industry.

2.1 Overview of Basic Fiberglass Boat Manufacturing Processes

There are two basic methods, or processes, that are used for fiberglass boat production in the boating industry: 1) open molding; and 2) closed molding. Crownline, along with the vast majority of boat manufacturers in the U.S., uses an open molding process. There are a variety of methods used in the general fiberglass products manufacturing industries (including the fiberglass boat building industry), however, all are simply variations of either of these two basic methods.

Typically, fiberglass boat manufacturing can be divided into the following process steps:

- Mold fabrication, mold cleaning, wax application
- Gelcoat application (see Photos #1 - #4)
- Lamination (resin application, see Photos #5 & #6)
- Grind and Trim (see Photo #7)
- Woodworking

- Upholstery installation (see Photo #8)
- Final Assembly (see Photo #9)
- Shipping

Photographs of Crownline's production operations are located in **Appendix 2**.

The gelcoat and lamination operations generate most of Crownline's VOM emissions (the majority of which consist of styrene). Accordingly, the overview of boat manufacturing technologies presented in this section is focused on these two primary operations.

By far, the most common method of production in boat building is the open molding method and the method employed by Crownline. The open-molding process typically consists of applying gelcoat and resin to a mold using an air-atomized spraying device, referred to as the applicator "gun". An open molding operation means any process in which the resin (and/or gelcoat) is applied to the mold in an area that is open to the room in which the application is made. Open molding includes operations in which a vacuum bag or similar cover is used to compress an uncured laminate to remove air bubbles or excess resin, or to achieve a bond between a core material and a laminate. According to EPA's definition, a mold is defined as the cavity or surface into or onto which gelcoat, resin and, as appropriate, glass fibers are placed and from which finished fiberglass parts take their form.1

Styrene is emitted both during the application stage (the time period when the applied gelcoat or resin is atomized and sprayed onto a mold) and during the curing period (the time it takes for the sprayed material to convert from a liquid to a polymerized solid). Other VOMs besides styrene are also emitted during gelcoat application (mostly methyl methacrylate), but these are emitted in significantly lower amounts due to the total amount (percentage) of these other organic constituents that make-up the entire mass of the as-applied gelcoat material.

Most open-molding boat building facilities use high ventilation rates to ensure that styrene levels are kept below the OSHA worker exposure limit established by the Occupational Safety and health Administration (OSHA). Since the cost of add-on emission control is a strong function of the total airflow, these diluted air streams are extremely costly to control. Some facilities designate certain areas for gelcoat or resin spraying to reduce the contamination of plant air. In these cases, a spray booth equipped with a dry filter medium may be used to reduce particulate emissions, but diluted styrene emissions are typically vented directly to the atmosphere.2

A closed molding process is one in which pressure is used to distribute the resin through the reinforcing fabric placed between two mold surfaces to either saturate the fabric or fill the mold cavity. In the boat building industry, closed molding is used far less than open molding. Closed molding can consist of various methods including compression molding using a sheet molding compound, infusion molding, resin injection molding (RIM), vacuum-assisted resin transfer molding (VARTM), resin transfer molding (RTM), and vacuum-assisted compression molding. The closed molding process does not emit as much styrene as the open molding process.

2.2 Boat Manufacturing Processes at Crownline Boats

Crownline uses the open molding process to manufacture its custom boats. Fiberglass boats are manufactured in pre-formed molds. The molds are first developed and constructed in the mold fabrication shop.

After the molds are developed, they are prepared for the application of gelcoat. The molds, as required, are cleaned with a stripping solvent and then a wax releasing agent is applied. The molds are then moved to one of four gelcoat booths for the application of gelcoat using spray guns. Air atomized guns are used at Crownline. The gelcoat area has 31 gelcoat spray guns, some of which are stationary, some mobile (can be moved between booths) . Gelcoat is applied to the mold to provide color and a smooth surface to the outside of the fiberglass boats. Particulate emissions from the overspray of the spray guns are controlled with panel filters built into the booths.

After the gelcoat has dried, the molds are moved to one of twenty-four laminating stations. At the laminating station, glass fibers, polyester resin and a resin catalyst were previously applied to the mold using a spray air-atomized chopper gun. To achieve compliance with the Boat Manufacturing MACT emission standard (described below), as of early 2003, Crownline has replaced all of its atomized spray chopper guns used for resin application with flow coat guns (i.e., low pressure, internal mix, non-atomized chopper guns). The lamination area has twenty-four flow coat guns. A flow coat gun simultaneously chops strands of glass fibers into predetermined lengths and coats the glass fibers with resin as the resin is discharged from the gun nozzle. The flow of resin discharged from the gun nozzle not only helps to coat the "chopped" glass fiber pieces, but also to simultaneously deposit the resin droplets and resin-coated fibers onto the mold surface. The layer of fiberglass and resin is then rolled out by hand to remove any air bubbles that are sometimes created in spray application process. After the desired amount of material has been applied to the mold, it is then allowed to cure (harden) for some time before another layer is applied. Additional layers of fiberglass and resin are applied as needed per the design of the boat model being built.

When the laminating process is completed (all layers have been applied and allowed to sufficiently cure), the finished solid fiberglass part is removed from the mold and transferred to the grind and trim area of the plant. Air emissions from the gelcoat and laminating stations are exhausted to atmosphere via an elaborate ventilation system which moves approximately 400,000 cubic feet of air every minute. This air ventilation rate is necessary to maintain the styrene concentration level below OSHA worker exposure protection levels. Particulate emissions are controlled with panel filters provided on each side of and along the length of the gelcoat area.

2.3 New MACT Standard and Crownline's Compliance With the 8 lb/hr Rule

Beginning August 23, 2004, Crownline, like all other boat manufacturers in the U.S., must meet the newly promulgated National Emission Standards for Hazardous Air Pollutants for Boat Manufacturing, 40 CFR Part 63 Subpart VVVV, (hereafter referred to as the "MACT"). The rule requires that subject boat manufacturers meet the "MACT floor", which is the emission limitations achieved by the best-performing 12% of boat manufacturers in the nation. USEPA determined that the MACT floor for boat manufacturers would not be air pollution control equipment since only one facility in the country uses such equipment. As discussed further below, by complying with the MACT standard, boat manufacturers are expected to reduce styrene emissions by an average of 36%.

3.0 VOM AND HAP EMISSION SUMMARY FOR CROWNLINE BOATS

Section 3.1 sets forth the calculation methodology and results for VOM and HAP emissions under three scenarios. First, **Section 3.1.1** discusses hourly VOM emissions from Crownline's gelcoat and resin operations prior to implementing any MACT reductions (Crownline has already implemented the MACT requirements). Second, **Section 3.1.2** discusses the hourly VOM emissions from Crownline's gelcoat and resin operations for Crownline's current operations (i.e., in compliance with the MACT emission limitations). The MACT compliance calculations are presented here since one of the conditions of the Petition is to comply with the Boat Manufacturing MACT. Third, **Section 3.1.3** discusses the hourly VOM emissions from Crownline's gelcoat and resin operations if Crownline were to comply with the Boat Manufacturing MACT and the 8 lb/hr Rule (on a strict hourly basis). Each of these scenarios is based on using the most current boat production data for Crownline's operations (using actual data from January thru July 2003 and extrapolated data for August thru December 2003 by inserting the July production and material usage data for these last five months of 2003). **Section 3.1.4** provides a summary comparison of the three scenarios. **Section 3.2** describes the VOM emissions from the manufacture of the small boat parts and from the final assembly operations (e.g., emissions from use of lacquer, adhesives, caulk, etc.).

3.1 Methodology for Calculating VOM Emissions from Gelcoat and Lamination

3.1.1 VOM Emissions From Resin and Gelcoat Operations Prior to MACT Implementation

To estimate styrene emissions from two processes at Crownline, a series of calculations were performed using a basic formula. The two processes are (1) gelcoat application to boat hulls and decks and (2) resin application to boat hulls and decks using air-atomized chopper guns. Specifically, the emission calculations consist of the following equation and input data:

Emissions = Q x Fa x Fe

Where,

Q = quantity (amount by weight) of material applied to the part (deck or hull mold)

Fa = fraction of material, as applied, that is styrene (i.e., the total styrene content, typically referred to as the amount of "available*" styrene)

Fe = fraction of available styrene that is emitted as a volatile organic after application to the part (based on NMMA emission factors)

*- *available* styrene refers to the amount present in the resin or gelcoat material as-applied and is, therefore, *available* to react to form the desired product (in the open molding process, a significant amount of the *available* styrene is not reacted because it evaporates into the building room air and, eventually, is emitted to atmosphere (ref: verbal communication with Mr. John Stelling, Stelling Engineering, March 21, 2002).

Important considerations in the processes of gelcoat and resin application that affect the amount and rate of VOM released per unit time are presented below.

Q, Is the quantity of material (gelcoat and resin) used to build each boat part for each boat model produced. Gelcoat is applied to the part (hull or deck mold) in a single application (using air-atomized spray guns), thereby, creating a single initial layer. However, laminate (resin) is applied to a part in a series of layers called "skins". The process involves application of a skin, followed by a curing period before the next skin can be applied. This process is repeated until all of the skins required to achieve the desired thickness have been applied (allowing cure time between the application of each skin.

For decks, 3 resin skins are typically applied. For hulls, 2-3 resin skins are applied, followed by a separate application to build the boat floor. That is, the floor contains wood "stringers" (wood boards that act like floor joists) that are attached to the hull at the point where the stringer meets the hull (joint). Each stringer joint is constructed by first being covered with fiberglass cloth and then by being saturated with resin using an air-atomized chopper gun. The time it takes to apply one skin of resin to a small boat (e.g., 18 - 22 feet long), takes approximately 30-35 minutes. The time it takes to apply a skin to a large boat (24 - 29 feet long), is approximately 45 to 55 minutes. However, regardless of boat size, no skin takes more than an hour to be applied. Gelcoat is also applied within less than a one-hour time frame. The application times are largely dictated by the resin "kick" time, which is the duration of time after application when the resin begins to cure and become a solid.

The amount of material applied per skin varies. This variability occurs primarily with application of the second skin. That is, the amount of resin that is applied to create the second skin typically requires the greatest mass of resin regardless of boat size. It is also important to note that the fraction of available styrene in both gelcoat and resin that is emitted upon application to a mold is largely a function of part geometry (shape) and size (boat length). It is a known fact (from NMMA data) that, of the total styrene content in the resin as applied, the fraction of styrene that is emitted (versus that which remains with the solidified mass that makes up the part), is greater for the building of boat hulls than it is for the building of boat decks. Again, this is due to the fact that the concave geometry of the hulls creates a larger average distance between the resin application device ("the resin gun") and the part. Similarly, the fraction of available styrene that is emitted increases as part length increases. Using NMMA data from Tables 2-3 and 2-5 (**See Appendix** 4), we identified the simplest function (a line) that would run through both points plotted for percent of available styrene emitted from the application of resin to two different sized hulls. Interpolation of the fraction of available styrene emitted from gelcoat and resin application to decks and hulls is presented on attached **Exhibits 1** and 2 of **Appendix 6**.

As presented earlier, the total amount of styrene in the gelcoat and resin as applied is referred to as "available styrene". However, only a fraction of the available styrene in these two materials is emitted because the balance reacts to form the solid fiberglass matrix of the part being built. In year 2000, Crownline used gelcoat that contained approximately 43% HAP (33.4 wt-% styrene and 9.65 wt-% methyl methacrylate (MMA)). The resins used that year contained approximately 42 wt-% styrene. The results of the calculations for estimating hourly VOM (styrene/MMA) emissions from the gelcoat and resin application processes at Crownline prior to implementing MACT requirements are presented in **Exhibit 3** of **Appendix 6**.

3.1.2 Emissions From Crownline's Current Operations (Compliance With the MACT Emission Limitations)

For this scenario (i.e., Crownline's operations in compliance with the MACT emission limits), the basic computation used to estimate styrene emissions from application of gelcoat and resin to boat decks and hulls was modified based upon following assumptions: (1) a reduced styrene content resin is used (35 wt-% versus 42 wt-%); (2) a reduced HAP content (styrene, MMA and other volatile organic HAPs) gelcoat is used (33 wt-% versus 43.2 wt-%); and (3) non-atomized spray (flow-coat applicators) are used. To comply with MACT, most boat manufacturers with open molding operations nationwide will use these flow-coat applicators and low-HAP resins and gelcoats.

Based on these three assumptions, the following equation and input data were used to compute the VOM (styrene) emissions from the resin application process:

Emissions = Q x Fa x Fe x Ffc

Where Q = quantity of material applied, by weight

Fa = fraction of material that is styrene, or "available" styrene

Fe = fraction of styrene that evaporates after application to a part

Ffc = fraction of styrene emitted from flow-coater spray gun

The following discussion addresses important factors that affect the amount and rate of VOM released per unit time in the resin application process:

- The fraction of styrene emitted from resin application using air-atomized chopper guns was determined using the data presented in Table 2-1 from the 1997 NMMA study report (See **Appendix** 4). As of October 2001, Crownline began using a resin with a styrene content of 35 wt-%, or less, (versus the previously used 42 wt-%) and the emission factors used in the calculations were an interpolation of the data in Table 2-1 of the NMMA study report. For gelcoat spray guns, the emission factors were also taken from Table 2-1.
- The fraction of styrene emitted from resin application using flow-coat applicators was determined using the data presented in Table 2-1 from the 1997 NMMA study. Per the NMMA Study, the emission reduction that can be achieved by replacing the air-atomized chopper guns with flow-coat (non-atomized) applicator guns is 7.8% for decks and 27% for hulls.

Estimates of hourly VOM emissions from Crownline's gelcoat and lamination operations in compliance with the MACT are set forth in **Exhibit 4 of Appendix 6**. The hourly VOM emission estimates shown in Exhibit 4 of Appendix 6 are conservative, since they assume 100% of the styrene is emitted in the first hour. However, according to the NMMA Study, only 70% of the styrene emissions occur with in the first hour, while the remaining 30% occur subsequently. See **Figure 2-3** of **Appendix** 4.

The following table sets forth a break-down of the estimated VOM emissions from all of the affected operations at Crownline for year 2003 (extrapolated for August through December of 2003 using boat production and material usage data for July 2003).

Total VOM Emissions[1] Based on Crownline's Current Mode of Operation[2] – Using Year 2003 Boat Production and Material Usage Data[3]

Emission Source	VOM Emissions (TPY)
Resin Application (Lamination) Areas	88.1
Gelcoat Use Areas (Booths)	59.6
Subtotal	**147.7**
Other Areas (where VOM containing materials are used)	52.1
TOTAL	**199.8**

(1) – Based on applicable NMMA emission factors;
(2) – Crownline's current operations are in compliance with MACT emission standards (compliant with emission limits computed using the MACT model point value method of compliance);
(3) – Reported values reflect level of VOM emissions assuming year 2003 boat production (number and model mix produced during Jan-July of 2003 and July 2003 data was used to extrapolate emissions for Aug-Dec of 2003);
(4) – Other areas include such operations as mold fabrication, grind & trim area (floor and stringer installation), lacquer application, hull and deck tie-in, carpet installation and seat building (adhesive usage), caulk application, resin storage, etc. See Section 3.2 for a more detailed discussion of these operations and their VOM emissions.

3.1.3 VOM Emissions from Crownline's Operations if Crownline were to comply with the 8 lb/hr Rule on a Strict Hourly Basis.

This scenario estimates VOM emissions assuming that Crownline were to comply with the 8 lb/hr Rule on a strict hourly basis. This last scenario is based on a set of hypothetical conditions in order to simulate compliance with the 8 lb/hr Rule (on a strict hourly basis) for all boat models. Under this scenario a default value of 8 lb/hr was artificially substituted for all boat models to estimate what the annual level of VOM emissions would be if each of Crownline's gelcoat and lamination operations (e.g., emissions from the application of each gelcoat layer and resin skin) were assumed to equal 8 lbs/hr and, therefore, comply exactly with the limit of 8 lbs VOM/hr on a strict hourly basis. The calculations and assumptions used to develop the estimate of VOM emissions for this 3rd scenario are presented in **Exhibit 5 of Appendix 6.**

3.1.4 Summary Comparison of Annual VOM Emissions From Crownline's Operations For the Three Compliance Scenarios

Table 3-1: Annual Emissions Comparison From Crownline's Gelcoat , Lamination, and Other[1] Production Areas For 3 Compliance Scenarios[2]

Pre-MACT	MACT	8 lb/hr
245	200	144

(1) - Includes VOM emissions from such production areas as Grind and Trim and Final Assembly)
(2) - Scenario 1 = Uses Y2003 Jan-July actual boat production and material usage data and July 2003 data extrapolated for months of Aug – Dec 2003, but assumes HAP/VOM content of resins and gelcoats at pre-MACT levels and use of atomized spray guns for resin application; Scenario 2 = Uses the same boat production numbers and materials usage data and the same extrapolations as used for Scenario 1, but uses actual HAP/VOM content of materials actually used during Jan-July of 2003 and actual condition of all resin application being done using flowcoat guns; Scenario 3 = uses the same boat production numbers and assumes that each resin and gelcoat application operation (application of each gelcoat layer and each resin skin) emits exactly 8 lb/hr. Each scenario includes the 2003 VOM emissions estimates from all other production areas (approximately 52 tons/yr).

As Table 3-1 clearly shows, when Crownline's gelcoat and lamination operations comply with the MACT standard via use of lower HAP resins and gelcoat materials and installation of flowcoat applicator guns in the resin application area, (i.e., compliance scenario 2) as shown in **Exhibit 4 of Appendix 6**, Crownline will achieve significant reductions in total VOM emissions. If Crownline were to comply exactly with the 8 lb/hr Rule on a strict hourly basis, annual VOM emissions (as illustrated by scenario 3 presented as **Exhibit 5 of Appendix 6**) an additional reduction of annual VOM emissions would be achieved. However the third scenario is based on a hypothetical set of conditions that are not actually achievable without the application of emission control equipment. As discussed in Section 4.3, this is not an economically feasible option.

However, if it were technically possible for Crownline to demonstrate compliance with the 8 lb/hr Rule on a strict hourly basis by changing the total time frame over which each resin and gelcoat application to each boat part is made (by applying the same total mass of resin or gelcoat, but over a period of two or more hours), Crownline could comply with the Rule (on a strict hourly basis), yet emit the same total amount of VOMs on a daily (24-hr) and annual basis. That is, by extending the time frame over which resin skins and gelcoats are applied, VOM emissions would also be distributed over this longer period of time. This hypothetical scenario would show Crownline to technically comply with the 8lb/hr Rule (on a strict hourly basis) but without realizing any true reduction in total daily or annual VOM emissions. The following example helps to illustrate this point:

Assuming an individual skin (or layer) of resin or gelcoat (as now dictated by the normal resin reaction processes) takes one hour to apply and this results in VOM emissions of say 14 lbs/hr, if it were possible to apply the same total mass of resin or gelcoat for an individual skin over a two hour period instead of just one hour, the associated VOM emissions would comply with the 8 lb/hr Rule on a strict hourly basis (i.e., 7 lbs would be emitted in the first hour and 7 lbs in the next hour). However, the total mass of VOMs emitted for the entire day would be the same (14 lbs) Consequently, compliance with the 8 lb/hr Rule in this manner results in no real reduction in the total daily or annual amounts of VOMs emitted to atmosphere. This is one of the reasons why Crownline believes that demonstrating compliance on a strict hourly basis is neither practical nor necessary. However, by complying with the MACT standard and no other measures, Crownline achieves significant real reductions in the total amounts of VOM emitted from their operations on a daily and annual basis.

3.2 VOM Emissions from Small Boat Parts and Final Assembly

The gelcoat and lamination departments are not the only source of VOM subject to the 8 lb/hr Rule. For each boat model, there are a number of small parts that are manufactured using the same methods and materials as those employed for the manufacture of hulls and decks. In final assembly, hulls and decks are sealed together and the small parts are installed to complete the boat. In this assembly step, additional laminates are applied. The decks are first moved to deck rigging where carpet, headliner and upholstered parts are attached to the decks. VOM containing materials (i.e., adhesives and caulk) are used in this operation. From the carpet area, the hulls are then move to engine assembly. After engine assembly, the finished decks from deck rigging are attached to the hulls, final caulked and then moved to final assembly. The boats are then fitted with interiors and miscellaneous hardware.

Based on AEA/Crownline's calculations, some VOM emissions from Crownline's final assembly operations (use of caulk/adhesive/lacquer) would not be in compliance with the 8 lb/hr Rule on a strict hourly basis. The current level of VOM emissions from the final assembly operations which exceed 8 lbs/hour on a strict hourly basis total approximately 14 tons/year. Data and sample calculations for final assembly area and small parts production are presented in **Appendices 7 and 8**, respectively.

4.0 INVESTIGATION OF COMPLIANCE ALTERNATIVES: METHODS FOR REDUCING VOM EMISSIONS FROM BOAT MANUFACTURING

The opportunities available to the industry to reduce or avoid waste and pollution streams are emerging. This section presents various alternatives currently used by the fiberglass manufacturing industry that potentially may be applied by boat builders for reducing VOM emissions from the boat manufacturing industry. Some of these alternatives are currently in use by Crownline in order to comply with the MACT. The section is divided into three areas: 1) reduce VOMs in production materials; 2) alternative manufacturing technologies; and 3) installation of air pollution control equipment.

4.1 Method 1 - Reduce VOMs in production materials

Crownline has already reduced VOM emissions in its production materials. In complying with MACT, Crownline has already reduced its total VOM emissions by a significant amount (see Table 3-1 and **Exhibit 4 of Appendix 6**). The majority of the reduction has been realized by converting to low HAP resins and gelcoats and, as discussed later in this document, by replacing the atomized spray resin applicator guns with the flow coat guns.

Further reduction of styrene in the resins (below that needed to comply with MACT) is not feasible because this would result in the loss of important physical characteristics of the manufactured boat parts, thereby, significantly affecting the appearance, integrity and safety of each boat.

"Traditional" general-purpose (GP) orthophthalic polyester resins were widely used by the industry into the early 1980's. These resins had approximately 44 - 48% styrene content by weight. By the mid 1980's, DCPD (dicyclopentadiene) resins became popular because of cost-competitiveness and improved cosmetics due to reduced shrinkage. DCPD blends currently have a slightly lower styrene content. However, in 1988, rule 1162 (a South Coast Air Quality Management District VOC spray application for applying gelcoat. This is accomplished through an employee training program. Employees learn how to apply a controlled spray using various techniques learned in this training program.

4.2.2 Closed Molding Methods [3] -

(7) ***RTM*** – Resin transfer molding (RTM) is a process that begins with the application of a gelcoat to one or both sides of the mold, depending on requirements. Glass reinforcing and other materials, such as core stock, are placed in the bottom half of the mold. The mold halves are closed and securely clamped. After the mold is closed, catalyzed resin is injected through one or more strategically located ports. Inlet ports and vents are normally located in the top half of the mold.

Crownline has determined that RTM is not feasible at their facility because the boat product is too sensitive to damage during manufacture resulting in the scraping of numerous damaged parts. Finally, retooling costs could be 20 times the current cost of conventional tooling.

(8) ***Resin infusion*** - Resin infusion shares many of the characteristics of vacuum bag molding and resin transfer molding (RTM) but is based on a patented resin distribution process. To use the process laminators must acquire a license to use the patents and pay for training covering some proprietary techniques. As with RTM, the costs of this process are expensive due to increased labor and materials costs as well as increased facility, machinery and tooling costs. For these reasons, Crownline does not feel that this technology will work at their facility.

(9) *VEC System – VEC Technology Description*

At the request of IEPA, Crownline has investigated a new technology that is called VEC or Virtual Engineered Composites. Genmar, Inc., a boat manufacturer, headquartered in Minnesota purchased this technology. IEPA has recommended this technology because it believes that this technology can significantly reduce styrene emissions. A brief description of the VEC Technology is included in this section but a more detailed one is found in **Appendix 9**.

The VEC technology is a complex, patented, computerized system that manages the entire injection molding process, including all equipment operations and the curing of resins. It controls the elements of the process to eliminate inconsistencies in the finished product. The VEC process involves a patented flexible mold system. This system uses a thin composite skin in the shape of the part to be produced that's mounted on a water-filled pressure vessel, creating a low-pressure, closed-mold process. 4

Here are some other basic facts about the VEC Technology 4:

- Protected by 31 Patents
- Most boat building companies are either too small to take advantage of the system, or are already wedded to other processes that would be too expensive to scrap

- Recently opened an 8,835 m2 VEC boat building facility - $22 million for equipment and materials in the plant
- Level of investment is far greater than the cost to get an open-mold boat building operation going
- Not good for building customized larger boats

Crownline has contacted Genmar and VEC technology owners to determine if it is possible to implement the VEC technology at our Crownline facility. The main issue that Genmar is dealing with concerning VEC technology is whether they should license this technology to its competition. Genmar is promoting the licensing of the VEC technology to manufacturers of Fiberglass Reinforced Plastic products other than boat builders. Genmar's management does not believe it makes sense for them to license it to their competitors in the boat building industry.

In summary, the VEC technology appears to allow certain types of boats to be produced with significantly reduced VOM (styrene) emissions. However, the initial capital cost of a VEC system is extremely high when compared to traditional open molding manufacturing methods and equipment. Also, since Genmar owns the patents for this technology and is not willing to license it to their competitors in the boat manufacturing industry, it cannot be considered a viable alternative regardless of its ability to produce boat parts while significantly reducing VOM emissions.

4.2.3 Evaluation of Fiberglass Reinforced Plastic Manufacturing Technologies For Application at Crownline Boats

For purposes of evaluating the fiberglass reinforced plastic (FRP) manufacturing technologies for applicability to Crownline Boats' manufacturing operations, the various alternative production methods listed above fall into one or more of three categories of reasons that define why these FRP product manufacturing technologies cannot be practically applied at Crownline. These three categories are:

A. Prohibitively high re-tooling cost;

B. Would require Crownline to completely change its production methods resulting in drastically reduced production efficiency, thereby, requiring a far greater number of labor hours to complete the hull and deck of each boat. This would increase manufacturing costs beyond that which could be recovered competitively in the price of the boat;

C. Significant loss of future sales caused by (a) diminished product quality (appearance, performance, reliability, etc.); and/or (b) inability to produce the variety (broad number of models and sizes) of boats that Crownline now has the ability to produce on a regular basis.

The following table identifies which of these three categories apply to each of the listed alternative technologies.

	Category A	Category B	Category C

Technology			
Open Molding Methods			
(1) Flow coat resin applicators	-	-	
(2) Controlled spraying	-	-T	
(3) Roller Application	-	√	√
(4) Prepreg	√	√	√
(5) In-house resin impregnation	√	√	√
(6) Vacuum bagging	-	√	√
Closed Molding Methods			
(7) Resin Infusion	√	√	√
(8) RTM	√	√	√
(9) VEC System	√ T	T	T

T - The VEC System is a proprietary methodology owned by the Genmar Corporation and is only available to non-competing fiberglass manufacturing companies via license from Genmar (not available to Crownline or any other boat manufacturer).

Please note, however, that the installation of flow coat chopper guns (under open molding methods) and reducing gelcoat VOM content are both viable methods that can and <u>are being</u> used by Crownline Boats to comply with MACT. Similarly, Crownline already switched to low styrene resins (early in the Fall of 2001). Also, Crownline employs controlled spraying in its gelcoat operations. This allows Crownline to reduce material usage, improve product quality and, concomitantly, reduce styrene emissions.

The cost of each alternate manufacturing method aside, it is important to note that, other than for resin application using air-atomized chopper guns or flowcoat chopper gun guns, there is no quantitative data that we know of which accurately shows how much styrene and/or VOM emissions would actually be reduced if any of these methods were to be employed. The new (NMMA) emissions factors are based on carefully conducted emissions tests. But, these were limited to the testing of styrene emissions from those facilities that use air-atomized chopper guns and flow coat chopper guns for resin application. Therefore, even if Crownline could afford to modify its plant to employ another manufacturing technology, there would be no assurance that this would meet the 8 lb/hr Rule on a strict hourly basis as interpreted by IEPA.

Finally, all of the above-listed manufacturing methods are limited to the resin application process. To our knowledge, there are no gelcoat application technologies that could be feasibly employed to reduce styrene/VOM emissions from Crownline's gelcoating operations except low-HAP gelcoats.

In summary, information on the use of alternate manufacturing methods/technologies strongly suggests that, other than converting to flow coat chopper guns for resin application and reducing the HAP content of the gelcoats to the 33% MACT compliance level (which Crownline has done), respectively, there are no alternative manufacturing methods/technologies that can be used by Crownline to comply with the 8 lb/hr Rule on a strict hourly basis.

4.3 Method 3 - VOC Reduction Through the Application of Tail-End Emission Control Equipment

A strict condenser system is neither technologically nor economically feasible for high flow, low VOC concentration, air streams especially those that contain mixed solvents. Also, the VOCs in the air stream to be treated would contain a variety of organic HAPs that could not be easily separated for re-use. That is, the VOM emissions from the gelcoat area contain both MMA as well as styrene and the VOM emissions from the final assembly area contain numerous other organics (such as acetone). Condensers are typically used for applications with low volume and high VOM concentration air flow streams that consist of one or two, easily recoverable and recyclable solvents. Therefore, due to the high flow rate, low VOC concentration and the mixture of organics in the air stream that would need to be treated from Crownline's boat production operations, a condenser system is not a feasible control for Crownline.

A straight thermal oxidizer is not economically feasible due to the extremely high operating cost that would result from heating 654,000 cfm of air to achieve the required destruction temperature of 1450°F (very high fuel usage needed to attain operating temperatures high enough to thermally convert the VOCs to CO_2 and water vapor).

The presence of PM in the ventilation air stream to be treated would contaminate any of the carbon or polymer-based absorption media unless a high efficiency particulate matter control system were also installed. The additional cost of such a system makes any of the adsorption systems economically infeasible.

Crownline's consultant, AEA, examined available emission control technologies for specific applicability to Crownline's operations for purposes of complying with the 8 lb/hr Rule on a strict hourly basis. This included obtaining cost quotes from a select number of control system suppliers. The vendor quotes were inserted into a spreadsheet developed by USEPA. USEPA's spreadsheet was used in support of the study titled, ***"Assessment of Styrene Emission Controls for FRP/C and Boat Building Industries"***. The spreadsheet was downloaded from USEPA's website.

A cost per ton of pollutant removed was calculated for a rate of 654,000 cfm which includes lamination and gelcoat areas and all other areas where VOM materials are used in significant amounts. The results of the cost/ton estimates using the USEPA spreadsheet are summarized in **Table 4-1** which shows a comparison of selected VOM emission control systems evaluated by AEA.

As can be seen from **Table 4-1**, the cost per ton of controlled VOM for treating the air flow from Crownline's operations ranges from approximately $35,000 to $58,000. Copies of the spreadsheets used to compute these cost/ton values are presented in **Exhibit 4** of **Appendix 6**. These values also assume a control efficiency of only 85% which is the level required to comply with the 8 lb/hour Rule on a strict hourly basis (35 IAC 215.302 (a), (b) or (c).

The up-front capital costs for the control technologies shown in **Table 4-1** range from approximately $ 7 million to $14 million and annualized cost for these same control technologies range from approximately $4.5 million to nearly $6 million. The spreadsheets used to generate the values presented in **Table 4-1** are presented in **Appendix 10**. Copies of vendor quotes and related information are located in **Appendices 11-15**.

Based upon these costs and the cost per ton values generated using the USEPA spreadsheet, it is reasonable to conclude that the installation of emission controls for Crownline's operations is not economically feasible. It would not allow Crownline to remain competitive in a market where Crownline's competition operating outside of Illinois would not have to install such controls. As a result, tail-end controls are not a feasible option regardless of which technology one may choose to apply.

The primary reason for these high costs is the very large volume of air (654,000 cfm) that would have to be treated in order to reduce the emitted VOM from these areas to achieve compliance with the 8 lb/hour Rule on a strict hourly basis. This large volume of air is necessary to maintain compliance with OSHA's 8-hour worker exposure limit for styrene. In order to protect worker health and safety in accordance with this OSHA requirement, approximately two years ago Crownline installed a specially designed air flow management system. It is important to note that this design took into account the feasibility of using methods to limit (reduce) the amount of air needed to comply with the OSHA styrene standard. It was concluded, however, that to do so would require Crownline to dramatically revise its manufacturing methods and procedures. The cost of these changes was found to be prohibitive. That is, besides the capital cost of the physical modifications, increased labor costs associated with the greater amount of time required to build each boat hull and deck would go far beyond that which Crownline could competitively recover in the price of the boat.

In summary, the application of tailstack emission controls is not a viable method for reducing VOM emissions in order to comply with the 8 lb/hr Rule on a strict hourly basis. The primary basis for this conclusion is the prohibitively high cost of such controls as a result of the high air volumes required to comply with the OSHA 8-hour worker exposure limit for styrene.

TABLE 4-1

Crownline Control Technology Evaluation	
Cost Per Ton of VOM Removed	
Control Technology Name & Vendor	**Cost Per Ton of VOM Removed** (For a flow rate of 654,000 cfm)
Preconcentrator with RTO Oxidation – Frees Quote	$38,302
Rotary Concentrator with RTO Oxidation – MegTec Quote	$34,917
Rotary Concentrator with RTO Oxidation – Durr Quote	$38,973
Biofiltration System – BioRem Quote	$45,318
Biofiltration System – BacTee Quote	$58,166

Notes:

1. All cost estimates are based on spreadsheet created by USEPA as part of their study "Assessment of Styrene Emission Controls for FRP/C and Boat Building Industries"
2. The equipment costs have been modified based on vendor quotes specific to Crownline's facility. They have been scaled up based on the original quotes for 300,000 cfm to total of 654,000 cfm)
3. $/ton are based on 85% control efficiency for each device
4. $/ton are based on Y2000 dollars
5. Baseline VOM levels used in spreadsheet assume the MACT compliance values for gelcoat, lamination and final assembly emissions.

5.0 QUANTITATIVE AND QUALITATIVE IMPACT OF CROWNLINE'S OPERATIONS ON AMBIENT AIR QUALITY

This Section presents a discussion of the impacts that Crownline's current operation has on the ozone formation in south-central Illinois. Based on compliance with the adjusted standard, as opposed to complying with the rule of general applicability, it appears that the impact on ambient air quality of VOM emissions from Crownline's operations is insignificant – does not cause any measurable increase in the observed ozone levels in south-central Illinois.

5.1 Description of Ozone Impact Analyses

The Ambient Air Quality (AAQ) Impact Analysis was performed by Advance Environmental Associates (AEA), Crownline's air compliance consultant. This analysis examined Crownline's impact on ozone formation in south central Illinois, using data from an ozone monitor located in Dale, (Hamilton County5), Illinois (henceforth referred to as the "Dale monitor") as a basis. The Dale monitor is located 25 miles ENE of the Crownline facility and is otherwise sited in a location appropriate for determining impacts of Crownline's operations on outdoor ambient ozone levels. It should be noted that the IEPA monitor was sited in its present location for reasons not related to Crownline or any of its operations.

The analysis, which is quantitative in nature, was performed by AEA using a method developed by USEPA. This method is titled, "VOC/NO_x Point Source Screening Tables" by Richard D. Scheffe, September 1988[6]. For purposes of this report, it is referred to as the "Ozone Screening Method". A copy of the substantive sections of this method is presented in **Appendix 16**.

The Ozone Screening Method is based on examining the short term (24hr) maximum amount of VOCs and also the average annual amounts of both VOCs and NO_x that the source in question emits. Using this information, the method requires a computation to that establishes a reference value for subsequent use in either of two tables that estimate the amount of ozone likely to be formed for different reference values. One table is designed for addressing impacts from sources located in rural areas only and the other table is for sources in urban areas. This procedure produces an ambient air quality ozone concentration value that is then added to the background air quality levels measured at an ozone monitor considered to be representative of the area that can be impacted by the VOC/NO_x emissions from the source of interest. This combined value is then compared to the National Ambient Air Quality Standard (NAAQS) for ozone (1-hour standard) of 0.12 ppm to determine if the impact will cause (or contributed significantly enough) to the exceedance of this 1-hour ozone standard.

After computing the amount of ozone predicted by the Ozone Screening Method, the results show that the potential impact from Crownline's operations will not cause ozone concentrations at the Dale monitor to exceed the NAAQS of 0.12 ppm. The maximum level of ozone that the Ozone Screening Method produced is 0.103 ppm (0.01 ppm contributed by Crownline plus 0.093 ppm – the 4th highest ozone level measured at the Dale monitor during 1999, 2000, and 2001 from data provided in Illinois EPA monitoring reports corresponding to these three years). A copy of the calculations performed and assumptions used by AEA following the Ozone Screening Method are presented in **Appendix 16** to this document.

REFERENCES

1. **40 CFR 63 Subpart VVVV – National Emission Standards for Hazardous Air Pollutants for Boat Manufacturing** – FR Vol. 66, No. 163 – Wednesday, August 22, 2001, Pgs 44232-44250

2. **"Assessment of Styrene Emission Controls for the FRP/C and Boat Building Industries"** EPA Contract 68-D1-0118, W.A. 156

3. **"Waste Reduction Strategies for Fiberglass Fabricators"**, by David Hillis and Darryl Davis of Eastern Carolina University, which is posted on the Pacific Northwest Pollution Prevention Resource Center website, Seattle, WA (PPRC Web site is a joint project of the Washington State Department of Ecology and the Small Business Assistance Programs in Alaska, Idaho, Oregon and Washington and is funded by grants from the U.S. Environmental Protection Agency.) Some of the descriptions in the Supporting document are from suppliers and vendors of the technologies.

4. **"Virtual Engineered Composites: The Future of Fiberglass Manufacturing"** - Genmar Corporation website – www.genmar.com

5. Hamilton County Illinois Ozone Data, 1999-2000 – data obtained from IEPA – Bob Swinford, Monitoring Section on August 15, 2001.

6. "Ozone Screening Method - "VOC/NO_x Point Source Screening Tables" by Richard D. Scheffe, September 1988.

Appendix 16

Details of Crownline's Ozone Impact Analysis

Advance Environmental Associates, L.L.C.™

Client: Crownline Boats, Inc. Scope I.D.: CO2C005
Project: Ozone Impact Modeling - Adj. Std. Petition Page: 1 of 2
Prepared by: Al Polayn Date: 3/14/03
Checked by: Date:

— As required by Illinois EPA, the following computations were performed to estimate the potential impact of VOC/NO_x emissions from Crownline's boat manufacturing operations on ozone air quality as determined by a USEPA approved and recommended procedure.

— Procedure used to perform this ozone impact assessment: "Screening Method for Ozone Increment Determination" by Richard D. Scheffe, Sept. 1988 Referred to as, "OZONE SCREENING PROCEDURE" or, simply "PROCEDURE"

— Procedure as applied to Crownline Boats, Inc. is presented as follows:

Step 1 Identify estimated average annual VOC emissions (NMVOC) from Crownline's operations
↳ From most recent AER, this is approx. 235 Tons/yr
Identify estimated average annual NO_x emissions
↳ From natural gas usage data per fuel bills this is approx. 27.5 Tons/yr
Identify estimated maximum daily VOC emissions
↳ Based on max. daily boat production, VOC emissions are approx. ≤ 1600 lbs/day (0.8 Tons/day)

Step 2 Divide $NMVOC_{annual}$ by $NO_{x\,annual}$ to compute "R" Factor (VOC/NO_x ratio) $= \frac{235}{27.5} = 8.55$

Step 3 Land use area impacted by Crownline's emissions is rural. Therefore, per procedure, use Table 1 of screening procedure. Since R = 8.55, which is > 5.2, but < 20.7, per the procedure column two (middle column) of Table 1 applies for estimating rural based ozone increment contributed by Crownline's operations.

(Cont'd)

Advance Environmental Associates, L.L.C.™

Client: Crownline Boats, Inc — Scope I.D.: C02C005

Project: Ozone Impact Modeling-Adj. Std. Petition — Page: 2 of 2

Prepared by: [signature] — Date: 3/14/03

Checked by: — Date:

Step 3 (cont'd) Using the middle column of Table 1 of the OZONE SCREENING PROCEDURE and considering the max. daily VOC emissions of 0.8 Tons/day the Table 1 ozone increment (amount added to existing background ozone levels) falls between 100 Tons of NMVOC annual emissions and 300 Tons. (i.e., 0.8 Tons/day x 365 days per year = 292 Tons/yr) Since 292 Tons/yr is nearest to 300 Tons in Table 1, the predicted ozone increment is 1.0 pphm.

Step 4 Converting the value of 1.0 pphm to ppm, the procedure specifies multiplying by a factor of 0.01. Therefore, the ozone increment generated by Crownline's operations is (1.0 pphm) x (0.01) = 0.01 ppm

Step 5 This ozone increment is then added to background air quality as measured by the nearest ozone monitor (Dale Monitor located in Hamilton County, Illinois). Using Illinois EPA air quality monitoring reports for years 1999, 2000 and 2001, the highest 4th high measured ozone concentration from any of these three consecutive years of data is 0.093 ppm

Adding this value to the increment as determined by the ozone screening procedure, we get a combined ozone level of 0.103 ppm. This is < 0.12 ppm (the 1-hour ozone standard) Therefore, the impact on ambient ozone air quality from Crownline's operations can be considered negligible.

A-88-04
II-I-5

VOC/NOx POINT SOURCE SCREENING TABLES

by Richard D. Scheffe

DRAFT

September, 1988

United States Environmental Protection Agency
Office of Air Quality Planning and Standards
Technical Support Division
Source Receptor Analysis Branch

3.0 SCREENING TABLES

The interpretation or definition of a "rural" or "urban" area within the framework of this technique is intended to be rather broad and flexible. The rationale for having rural and urban tables stems from the need to account for the coupled effect of point source emissions and background chemistry on ozone formation. Background chemistry in the context of this procedure refers to a characterization of the ambient atmospheric chemistry into which a point source emits. The underlying model runs used to develop the rural table (Table 1) were performed with spatially invariant background chemistry representative of "clean" continental U.S. areas. Model runs used to develop the urban table (Table 2) were based on background chemistry incorporating daily temporal fluctuations of NOx and hydrocarbons associated with a typical urban atmosphere (refer to Appendix A for details regarding background chemistry). Background chemistry is an important factor in estimating ozone formation; however, characterization of background chemistry is perhaps the most difficult aspect of reactive plume modeling because of data scarcity and the level of resources required to measure or model (temporally and spatially) the components necessary to characterize the ambient atmospheric along the trajectory of a point source plume.

Recognizing the conflicting needs of using simple characterizations of background chemistries and applying this screening technique in situations where sources are located in or impact on areas which can not be simply categorized, the following steps should be used to choose an appropriate table:

(1) If the source location and downwind impact area can be described as rural and where ozone exceedances have never been reported, choose the rural area table.

(2) If the source location and downwind impact area are of urban character, choose the urban area table.

(3) If an urban based source potentially can impact a downwind rural area, or a rural based source can potentially impact a downwind urban area, use the highest value obtained from applying both tables.

The VOC point source screening tables (Tables 1 and 2) provide ozone increments as a function of NMOC (nonmethane organic carbon) mass emissions rates and NMOC/NOx emissions ratios. To determine an ozone impact the user is required to apply best estimates of maximum daily NMOC emissions rate, and estimated annual mass emissions rates of NMOC and NOx which are used to determine NMOC/NOx ratio for ascribing the applicable column in Table 1 or 2. The reasons for basing application on daily maximum NMOC emissions rates are (1) to avoid underestimates resulting from discontinuous operations and (2) the underlying modeling simulations are based on single day episodes. The NMOC emissions rates in Tables 1 and 2 are given on an annual basis; consequently the user must project daily maximum to annual emissions rates, as illustrated in the example application given below. One purpose of this technique is to provide a simple, non-resource intensive tool; therefore, annual NMOC/NOx emissions ratios are used because consideration of daily fluctuations would require a screening application applied to each day.

Parameters describing background chemistry, episodic meteorology, and source emissions speciation affect actual ozone impact produced by a point source. However, as a screening methodology the application should be simple, robust and yield conservative (high ozone) values. Thus, only NMOC and NOx emissions rates are required as input to Tables 1 and 2.

Rural Example Application

A manufacturing company intends to construct a facility in an isolated rural location where ozone exceedances have never been observed. The pollution control agency requires that the company submit an analysis showing that operation of the proposed facility will not result in an ozone increment greater than X ppm in order to permit operation. The estimated daily maximum NMOC emissions rate is 9000 lbs/day. The annual estimated emissions rates for NMOC and NOx are 1000 tons/yr and 80 tons/yr, respectively. The company's strategy is to provide a screening analysis using the rural area table to prove future compliance. If the screening result exceeds X ppm, the company will initiate a detailed modeling analysis requiring characterization of source emissions speciation, ambient chemistry, and episodic meteorology.

Screening Estimate:

1 - Determine which column of Table (1) is applicable:

The NMOC/NOx ratio is based on annual estimates; thus, 1000/80 = 12.5 and middle column values are applied.

2 - Calculate annual NMOC emissions rates in tons/yr from maximum daily rate:

(9000 lbs/day)(1 ton/2000 lbs)(365 days/yr) = 1643 tons/yr

3 - Interpolate linearly between 1500 tons/yr and 2000 tons/yr to produce an interpolated column 2 ozone increment:

$$\left[(1643-1500)(3.84-3.05)/(2000-1500)\right] + 3.04 = 3.27 \text{ pphm}$$

$$3.27\text{pphm}(1 \text{ ppm}/100 \text{ pphm}) = \underline{0.0327 \text{ ppm}}$$

If 0.0327 ppm is below the criterion value (X ppm), no further modeling analysis is required and operation may be permitted. Otherwise, the company will procede with an additional case-specific modeling analysis.

Table 1. Rural based ozone increment (pphm) as a function of NMOC emissions and NMOC/NOx ratios.

NMOC EMISSIONS (TONS/YR)	NMOC/NOx TONS NMOC/TONS NOx (PPMC/PPM) > 20.7 (> 20)	5.2-20.7 (5-20)	< 5.2 (< 5)
50	0.4	0.4	1.1
75	0.4	0.4	1.2
100	0.4	0.5	1.4
300	0.8	1.0	1.7
500	1.1	1.4	1.9
750	1.6	1.9	2.3
1000	2.0	2.4	2.7
1500	2.7	3.0	3.3
2000	3.4	3.8	3.7
3000	4.8	5.2	4.3
5000	7.0	7.5	4.8
7500	9.8	10.1	5.1
10000	12.2	12.9	5.4

* multiply pphm by 0.01 to obtain ppm

DRAFT

(0.8 T/day) × (365 days/yr) = 292 Tons/yr,

Table B2

2000
OZONE

STATION	ADDRESS	NUMBER OF DAYS VALID APR-OCT	GREATER THAN 0.12 PPM	HIGHEST SAMPLES (parts per million) 1-HOUR 1ST	1-HOUR 2ND	1-HOUR 3RD	1-HOUR 4TH	8-HOUR 1ST	8-HOUR 2ND	8-HOUR 3RD	8-HOUR 4TH
69 METROPOLITAN QUAD CITIES INTERSTATE (IA - IL)											
ROCK ISLAND COUNTY											
Moline	30 18th St.	204	0	0.081	0.074	0.072	0.067	0.070	0.068	0.067	0.064
70 METROPOLITAN ST. LOUIS INTERSTATE (IL - MO)											
MADISON COUNTY											
Alton	409 Main St.	198	0	0.111	0.107	0.104	0.093	0.085	0.082	0.079	0.077
Edwardsville	Poag Road	208	0	0.112	0.098	0.094	0.091	0.091	0.079	0.078	0.078
Maryville	200 W. Division	214	0	0.122	0.112	0.103	0.101	0.090	0.089	0.088	0.078
Wood River	54 N. Walcott	214	0	0.116	0.099	0.099	0.095	0.089	0.081	0.079	0.078
RANDOLPH COUNTY											
Houston	Twp Rds. 150 & 45	214	0	0.092	0.091	0.089	0.088	0.086	0.078	0.078	0.076
ST. CLAIR COUNTY											
East St. Louis	13th & Tudor	214	0	0.110	0.105	0.103	0.102	0.090	0.087	0.086	0.084
73 ROCKFORD - JANESVILLE - BELOIT INTERSTATE (IL - WI)											
WINNEBAGO COUNTY											
Loves Park	1405 Maple	213	0	0.084	0.082	0.080	0.079	0.076	0.075	0.075	0.070
Rockford	1500 Post	214	0	0.086	0.084	0.081	0.078	0.078	0.076	0.075	0.069
74 SOUTHEAST ILLINOIS INTRASTATE											
EFFINGHAM COUNTY											
Effingham	Route 45 South	213	0	0.086	0.085	0.085	0.080	0.084	0.082	0.079	0.074
HAMILTON COUNTY											
→ Dale	Route 142	211	0	0.097	0.096	0.095	0.093	0.088	0.085	0.081	0.080
75 WEST CENTRAL ILLINOIS INTRASTATE											
ADAMS COUNTY											
Quincy	732 Hampshire	213	0	0.094	0.082	0.081	0.077	0.079	0.073	0.071	0.071
JERSEY COUNTY											
Jerseyville	Liberty St.	214	0	0.105	0.104	0.101	0.100	0.087	0.083	0.083	0.083
MACON COUNTY											
Decatur	2200 N. 22nd St.	214	0	0.097	0.092	0.085	0.085	0.084	0.080	0.077	0.077
MACOUPIN COUNTY											
Nilwood	Heaton & DuBois	210	0	0.107	0.104	0.102	0.099	0.091	0.089	0.088	0.083
SANGAMON COUNTY											
Springfield	2875 N. Dirksen	211	0	0.102	0.100	0.092	0.089	0.091	0.083	0.079	0.079

Primary 1-Hour Standard 0.12 ppm; 8-Hour Standard 0.08 ppm

Table B2

1999
OZONE

STATION	ADDRESS	NUMBER OF DAYS VALID APR-OCT	GREATER THAN 0.12 PPM	1-HOUR 1ST	1-HOUR 2ND	1-HOUR 3RD	1-HOUR 4TH	8-HOUR 1ST	8-HOUR 2ND	8-HOUR 3RD	8-HOUR 4TH
69 METROPOLITAN QUAD CITIES INTERSTATE (IA - IL)											
ROCK ISLAND COUNTY											
Moline	30 18th St.	211	0	0.092	0.090	0.089	0.088	0.083	0.079	0.076	0.074
70 METROPOLITAN ST. LOUIS INTERSTATE (IL - MO)											
MADISON COUNTY											
Alton	409 Main St.	213	1	0.129	0.118	0.118	0.112	0.100	0.097	0.096	0.090
Edwardsville	Poag Road	211	0	0.115	0.111	0.111	0.106	0.105	0.093	0.092	0.092
Maryville	200 W. Division	211	0	0.124	0.114	0.110	0.105	0.104	0.096	0.092	0.085
Wood River	54 N. Walcott	209	1	0.125	0.112	0.111	0.109	0.111	0.101	0.091	0.084
RANDOLPH COUNTY											
Houston	Twp Rds. 150 & 45	214	0	0.100	0.100	0.094	0.092	0.088	0.087	0.084	0.082
ST. CLAIR COUNTY											
East St. Louis	13th & Tudor	214	0	0.119	0.110	0.108	0.097	0.096	0.096	0.085	0.084
73 ROCKFORD - JANESVILLE - BELOIT INTERSTATE (IL - WI)											
WINNEBAGO COUNTY											
Loves Park	1405 Maple	214	0	0.091	0.086	0.085	0.085	0.083	0.079	0.078	0.077
Rockford	1500 Post	211	0	0.096	0.093	0.092	0.089	0.085	0.084	0.082	0.082
74 SOUTHEAST ILLINOIS INTRASTATE											
EFFINGHAM COUNTY											
Effingham	Route 45 South	212	0	0.104	0.103	0.103	0.100	0.095	0.095	0.094	0.092
HAMILTON COUNTY											
Dale	Route 142	209	0	0.097	0.097	0.095	0.088	0.092	0.087	0.087	0.080
75 WEST CENTRAL ILLINOIS INTRASTATE											
ADAMS COUNTY											
Quincy	732 Hampshire	214	0	0.095	0.091	0.089	0.088	0.086	0.083	0.080	0.075
JERSEY COUNTY											
Jerseyville	Liberty St.	214	3	0.139	0.128	0.127	0.123	0.104	0.104	0.103	0.100
MACON COUNTY											
Decatur	2200 N. 22nd St.	213	0	0.104	0.102	0.096	0.096	0.091	0.088	0.087	0.087
MACOUPIN COUNTY											
Nilwood	Heaton & DuBois	211	0	0.104	0.101	0.098	0.097	0.092	0.089	0.086	0.085
SANGAMON COUNTY											
Springfield	2875 N. Dirksen	213	0	0.111	0.099	0.097	0.090	0.091	0.088	0.078	0.075

HIGHEST SAMPLES (parts per million)

Primary 1-Hour Standard 0.12 ppm; 8-Hour Standard 0.08 ppm

Table B2

2001
OZONE

STATION	ADDRESS	NUMBER OF DAYS VALID APR-OCT	GREATER THAN 0.12 PPM	1-HOUR 1ST	1-HOUR 2ND	1-HOUR 3RD	1-HOUR 4TH	8-HOUR 1ST	8-HOUR 2ND	8-HOUR 3RD	8-HOUR 4TH
69 METROPOLITAN QUAD CITIES INTERSTATE (IA - IL)											
ROCK ISLAND COUNTY											
Rock Island	32 Rodman Ave.	201	0	0.087	0.083	0.082	0.082	0.082	0.080	0.078	0.073
70 METROPOLITAN ST. LOUIS INTERSTATE (IL - MO)											
MADISON COUNTY											
Alton	409 Main St.	214	0	0.117	0.116	0.108	0.108	0.090	0.087	0.085	0.082
Edwardsville	Poag Road	214	0	0.107	0.089	0.086	0.084	0.083	0.079	0.077	0.075
Maryville	200 W. Division	211	0	0.103	0.091	0.084	0.084	0.078	0.075	0.075	0.073
Wood River	54 N. Walcott	212	1	0.125	0.116	0.100	0.098	0.088	0.080	0.079	0.078
RANDOLPH COUNTY											
Houston	Twp Rds. 150 & 45	214	0	0.095	0.092	0.091	0.088	0.082	0.081	0.081	0.077
ST. CLAIR COUNTY											
East St. Louis	13th & Tudor	214	0	0.110	0.101	0.091	0.089	0.082	0.080	0.079	0.078
73 ROCKFORD - JANESVILLE - BELOIT INTERSTATE (IL - WI)											
WINNEBAGO COUNTY											
Loves Park	1405 Maple	213	0	0.090	0.084	0.080	0.080	0.081	0.081	0.076	0.075
Rockford	1500 Post	204	0	0.091	0.086	0.083	0.082	0.082	0.082	0.078	0.078
74 SOUTHEAST ILLINOIS INTRASTATE											
EFFINGHAM COUNTY											
Effingham	Route 45 South	213	0	0.094	0.090	0.084	0.084	0.079	0.078	0.078	0.077
HAMILTON COUNTY											
Dale	Route 142	207	0	0.082	0.080	0.079	0.078	0.077	0.074	0.073	0.071
75 WEST CENTRAL ILLINOIS INTRASTATE											
ADAMS COUNTY											
Quincy	732 Hampshire	213	0	0.097	0.088	0.088	0.087	0.088	0.082	0.078	0.078
JERSEY COUNTY											
Jerseyville	Liberty St.	213	1	0.131	0.102	0.101	0.101	0.094	0.091	0.089	0.084
MACON COUNTY											
Decatur	2200 N. 22nd St.	213	0	0.084	0.078	0.078	0.075	0.074	0.073	0.072	0.071
MACOUPIN COUNTY											
Nilwood	Heaton & DuBois	214	0	0.100	0.098	0.094	0.086	0.091	0.077	0.075	0.074
SANGAMON COUNTY											
Springfield	2875 N. Dirksen	208	0	0.107	0.095	0.094	0.090	0.095	0.080	0.073	0.073

HIGHEST SAMPLES (parts per million)

Primary 1-Hour Standard 0.12 ppm; 8-Hour Standard 0.08 ppm