

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report for

PROPOSED AMENDED RULE 1162 - POLYESTER RESIN OPERATIONS

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EXECUTIVE SUMMARY

The proposed amendment to the South Coast Air Quality Management District (AQMD) Rule 1162 – Polyester Resin Operations seeks to incorporate all feasible control measures by incorporating the requirements of the US Environmental Protection Agency (U.S. EPA) Control Techniques Guidelines (CTG) for Fiberglass Boat Manufacturing Materials and improves rule language and enforceability. Furthermore, the CTG triggers the amendment of Rule 1132 – Further Control of VOC Emissions from High-Emitting Spray Booth Facilities to lower the monomer content value of pigmented, non-white gel coat in subparagraph (d)(1)(D).

In September 2008, the U.S. EPA established the CTG for fiberglass boat manufacturing materials based on the 2001 National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR Part 63, Subpart VVVV. The CTG requires lower monomer content in gel coats and resins and establishes two new control measures for mixing and storage containers and for cleanup solvents to further reduce the volatile organic compound (VOC) and Hazardous Air Pollutant (HAP) emissions from fiberglass boat manufacturing operations. The CTG is applicable to fiberglass boat manufacturing facilities where the total actual VOC emissions equal or exceed 15 pounds per day or 2.7 tons in a 12-month rolling period.

Based on the 2008 Emissions Inventory of composite facilities in the AQMD, the proposed amendment is applicable to three fiberglass boat manufacturing facilities (one major and two area source facilities). Implementation of these additional feasible control measures through the proposed amendment is expected to result in modest VOC and HAP emission reductions from the three boat manufacturing facilities, estimated at 0.133 ton per year (0.73 pounds per day).

The CTG requirement is based on the 2001 NESHAP for boat manufacturing, which has been fully implemented at composite industry major sources. For the two boat manufacturing area source facilities, the proposed amendment impact is considered negligible. Accordingly, there will be no anticipated cost impact associated with the proposed amendment. The proposed rule does not significantly affect air quality or emissions limitations, and does not impose new controls. Therefore, the proposed amendment is not expected to result in significant adverse socioeconomic or environmental impacts.

BACKGROUND

One of the main objectives of the South Coast Air Quality Management District (AQMD) in reducing regional ozone formation is to control the emissions of VOCs and HAPs from stationary sources, such as polyester resin operations. Polyester resin operations involve the application of gel coats, resins, coatings, solvents and adhesives which emit VOCs and HAPs into the atmosphere.

Rule 1162 – Polyester Resin Operations, was adopted on March 6, 1987 to control emissions from polyester resin operations and subsequently amended 11 times, including on April 3, 1987; August 3, 1990; December 7, 1990; August 2, 1991; July 10, 1992; May 13, 1994; November 17, 2000; November 9, 2001; July 11, 2003; July 9, 2004 and July 8, 2005.

CTG for Fiberglass Boat Manufacturing Materials

The U.S. EPA promulgated the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for boat manufacturing (40 CFR Part 63, Subpart VVVV) in 2001, which established organic hazardous air pollutant (HAP) emission limits based on low HAP resins and gel coats and low-emissions resin application techniques. The U.S. EPA's Office of Air Quality Planning and Standards, based on the 2001 NESHAP, published the CTG for Fiberglass Boat Manufacturing Materials (EPA-453/R-08-004) in September 2008.

The CTG requirements apply to fiberglass boat manufacturing facilities that emit 15 pounds per day, or 2.7 tons in a 12-month rolling period. The CTG identifies three primary sources of VOC and HAP emissions from fiberglass boat manufacturing materials: 1) emissions from gel coats and resins applications, 2) emissions from gel coat and resins mixing and storage containers, and 3) emissions from cleanup solvent applications. Accordingly, the objective of the CTG is to achieve further emissions reductions from the three identified emission sources by requiring lower monomer content gel coat and resin for boat manufacturing facilities and applying additional emission control measures to resin and gel coat mixing and storage containers, and cleanup solvents.

The CTG defined VOC emissions from fiberglass boat manufacturing materials as monomer and non-monomer emissions. A monomer is a chemically reactive VOC that partially combines with itself, or other similar compound, by a cross-linkage reaction. A fraction of the monomer VOC evaporates during gel coat and resin applications and curing, while the majority is incorporated into the final product and is not emitted. A non-monomer is a VOC that does not become part of the hardened gel coats or resins, but is assumed to be emitted completely. However, the non-monomer VOC constitutes less than five percent by weight of all gel coat and resin emissions and less than one percent by weight of each gel coat or resin.

The CTG affirmed that styrene and methyl methacrylate (MMA) are the primary VOCs, as well as the primary HAPs emitted from composite operations. Therefore the HAP limits in the NESHAP and the VOC limits in local air districts rules can be compared directly.

The CTG also indicated that compliant gel coats and resins for boat manufacturing facilities are part of the 2001 NESHAP which is fully implemented, reasonably available, and technically and economically feasible.

In California, there is no statewide regulation for polyester resin operations, but there are 16 air district rules for such operations, including AQMD Rule 1162. Rule 1162 represents the most stringent requirements in the state, although it is currently not as stringent as the 2001 NESHAP in specific categories.

Purpose

The main objective of PAR 1162 is to achieve further emission reductions of VOCs and HAPs by incorporating the CTG requirements which include lower monomer content gel coats and resins for boat manufacturing operations and more stringent requirements for gel coat and resin mixing and storage containers, and cleanup solvents.

Affected Sources

PAR 1162 applies to all composite operations in the District which include, but is not limited to, the manufacturers of fiberglass recreation and commercial boats; tubs, showers and vanities; building panels and appliances; sports equipment and power tools; automotive, aerospace and aircraft components; and chemical process equipment and storage tanks.

Based on the 2008 Emissions Inventory, staff has identified 50 composite facilities in the District subject to PAR 1162 (See Appendix A). The annual emissions inventory of these facilities, based on the Uniform Emission Factor (UEF) table of 2001, is estimated at 554 tons per year (tpy) or 1.52 tons per day (tpd) of VOC and HAP (See Appendix B). Additionally, the 2008 Emissions Inventory indicates that five of the composite facilities in the District are large emitters (emits more than 20 tpy/each) and utilize spray booths in their operations. These facilities are also subject to Rule 1132 – Further Control of VOC Emissions from High-Emitting Spray Booth Facilities.

The emissions inventory of these five facilities are estimated, based on the UEF of 2001, at 353 tpy or 0.97 tpd, which represents approximately 64 % of the total VOC and HAP emissions of the composite operations.

The CTG requirements apply to boat manufacturing facilities that emit 15 lb/day (2.7 tpy) or greater. The 2008 Emissions Inventory identified only one boat manufacturing facility in the SCAQMD that emits 16.54 tpy and therefore subject to the CTG requirements. The 2008 Emission Inventory also identified two other boat manufacturing facilities that emit less than 2.7 tpy of VOCs and HAPs and currently not subject to the CTG requirements.

PROPOSED AMENDMENT

The proposed amendment is crafted to be equivalent to or more stringent than the CTG requirements and include the following:

- Lower monomer content gel coat and resin for boat manufacturing facilities.
- New control measures for mixing and storage containers.
- New control measures for cleanup solvents.
- Definitions of tooling gel coat and tooling resin.
- Definition of the monomer percent by weight of a resin or gel coat.
- Deletion of the outdated rule requirements.

Lower Monomer Content Gel Coats and Resins

The proposed amendment requires all boat manufacturing facilities in the District to comply with the lower monomer content for pigmented, non-white gel coats, from 37% to 33%, and with tooling gel coat and tooling resin from 48% to 40% and 48% to 39% by weight, respectively as specified in Table (1).

New Control Measures for Mixing and Storage Containers

The proposed amendment establishes new control measures to further reduce the VOC and HAP emissions from mixing and storage containers of gel coats and resins. Presently, similar

requirements are included in AQMD Rule 1141.1 – Coatings and Inks Manufacturing, and the proposed amendment clarifies applicability of these requirements to polyester resin operations. Table (2) compares the mixing and storage requirements of the CTG and PAR 1162. As indicated previously, the HAP limit in the NESHAP and the VOC limits in local air districts rules can be compared directly.

Table (1) - Comparison between the HAP Limits by weight of the CTG and the Corresponding Monomer Contents by weight of PAR 1162 for Boat Manufacturing Facilities

HAPs by Weight (CTG)	Monomer Content by Weight (PAR 1162)
Production Resin Operations (Atomized) -28%	Not Applicable*
Production Resin Operations (Nonatomized) - 35%	General Purpose Resin (Nonatomized) - 35%
Pigmented Gel Coat Operations (Any Method) - 33%	Pigmented, Non-White Gel Coat (Compliant Application)**- 33%
Clear Gel Coat (Any Method) - 48%	Clear Gel Coat (Compliant Application)** - 40% & 44%
Tooling Resin Operation (Atomized) - 30%	Not Applicable*
Tooling Resin Operation (Nonatomized) - 39%	Tooling Resin (Nonatomized) 39%
Tooling Gel Coat Operation (Any Method) - 40%	Tooling Gel Coat (Compliant Application)** 40%

*: R 1162 does not allow the atomized application of resin.

** : Gel coats compliant application techniques are listed in subparagraph (c)(2)(A). For pigmented, white and off-white gel coat, current Rule 1162 (30% monomer content by weight) is more stringent than the CTG requirement (33% HAP limit by weight).

New Controls for Cleanup Solvents

The proposed amendment establishes new controls to further reduce the VOC and HAP emissions from cleanup solvents of gel coats and resins applications and tools. Presently, these requirements are covered under AQMD Rule 1171 – Solvent Cleaning Operations. Table (3) compares the cleanup solvent requirements of the CTG and PAR 1162.

Table (2) - Mixing and Storage Containers Requirements of the CTG and PAR 1162

CTG	PAR 1162
<p><u>Containers</u> Mixing and storage containers with capacity of 208 liters (55 gallons) or greater shall be sealed with tightly fitting covers during mixing operations.</p>	<p>All mixing and storage containers shall be sealed with tightly fitted covers during mixing and storage operations, except to add ingredients or take samples.</p>
<p><u>Covers</u> Covers shall be modified with openings to allow the mixing and pumping equipment into the containers.</p>	<p>Covers shall extend at least ½ inch beyond the outer rim of the containers or attach to the rim of the containers.</p> <p>Covers shall be maintained in good conditions such that, when in place, they maintain contact with the circumference of the rim of the containers.</p> <p>Covers may have slits to allow clearance for insertion of mixing and pumping equipment into the containers.</p>
<p><u>Openings/Slits</u> Openings shall be sealed to reduce the VOC emissions, when they are not in use.</p>	<p>Slits shall be covered after insertion of the mixtures or pumping equipment, except to allow the safe clearance and shall be sealed when they are not in use.</p>

Table (3) - Cleanup Solvents Requirements of the CTG and PAR 1162

CTG	PAR 1162
<p>Use water-based emulsifiers with less than 5 percent VOC by weight or organic solvents with low vapor pressure (equal to or less than 0.5 mm Hg at 68 °F) such as dibasic esters (DBE).</p> <p>Cleanup solvents can typically be recovered and recycled.</p>	<p>Cleanup solvents used in cleaning gel coat and resin applications and tools shall comply with the VOC limit of 25 g/l, as specified in Rule 1171 - Solvents Cleanup Operations.</p> <p>Cleanup solvents used in remote reservoir cleaners (as defined in Rule 1171) shall be recovered and recycled.</p>

Definitions of Tooling Gel Coat and Tooling Resin

The proposed amendment includes in subparagraph (b)(39) a definition for tooling gel coat as a polyester resin material which is used in the construction of molds (tools). Tooling gel coat is specially formulated to provide high heat resistance, high gloss, and hard durable surface to endure the repeated mold cycles.

The proposed amendment in subparagraph (b)(40) also defines tooling resin as a polyester resin material which is used to build up or repair molds. Molds are used in the fabrications of composite products.

Definition of Monomer Percent by Weight of a Gel Coat or Resin

The proposed amendment includes a clarification in the definition of the monomer percent by weight [subparagraph (b)(20)] to read “monomer percent by weight of a gel coat or a resin is the weight of the monomer divided by the weight of the gel coat or resin applied” to be consistent with standard monomer content calculations, as implemented in practice. The necessity for this amendment can be illustrated using the following example:

- An open molding application of one ton (2000 pounds) of general purpose resins (37% monomer content by weight) using non-atomized spray application techniques.
- 2000 lbs of a general purpose resin
= 740 lbs monomer + 1260 lbs solids
= 377 lbs emitted VOCs and HAPs (UEF table 2001) + 363 lbs crosslinked monomer + 1260 pounds solids
- Weight of the polymer = 363 lbs crosslinked monomer + 1260 lbs solids = 1623 lbs
- Based on the current monomer definition, the monomer percent by weight
= weight of monomer / weight of polymer = 740 lbs / 1623 lbs = 45.6%
- Based on the proposed definition, the monomer percent by weight
= weight of monomer / weight of resin applied = 740 lbs / 2000 lbs = 37%

Deletion of the Outdated Rule Requirements

To improve rule clarity, staff deleted the following:

- Subparagraph (c)(2)(A) - outdated monomer content requirements.
- Subparagraph (c)(2)(B) - “Compliance operations... shall comply... on January 1, 2002”
- Subparagraph (c)(3)(B) - “Until July 1, 2002 ...”

CONTROL TECHNOLOGY

The proposed amendment contains no additional control technologies requirements applicable to the polyester resin operations.

EMISSIONS INVENTORY AND REDUCTION

All composite facilities in the District are subject to Rule 1162. Composite facilities that emit more than twenty (20) tpy and utilize paint spray booths as part of their operations are also subject to Rule 1132. The 2008 emissions inventory of composite facilities in the AQMD includes 50 composite facilities that are subject to Rule 1162 and five of these facilities are also subject to Rule 1132. The total usage of composite materials in the SCAQMD was estimated at 13,445 tpy and the total VOC/HAP emissions were estimated at 554 tpy. Table (4) shows the breakdown of the number of composite facilities, their VOC and HAP emissions (tpy) and relative contribution to the overall emissions inventory in 2008.

Table (4) –Composite Facilities Subject to Rules 1162 and 1132, their Emissions and Relative Contribution to the Emissions Inventory in 2008

Emission Category	Applicable Rule	Number of Facilities	VOC & HAP Emissions (tpy)	Emissions %
> 20 tpy	R1162, R1132	5	353.44	64
≤ 20 tpy	R1162	45	200.49	36
Total		50	553.93	100

Emission Reductions Associated with the Implementation of the CTG for Fiberglass Boat Manufacturing Materials

Based on 2008 Emissions Inventory of composite facilities in the SCAQMD, the implementation of the CTG requirements will apply to three (3) boat manufacturing facilities which emit a total of 20.66 tpy of VOC and HAPs. The CTG requirements will lower the monomer content of pigmented, non-white gel coats from the current Rule 1162 requirements of 37% to the CTG requirements of 33% by weight. There were no mold building at these boat manufacturing facilities; therefore there were no usage of tooling resins and gel coat at these facilities. The emission reductions associated with lower monomer content were calculated as follows:

- Based on the 2008 Emissions Inventory, the total usage of and emissions from composite materials at the three (3) boat manufacturing facilities were estimated at 363.28 tpy and 20.66 tpy, respectively, which include, but are not limited to, the usages of and emissions from resins, gel coats, solvents, coatings and adhesives.
- Based on composite material usages and emissions analyses stated in the Final Staff Report of 2001 Rule 1162 amendment:
 - The average emissions from solvents, coatings and adhesives of composite operations is estimated at 10.75% of the total emissions of the composite operations and the average gel coats usage was estimated at 7.75% of the total usage of gel coats and resins in composite operations.
 - The average pigmented gel coat usage was estimated at 85% of the total gel coats usage in composite operations and the average pigmented (non-white) gel coat usage was estimated at 15% of the total pigmented gel coats usage in composite operations.

- The emissions from monomer content of pigmented (non-white) gel coat are calculated using the Unified Emissions Factors Table in Appendix B.

The emission reductions associated with the implementation of the CTG requirements in the three boat manufacturing facilities is calculated as follows:

1. *Total Emissions of Resins and Gel Coats* =
Total Emissions [1-Average Percentage of Solvents, Coatings and Adhesives Emissions (10.75%)] =
Total Emissions (1- 0.1075) =
 $20.66 \text{ tpy} \times 0.8925 = 18.44 \text{ tpy}$
2. *Total Usage of Resins and Gel Coats* =
Total Usage of Composite Facilities x Emissions of Resins and Gel Coats/ Total Emissions =
Total Usage of Composite Facilities x 18.44 tpy/20.66 tpy =
 $363.28 \text{ tpy} \times 18.44 \text{ tpy}/20.66 \text{ tpy} = 324.24 \text{ tpy}$
3. *Estimated Total Usage of Gel Coats* =
Total Usage of Resins and Gel Coats x Average Percentage of Gel Coats Usage (7.75%) =
 $324.24 \text{ tpy} \times 0.0775 = 25.13 \text{ tpy}$
4. *Estimated Total Usage of Pigmented (Non-white) Gel Coats* =
Total Usage of Gel Coats x Average Percentage of Pigmented Gel Coats (85%) x Average Percentage of Pigmented, Non-white Gel Coats (15%) =
 $25.13 \text{ tpy} \times 0.85 \times 0.15 = 3.20 \text{ tpy}$
5. *Estimated Emissions Reduction of Pigmented (Non-white) Gel Coats* =
Total Usage of Pigmented, Non-white Gel Coats x (Emission of 37% Monomer Content - Emission of 33% Monomer Content) =
 $3.20 \text{ tpy} \times (377 \text{ lb/t}-294 \text{ lbs/t}) = 265.6 \text{ lb/yr} = \underline{0.133 \text{ tpy}} = \underline{0.73 \text{ pounds per day (ppd)}}$

Accordingly, the total emission reductions associated with lower monomer content requirements of CTG for fiberglass boat manufacturing materials is estimated at **0.133 tpy or 0.73 ppd.**

COST IMPACTS

The proposed amendment to Rule 1162 incorporates the CTG for fiberglass boat manufacturing materials. These guidelines are based on the 2001 NESHAP for boat manufacturing (40 CFR Part 63, Subpart VVVV), which are fully implemented in composite industry. Accordingly, there will be no cost impacts associated with the proposed amendment.

INCREMENTAL COST EFFECTIVENESS ANALYSIS

Because the proposed amendment will not result in cost impacts, no incremental cost effectiveness analysis is required.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Pursuant to the California Environmental Quality Act (CEQA) and AQMD Rule 110 a Draft Environmental Assessment (EA) will be prepared. The Draft EA, when completed, will be available by contacting the SCAQMD's Public Information Center at (909) 396-2039.

SOCIOECONOMIC ANALYSIS

The proposed amendment is not expected to result in adverse socioeconomic or environmental impacts since the proposed rule does not significantly affect air quality or emissions limitations, and does not impose new controls.

COMPARATIVE ANALYSIS

As required by California Health and Safety Code Section 40727.2, the comparative analysis identifies and analyzes federal and other AQMD regulations that apply to the same equipment or source category (fiberglass boat manufacturers) as the proposed amendment. The comparative analysis included the requirements of PAR1162, PAR 1132, and the 2001 National Emission Standards for Hazardous Air Pollutants (NESHAP) for Boat Manufacturing (40CFR, Part 63, Subpart VVVV), and is summarized in Table (5), pages 10 & 11. The strikeouts denote the current values that will be amended.

DRAFT FINDINGS

Before adopting, amending or repealing a rule, the AQMD shall make findings of necessity, authority, clarity, consistency, non-duplication, and reference, as defined in Health and Safety Code Section 40727. The draft findings are as follows:

Authority - The AQMD Governing Board obtains its authority to adopt, amend or repeal rules and regulations from Health and Safety Code §§40000, 40001, and 40440.

Clarity - The AQMD Governing Board finds and determines that Proposed Amended Rule 1162 is written and displayed so that the meaning can be easily understood by persons directly affected by it.

Consistency – The AQMD Governing Board finds and determines that Proposed Amended Rule 1162 is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or federal or state regulations.

Non-Duplication – The AQMD Governing Board has determined that Proposed Amended Rule 1162 does not impose the same requirements as any existing state or federal regulation.

Reference - In adopting this proposed amendment, the AQMD Governing Board references the following statutes which AQMD hereby implements, interprets or makes specific: Health and Safety Code Sections 40001 and 40440.

PAR 1162	PAR 1132	40 CFR PART 63 Subpart VVVV
- Non-White for Boat Mfg. (37**) 33	(37**) 33	33
- Non-White for Others 37	37	N/A
Tooling Gel Coat for Boat Mfg. (48**) 40	N/A	40
- Tooling Gel Coat for Others 48	N/A	N/A
- Primer 28	N/A	N/A
- Specialty Gel Coat 48	N/A	N/A
General Purpose Resins		
- Marble Resins 10 FR or 35 NR*	35	35 %
- Tub/Shower Resin 24 FR or 35 NR*	N/A	N/A
- Lamination Resins 31 FR or 35 NR*	N/A	N/A
- Others 35	N/A	N/A
Specialty Resins		
- Fire Retardant 38	N/A	N/A
- Corrosion Resist. 48	N/A	<u>N/A</u>
- High Strength 40	N/A	N/A
- Tooling Resin for Boat Mfg 39	N/A	39
- Tooling Resin for Others 48	N/A	N/A
Mixing and Storage Containers		
Mixing and storage containers requirements as specified in AQMD's Rule 1141.1- Coatings and Inks Manufacturing [See Table (2)]	N/A	CTG – New Control Measure for Mixing and Storage Containers [See Table (2)]
Cleanup Solvents		
Cleanup solvents requirements as specified in AQMD's Rule 1171- Solvent Cleanup Operations [See Table (3)]	N/A	CTG – New Control Measure for Cleanup Solvents [See Table (3)]

* - FR is a filled resin and NR is a neat resin (no filler)

** - Indicates current limits.

CONCLUSIONS AND RECOMMENDATIONS

Staff recommends Rule 1162 be amended to incorporate the CTG requirements for fiberglass boat manufacturing materials as stated by the U.S. EPA. In addition, staff proposes minor changes to enhance rule language clarity and enforceability.

REFERENCES

US Environmental Protection Agency “National Emission Standards for Hazardous Air Pollutants for Boat Manufacturing”, US.EPA, 40 CFR Part 63 Subpart VVVV, August 22, 2001.

US Environmental Protection Agency, “Control Techniques Guidelines for Fiberglass Boat Manufacturing Materials”, September 2008.

South Coast Air Quality Management District, “Final Staff Report For Proposed Amended Rule 1162-Polyester Resin Operations,” November 9, 2001.

R.A. Haberlein, “Technical Discussion of the United Emission Factors for Open Molding Composite,” Engineering Environmental, July 17, 2001.

Appendix A
LIST OF COMPOSITE FACILITIES
(Based on 2008 Emissions Inventory)

Facility ID	Facility Name	Facility ID	Facility Name
2344	20 TH Century Fox Film Corp	101542	Six-Eleven Limited Inc
59225	Americh Corp	1334	SOC-CO Plastic Coating Co
22963	Armorcast Prod. Co	123970	Sundance Spas Inc
110577	Armorcast Products Company	105395	Sunrise Sets & Effects, Inc
54219	AZ Countertops, Inc	2852	The Walt Disney Company
115996	Blackhawk Manufacturing, Inc	129739	Tropitone Furniture Co. Inc
11110	Bristol Fiberlite Industries, Inc	80321	Vista Consolidated Inc
138264	California Art Products	88228	Vortex Whirlpool Systems, Inc
98492	Century Plastics Inc	148400	Western Mill Fabricators, Inc
4002	Crockett Container Corp	62617	Willard Marine Inc*
7949	Custom Fiberglass Mfg Co	70021	Xerxes Corporation
115253	Designing Manufacturing Install.		
51849	Eliminator Custom Boats		
152947	Franklin Acquisition, LLC		
21732	G & B Fiberglass Prod. Co Inc		
2044	GB Mfg Inc/Calif. Acrylic dba		
18378	Gruber Systems, Inc		
153785	Guy Martin Design, Inc		
95831	Hannemann Fiberglass Inc		
23401	Hood Mfg Inc		
24647	J.B.I. Inc		
74529	K.F. Fiberglass, Inc		
142686	L.A. Spas, Inc		
18730	LA Steel Craft Production		
24060	Lasco Bathware Inc.		
14146	MAC Gregor Yacht Corp*		
142391	Moonlight Molds, Inc		
40806	New Basis		
10656	Newport Laminates		
154974	Nix & Nixie, Inc		
44707	Old Town Fiberglass, dba Fiber.		
140552	Performance Composites, Inc		
137672	Plastics Research Corporation		
148195	RC Fiberglass		
149241	Regal Cultured Marble		
44655	Reinhold Industries Inc		
8820	Reuland Electric Co		
128086	Shockwave Water Sports*		
25513	Six Flag Themes Parks Inc		

* Boat manufacturing facilities are highlighted

Appendix B
Unified Emission Factors for Open Molding of Composites
(Engineering Environmental Consulting Services, 2001)

<http://www.compositesone.com/documents/industryregs/UEFTable-Jul01.pdf>

Unified Emission Factors for Open Molding of Composites

July 23, 2001

Emission Rate in Pounds of Styrene Emitted per Ton of Resin or Gelcoat Processed

Styrene content in resin/gelcoat, % ⁽¹⁾	<33 ⁽²⁾	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	>50 ⁽²⁾
Manual	0.126 x %styrene x 2000	83	89	94	100	106	112	117	123	129	134	140	146	152	157	163	169	174	180	((0.286 x %styrene) - 0.0529) x 2000
Manual w/ Vapor Suppressed Resin VSR ⁽³⁾	Manual emission factor [listed above] x (1 - (0.50 x specific VSR reduction factor for each resin/suppressant formulation))																			
Mechanical Atomized	0.169 x %styrene x 2000	111	126	140	154	168	183	197	211	225	240	254	268	283	297	311	325	340	354	((0.714 x %styrene) - 0.18) x 2000
Mechanical Atomized with VSR ⁽³⁾	Mechanical Atomized emission factor [listed above] x (1 - (0.45 x specific VSR reduction factor for each resin/suppressant formulation))																			
Mechanical Atomized Controlled Spray ⁽⁴⁾	0.130 x %styrene x 2000	86	97	108	119	130	141	152	163	174	185	196	207	218	229	240	251	262	273	0.77 x ((0.714 x %styrene) - 0.18) x 2000
Mechanical Controlled Spray with VSR	Mechanical Atomized Controlled Spray emission factor [listed above] x (1 - (0.45 x specific VSR reduction factor for each resin/suppressant formulation))																			
Mechanical Non-Atomized	0.107 x %styrene x 2000	71	74	77	80	83	86	89	93	96	99	102	105	108	111	115	118	121	124	((0.157 x %styrene) - 0.0165) x 2000
Mechanical Non-Atomized with VSR ⁽³⁾	Mechanical Non-Atomized emission factor [listed above] x (1 - (0.45 x specific VSR reduction factor for each resin/suppressant formulation))																			
Filament application	0.184 x %styrene x 2000	122	127	133	138	144	149	155	160	166	171	177	182	188	193	199	204	210	215	((0.2746 x %styrene) - 0.0298) x 2000
Filament application with VSR ⁽³⁾	0.120 x %styrene x 2000	79	83	86	90	93	97	100	104	108	111	115	118	122	125	129	133	136	140	0.65 x ((0.2746 x %styrene) - 0.0298) x 2000
Gelcoat Application	0.445 x %styrene x 2000	294	315	336	356	377	398	418	439	460	481	501	522	543	564	584	605	626	646	((1.03646 x %styrene) - 0.195) x 2000
Gelcoat Controlled Spray Application ⁽⁴⁾	0.325 x %styrene x 2000	215	230	245	260	275	290	305	321	336	351	366	381	396	411	427	442	457	472	0.73 x ((1.03646 x %styrene) - 0.195) x 2000
Gelcoat Non-Atomized Application ⁽⁶⁾	SEE Note 9 below	196	205	214	223	232	241	250	259	268	278	287	296	305	314	323	332	341	350	((0.4506 x %styrene) - 0.0505) x 2000
Covered-Cure after Roll-Out	Non-VSR process emission factor [listed above] x (0.80 for Manual <or> 0.85 for Mechanical)																			
Covered-Cure without Roll-Out	Non-VSR process emission factor [listed above] x (0.50 for Manual <or> 0.55 for Mechanical)																			

Emission Rate in Pounds of Methyl Methacrylate Emitted per Ton of Gelcoat Processed

MMA content in gelcoat, % ⁽⁶⁾	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	≥20
Gel coat application ⁽⁷⁾	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	0.75 x %MMA x 2000

Notes

- 1 Including styrene monomer content as supplied, plus any extra styrene monomer added by the molder, but before addition of other additives such as powders, fillers, glass, etc.
- 2 Formulas for materials with styrene content < 33% are based on the emission rate at 33% (constant emission factor expressed as percent of available styrene), and for styrene content > 50% on the emission rate based on the extrapolated factor equations; these are not based on test data but are believed to be conservative estimates. The value for "% styrene" in the formulas should be input as a fraction. For example, use the input value 0.30 for a resin with 30% styrene content by wt.
- 3 The VSR reduction factor is determined by testing each resin/suppressant formulation according to the procedures detailed in the *CFA Vapor Suppressant Effectiveness Test*.
- 4 SEE the *CFA Controlled Spray Handbook* for a detailed description of the controlled spray procedures.
- 5 The effect of vapor suppressants on emissions from filament winding operations is based on the *Dow Filament Winding Emissions Study*.
- 6 Including MMA monomer content as supplied, plus any extra MMA monomer added by the molder, but before addition of other additives such as powders, fillers, glass, etc.
- 7 Based on gelcoat data from *NMMA Emission Study*.
- 8 SEE the July 17, 2001 EECS report *Emission Factors for Non-Atomized Application of Gel Coats used in the Open Molding of Composites* for a detailed description of the non-atomized gelcoat testing.
- 9 Use the equation ((0.4506 x %styrene) - 0.0505) x 2000 for gelcoats with styrene contents between 19% and 32% by wt.; use the equation 0.185 x %styrene x 2000 for gelcoats with less than 19% styrene content by wt.

UEF unified factors table revised July 23 '01.xls