AP42 Section:	4.4
Related:	3
Title:	Comments and notes to and from Ron Ryan regarding Baseline Characterization Of Emissions From Fiberglass Boat Manufacturing For National Marine Manufacturers Association 1997

NATIONAL MARINE MANUFACTURERS ASSOCIATION

September 3, 1997

Mr. Ron Ryan
USEPA
Emissions, Monitoring and Analysis Division
MD-14
Research Triangle Park, North Carolina 27711

Dear Ron,

On behalf of the recreational boat building industry, I want to thank you for taking the time to review and discuss the NMMA boat builders styrene emission study. We support your efforts to provide the most current best available information to both state regulators and industry.

I have continued to retain John Stelling to assist you in condensing the full report and converting it to a suitable format to be accessed via the EPA bulletin board.

If you should need any further assistance, please do not hesitate to call me.

Sincerely,

John McKnight

John McKnight, Director
Environmental and Safety Compliance

cc: Mr. Bill Hunt, EPA

JOHNNMMA@AOL.COM

Washington Harbour, 3050 K Street, N.W., Suite 145
Washington, D.C. 20007 • 202/944-4980

From: John H E Stelling <stellingengr@mindspring.com>
To: ~~RTP10.RTPTSD(RYAN-RON)~~
Date: 9/4/97 9:53pm
Subject: ~~Final Report~~

Ron

Here is the final report with two changes made. Attached is a zipped file with a PDF version of the NMMA report.

The two changes were to p. 1-6 to clarify the types of equipment used to apply the resin and gelcoat and to p. ~~2-16~~ 2-16 appears to be the same 2-17 has Table 2-5 & to report the correct values for resin application in Table 2-5 (as reported in Table 2-1). on pg. 2-17

I have forwarded the two change pages to Eric Goehl of ERG who will send them out with his meeting minutes from the Thursday meeting on the draft standard.

I appreciate your ~~patience as we received~~ these final review comments. Please feel free to post this version at your earliest convenience. I will provide a diskette version to you on Monday next week.

John

— I have 9-4-97 versions on floppy - chapters 1-4 only, not chapp. A→I

Ceron: Ambient Temp was very low in WA? & Boat could be flipped around easily for closer quarter coverage

STELLING ENGINEERING, P.A.
1319 ARNETTE AVENUE, DURHAM, NC 27707
(919) 419-0395 FAX 489-2064

August 31, 1997 rec'd opened 9/12/97

Mr. Ron Ryan
U.S. Environmental Protection Agency
OAQPS
Research Triangle Park, NC 27709

Re: Transmittal of Final NMMA Test Report File

Dear Ron:

Thank you for providing the opportunity to present the results of the testing of emissions from fiberglass boat manufacturing conducted by the National Marine Manufacturers Association (NMMA) last Wednesday. The comprehensive test program provides significant new information on emissions from this particular source category not previously documented.

We thank you also for your comments about the report and your desire to provide it on the Environmental Protection Agency's (EPA) information website. Enclosed is the entire text of the report in a single file readable with Adobe Acrobat (PDF format). The entire file is a little larger than a half megabyte; zipped the file is still over 300 Kbytes. Both versions are provided to you on the diskette. NMMARE~1.PDF ?

As you continue to review the report and move forward with revision of the AP-42 section for fiberglass boat manufacturing, please let me know how I can help.

Sincerely,

John H E Stelling, PE, CEP
Principal

9-4-97 I have on disk:
versions

NMMARE~1.ZIP 499,969 9-4-97 09:36:96pm
NMMARE~1.PDF 905,774 9-4-97 08:49:10pm
contains chap. 1→4 only
not App. A→I

Enc.

C: John McKnight, NMMA

NATIONAL MARINE MANUFACTURERS ASSOCIATION

August 22, 1997

Mr. Ron Ryan
USEPA
Emission Monitoring and Analysis Division
Research Triangle Park, North Carolina 27711

Dear Ron,

August 1997 rev. 1

Enclosed please find a copy of the report entitled, "Baseline Characterization of Emissions From Fiberglass Boat Manufacturing." We look forward to discussing the results with you on Wednesday, August 27th at 2:00 pm. In the meantime, if you have any questions, please do not hesitate to call me at 202-944-4980.

Sincerely,

John McKnight

John McKnight, Director
Environmental and Safety Compliance

cc: Madeleine Strum, USEPA, *abridged version*
Emery Kong, RTI, *abridged version*
Geddes Ramses USEPA, *abridged version*

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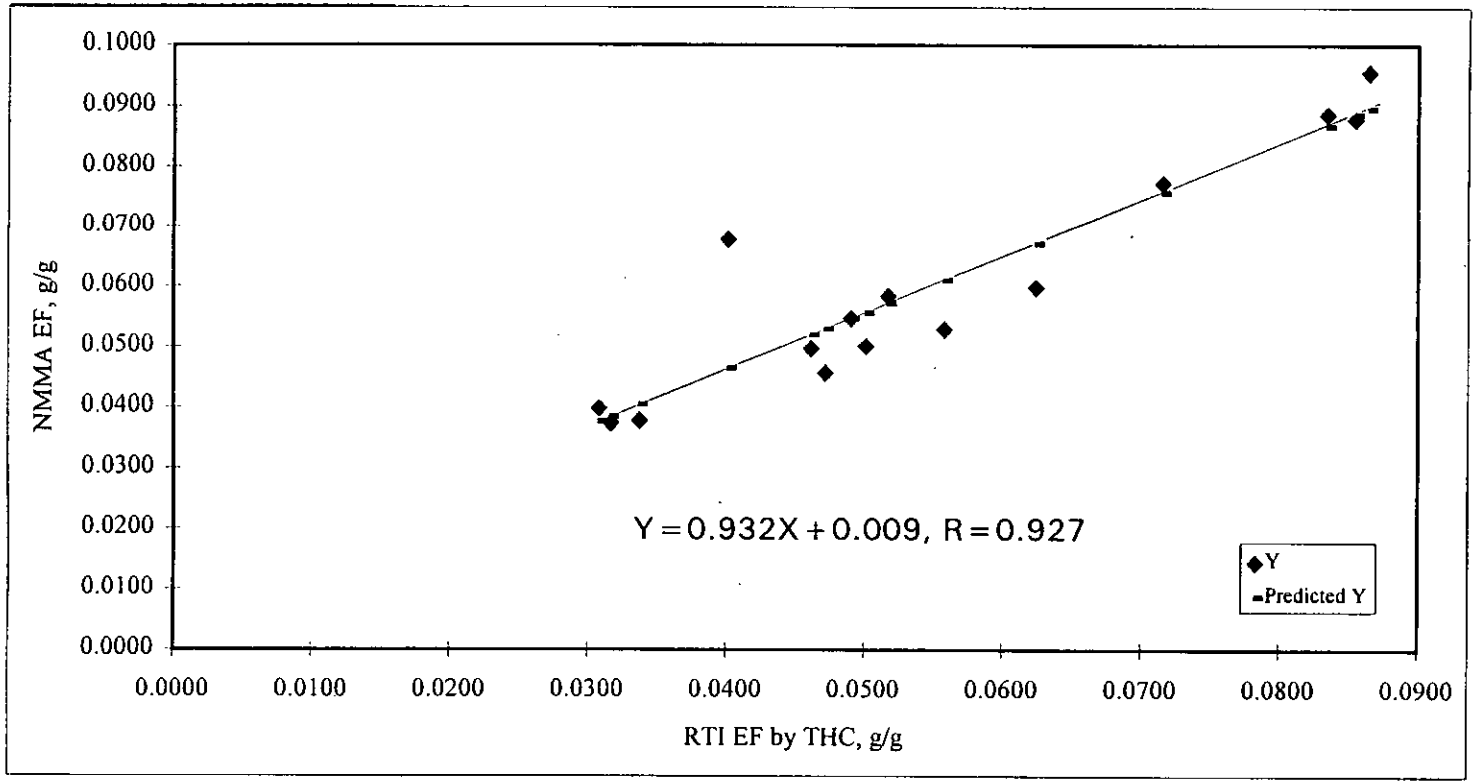
Washington, D.C. 20007 • 202/944-4980 • FAX: 202/944-4988

one operator only for tail panel

Regression Statistics			Coefficients	Standard Error	P-value	Lower 95%	Upper 95%
Multiple R	0.927	Intercept	0.009	0.006	0.167	-0.004	0.022
R Square	0.859	Slope	0.932	0.105	0.000	0.706	1.158
Standard Error	0.007						
Observations	15						



test panel

Table 6-22. Comparison of Gel Coat Emission Factors from the RTI's THC Results and the NMMA Results

Date	Equivalent NMMA test-run no.	Corresponding NMMA mold size, material, and equipment	RTI EF by THC (g/g)	RTI EF by THC (%/AV)	NMMA EF (g/g)	NMMA EF (% AV)	NMMA/RTI ratio
4/4/97	3-1	18' Hull gel coat	0.2086	55.6%	0.1593	43.0%	
4/8/97	3-2	18' Hull gel coat	0.2001	53.4%	0.2115	57.2%	
Average			0.2044	54.5%	0.1854	50.1%	0.91-0.92
4/8/97	6-1	18' Deck gel coat	0.1972	52.6%	0.1725	46.6%	
4/11/97	6-2	18' Deck gel coat	0.1866	49.8%	0.1756	47.5%	
Average			0.1919	51.2%	0.1741	47.1%	0.91-0.92
4/3/97	8-1	28' Hull gel coat	outlier	outlier	0.2008	54.3%	
4/5/97	8-2	28' Hull gel coat	0.2082	55.5%	0.1960	53.0%	
Average			0.2082	55.5%	0.1984	53.7%	0.95-0.97
Overall Average			0.2001	53.4%	0.1860	50.3%	0.93-0.94

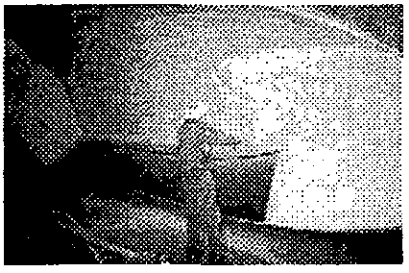
NMMA Test Results

August 26, 1997

Testing

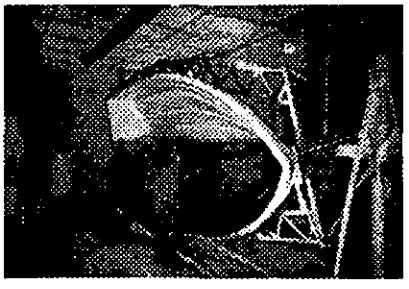
- April 1997
- Arlington, Washington
- 3 boat part sizes 18' deck 27' Hull 27' deck
- 2 styrene resins and one gelcoat (+ 1 run w/ a different gel coat) slightly
- Spray chopper and flow chopper ★35, 42 ★4 tests funded separately
- Large enclosure meeting TTE specifications

Gelcoating



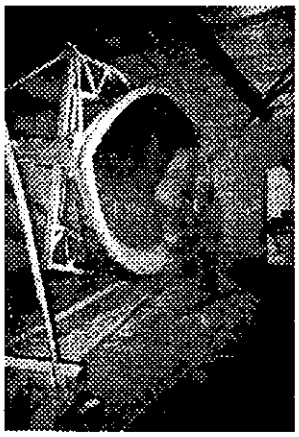
- Dust coat
- Single 20-mil layer
- One pass for 18-ft
- Two passes for 28-ft

Skin Coat - 18-ft hull



- Single layer
- Apply resin-glass
- Roll out
- After tack, spin
- Repeat

Resin Lamination - 18-ft hull

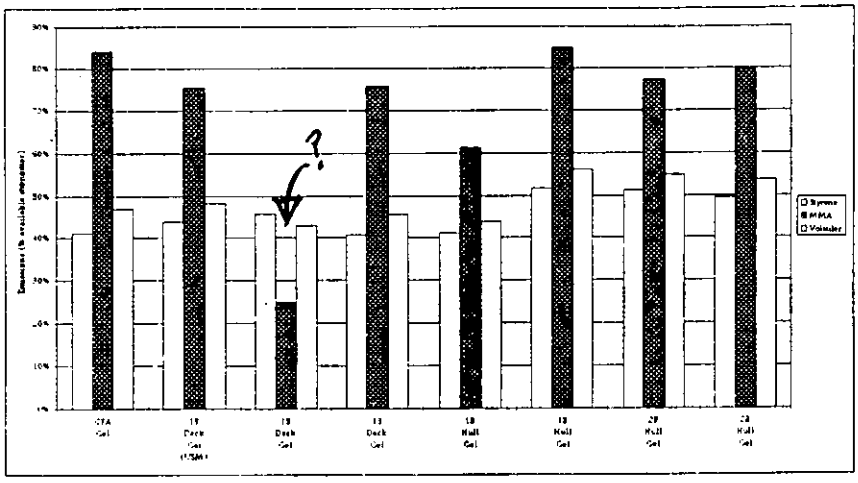


- Apply glass-resin to buiild thickness
- Roll out
- After tack, spin
- Repeat
- Repeat, until final thickness achieved

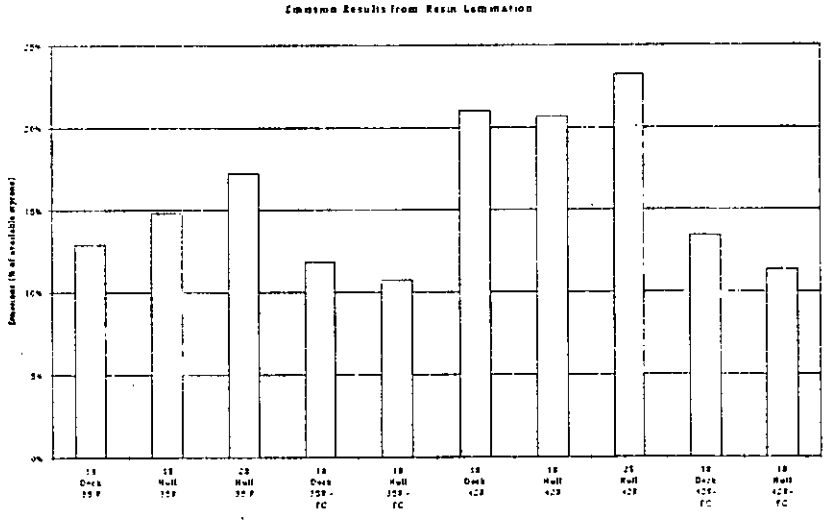
Summary of Results from Testing

Test	Styrene	MMA	Propane
CFA Gelcoat	41.1%	84.0%	46.9%
18-ft Deck Gelcoat	43.5%	58.7%	45.6%
18-ft Hull Gelcoat	46.4%	73.2%	50.0%
28-ft Hull Gelcoat	50.4%	78.6%	54.3%
CFA 35% Styrene Resin	41.8%	N/A	41.8%
18-ft Deck 35% Styrene Resin	12.9%	N/A	12.9%
18-ft Hull 35% Styrene Resin	14.8%	N/A	14.8%
28-ft Hull 35% Styrene Resin	17.3%	N/A	17.3%
18-ft Deck 35% Styrene Resin - Flow Chopper	11.9%	N/A	11.9%
18-ft Hull 35% Styrene Resin - Flow Chopper	10.8%	N/A	10.8%
CFA 42% Styrene Resin	48.7%	N/A	48.7%
18-ft Deck 42% Styrene Resin	21.1%	N/A	21.1%
18-ft Hull 42% Styrene Resin	20.7%	N/A	20.7%
28-ft Hull 42% Styrene Resin	23.3%	N/A	23.3%
18-ft Deck 42% Styrene Resin - Flow Chopper	13.4%	N/A	13.4%
18-ft Hull 42% Styrene Resin - Flow Chopper	11.4%	N/A	11.4%

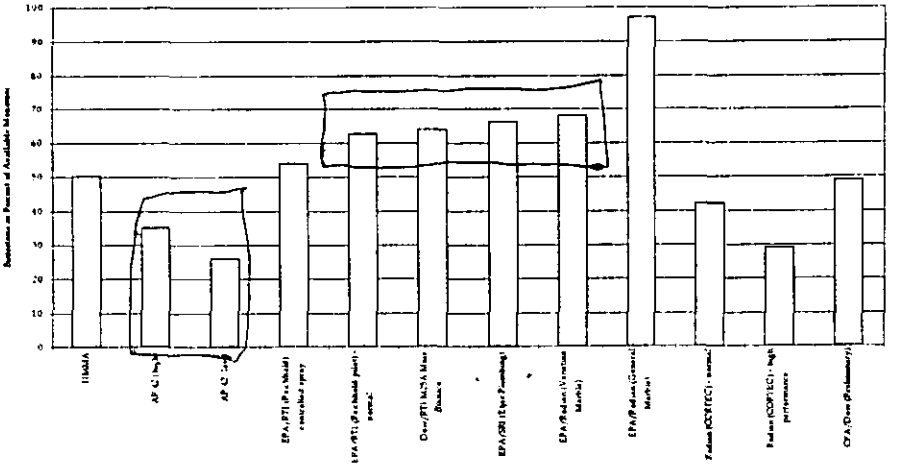
Results of Gelcoat Testing



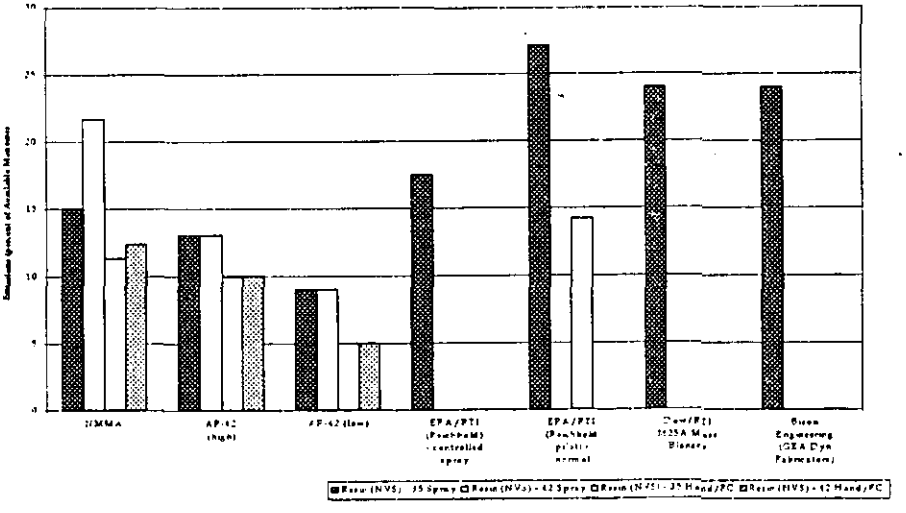
Results of Resin Lamination Testing



Comparison of Results from Studies
Gelcoat - % of available monomer



Comparison of Results from Studies
Resins - % of available monomer



Date: 2/4/99 10:11 pm

To: RR cc: John Rel Knight

From: ~~RON RYAN~~ John Stelling

Subject: errata

Ron

Thanks for the message. I have reviewed your concern and have discovered the source of the discrepancy. First, and foremost, the values for percent of available styrene are correct and should be used. We really believe these are the only valid numbers to use as they reflect the content in the resin.

So why do the values for flux and normalized emissions yield similar results that are so different from the percent of available styrene emission factor? First, why do these other values yield similar results? Normalized emission factors were calculated from the flux emission factors. But then, why do the flux emission factors yield such different total emissions from the percent of available styrene factors? The answer came in the final round of changes made, from the first document to the second one provided.

We had done quite a bit of quality assurance work, checking the results from gas chromatography by Method 18 (looking at styrene and methyl methacrylate explicitly) to those using THC instrument (in terms of propane). Our results in the first draft reflected correction to styrene basis; the final numbers came directly from the THC results, to reflect what we had in our protocol. In that last round of changes, we introduced an error in the flux calculation for the propane results. In checking the summary results tables in our spreadsheets we find that the flux values for styrene and methyl methacrylate are in line with what would ee expected. Only the propane flux values needed to be corrected.

We provide those values below for your use. We will draft a complete letter this weekend for your files.

Description	Flux	Normalized
CFA Gel	0.0171	5.35
18 Deck Gel	0.0175	0.88
18 Hull Gel	0.0185	0.73
28 Hull Gel	0.0251	0.38
CFA 35R	0.0296	3.93
18 Deck 35R	0.0328	0.26
18 Hull 35R	0.0341	0.24
28 Hull 35R	0.0472	0.13
18 Deck 35R-FC	0.0279	0.24
18 Hull 35R-FC	0.0242	0.17
CFA 42R	0.0282	5.51
18 Deck 42R	0.0580	0.52
18 Hull 42R	0.0563	0.40
28 Hull 42R	0.0658	0.22
18 Deck 42R-FC	0.0402	0.33
18 Hull 42R-FC	0.0336	0.22

We apologize for the inconvenience and ar happy that these values can be corrected. Again, we really do not recommend that the flux and normalized values be used for emission estimation. We feel that the percent of available styrene yields better values for preparing representative inventories.

John

Table 1-4
Test Schedule

Date	Test	Description	Run
2-Apr	NMMA-6-P	18-ft Deck Gelcoat	0402-01
3-Apr	NMMA-8-1	28-ft Hull Gelcoat	0403-01
3-Apr	NMMA-4-1	18-ft Deck 35 % Styrene Resin	0403-02
4-Apr	NMMA-7-1	28-ft Hull 35 % Styrene Resin	0404-01
4-Apr	NMMA-3-1	18-ft Hull Gelcoat	0404-02
5-Apr	NMMA-8-2	28-ft Hull Gelcoat	0405-01
5-Apr	NMMA-1-1	18-ft Hull 35 % Styrene Resin	0405-02
7-Apr	NMMA-7-2	28-ft Hull 35 % Styrene Resin	0407-01
8-Apr	NMMA-6-1	18-ft Deck Gelcoat	0408-01
8-Apr	NMMA-3-2	18-ft Hull Gelcoat	0408-02
8-Apr	NMMA-4-2	18-ft Deck 35 % Styrene Resin	0408-03
9-Apr	NMMA-1-2	18-ft Hull 35 % Styrene Resin	0409-01
9-Apr	NMMA-11-1G	CFA Mold Gelcoat	0409-02
9-Apr	NMMA-11-1	CFA Mold 35 % Styrene Resin	0409-03
10-Apr	NMMA-14-1	18-ft Deck 35 % Styrene Resin - Flow Chopper	0410-01
10-Apr	NMMA-13-1	18-ft Hull 35 % Styrene Resin - Flow Chopper	0410-02
10-Apr	NMMA-11-2	CFA Mold 35 % Styrene Resin	0410-03
11-Apr	NMMA-6-2	18-ft Deck Gelcoat	0411-01
11-Apr	NMMA-14-2	18-ft Deck 35 % Styrene Resin - Flow Chopper	0411-02
11-Apr	NMMA-13-2	18-ft Hull 35 % Styrene Resin - Flow Chopper	0411-03
12-Apr	NMMA-11-3	CFA Mold 35 % Styrene Resin	0412-01
12-Apr	NMMA-5-1	18-ft Deck 42 % Styrene Resin	0412-02
12-Apr	NMMA-2-1	18-ft Hull 42 % Styrene Resin	0412-03
14-Apr	NMMA-5-2	18-ft Deck 42 % Styrene Resin	0414-01
14-Apr	NMMA-2-2	18-ft Hull 42 % Styrene Resin	0414-02
15-Apr	NMMA-16-1	18-ft Deck 42 % Styrene Resin-Flow Chopper	0415-01
15-Apr	NMMA-15-1	18-ft Hull 42 % Styrene Resin-Flow Chopper	0415-02
16-Apr	NMMA-16-2	18-ft Deck 42 % Styrene Resin-Flow Chopper	0416-01
16-Apr	NMMA-15-2	18-ft Hull 42 % Styrene Resin-Flow Chopper	0416-02
17-Apr	NMMA-12-1	CFA Mold 42 % Styrene Resin	0417-01
18-Apr	NMMA-9-1	28-ft Hull 42 % Styrene Resin	0418-01
18-Apr	NMMA-12-2	CFA Mold 42 % Styrene Resin	0418-02
19-Apr	NMMA-9-2	28-ft Hull 42 % Styrene Resin	0419-01

pg. 2-2
144.5 lbs used
14.8 % emitted
14.6 %

lbs used Resin | % sty
~~27.2 30.8~~

152.7 lbs
0.35/ sty
= 53.6 lbs In
8.2 lbs Em.
= 15.3 %

136.2 lbs
0.35/
47.8 lbs I
6.68 lbs Em
= 13.9 %

(152.7 + 136.2) / 2 = 144.5

(15.3 + 13.9) / 2 = 14.6

(8.2 + 6.6) / 2 = 7.4 lbs = 14.6 %

mold is 220.5 ft²? ← pg. 1-9
7.4 / x = .0143? x = 517 ft²

7.4 lbs / 220.5 = .034 lbs/SF; not 0.0143 on pg. 2-2

7.4 / 220.5 ~~0.1445~~ = 0.232 lbs/SF/mobs; not 0.10 on pg. 2-2

Flux & normalized appear to be based on 3.15 lbs E, not 7.4

File: NMMARE~1.TXT

January 6, 1998

The USEPA's Emission Factors and Inventory Group (EFIG) is making available today for review, comment, and use an emissions characterization report entitled "Baseline Characterization of Emissions from Fiberglass Boat Manufacturing". The report and the testing it describes were prepared by the National Marine Manufacturers Association (NMMA). This material is related to existing AP-42 section 4.4 "Polyester Resin Plastic Products Fabrication". However, none of the tests used to develop that AP-42 section were performed on large parts such as boat hulls, and the USEPA has reason to believe that the existing AP-42 section may underpredict styrene emissions from most polyester resin operations, whether making boat hulls or other products. Additional testing on non-boat polyester resin operations has been performed over the past two years by both the Composite Fabricators Association (CFA) and by Research Triangle Institute (RTI, under contract to USEPA). We expect to make the CFA results available via the CHIEF web site (www.epa.gov/ttn/chief/ap42etc.html) by the end of January 1998. The RTI efforts are aimed at bringing all available data (NMMA, CFA, and RTI) together into a consistent, explanatory model, and we hope to post those results on the CHIEF web site when they become available.

Users should be aware that although the NMMA, CFA, and RTI work has made great advances in quantifying the effects of many different parameters on emissions, the impacts of one of the most significant parameters, the degree of overspray, remains difficult to quantify in a simple manner. The percentage of styrene in the resin which escapes to the atmosphere appears to be much greater for the resin which is sprayed off the edge of the mold as compared to the resin which lands on the mold. Thus, facilities which have a larger proportion of oversprayed material than the operations tested can expect to have higher percentages of the styrene emitted.

The USEPA thanks the NMMA, their contractors, their members, and others who assisted the NMMA in performing this testing and preparing this report.

Comments on this material can be addressed to:

Ron Ryan
U.S. EPA (MD-14)
RTP, NC 27711
Phone - (919) 541-4330
FAX - (919) 541-0684
EMAIL - ryan.ron@epamail.epa.gov

Agenda?

What is Process from here?

- I would like to put 1st ¼ of material out on our web site as BACKGROUND REPORT ⇒ CAN I GET A WP or ~~Adobe File~~ of it? (requesting posted 1-6-98)
- Will Also need a DRAFT XP-Y2 SECTION FOR WEB [BOTTOM-LINE EF RECS]
  → ? ½ pg OVERVIEW OF INDUSTRY & PROCESSES THAT THIS APPLIES TO (CAN ANYONE POINT ME TO SOMETHING? MACT?)
  will need to explain all terms used in EF Table. — use pp. 1-3
- Can we get Permission to Reproduce ~~Any~~ All other material ~~Submitted~~ for Reviewers? How about for CD
  ↳ what else is there?