AP42 Section:	4.4
Related:	9
Title:	Comments and memos regarding revision of AP42 4.4 1996-1998

From: MADELEINE STRUM
To: RTPMAINHUB.WPXGATE.CERON-LEONARDO, HERRING-LINDA, ...
Date: 8/22/96 3:39pm
Subject: emission factor dilemna with potential new source

Here is a specific dilemna which needs to be solved even before we work on some interim emission factors. Let me know what you think...

DILEMNA:
New source planned to operate Sept 1996 (planning was done over several years). Planning and permit used AP-42 to set a production limit such that they would be below the VOC major source threshold (nonattainment area) of around 35 TPY VOC.
Region 4 learns AP-42 could be off by a factor of 2. Region 4 does not approve permit at that production rate; says source can only produce half as much.

Source already spend lots of money on equipment, etc. to open up Sept. Source says that at half the production rate, their plant will not be cost effective. They want to continue to use AP 42.

POSSIBLE SOLUTION:
Region 4 agrees that AP-42 could be used UNTIL a source test is performed. Region 4 requests a time schedule for source test and says it needs to be done within ____ months of startup. (Is 4 months reasonable?) NMMA agreed to do source tests and this could be one that they pay for. EPA/ORD reviews test plan with Region 4. Region 4 is in charge of test procedure, making sure process data is gathered correctly, etc.

If source test shows source violates permit at their permitted production level, one or more of several possible actions can be taken:
1) require emission reduction through further P2 measures or abatement such that original permit could be met. If P2 is done, testing after measures are in place may need to be done.
2) Plant pays penalty (for using AP-42 and opening up at a production rate that they were warned would violate the permit)
3) require lower production from plant

I am inclined for number 1 only.

If the source's emissions are in line with the permitted numbers based on AP-42, then the plant would be able to operate at its permitted production level.

Its an idea, and would need to be implemented by Region 4, with support from OAQPS. Please Let me know what you think.

From: MADELEINE STRUM
To: RTMU538.COX-KIRT
Date: 8/27/96 7:17am
Subject: meeting with CFA (industry trade group) on Emission Factors -Reply -Reply

Thanks for your reply that you will be coming to (at least part) of the meeting this Thursday. Your comments seem to me to be on target, except that I think that permitting has more relevance to this matter than you do.

The key issues for permitting which you presented are extremely relevent to this matter. Especially the first. Here are the facts: Most sources use AP-42 for estimating their emissions. The sources that I know that have done source tests (except for maybe 1 continuous lamination company, not one of the processes we've been discussing) have been above AP-42. For this reason and other data we have, it is safe to say that AP-42 accuracy is in question. I have told Regional offices about this. Some acted. Some didn't. Those that did are getting blasted (as are we) by trade associations who seem to think AP-42 is a rulemaking and that we are changing the rules, haphazardly and without public comment. However, I understood you saying that sources shouldn't use it, or should modify it accordingly, if it is at all in question. That is what I was trying to accomplish, but it somehow didn't work.

With regard to your second point (the flagging of AP-42 is in my jurisdiction...). Actually it is difficult to figure out whose jurisdiction it is. I am in the Emission Standards Division and we write MACT standards. We provide data to the AP-42 (Ron Ryan, Dave Mobley) folks for them to write or modify AP-42. The AP-42 folks don't write AP-42 for permitting; they write it for emission inventories. There may not be as pressing a time-need to change AP-42 (but I am stepping out of my territory here) for inventories, but there will be for permitting. So yes, if there is a way you might deal with the use or non use of AP-42 within the framework of permitting, it would be helpful.

The issue of what the numbers should be changed to is also something we would like your input on --- not the exact numbers, but do you think they should err high on the conservative side (for example, "normal" spraying) or low ("controlled"-- less overspray spraying). It seems based on the Eric Noble memo you might have wanted to error on the conservative side. It makes sense to me to error on the conservative side for the purposes of permitting (reasoning in Eric Noble memo makes sense to me), but your latest input on this (and could it be made public?) would be helpful.

>>> KIRT COX 08/23/96 12:41pm >>>
Madeleine,

I would be available for participating in part of this August 29 meeting, but would not be able to be there all day. I doubt that my participation would be relevant to more than a relatively small part of the session, so I presume that this would not present a problem.

I see permitting as having only limited relevance to this matter. The gist of this is that sources must estimate their emissions for determining whether they are "major," and for determining which requirements apply to them. The key issues which this presents for permitting are:
- The AP-42 emissions factors are an important part of this determination for some sources. We must make it clear, though, that the job is estimating emissions -- not "using AP-42" -- and that the EPA emissions factor is merely one tool that is available for this task. The emissions factor can, and should, be ignored or used differently (e.g., perhaps the reviewing agency would adjust the use of the factor at issue here, even if it were not so questioned, if the source being evaluated processed small items, rather than

large ones) whenever its accuracy is in question or whenever there is better evidence. This is the case regardless of whether EPA has gone on record as questioning the use of the emissions factor for the particular purpose.
- Obviously, EPA should make concerns with an emissions factor public. Perhaps this would include "flagging" the factor in AP-42, and making guidance on the factor's use (or non-use) available to the public. This is primarily within your area of jurisdiction, rather than mine, but there may be specific ways in which permitting could contribute to this. These might include EPA's asking state permitting authorities to "flag" the proposed Title V permits, that address this type of source, when the proposed permits are submitted to the EPA Regional Office.
- There are also the enforcement implications in the cases of sources that have avoided requirements, based on the use of flawed or inappropriate emissions factors. I presume that these would be handled with an eye to whether the source had acted with reasonable diligence and good faith. The approach here would probably be the same as for many other types of analogous violations.

Does this generally seem to be on target and not too simplistic, or am I overlooking things? I would be happy to discuss this further.

Kirt.

P.S. Mike Trutna and I are both in ITPID. He is staff to the Division Director; I am in the Operating Permits Group.

>>> MADELEINE STRUM 08/22/96 02:54pm >>>
This is to ask if either Mike, Kirt or both can attend the meeting that will be held with the industry trade group (the one that has all of the data) regarding the possibility of us getting together to come up with interim emission factors for non-boat (at least) reinforced plastic composite parts.

It will be next **Thursday, Aug 29, from 10am to 5pm** and the following topics will be discussed:
1) ORD emission factor model: status, results
2) CFA emission factor model: same
3) whether we can agree on interim non-AP 42 emission factors for specific situations.

The attendees thus far include: 3 persons from CFA, Madeleine Strum, Linda Herring, Dave Mobley, Carlos Nunez (ORD), Geddes Ramsey (ORD), Mark Bahner (RTI).

Please rsvp to me or to Mark Bahner (Internet."bahner@rti.org" or 541 6016). I also need to know are you both in ITPID?

CC: markbahner, HERRING-LINDA, RTP10.RTPTSD.RYAN-RON, ...

From: David Mobley
To: RTP10.RTPTSD(BEAUREGARD-DENNIS), RTP3.RTMU538(COX-...
Date: 8/28/96 9:23pm
Subject: Fiberglass permitting options -Reply

Ron's recommendation seems reasonable. Unfortunately neither Ron nor I can be at the meeting tomorrow. However, Dennis Beauregard plans to be there and pitch hit on AP-42 issues. Good Luck!

> > > RON RYAN 08/28/96 07:01pm > > >

Per a meeting held two weeks ago in the 4201 building, I have drafted the following options. They should be considered draft and for internal distribution only at this time, although I don't think there's any concept in here that we couldn't discuss with the industry as a possibility on Thursday.

I'm not sure the options listed below are what anyone expected, or if they will satisfy anyone's needs. They are primarily options of what we can do with AP-42 in the very near-term to try to address the issue of how to permit fiberglass products sources now. There should be other options available that go beyond just the role of AP-42. These could include options that "buy time" using one of the options below, while committing the industry and EPA to perform more testing by a specified deadline. Part of these "buy time" options should include considering how to handle sources which get permits during the testing period.

These options can and probably should be considered separately for Boat manufacturers versus non-boat manufacturers.

Four Primary Options:

1. Do nothing. Leave AP-42 "as is" and reiterate the position that AP-42 is only one of many sources that should be used to estimate emissions for permits. This position is supported by Kirt Cox in a recent e-mail to Madeleine Strum. This option would appear to be consistent with the historical positions of both OAQPS-Permits and the AP-42 Group. However, it leaves each Region, State, or Permittee to make their own choice, and some inequities may result from State to State or Region to Region.

2. Issue a policy memorandum that final AP-42 sections should be used wherever available, and that any more recent data can be ignored by the permittee until a revised AP-42 section can be drafted, commented upon, and finalized. This may be what the industry thinks they can push for, but it is contrary to all previous positions taken by OAQPS, and is the opposite of option 1.

3. Pull the current AP-42 section off the Bulletin Board and replace it with a statement that we have sufficient reason to suspect that the numbers are low. This is a variation on option 1, in that it still requires each permittee to use the "best available data", but it removes the shield which industry perceives is AP-42. Industry would not be able to point to a published AP-42 factor as the "best available data" and would have to assess other sources.

4. Pull the current AP-42 section off the Bulletin Board and replace it with an interim statement of what we think are the "best available data". This would address the industry's complaint that EPA has been issuing opinions in a "haphazard" fashion, although they may still not like our recommended numbers. It also lessens, if not removes, the need for each permittee and State to evaluate all sources to determine the best data, and it recreates the perceived "shield" of an official EPA number. Although contrary to our general policy, this option is not without precedent. This option would require an agreement by all parties that the existing AP-42 is clearly erroneous, that a better estimate is available, and that the confusion resulting from not having an EPA-recommended number should be avoided. The States should be brought into this process before EPA issues such a recommend interim replacement factor.

My personal opinions:

Option 2 is the most clear-cut "NO, we can't do that". This is significant in that we should be able to answer one of Region 4's questions, in that we do not foresee OAQPS undercutting them by disagreeing with any decision they make about which numbers to use. On the other hand, this does not say that OAQPS will tell Region 4 what number should be used.

Options 1 and 3 bother me in that OAQPS is not providing any opinions based on recent reviews of the data.

This leaves only option 4 as my preferred option, by default. Depending on the CFA testing results, and allowing for time to coordinate with several key states, this will not be available immediately either, so consider some creative options to living under an option 1 scenario for a bit longer. Perhaps an agreement that any source permitted prior to the completion of some testing will need to be reevaluated somehow.

CC: RTPMAINHUB.INTERNET(RAMSEY-GEDDES),

chap 4-4. wpd

File: READ_ME.TXT for AP-42 section 4.4, "Polyester Resin Plastic Products Fabrication"
FOR POSTING AT: http://www.epa.gov/ttn/chief/ap42/chap4_4.html
June 15, 1998 update

Section 4.4 of AP-42 was removed from this web site as of March 18, 1998 because a number of individual site tests and studies performed over the past few years provided sufficient evidence that the emission factors presented for the open molding processes of hand layup, spray layup, gel coating, and filament winding would underpredict actual styrene emissions for most facilities. However, the recent tests did not address the emission factors for continuous lamination, pultrusion, and closed molding operations, and we have no reason to question the validity of the emission factors for those processes at this time. In addition, commenters have requested that the old section be made available for its narrative description of the industry and its processes, without the suspect emission factors. Accordingly, we are today (6-15-98) reposting the old section 4.4 ("Polyester Resin Plastic Products Fabrication"), with the suspect emission factors removed, pending completion of a revised draft section. We expect that some of the statements in the narrative portions of the old section may be as outdated or erroneous as the removed emission factors, and so we urge you to use this material with caution.

The user is referred to the "Potentially Useful for Emissions Estimation - FYI" page on this web site, where we have previously posted two reports which document and analyze much of the recent data on open molding operations. The first report is entitled "Baseline Characterization of Emissions from Fiberglass Boat Manufacturing", prepared by Stelling Engineering, Air-Tech Environmental, and Radian International for the National Marine Manufacturers Association (NMMA). The second report is entitled "CFA Emission Models for the Reinforced Plastics Industries", prepared by Dr. Robert Haberlein of Engineering Environmental on behalf of the Composite Fabricators Association (CFA), the International Cast Polymer Association, and the Composites Institute. The USEPA is requesting comments on these two reports while we begin drafting a replacement AP-42 section based largely on the testing documented in the two reports. The CFA is also planning additional testing to quantify the effects of combining various control techniques.

We are also posting today (6-15-98) on the "Potentially Useful for Emissions Estimation - FYI" page of this web site for your review, comment, and use as you see fit an emissions estimation model (FRP Model, Version 1.0), prepared by Research Triangle Institute (RTI) for the USEPA's Office of Research and Development (ORD). Documentation on the development of the model is not yet available, pending review and publication by a journal. The model is based on the testing data reported in the above-cited NMMA and CFA reports, along with a few other data points, and it is an attempt to bring all of the available data together into a consistent, explanatory parametric model. The model allows the user to adjust up to nine individual process parameters from the "baseline" values presented in the model in order to calculate individual modification factors for each parameter and a resultant overall emissions rate. We caution you that the "baseline" values for the parameters are not necessarily always representative of average conditions existing in the industry today. In particular, the "distance from spray gun to mold" and "dry material off mold" parameters may vary widely in practice, and representative values are NOT being offered by the model's "baseline" values. Some of the other parameters required by this model may also be difficult to monitor in a production setting. For these reasons, we propose to draft the replacement AP-42 section around the CFA one-variable equations for non-boat manufacturers and around the NMMA factors for boat

manufacturers, although the ORD model appears to be a valid tool for research and to promote understanding of what most influences emissions. We expect that the CFA, NMMA, and ORD predictions will be generally consistent if all applied to similar input parameters.

The CFA report ("CFA Emission Models for the Reinforced Plastics Industries") was posted on this web site on March 18, 1998. The report describes the development of a set of four emission estimating equations or models that can be used to predict the styrene emissions from open molding processes used by the reinforced plastics industry. Although the report presents both multi-variable and single variable equations for predicting emissions from each of four open molding processes, we agree with the report's conclusion that the single-variable (% styrene in the resin) equations account for almost all of the variation due to parameters that can be reasonably monitored in a production setting. The recommended one-variable equations and associated control factors are summarized as eqns. 12, 15, 18, and 21 on pages 20 and 21 of the report. Table 2.16 on page 24 of the report provides a table of results from these equations for a number of given input assumptions. The equations have also been packaged into a spreadsheet model to facilitate users generating emission factors for their own scenarios. The spreadsheet model is available from this web site in three formats: QuattroPro, Excel, and Lotus. All three versions are "zipped" together in one file on the "Potentially Useful for Emissions Estimation - FYI" page of this web site. A PDF version of Table 2.16 is also available there for separate viewing.

Users should note that the equations in the CFA report and the spreadsheet models produce emission factors in units of "% neat resin". These factors are expressed as decimals and should be multiplied directly by the pounds of neat resin consumed to yield pounds of styrene emissions. There is no need to divide by 100. Also note that these units differ from the old AP-42 units, the NMMA report units, and the ORD model output units, which are all "percent of available styrene". The USEPA thanks the CFA, their members, Dr. Haberlein, Larry Craigie of Dow Chemical, RTI, and others who contributed to the development and analysis of the data presented in this report.

The NMMA report ("Baseline Characterization of Emissions from Fiberglass Boat Manufacturing") was posted on this web site on January 6, 1998. This report presents test results for the lamination and gel coating of the large parts seen in the boat manufacturing industry. The results are presented in units of percent available styrene. The USEPA thanks the NMMA, their members, John Stelling P.E, Air-Tech Environmental, Radian International, and others who assisted the NMMA in performing the testing and preparing the report.

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.

Comments on this material can be addressed to:

Ron Ryan
U.S. EPA (MD-14)
Phone - (919) 541-4330
FAX - (919) 541-0684

RTP, NC 27711 EMAIL - ryan.ron@epa.gov

AP-42 section 4.4 - Polyester Resin Plastic Products Fabrication

March 3, 1999 Update

Section 4.4 of AP-42 was removed from this Web site as of 3/18/98 because the emission factors presented in that section appeared to under predict styrene emissions from most polyester resin operations. A number of individual site tests and planned studies performed over the past few years lead to this conclusion. The user is referred the Related Emission Factor Documents page on this web site, where EPA has posted three sets of materials which document and analyze much of the recent data. At this tir there is no "AP-42 factor" or estimation method for this category. As would be the case even if there were an AP-42 method, users must evaluate their own application to determine the most appropriate method of estimating emissions. In the case of permits sources are expected to use "best available data", not necessarily AP-42, to determine their emissions (see OAR's Memoranda for Operating Permits & New Source Review (Title V) Policy & Guidance Web site for permitting policies). As detailed in the Introduction to AP-42, AP-42 emission factors are not provided as recommended perm limits.

The first set of materials is a report entitled "Baseline Characterization of Emissions fro Fiberglass Boat Manufacturing", prepared by Stelling Engineering, Air-Tech Environmental, and Radian International for the National Marine Manufacturers Association (NMMA). The second set of materials is a report entitled "CFA Emission Models for the Reinforced Plastics Industries", prepared by Dr. Robert Haberlein of Engineering Environmental on behalf of the Composite Fabricators Association (CFA), the International Cast Polymer Association, and the Composites Institute. This report h associated with it a zipped file containing three different spreadsheet versions (Lotus, Excel, and Quattro) of a one-variable model which predicts emissions based on the styrene content of the resin. The third set of materials is a nine-variable model ("FRP Model, version 1.0") developed by Research Triangle Institute for EPA's Office of Research and Development, along with a WordPerfect file containing documentation o the data used to develop that model. A two-page User's Guide to the FRP model is als provided.

We would like to turn some or all of this material into an AP-42 section at some point, b we need to know what would be most useful to you in your applications, what guidance should be provided with any model, etc. Your comments on this material as it relates to AP-42 section should be addressed to: ryan.ron@epa.gov.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW
ATLANTA, GEORGIA 30303-8909

Postmarked 12-5, Fri
recd 12-9, Tues

DEC 3 1997

4APT-ARB

MEMORANDUM

SUBJECT: Requested Revision of Existing Emission Factors for Polyester Resin Plastic Products Fabrication

FROM: Winston A. Smith, Director
Air, Pesticides and Toxics Management Division

TO: William F. Hunt Jr.,Director
Emissions, Monitoring, and Analysis Division,
Office of Air Quality Planning and Standards (MD-14)

EPAD is not (3)

As an active participant in the maximum achievable control technology (MACT) partnership program for developing the Boat and Reinforced Composite Manufacturing regulations, Region 4 has been involved with many detailed analyses of hazardous air pollutants (HAPs) emissions. During the data acquisition and evaluation phase, it became apparent that industry relies heavily on Environmental Protection Agency (EPA) emission factors, and therefore, accurate emissions data are critical to the success of the MACT program. However, Region 4 has reviewed several research reports which indicate that the existing EPA emission factors used to estimate emissions from uncontrolled polyester resin product fabrication processes are antiquated.

(2) contrary to permit guid.

(1) we agree

Based on the recently published EPA research document entitled Evaluation of Pollution Prevention Techniques to Reduce Styrene Emissions From Open Contact Molding Processes, Volume I & II, Final Report, EPA-600/R-97-018a -018b, March 1997, and two (2) supporting research documents published by industry entitled Baseline Characterization of Emissions from Fiberglass Boat Manufacturing, August 1997, by the National Marine Manufacturers Association (NMMA) and Phase I-Baseline Study, Hand Lay-Up, Gel Coating, Spray-Up Final Report, September 1996, by the Composites Fabricators Association (CFA), it is this Region's position that the existing AP-42 emissions factors for this category of sources greatly underestimates actual emissions of HAPs.

(1)

The Regional office is very supportive of all activities provided by your Division to supply accurate emissions data. To that end, the Region has compiled the attached "Summary of Data Results" which provides a revised tool to carry out existing permitting and compliance requirements for certain polyester resin plastic products fabrication, while maintaining a high

(3)

degree of protection to human health and the environment. Region 4, as sub-lead region for air toxics, requests your review of this information and an indication of whether your office could support the results.

certainly! we are currently eval. several other studies & proposals

Concurrently, the Regional office acknowledges that the ultimate responsibility for the maintenance of all AP-42 emissions data lies within the Emissions, Monitoring, and Analysis Division. Therefore, Region 4 also requests your assistance in revising the appropriate AP-42 emission factors. I would appreciate an indication from you regarding the time table involved in making adjustments to AP-42 for this industry category.

If this Regional office can be of further assistance in the development of these respective emission factors or models, please contact Mr. Leonardo Ceron of my staff at (404) 562-9129.

Attachments:

cc: Ron Ryan EMAD
Madeleine Strum, ESD
Carlos Nunez, ORD
Kirt Cox, IPTID
Greg Foot, OGC
Cary Secrest, ORE
Robert Dresdner, OC
Floyd Ledbetter, R4 ECB

what they're asking for:
① review & indicate if we could support results
② revise AP-42 - time table

From: leonardo ceron
To: R6DAL02.R6TOXIC2(AHUJA-ANUPA,TODD-ROBERT),RTP3.RTM...
Date: 12/3/97 5:26pm
Subject: Discusion Material on Styrene During Air Toxics Call 12/4

Region 4 is requiring its S/L's to use of new emissions factor data, in lieu of testing, for sources which emit styrene as a primary pollutant.

Affected sources: Primarily the Boat and Composite Manufacturing Industry

Reason: New research data by EPA and industry associations agree that existing AP-42 is underestimating emissions

Request: National consistency (All Regions) to require the use of the new emissions data listed below and summarized in chart

History:

Region 4 has been actively working with OAQPS on the boat and composite manufacturing MACTs, both of which use styrene emissions as the primary HAP to be regulated. During this process it has become evident (through industry questionnaires, site specific test results, etc..) that the existing emission factors listed in section 4.4 of AP-42 for styrene emissions (monomer emissions) are not representative of the industry. This presumption was confirmed by field test data conducted by the industry associations (from both the composite and boat manufacturing industry), and EPA. (See citation listed below) Based on these test results it is clear that AP-42 is not the best source for styrene (monomer) emissions factor data for these affected sources to use.

TRUE

TRUE - but interpretation of data is open

synthetic minor

With the receipt of many title v and FESOP documents (for boat and composite manufacturing sources) Region 4 is now requiring affected sources to use the new data (in lieu of site specific testing) and hence emissions estimations now are "more accurate". However, the use of the new emissions factors creates several domino affects on permitting & FESOP limitations, and NSR/NSPS & SIP trigger limits. This is probably a greater issue when BACT etc.. is triggered as a result of new emissions factors.

therefore we would urge you to anticipate those issues & coordinate with all affected parties

Based on the new data the Region has participated in several discussions, white paper developments, and proposed action steps with the Emissions Monitoring and Assessment Division which publishes AP-42 and yet little or no changed has occurred with the AP-42's emissions factor listing for styrene emission as listed in section 4.4., Why ????? We don't know.

our understanding that they — these actions were based on establishing an agency position on how to handle this situation (& maybe others like it) in the interim

not on what section AP-42 should be changed.

However, as lead Region for air toxics we have reviewed the data in the reports listed below and would propose a national consensus to use the following approach when styrene emissions are in question for spray, non-spray and gel coating operations in both the boat and composite manufacturing industry.

Region 4 has attached a one-page chart which summarizes the data from the associated reports and provides affected sources with the opportunity to use a model which generates a "number" provided by EPA in lieu of a sources specific test. This "number" would facilitate

the sources permitting and reporting burden and process.

Several questions come to our mind, what do other Regions think about this process?, would their enforcement and compliance groups provide the same support/backing as we have in Region 4?, Does anyone have a better process or mechanism given the current data and permitting timelines?, will other regions not support this process - hence creating a lack of national consistency?, etc....

good question — will not be answered by AI-42

These are just some of the questions we can conjure up, but we would like to hear your opinion of our position and steps to use the attached emissions factors.

Not addressed on conf call

WP60 file format Chart = sum2.wpd = bp000002.bin = c:\archive\bp01co02.bin
Example = styexamp.wpd = bp000003.bin = c:\archive\bp\co03.bin

Reports

1. Evaluation of Pollution Prevention Techniques to Reduce Styrene Emissions From Open Contact Molding Processes, Volume I & II, Final Report, EPA-600/R-97-018a & b, March 1997, by Research Triangle Institute (RTI) for EPA.

2. Baseline Characterization of Emissions from Fiberglass Boat Manufacturing, August 1997, by the National Marine Manufactures Association (NMMA).

3. Phase I-Baseline Study, Hand Lay-Up, Gel Coating, Spray-Up Final Report, September 1996, by the Composites Fabricators Association (CFA).

4. Derivation and Verification of the CFA Emission Models, September 18, 1997, by the Composites Fabricators Association (CFA).

sum2.wpd = bp000002.bin = c:\archive\sum2.wpd
~~bp01ec02.bin~~

Summary of Emission Data Results:

Date: December 1, 1997		NVS[1] Monomer-35%[2]	NVS Monomer-38%	NVS Monomer-42%
Resin Non-Spray Layup[3] (ns)	**(Emissions as a percent (%) of Available Monomer)**			
	AP-42	5 - 10		
	EPA / RTI	NA	14.2[4] - 15.4[5]	NA
	NMMA	10.5 - 12.1	NA	10.6 - 14.0
	CFA[6]	9.6 - 17.7	NA	11.5[7] - 21.2
	Range of New Data	9.60 - 21.20		
	Emission Factor[8]	E_{1ns}[9] X (1.11) or a minimum of 15.4[10]		
Resin Spray Layup[11] (s)	**(Emissions as a percent (%) of Available Monomer)** what is this? √ std dev. of 4 variable model vs. 1 variable?			
	AP-42	9 - 13		
	EPA / RTI	16.2[12] - 17.4	13.9[13] - 27.1	20.6[14] - 28.5
	NMMA	13.9 - 18.8	NA	18.2 - 23.0
	NNMMA (CFA MOLD[15])	28.8 - 52.0	NA	39.2 - 54.6
	CFA	16.1 - 23.3	NA	22.4[16] - 38.0
	Range of New Data	13.9 - 38.0		
	Emission Factor[8]	E_{1s}[17] X (1.25) or a minimum of 25.9		
Gel Coat[18] (gc)	**(Emissions as a percent (%) of Available Monomer)**			
	AP-42	26 - 35		
	EPA / RTI	NA	49.2[19] - 60.2	62.5
	NMMA	42.3[20] - 54.2	NA	NA
	NMMA (CFRA MOLD14)	43.4 - 45.2	NA	NA
	CFA	41.8 - 58.0	NA	45.8[21] - 62.0
	Range of New Data	41.8 - 62.5		
	Emission Factor[8]	E_{1gc}[22] X (1.04) or a minimum of 52.1		

Copies of :

1. Evaluation of Pollution Prevention Techniques to Reduce Styrene Emissions From Open Contact Molding Processes, Volume I & II, Final Report, EPA-600/R-97-018a & b, March 1997, by Research Triangle Institute (RTI) for EPA.

2. Baseline Characterization of Emissions from Fiberglass Boat Manufacturing, August 1997, by the National Marine Manufactures Association (NMMA).

3. Phase I-Baseline Study, Hand Lay-Up, Gel Coating, Spray-Up Final Report, September 1996, by the Composites Fabricators Association (CFA).

4. Derivation and Verification of the CFA Emission Models, September 18, 1997, by the Composites Fabricators Association (CFA).

1. NVS = non-vapor suppressed.

2. Monomer = Monomer content of test results in percent by weight of resin.

3. Non-Spray Lay-up (ns), data **does not include** Continuous Laminations; Pultrusion; Marble Casting; or Closed Molding processes.

4. Non-Spray, data is based on flow coater range (Range of data for flow coater process was 13.9% -14.6% of available monomer).

5. Non-Spray, data is based on pressure fed roller range (Range of data for pressure fed roller process was 14.5%-16.3% of available monomer).

6. All CFA Non-Spray Lay-up data is based on a bucket and brush process.

7. CFA styrene content was 40% for data results.

8. **Emission Factor** - Regionally accepted as best available data when E_1 (x) is equal to/or greater than the midpoint. Any $E_{1\ (ns,\ s,\ gc)}$(x) value below the midpoint will be required to use the midpoint as the emission factor. Any $E_{1\ (ns,\ s,\ gc)}$(x) value above the midpoint will represent that specific sources emission factor. Facility specific test data to determine emissions factors may superceed listed emission factors as best available data, when approved on a case by case basis.

9. (See document #4)

$$E_{1ns} = \{[-0.46365(TH) + 0.00265(SC) + 0.00068(GT) + 0.00003(AF) - 0.0320] / (SC/100)\} (0.11)$$

what is this?

GT = Gel Time, (min) SC = Styrene Content, (%)
AF = Air Flow Rate, (ft/min) TH = Thickness of Part, (inches)
E_{1ns} = Emissions as a % of available monomer

10. Non-spray pressure fed roller data values will be accepted for hand lay-up and filament winding in lieu of AP-42 values.

11. Spray Lay-up (s), data **does not include** Continuous Laminations; Pultrusion; Marble Casting; or Closed Molding processes.

12. EPA/RTI styrene content was 35.34% for data results.

13. EPA/RTI styrene content was 38.33% for data results.

14. EPA/RTI styrene content varied from 42.61% to 43.29% for data results.

15. The August 1997 NMMA report has also provided test data from the use of a CFA mold, (this mold was the same mold used durng the CFA Phase I testing in 1996), these new data points were obtained to provide some correlation between the two distinct testing result. These CFA mold data points were not included in the average determination however, the exitance of these data points do provide further variablity of existing data.

16. CFA styrene content was 40% for data results.

17. (See document #4)

$$E_{1s} = \{[- 0.19881(TH) + 0.00827(SC) + 0.00038(GT) - 0.00854(RF) + 0.00003(AF) - 0.1941] / (SC/100)\} \quad (0.25)$$

GT = Gel Time, (min)
SC = Styrene Content, (%)
TH = Thickness, (inches)
E_{1s} = Emissions as a % of available monomer
RF = Resin Flow, (lbs/min)
AF = Air flow velocity, (ft/min)

18. Gel Coat (gc), data **does not include** Continuous Laminations; Pultrusion; Marble Casting; or Closed Molding processes.

19. EPA/RTI styrene content was 38.75% for data results.

20. Total monomer of 37% from 32% styrene + 5% Methyl Methacrylate (MMA) for data results.

21. CFA styrene content was 40% for data results.

22. (See document #4)

$$E_{1gc} = \{[- 5.34119(TH) + 0.00897(SC) + 0.00083(GT) - 0.00018(RF) + 0.00004(AF) - 0.0476] / (SC/100)\} \quad (0.04)$$

GT = Gel Time, (min)
SC = Styrene Content, (%)
TH = Thickness, (inches)
E_{1gc} = Emissions as a % of available monomer
RF = Resin Flow, (lbs/min)
AF = Air flow velocity, (ft/min)

styexamp.wpd = bp000003.bin = c:\archive\styexamp.wpd

Non-Spray Examples

1. 40% Non-spray resin process

E_{lns} = [- 0.46365(TH)+ 0.00265(SC)+ 0.00068(GT)+ 0.00003(AF)- 0.0320] /(SC%)

	EXAMPLE
GT = Gel Time, (min)	20
SC = Styrene Content, (%)	40%
AF = Air Flow velocity, (ft/min)	50
TH = Thickness of Part, (inches)	0.023
E_{lns} = Emissions as a % of available monomer	

E_{lns} =[-0.46365(.023)+ 0.00265(40)+ 0.00068(20)+ 0.00003(50)- 0.0320] /(0.40)

E_{lns} =(-0.01066395)+ (0.106)+ (0.0136)+ (0.0015) - (0.0320) = -0.07844 / .40)
= 0.1961, = 19.61%

Emission Factor (minimum) = 15.4%

The source would use the minimum Emission Factor of 15.4% if the E_{lns} results are no greater then 15.4%, however if the E_{lns} results are greater then 15.4% then the source would be required to use result of E_{lns} = 19.6% as the Emissions Factor. In this example **the Emission Factor would be 19.6%.**

2. 40% Non-spray resin process

GT = 10, SC = 40%, AF = 100, TH = 0.053

E_{lns} =[-0.46365(.053)+ 0.00265(40)+ 0.00068(10)+ 0.00003(100)- 0.0320] /(0.40)

E_{lns} =(-0.02457345)+ (0.106)+ (0.0068)+ (0.03) - (0.0320) = 0.08622655 / .40
= 0.215566375, = 21.56%

The source would use the minimum Emission Factor of 15.4% if the E_{lns} results are no greater then 15.4%, however if the E_{lns} results are greater then 15.4% then the source would be required to use the results of E_{lns} = 21.6% as the Emission Factor. In this example **the Emission Factor would be 21.6%.**

3. 35% Non-spray resin process

GT = 10, SC = 35%, AF = 100, TH = 0.028

E_{lns} =[-0.46365(.028)+ 0.00265(35)+ 0.00068(10)+ 0.00003(50)- 0.0320] /(0.35)

E_{lns} =(-0.0129822)+ (0.09275)+ (0.0068)+ (0.0015) - (0.0320) = 0.0560678 / .35
= 0.160193714, = 16.02%

The source would use the minimum Emission factor of 15.4% if the E_{lns} results are no greater then 15.4%, however if the E_{lns} results are greater then 15.4% then the source would be required to use the results of E_{lns} = 16.0% as the Emission Factor. In this example **the Emission Factor would be 16.0%.**

4. 35% Non-spray resin process

GT = 10, SC = 35%, AF = 50, TH = 0.040

E_{lns} =[-0.46365(.040)+ 0.00265(35)+ 0.00068(10)+ 0.00003(50)- 0.0320] /(0.35)

E_{lns} =(-0.018546)+ (0.09275)+ (0.0068)+ (0.0015) - (0.0320) = 0.05054 / .35
= 0.1443, = 14.43%

The source would use the minimum Emission Factor of 15.4% if the E_{lns} results are no greater then 15.4%, however if the E_{lns} results are greater then 15.4% then the source would be required to use the result of E_{lns} =14.4% as the Emission Factor. In this example **the Emission Factor would be 15.4%.**

Spray Examples

1. 40% spray resin process

E_{ls} = [-0.19881(TH)+0.00827(SC)+0.00038(GT)-0.00854(RF)+0.00003(AF)-0.1941] /(SC%)

	EXAMPLE
GT = Gel Time, (min)	20
SC = Styrene Content, (%)	40%
AF = Air Flow velocity, (ft/min)	50
TH = Thickness of Part, (inches)	0.023
RF = Resin Flow, (lbs/min)	4
E_{ls} = Emissions as a % of available monomer	

E_{ls} = [-0.19881(0.023)+0.00827(40)+0.00038(20)-0.00854(4)+0.00003(50)-0.1941] /(0.40)

E_{ls} = 0.267668, = 26.77%

Emission Factor (minimum) = 25.9%

The source would use the minimum Emission Factor of 25.9% if the E_{ls} results are no greater then 25.9%, however if the E_{ls} results are greater then 25.9% then the source would be required to use the result of E_{ls} = 26.8% as the Emission Factor. In this example **the Emission Factor is 26.8%.**

2. 35% spray resin process

GT = 10, SC = 40%, AF = 100, TH = 0.053, RF = 2

E_{ls} = [-0.19881(0.053)+0.00827(40)+0.00038(10)-0.00854(2)+0.00003(100)-0.1941] /(SC%)

E_{ls} = 0.289707, = 28.97%

The source would use the minimum Emission Factor of 25.9% if the E_{ls} results are no greater then 25.9%, however if the E_{ls} results are greater then 25.9% then the source would be required to use the results of E_{ls} = 29.0% as the Emission Factor. In this example **the Emission Factor is 29.0%.**

3. 37% spray resin process

GT = 10, SC = 35%, AF = 100, TH = 0.040, RF = 4

E_{ls} =[-0.19881(0.040)+ 0.00827(35)+ 0.00038(10)- 0.00854(4)+ 0.00003(100)- 0.1941] /(SC%)

E_{ls} = 0.17153, = 17.15%

The source would use the minimum Emission Factor of 25.9% if the E_{ls} results are no greater then 25.9%, however if the E_{ls} results are greater then 25.9% then the source would be required to use results of E_{ls} = 17.2% as the Emission Factor. In this example **the Emission Factor is 25.9%.**

Gel Coat Examples

1. 40% gel coat process

E_{lgc} = [-5.34119(TH)+ 0.00897(SC)+ 0.00083(GT)- 0.00018(RF)+ 0.00004(AF)- 0.0476] /(SC%)

E_{lgc} = 0.552996, =55.30%

	Example
GT = Gel Time, (min)	10
RF = Resin Flow, (lbs/min)	4
SC = Styrene Content, (%)	38
AF = Air Flow Rate, (ft/min)	100
TH = Thickness of Part, (inches)	0.018
E_{lgc} = Emissions as a % of available monomer	

Emission Factor (minimum) = 52.2%

The source would use the minimum Emission Factor of 52.2% if the E_{lgc} results are no greater then 52.2%, however if the E_{lgc} results are greater then 52.2% then the source would be required to use the result of E_{lgc} = 55.3% as the Emission Factor. In this example **the Emission Factor is 55.3%.**

2. 35% gel coat process

GT = 20, SC = 42%, AF = 100, TH = 0.024, RF = 2

E_{lgc} =[-5.34119(0.024)+ 0.00897(42)+ 0.00083(20)- 0.00018(2)+0.00004(100)- 0.0476] /(SC%)

E_{lgc} = 0.489232, = 48.92

The source would use the minimum Emission Factor of 52.2% if the E_{lgc} results are no greater then 52.2%, however if the E_{lgc} results are greater then 52.2% then the source would be required to use the results of E_{lgc} = 48.9% as the Emissions Factor. In this example **the Emission Factor is 52.2%.**

3. 37% gel coat process

GT = 20, SC = 35%, AF = 50, TH = 0.024, RF = 2

E_{lgc} =[- 5.34119(0.024)+ 0.00897(35)+ 0.00083(20)-0.00018(2)+0.00004(50)-0.0476] /(SC%)

E_{lgc} = 0.448918, = 44.89%

The source would use the minimum Emission Factor of 52.2% if the E_{lgc} results are no greater then 55.2%, however if the E_{lgc} results are greater then 52.2% then the source would be required to use the results of E_{lgc} = 44.9% as the Emissions Factor. In this example **the Emission Factor is 52.2%.**