Draft Guide to the Estimation and Permitting of Particulate Emissions from the Manufacture of Reinforced Plastic Composites

prepared for

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ECRM

1. Introduction

Among the substances routinely emitted from composite plastics fabrication plants, particulate matter has received little attention. Because USEPA does not consider this industry to be a significant contributor to the nationwide particulate emission inventory, the agency has sponsored no research to develop or catalog particulate emission factors for this industry. Nevertheless, all states regulate these emissions and enforce compliance through terms and conditions specified on air permits. All but the very smallest composites plants are required to have air permits, so the need for guidance on this subject is critical. Accordingly, the Composite Fabricators Association (CFA) retained Environmental Compliance and Risk Management (ECRM) to develop practical guidance on the estimation and permitting of particulate matter emissions from typical composite fabrication plants.

This report provides an initial overview of current Federal and state regulations affecting particulate sources, and then addresses particulate emissions from the following processes:

- Application of gel coat, resin and reinforcement during open molding.
- Application of paints and coatings to formed parts.
- Sawing, grinding, and surface finishing of formed parts.

For each process, methods are presented to calculate allowable particulate emissions (based on state rules), potential emissions (based on maximum process throughput), and actual emissions. All critical assumptions are addressed. This report is best used in conjunction with the Excel spreadsheet workbook “PM Emission Calculation” to complete and document all estimates. “Screen shots” of that workbook are included as technical exhibits to illustrate the methods presented. The fully documented workbook can be downloaded from the CFA website as a separate file.

The overriding goal of this guidance is to simplify the acquisition of air permits for particulate sources. Sound practice requires that a regulator only grant a permit if convinced that enforcement of applicable emission limitations will be ensured by compliance with permit conditions, i.e. that emissions calculated as specified in the permit would not exceed allowable emissions. Permittees must therefore convince regulators that emissions would not be underestimated during such calculations. The easiest approach is to calculate emissions based on the most conservative assumptions that do not yield an exceedance or trigger a new requirement. This guidance presents methods whereby allowable emissions may be quickly compared to maximum potential emissions calculated using any given set of assumptions. It also provides a way for users to “work backward” by calculating the least conservative value of any parameter that will ensure compliance with a given limit.

2. Regulation of Particulate Emissions

USEPA defines particulate matter emissions as "all finely divided solid or liquid material, other than uncombined water, emitted to the ambient air as measured by applicable reference methods."[1]. Particulates actually consist of three overlapping but separately regulated entities: total suspended particulates (TSP), inhalable particulate matter less than 10 microns in diameter (PM10), and fine particulate matter less than 2.5 microns in diameter (PM2.5).

All forms of particulate emissions are Federally regulated as *criteria pollutants*, so called because USEPA has set concentration-based National Ambient Air Quality Standards (NAAQS) for each based on a published criteria document. Nationwide, USEPA has classified each county relative to attainment of each standard. For PM10 and PM2.5, NAAQS have been set at two levels, primary and secondary. Primary standards are designed protect public health, secondary standards to protect environmental values. For TSP, there is only a secondary standard.

Under Title 1 of the CAA, USEPA oversees the development by each state of an implementation program (SIP) that includes provisions (state regulations) designed to ensure that each region achieves and maintains compliance with all ambient standards. SIPs currently address only TSP and PM10. SIP provisions for PM 2.5 have been delayed by court action and the lack of a Federal Reference Method for emission analysis. Until such provisions are developed by states and approved by USEPA, the regulated community will be unaffected by the PM2.5 standard.

In practice the distinction between TSP and PM10 is somewhat blurred. Since few emission sources have reliable PM size distribution data, common permitting practice assumes that TSP equals PM10, i.e. all PM is PM10. Further, "default" efficiencies accepted by regulators for typical PM control devices reflect expected performance on airstreams laden with PM10. In effect, all PM emissions at any facility are simultaneously covered by all rules targeting both TSP and PM10. For these reasons, this report refers to both TSP and PM10 as PM.

For PM, all SIPs now include regulations that limit emissions from various source categories, and enforce those limitations through air permit programs. These programs require facilities to obtain one-time certificates or permits to construct or modify PM sources, and renewable permits to operate them. SIPS also include regulations that mirror Federal rules targeting major PM sources and new sources subject to performance standards (NSPS).

For composite fabricators, a major source of PM would be any plant (or process within a plant) with potential to emit (at full permitted capacity and control level) more than 250 TPY if located in a PM attainment area, and a lower level (generally 100 TPY, but less in some areas) if located in a nonattainment area. Given the nature of composite fabrication, few such plants will be major PM sources, and most of those will be located in areas where PM nonattainment is severe. Further, no current or proposed NSPS covers PM emissions from composite fabrication. For these reasons, neither Federal major PM source rules nor NSPS will be considered further.

State PM rules of concern to composite fabricators are those that limit general process emissions. Most states derive allowable emission limits as a numerical function of process rate, the rate in tons per hour at which all materials (not just PM) flow through the process. A small minority of states set PM limits based on concentration at the stack or, as determined by dispersion modeling, at some point offsite. However derived, these limits are enforced through air permits.

Composite fabricators emitting more than 10 tons of the hazardous air pollutant (HAP) styrene, 25 tons of total HAP, or (generally) 100 tons of volatile organic compounds will require special air permits under Title V of the CAA. Even if plants are minor PM sources, such permits must include applicable PM limits enforced by rigorous recordkeeping and exceedance reporting.

3. Composite Fabrication Processes Emitting PM

Reinforced plastic composites consist of a mixture of fibrous reinforcement that provides strength and plastic matrix that binds and protects the reinforcement. Composites may be formed (laid up) in molds as laminates (layers of matrix and reinforcement) or cast in molds as homogeneous mixtures. For most products fiberglass is used as reinforcement, although carbon and aramid fibers have gained acceptance in specialized applications. Reinforcement may be incorporated within products in three forms: as randomly oriented chopped fibers, woven cloth, or fiber bundles (roving). Plastic matrix is formed from the curing (chemical reaction) of liquid resin mixture, which contain a blend of resins (unconnected plastic subunits), monomers (connecting links between subunits), and various agents that promote curing and affect the properties of the resin mix. Fillers may also be added to a resin mix to improve fire rating or other physical characteristics. During the curing process, the resins polymerize (connect through monomer crosslinkage) to form a tough solid plastic [2].

Operations at a typical composites plant may include any of the following process categories:

- Mixing of resins and pastes, and production of sheet or bulk mold compounds.
- Primary fabrication (molding) of unfinished parts, through a variety of processes.
- Secondary operations such as sawing of parts or core material, grinding and polishing.
- Painting of finished formed parts.
- Cleanup via knockdown of dust deposited on surfaces within the plant.

Mixing/compounding emissions are the subject of a separate CFA-sponsored report. Dust cleanup emissions are extremely difficult to characterize. Clearly, fugitive dust heavy enough to settle out within a plant will resuspend if disturbed, then resettle. Good housekeeping practices can minimize dust resuspension. However, if compressed air is used to knock down dust, essentially all of it will be resuspended, and significant quantities could be emitted before resettling. Exactly how much is determined by site-specific conditions that cannot be generalized. It is sound practice to minimize cleanup emissions by improving capture efficiency of local process exhausts and avoiding cleanup methods, such as use of compressed air, that excessively mobilize dust.

Given the above limitations, ECRM has focused this report on primary, secondary, and painting operations. Within these, PM may be emitted wherever fine solids are produced. Note that although it is theoretically possible for some portion of emitted styrene vapor to condense to form very fine particulate (PM2.5), there is no firm evidence of this mechanism, and it will not be considered further.

The various primary fabrication processes fall (for the most part) into two classes. In open molding, resin and reinforcement are applied to one-sided molds, producing parts with one “good” side (facing the mold surface). In closed molding resin and reinforcement are either placed and pressed, injected or drawn through sealed molds, resulting in parts which are good on all sides.

Among the many primary processes employed, only open molding via atomized spray application of resin or gelcoat is considered likely to emit significant PM. Here PM is produced as suspended resin droplets not deposited on part or mold surfaces. These free aerosols lose much of their free monomer and solidify. If chopper guns are used to disperse glass fibers within the resin stream, free glass particles could form. However, these particles are likely to be too large to remain suspended long enough to be emitted as PM of regulatory significance [3]. Similarly, there are no PM emissions generated during application of resin or gelcoat by flowcoaters, by hand, or any other method that does not atomize applied liquid, because droplets small enough to become suspended or entrained by ventilation airflows virtually never form.

Secondary operations abrade the material removed, forming dry dust that can be carried outside the plant as PM emissions. Sawing “chews up” all of the material directly in front of the saw blade as it advances. Grinding to remove flashing or smooth edges can remove a great deal of material. However, because heavy sawing and grinding operations may be readily vented to filters and/or settling chambers, post-control PM emissions from such sources may be low.

At many facilities, the secondary operation emitting the most PM may be polishing [3]. Buffing compounds and the resulting abraded materials are fine-grained and hence easily suspended; moreover, the handheld polishing equipment typically used cannot easily be equipped with effective dust capture.

Conventional painting operations produce PM in the same way as does open molding: oversprayed paint droplets lose their solvent content to form fine paint aerosols.

4. Calculation of PM Emissions

This section presents methods to calculate allowable and potential PM emissions from primary, secondary, and painting processes. Potential and actual emissions calculated by the same equations (with different parameter values), hence the methods presented apply for both.

Since the ultimate goal of this guidance is to simplify permitting, the first issue to be resolved is whether permits are needed. While virtually all primary processes will require air permits, secondary processes may be exempt by definition or because potential uncontrolled emissions are below permitting thresholds. Before proceeding, users should check for such exemptions. If exemption is based on a permitting threshold, then the methods presented below should be used to calculate potential emissions for comparison.

The methods and formulas presented in this section have been incorporated within the Excel spreadsheet workbook "PM Emission Calculation," hereafter referred to as the workbook. Examples given in Section 6 will illustrate the use of the workbook to calculate PM emissions at a hypothetical facility.

Allowable Emissions

Of the 48 continental states, 37 currently calculate allowable PM emissions (E) in pounds per hour based upon process rate (P), defined effectively as the weight in tons per hour at which raw materials flow through the process. The general equation employed by all such states is:

$$E = aP^b + c$$

where a, b, and c are constants specified in each rule. There are currently seven common sets of values for these constants, meaning that there are seven specific equations used to calculate allowable PM emissions by process rate. Most states employ one of these equations for existing sources below a defined process rate threshold (often 30 tons per hour) and another for new sources (constructed after the PM rule became effective), larger existing sources, and/or existing sources located in designated counties. For instance, allowable PM emissions in Michigan (per rule 336.1331 Table 32) are calculated as:

$E = 4.1P^{0.67}$ for $P < 30$ tons per hour
$E = 55P^{0.11} - 40$ for $P >= 30$ tons per hour

The workbook allows the user to select the appropriate equation, from which allowable emissions are calculated for a given P.

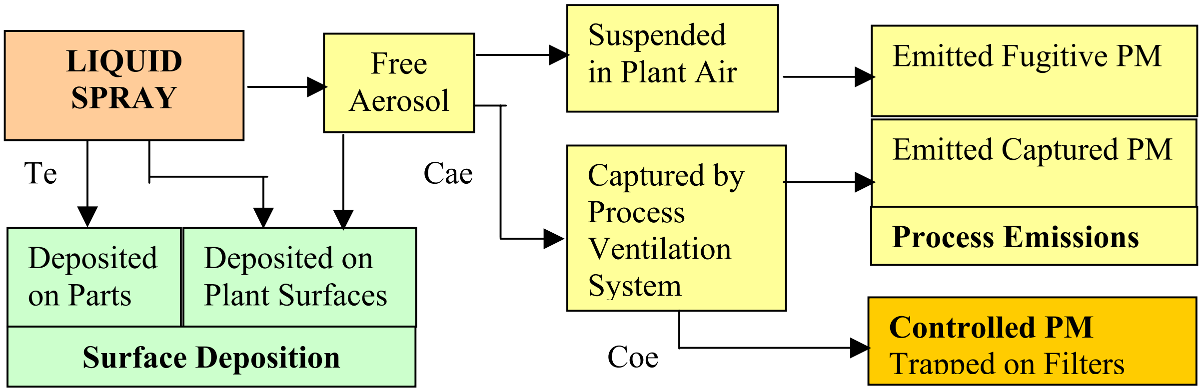
Most of the states that do not use process rate equations set allowable limits based on PM concentration in grains per dry standard cubic feet of process exhaust. For these sources, the workbook allows users to back-calculate allowable emissions in pounds per hour by specifying the concentration limit and dry process exhaust flow.

Remaining states (a small minority) set allowable PM emissions based on lookup tables or ambient PM concentration offsite estimated by dispersion modeling. The workbook does not support calculation of such site-specific limits.

Potential Emissions

PM Aerosols from Open Molding and Painting

As noted previously, spray application of liquids such as composite resins or paints to solid surfaces produces aerosols (fine droplets). The fate of this airborne material is depicted below.



Most of the liquid sprayed adheres to the part being coated. The ratio of liquid deposited on parts to liquid sprayed is commonly termed the transfer efficiency (Te). Another portion of the liquid sprayed settles immediately on part supports (hangers, mold flanges) and enclosure surfaces. The balance floats free; some being captured by the process ventilation system, with the remainder either settling out within the plant or being carried outside along with general plant ventilation airflow. Captured process air is typically routed to a fibrous filter to which most of its PM adheres (i.e. is controlled); the rest is released as process exhaust.

Assuming that none of the aerosol settling inside the plant is resuspended long enough to be emitted and none of the volatiles (resin monomers or paint solvents) remain in the emitted PM, we can calculate PM emissions from liquid spray processes by Equation 1[adapted from Reference 4]:

$$E = [\text{Captured Emissions}] + [\text{Fugitive Emissions}]$$

$$E = [MS(1-De)Cae(1-Coe)] + [MS(1-De)(1-Cae)] \qquad \text{(Eq.1)}$$

Where:
E = PM emission rate, pounds per hour
M = Usage rate of material sprayed, pounds per hour
S = Solids content, expressed as a ratio
De = Deposition efficiency of material on surfaces, ratio
Cae = Capture efficiency of process ventilation system, ratio
Coe = PM control efficiency of process ventilation system, ratio

Potential to emit PM is determined by evaluating the above equation at maximum M and S (worst-case liquid) for given De, Cae, and Coe. For resins with monomer content M (ratio), S may be estimated as (1-M). For paints, S may be estimated in terms of VOC content V (pounds per gallon) and paint density D (pounds per gallon) as (1-V/D).

Particulate mass transfer is dominated by surface deposition, so it is critical to estimate De realistically. Clearly, deposition efficiency De is somewhat greater than transfer efficiency Te; the bulk of the particulate deposited on surfaces will be transferred to parts. The non-transfer portion of deposition will vary with spray droplet size, density, airflow, and room configuration. Te itself is a function of part geometry, equipment configuration/setup, and operator skill. For resin application, CFA has devised a set of "Controlled Spray" procedures designed to reduce overspray and minimize atomization of resin. In a recent study conducted by the Indiana Clean Manufacturing Technology and Safe Materials Institute [5], strict adherence to Controlled Spray techniques increased transfer efficiency from 92% to 99%. On this basis, deposition efficiency could approach 95% for uncontrolled spray, and exceed 99% for controlled spray.

How reasonable are claims of deposition efficiency exceeding transfer efficiency? Calculate the assumed quantity of particulate accumulating on non-parts as MS(De-Te). That value must be consistent with observed conditions within the facility. For instance, if we employ non-controlled spray application of 100 pounds per hour resin at 50% solids, and we claim that deposition efficiency is 95% given a transfer efficiency of 92%, then (100)(0.5)(0.95-0.92) = 1.5 pounds per hour would be deposited on surfaces somewhere in the plant. If resin is applied for 2000 hours annually, then 3,000 pounds of solids would accumulate each year unless removed.

Capture efficiency Cae is dependent on process vent airflow, the proximity of vent pickups to the spray operation, and extent to which baffles or enclosures (booths) isolate the process from crossflows. Capture efficiency may be determined by enclosing the process within a temporary total enclosure and performing an emission test as specified in USEPA Method 204 [6]. Such tests are costly, time-consuming, and hence best avoided. As spray enclosures approach Method 204 enclosures in performance, capture efficiencies should approach 100%. For processes served by ventilation systems designed per practices recommended by ACGIH [7] a capture efficiency of at least 80% may be assumed. At least one state (Minnesota) has formalized acceptance of this assumption in permit rules [8].

Control efficiency Coe will typically be 95% or higher for spray aerosols, as long as filter media are properly sized, installed, and replaced. Many states require that differential pressure be monitored across filter media to establish a normal operating range, and then require reporting of excursions from this range. Regulators will assume that systems operating within their normal range are providing the control efficiency claimed in permit applications. Alternatively, states may allow operators to determine a filter replacement frequency sufficient to ensure that differential pressure remains within range, and then incorporate the resulting replacement schedule in the permit. Finally, some states will assume that PM controls are effective if installed as designed and operated/maintained in accordance with a program defined by the facility. These accommodations eliminate the need to conduct emission tests for compliance demonstration, and greatly simplify recordkeeping. All such options should be explored.

The workbook allows users to calculate captured, fugitive, and total PM emissions using the equation presented above. Users enter values for M, S, Te, and Cae and select Coe based on filter medium.

PM Emissions from Secondary Operations

Equation 1 may be simplified for use on secondary processes such as grinding, sawing, and finish polishing. Here we define M as the rate of material abrasion in pounds per hour. All of this is solid matter, so $S = 1$ and can be ignored. Since this material is being removed rather than deposited to make good parts, De now represents settling of fugitive dust within the plant. PM emissions from such processes can be calculated using Equation 2:

$$E = [\text{Captured Emissions}] + [\text{Fugitive Emissions}]$$
$$E = [M(1-De)Cae(1-Coe)] + [M(1-De)(1-Cae)] \qquad \text{(Eq.2)}$$

The workbook enables users to calculate secondary process emissions by entering equation parameters. The workbook uses Equation 1, but once the subject operation is tagged by the user as secondary, it automatically enters a value of 1 for S.

Deriving Worst-Case Parameter Values for Given Allowable Emissions

Sometimes it is useful to know the highest or lowest value of a parameter such that calculated potential emissions equal allowable emissions. Given that allowable and values for all other parameters in Equation 1, that "worst-case" parameter value can be calculated by backsolving Equation 1 for the desired value. This yields five equations, each of which is incorporated within Table 3 of the workbook, the Backsolver.

For instance, consider a buffing process removing solids at a rate of 100 pounds per hour, in a process with a calculated permit-allowable emission rate of 9.03 pounds per hour. If deposition efficiency is 50% and capture efficiency is determined to be 90%, Equation 5 can be used to calculate the lowest control efficiency (Coe) that must be provided so that potential emissions do not exceed allowable emissions. The resulting value is 91%. Suppose we provide that level of control, but the state drops the allowable PM limit for this process to 4.5 pounds per hour. Backsolver calculates the maximum solids removal rate that can be permitted to be just under 50 pounds per hour as the process is currently configured.

Example Calculations Using the Workbook

The following pages illustrate use of the workbook form, including data from a hypothetical plant with two primary resin spray operations, two paint spray booths, and two secondary operations. Operating parameters have been entered to illustrate the way the form works, and are not meant to represent real-world shop conditions.

Table 1 of the workbook is depicted below, along with accessory Lookup Tables 1A and 1B. Note that onscreen the lookup tables are to the right of the supported main table. Source descriptions and parameter values are entered in the unshaded cells. Column headers shaded green indicate entries that users must choose from lookup tables, also shaded green. Values displayed in other shaded cells are either copied from Table 1 (plain text in tan cells), copied from lookup tables (plain text in green cells) or final calculation results (bold text in yellow cells).

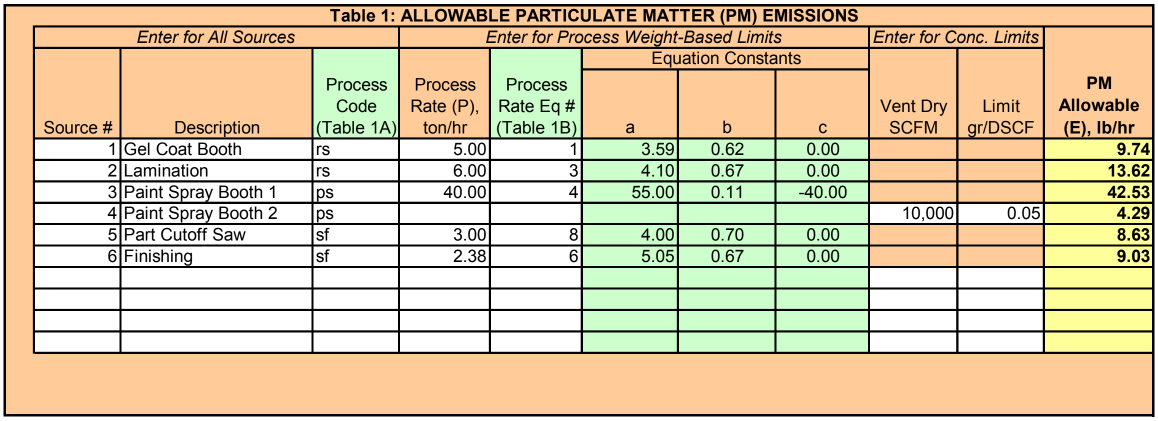


Table 1: ALLOWABLE PARTICULATE MATTER (PM) EMISSIONS

Enter for All Sources			*Enter for Process Weight-Based Limits*					*Enter for Conc. Limits*		
					Equation Constants					
Source #	Description	Process Code (Table 1A)	Process Rate (P), ton/hr	Process Rate Eq # (Table 1B)	a	b	c	Vent Dry SCFM	Limit gr/DSCF	**PM Allowable (E), lb/hr**
1	Gel Coat Booth	rs	5.00	1	3.59	0.62	0.00			**9.74**
2	Lamination	rs	6.00	3	4.10	0.67	0.00			**13.62**
3	Paint Spray Booth 1	ps	40.00	4	55.00	0.11	-40.00			**42.53**
4	Paint Spray Booth 2	ps						10,000	0.05	**4.29**
5	Part Cutoff Saw	sf	3.00	8	4.00	0.70	0.00			**8.63**
6	Finishing	sf	2.38	6	5.05	0.67	0.00			**9.03**

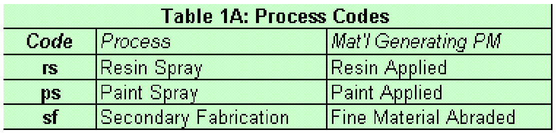


Table 1A: Process Codes

Code	*Process*	*Mat'l Generating PM*
rs	Resin Spray	Resin Applied
ps	Paint Spray	Paint Applied
sf	Secondary Fabrication	Fine Material Abraded

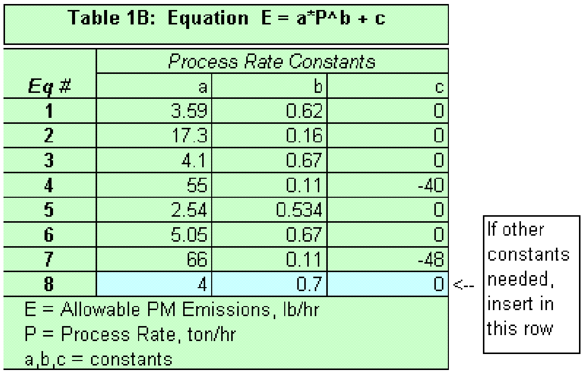


Table 1B: Equation E = a*P^b + c

	Process Rate Constants		
Eq #	a	b	c
1	3.59	0.62	0
2	17.3	0.16	0
3	4.1	0.67	0
4	55	0.11	-40
5	2.54	0.534	0
6	5.05	0.67	0
7	66	0.11	-48
8	4	0.7	0

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If other constants needed, insert in this row

E = Allowable PM Emissions, lb/hr
P = Process Rate, ton/hr
a,b,c = constants

Use Table 1 to calculate allowable PM emissions in lb/hr based on either process rate or exhaust concentration, whichever is appropriate in your state -consult the rules.

Table 2 is used to calculate potential emissions. Here source descriptions have been carried over from Table 1, and parameter values are entered in unshaded cells. Other cells display as before. If total potential emissions exceed the allowable emissions calculated in Table 1, the value is displayed in bold red text. Again, the accessory table (2A) is normally displayed onscreen to the right of the main table.

For secondary operations, "Mat'l Rate" (M in Equation 2) is sometimes hard to quantify. For sawing operations it can be calculated as (saw-cut width or kerf) x (saw cut length) x (saw cut depth) x (density) x (parts sawed per hour). For finishing operations, it can be calculated as (part area abraded) x (depth of abraded layer) x (density of abraded material) x (parts finished per hour). Alternatively, where operations are served by a dust collector, one can measure D, the rate at which dust is collected during part processing (pounds dust per hour). Then M may be estimated as D/(CoeCae).

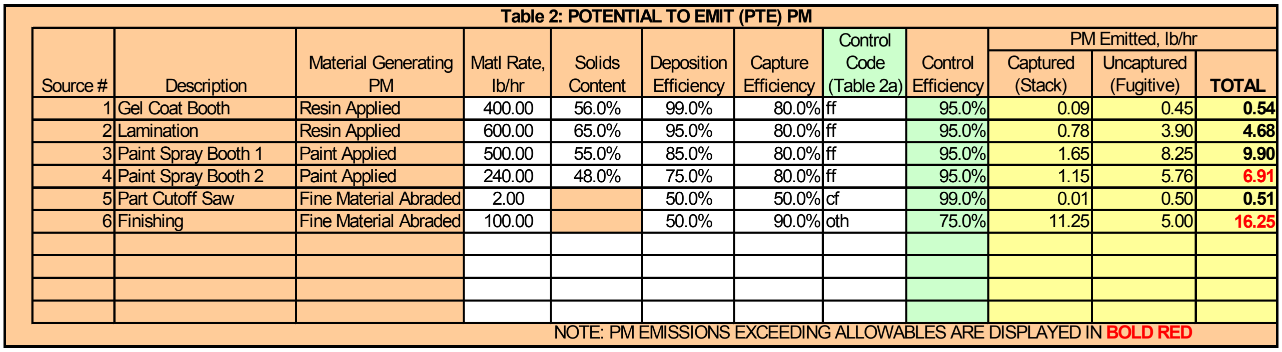

Table 2: POTENTIAL TO EMIT (PTE) PM

									PM Emitted, lb/hr		
Source #	Description	Material Generating PM	Matl Rate, lb/hr	Solids Content	Deposition Efficiency	Capture Efficiency	Control Code (Table 2a)	Control Efficiency	Captured (Stack)	Uncaptured (Fugitive)	**TOTAL**
1	Gel Coat Booth	Resin Applied	400.00	56.0%	99.0%	80.0%	ff	95.0%	0.09	0.45	**0.54**
2	Lamination	Resin Applied	600.00	65.0%	95.0%	80.0%	ff	95.0%	0.78	3.90	**4.68**
3	Paint Spray Booth 1	Paint Applied	500.00	55.0%	85.0%	80.0%	ff	95.0%	1.65	8.25	**9.90**
4	Paint Spray Booth 2	Paint Applied	240.00	48.0%	75.0%	80.0%	ff	95.0%	1.15	5.76	**6.91**
5	Part Cutoff Saw	Fine Material Abraded	2.00		50.0%	50.0%	cf	99.0%	0.01	0.50	**0.51**
6	Finishing	Fine Material Abraded	100.00		50.0%	90.0%	oth	75.0%	11.25	5.00	**16.25**

NOTE: PM EMISSIONS EXCEEDING ALLOWABLES ARE DISPLAYED IN **BOLD RED**

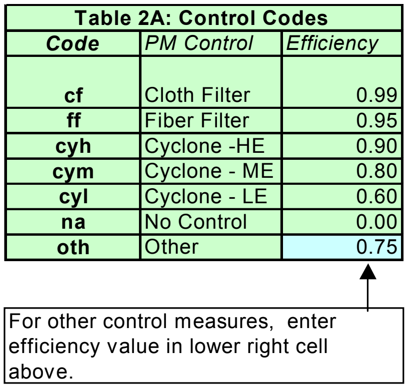

Table 2A: Control Codes

Code	*PM Control*	*Efficiency*
cf	Cloth Filter	0.99
ff	Fiber Filter	0.95
cyh	Cyclone -HE	0.90
cym	Cyclone - ME	0.80
cyl	Cyclone - LE	0.60
na	No Control	0.00
oth	Other	0.75

For other control measures, enter efficiency value in lower right cell above.

Table 3, the Backsolver, is used to calculate the worst-case value for any of the five process parameters such that potential emissions just equal a given allowable level at given values for the other four parameters. Two examples are shown.

In the first example, we backsolve for the lowest acceptable control efficiency, based on the allowable rate and other parameters from Table 1.

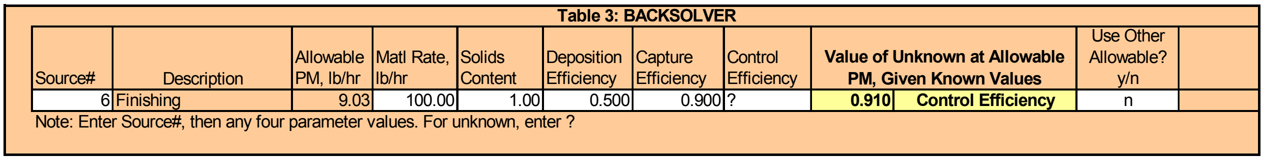

Table 3: BACKSOLVER

Source#	Description	Allowable PM, lb/hr	Matl Rate, lb/hr	Solids Content	Deposition Efficiency	Capture Efficiency	Control Efficiency	**Value of Unknown at Allowable PM, Given Known Values**		Use Other Allowable? y/n	
6	Finishing	9.03	100.00	1.00	0.500	0.900	?	**0.910**	**Control Efficiency**	n	

Note: Enter Source#, then any four parameter values. For unknown, enter ?

Note that the user enters the Source# number first, the same number used in Tables 1 and 2. The Description (of the source) is automatically carried over. The user then enters values for the known parameters (Matl Rate, Solids Content, Deposition Efficiency, and Capture Efficiency), and “?” for the unknown parameter to be solved for (Control Efficiency). As long as the value in the “Use Other Allowable?” field is “n”, the allowable emission rate calculated in Table 1 is copied into the “Allowable PM” field and used along with other known parameters to calculate the unknown, which is indicated in bold text in the cells shaded yellow.

In the second example, we backsolve the highest acceptable process rate, but based on an alternative value of the allowable level specified by the user. This would be useful to evaluate the impact of proposed rules reducing allowable PM on permitted production levels.

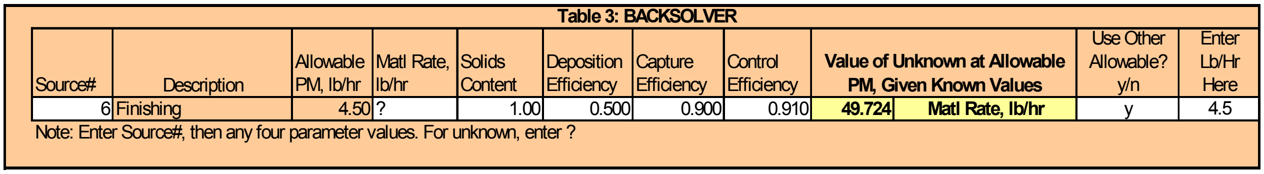

Table 3: BACKSOLVER

Source#	Description	Allowable PM, lb/hr	Matl Rate, lb/hr	Solids Content	Deposition Efficiency	Capture Efficiency	Control Efficiency	**Value of Unknown at Allowable PM, Given Known Values**		Use Other Allowable? y/n	Enter Lb/Hr Here
6	Finishing	4.50	?	1.00	0.500	0.900	0.910	**49.724**	**Matl Rate, lb/hr**	y	4.5

Note: Enter Source#, then any four parameter values. For unknown, enter ?

Note here that we enter “y” in the “Use Other Allowable?” field, which opens a field in which to enter the allowable value in pounds per hour. This value is then copied over into the “Allowable PM” field and used as before to calculate the unknown.

5. References

1. 40 CFR 51.100
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