Environmental Protection Agency
Pt. 63, Subpt. WWWW, App. A

APPENDIX A TO SUBPART WWWW OF PART 63—TEST METHOD FOR DETERMINING VAPOR SUPPRESSANT EFFECTIVENESS

1. Scope and Application

1.1 Applicability. If a facility is using vapor suppressants to reduce hazardous air pollutant (HAP) emissions, the organic HAP emission factor equations in Table 1 to this subpart require that the vapor suppressant effectiveness factor be determined. The vapor suppressant effectiveness factor is then used as one of the inputs into the appropriate organic HAP emission factor equation. The vapor suppressant effectiveness factor test is not intended to quantify overall volatile emissions from a resin, nor to be used as a stand-alone test for emissions determination. This test is designed to evaluate the performance of film forming vapor suppressant resin additives. The results of this test are used only in combination with the organic HAP emissions factor equations in Table 1 to this subpart to generate emission factors.

1.1.1 The open molding process consists of application of resin and reinforcements to the mold surface, followed by a manual roll-out process to consolidate the laminate, and the curing stage where the laminate surface is not disturbed. Emission studies have shown that approximately 50 percent to 55 percent of the emissions occur while the resin is being applied to the mold. Vapor suppressants have little effect during this portion of the lamination process, but can have a significant effect during the curing stage. Therefore, if a suppressant is 100 percent effective, the overall emissions from the process would be reduced by 45 percent to 50 percent, representing the emissions generated during the curing stage. In actual practice, vapor suppressant effectiveness will be less than 100 percent and the test results determine the specific effectiveness in terms of the vapor suppressant effectiveness factor. This factor represents the effectiveness of a specific combination of suppressant additive and resin formulation.

1.1.2 A resin manufacturer may supply a molder with a vapor-suppressed resin, and employ this test to provide the molder with the vapor suppressant effectiveness factor for that combination of resin and vapor suppressant. The factor qualifies the effectiveness of the vapor suppressant when the resin is tested in the specific formulation supplied to the molder. The addition of fillers or other diluents by the molder may impact the effectiveness of the vapor suppressant. Therefore, if a suppressant is 100 percent effective during the curing stage, the emissions generated during the curing stage is tested in the specific formulation supplied to the molder. The addition of fillers or other diluents by the molder may impact the effectiveness of the suppressant. The formulation, including resin/glass ratio and filler content, used in the test should be similar to the formulation to be used in production. The premise of this method is to compare laminate samples made with vapor suppressant additive and made without the additive. The difference in emissions between the two yields the vapor suppressant effectiveness factor.

1.1.3 The method uses a mass balance determination to establish the relative loss of the volatile component from unsaturated polyester or vinyl ester resins, with and without vapor suppressant additives. The effectiveness of a specific vapor suppressant and resin mixture is determined by comparing the relative volatile weight losses from vapor suppressed and non-suppressed resins. The volatile species are not separately analyzed. While the species contained in the volatile component are not determined, an extended listing of potential monomer that may be contained in unsaturated polyester or vinyl ester resins is provided in Table 1.1. However, most polyester and vinyl ester resin formulations presently used by the composites industry only contain styrene monomer.

2. Summary of Method

2.1 Differences in specific resin and suppressant additive chemistry affect the performance of a vapor suppressant. The purpose of this method is to quantify the effectiveness of a specific combination of vapor suppressant additive and resin formulation.

### Table 1.1—List of Monomers Potentially Present in Unsaturated Polyester/Vinyl Ester Resins

<table>
<thead>
<tr>
<th>Monomer</th>
<th>CAS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Styrene</td>
<td>100–42-5</td>
</tr>
<tr>
<td>Vinyl toluene</td>
<td>25013-15-4</td>
</tr>
<tr>
<td>Methyl methacrylate</td>
<td>80–62-6</td>
</tr>
<tr>
<td>Para methyl styrene</td>
<td>Vinyl toluene isomer.</td>
</tr>
<tr>
<td>Chlorostyrene</td>
<td>1331–28–8</td>
</tr>
<tr>
<td>Dialyl phthalate</td>
<td>131–17–9</td>
</tr>
<tr>
<td>Other volatile monomers</td>
<td>Various</td>
</tr>
</tbody>
</table>
unsaturated polyester or vinyl ester resin.

3. Definitions and Acronyms

3.1 Definitions

3.1.1 Vapor suppressant. An additive that inhibits the evaporation of volatile components in unsaturated polyester or vinyl ester resins.

3.1.2 Unsaturated polyester resin. A thermosetting resin commonly used in composites molding.

3.1.3 Unsaturated vinyl ester resin. A thermosetting resin used in composites molding for corrosion resistant and high performance applications.

3.1.4 Laminate. A combination of fiber reinforcement and a thermoset resin.

3.1.5 Chopped strand mat. Glass fiber reinforcement with random fiber orientation.

3.1.6 Initiator. A curing agent added to an unsaturated polyester or vinyl ester resin.

3.1.7 Resin application roller. A tool used to saturate and compact a wet laminate.

3.1.8 Gel time. The time from the addition of initiator to a resin to the state of resin gelation.

3.1.9 Filled resin system. A resin, which includes the addition of inert organic or inorganic materials to modify the resin properties, extend the volume and to lower the cost. Fillers include, but are not limited to; mineral particulates; microspheres; or organic particulates. This test is not intended to be used to determine the vapor suppressant effectiveness of a filler.

3.1.10 Material safety data sheet. Data supplied by the manufacturer of a chemical product, listing hazardous chemical components, safety precautions, and required personal protection equipment for a specific product.

3.1.11 Tare(ed). Reset a balance to zero after a container or object is placed on the balance; that is to subtract the weight of a container or object from the balance reading so as to weigh only the material placed in the container or on the object.

3.1.12 Percent glass. The specified glass fiber weight content in a laminate. It is usually determined by engineering requirements for the laminate.

3.2 Acronyms:

3.2.1 VS—vapor suppressed or vapor suppressant.

3.2.2 NVS—non-vapor suppressed.

3.2.3 VSE—vapor suppressant effectiveness.

3.2.4 VSE Factor—vapor suppressant effectiveness, factor used in the equations in Table 1 to this subpart.

3.2.5 CSM—chopped strand mat.

3.2.6 MSDS—material safety data sheet.

4. Interferences

There are no identified interferences which affect the results of this test.

5. Safety

Standard laboratory safety procedures should be used when conducting this test. Refer to specific MSDS for handling precautions.

6. Equipment and Supplies

NOTE: Mention of trade names or specific products or suppliers does not constitute an endorsement by the Environmental Protection Agency.

6.1 Required Equipment.

6.1.1 Balance enclosure.

6.1.2 Two (2) laboratory balances—accurate to ±0.01g.

6.1.3 Stop watch or balance data recording output to data logger with accuracy ±1 second.

6.1.4 Thermometer—accurate to ±2.0 °F(±1.0 °C).4

6.1.5 A lipped pan large enough to hold the cut glass without coming into contact with the vertical sides, e.g., a pizza pan.5

6.1.6 Mylar film sufficient to cover the bottom of the pan.6

6.1.7 Tape to keep the Mylar from shifting in the bottom of the pan.7

6.1.8 Plastic tri-corner beakers of equivalent—250 ml to 400 ml capacity.8

6.1.9 Eye dropper or pipette.9

6.1.10 Disposable resin application roller, 3⁄16″ diameter x 3″–4″ roller length.10

6.1.11 Hygrometer or psychrometer11 accurate to ±5 percent

6.1.12 Insulating board, (Teflon, card-board, foam board etc.) to prevent the balance from becoming a heat sink.12

6.2 Optional Equipment.

6.2.1 Laboratory balance—accurate to ±0.01g with digital output, such as an RS-232
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6.2.2 Computer with recording software configured to link to balance digital output. Must be programmed to record data at the minimum intervals required for manual data acquisition.

6.3 Supplies.
6.3.1 Chopped strand mat—1.5 oz/ft.² 14

7. Reagents and Standards
7.1 Initiator. The initiator type, brand, and concentration will be specified by resin manufacturer, or as required by production operation.
7.2 Polyester or vinyl ester resin.
7.3 Vapor suppressant additive.

8. Sample Collection, Preservation, and Storage
This test method involves the immediate recording of data during the roll out and curing phases of the lamination process during each test run. Samples are neither collected, preserved, nor stored.

9. Quality Control
Careful attention to the prescribed test procedure, routing equipment calibration, and replicate testing are the quality control activities for this test method. Refer to the procedures in section 11. A minimum of six test runs of a resin system without a suppressant and six test runs of the same resin with a suppressant shall be performed for each resin and suppressant test combination.

10. Calibration and Standardization
10.1 The laboratory balances, stopwatch, hygrometer and thermometer shall be maintained in a state of calibration prior to testing and thereafter on a scheduled basis as determined by the testing laboratory. This shall be accomplished by using certified calibration standards.
10.2 Calibration records shall be maintained for a period of 3 years.

11. Test Procedure
11.1 Test Set-up.
11.1.1 The laboratory balance is located in an enclosure to prevent fluctuations in balance readings due to localized air movement. The front of enclosure is open to permit work activity, but positioned so that local airflow will not effect balance readings. The ambient temperature is determined by suspending the thermometer at a point inside the enclosure.
11.1.2 The bottom of the aluminum pan is covered with the Mylar film. The film is held in position with tape or by friction between the pan and the film.
11.1.3 The resin and pan are brought to room temperature. This test temperature must be between 70 °F and 80 °F. The testing temperature cannot vary more than ±2 °F during the measurement of test runs. Temperature shall be recorded at the same time weight is recorded on suppressed and non-suppressed test data sheets, shown in Table 17.1.
11.1.4 The relative humidity may not change more than ±15 percent during the test runs. This is determined by recording the relative humidity in the vicinity of the test chamber at the beginning and end of an individual test run. This data is recorded on the test data sheets shown in Table 17.1.
11.1.5 Two plies of nominal 1.5 oz/ft² chopped strand mat (CSM) are cut into a square or rectangle with the minimum surface area of 60 square inches (i.e., a square with a side dimension of 7.75 inches).
11.1.6 The appropriate resin application roller is readily available.
11.2 Resin Gel Time/Initiator Percentage
11.2.1 Previous testing has indicated that resin gel time influences the emissions from composite production. The testing indicated that longer gel times led to higher emissions. There are a number of factors that influence gel time including initiator type, initiator brand, initiator level, temperature and resin additives. Under actual usage conditions a molder will adjust the initiator to meet a gel time requirement. In this test procedure, the vapor suppressed and non-vapor suppressed resin systems will be adjusted to the same gel time by selecting the appropriate initiator level for each.
11.2.2 All test runs within a test will be processed in a manner that produces the same resin gel time ±2 minutes. To facilitate the resin mixing procedure, master batches of resin and resin plus vapor suppressant of resin are prepared. These resin master batches will have all of the required ingredients except initiator; this includes filler for filled systems. The gel times for the tests are conducted using the master batch and adjustments to meet gel time requirements shall be made to the master batch before emission testing is conducted. Test temperatures must be maintained within the required range, during gel time testing. Further gel time testing is not required after the non-vapor suppressed and vapor suppressed master batches are established with gel times within ±2 minutes. A sufficient quantity of each resin should be prepared to allow for additional test specimens in the event one or more test fails to meet the data acceptance criteria discussed in Section 11.5 and shown in Table 17.2.
11.2.3 The specific brand of initiator and the nominal percentage level recommended by the resin manufacturer will be indicated on the resin certificate of analysis 15; or, if a unique gel time is required in a production laminate, initiator brand and percentage will be determined by that specific requirement.
11.2.4 Examples:
The resin for a test run is specified as having a 15-minute cup gel time at 77 °F using Brand X initiator at 1.5 percent by weight. The non-suppressed control resin has a 15-minute gel time. The suppressed resin has a gel time of 17-minutes. An initiator level of 1.5 percent would be selected for the both the non-suppressed and the suppressed test samples.

Based on a specific production requirement, a resin is processed in production using 2.25 percent of Brand Y initiator, which produces a 20-minute gel time. This initiator at level of 2.25 percent produces a 20 minute gel time for the non-suppressed control resin, but yields a 25-minute gel time for the suppressed resin sample. The suppressed resin is retested at 2.50 percent initiator and produces a 21-minute gel time. The initiator levels of 2.25 percent and 2.50 percent respectively would yield gel times within ±2 minutes.

The resin for a test run is specified as having a 15-minute cup gel time at 77 °F using Brand X initiator at 1.5 percent by weight. The non-suppressed control resin has a 15-minute gel time. The suppressed resin has a gel time of 17-minutes. An initiator level of 1.5 percent would be selected for the both the non-suppressed and the suppressed test samples.

11.2.4.2 Based on a specific production requirement, a resin is processed in production using 2.25 percent of Brand Y initiator, which produces a 20-minute gel time. This initiator at level of 2.25 percent produces a 20 minute gel time for the non-suppressed control resin, but yields a 25-minute gel time for the suppressed resin sample. The suppressed resin is retested at 2.50 percent initiator and produces a 21-minute gel time. The initiator levels of 2.25 percent and 2.50 percent respectively would yield gel times within ±2 minutes.

11.3 Test Run Procedure for Unfilled Resin (see the data sheet shown in Table 17.1).

11.3.1 The insulating board is placed on the balance.

11.3.2 The aluminum pan with attached Mylar film is placed on the balance, and the balance is tared (weight reading set to zero with the plate on the balance.)

11.3.3 Place two plies of 1.5 oz. CSM on the balance and record the weight (glass weight).

11.3.4 The resin beaker and stirring rod are put on the second balance and tared.

11.3.5 The required resin weight and initiator weight are calculated (refer to calculation formulas in 12.2).

11.3.6 The disposable resin application roller is placed on the edge of the plate.

11.3.7 The balance is tared, with the aluminum pan, Mylar film, glass mat, and resin application roller on the balance pan.

11.3.8 Resin is weighed into a beaker, as calculated, using the second balance. The mixing stick should be tared with the beaker weight.

11.3.9 Initiator is weighed into the resin, as calculated, using an eyedropper or a pipette, and the combination is mixed.

11.3.10 Initiated resin is poured on the mixed strand mat in a pre-determined pattern (see Figure 11.6).

11.3.11 A stopwatch is started from zero.

11.3.12 The initial laminate weight is recorded.

11.3.13 The plate is removed from balance to enable roll-out of the laminate.

11.3.14 The wet laminate is rolled with the resin application roller to completely distribute the resin, saturate the chopped strand mat, and eliminate air voids. Roll-out time should be in the range of 2 to 3½ minutes and vary less than ±10 percent of the average time required for the complete set of six suppressed and six non-suppressed runs.
11.4.14 Replace the second layer of fiberglass.

11.4.15 Remove the plate from the balance to allow roll-out of the laminate.

11.4.16 Roll the wet laminate with the resin application roller to completely distribute the resin, saturate the chopped strand mat, and eliminate air voids. Roll-out time should be in the range of 2 to 3½ minutes and vary less than ±10 percent of the average time required for the complete set of six suppressed and six non-suppressed runs.

11.4.17 Record the roll-out end time (time from start to completion of rollout).

11.4.18 Place the resin application roller on the edge of the plate when rollout is completed.

11.4.19 Place the plate back on the balance pan. The initial weight is recorded immediately.

11.4.20 For the first test run in a series of six, weight is recorded at every 5-minute interval (suppressed and non-suppressed). The end of the test occurs when three consecutive equal weights are recorded or a weight gain is observed (the last weight before the increased weight is the end of test weight). For the remaining five tests in the series, after the initial weights are taken, the next weight is recorded 30 minutes before the end of the test, as suggested by the results from the first test. It is likely that the time to reach the end point of a suppressed resin test will be shorter than the time required to complete a non-suppressed test. Therefore, the time to start taking data manually may be different for suppressed and non-suppressed resins.

11.5 Data Acceptance Criteria:

11.5.1 A test set is designed as twelve individual test runs using the same resin, initiator, and gel time, six of the test runs use the resin non-vapor suppressed and the other six use it vapor suppressed.

11.5.2 If a test run falls outside any of the time, temperature, weight or humidity variation requirements, it must be discarded and run again.

11.5.3 The laminate roll-out time for each individual test run must vary less than ±10 percent of the average time required for the complete set of six suppressed and six non-suppressed runs.

11.5.4 Test temperature for each test run must be maintained within ±2 °F and the average must be between 70° and 80 °F. Refer to 11.1.3.

11.5.5 The difference in the amount of resin for each run must be within ±10 percent of the average weight for the complete set of six suppressed and six non-suppressed runs.

11.5.6 The relative humidity from each test run must be maintained within ±15 percent of the average humidity for the complete set of six suppressed and six non-suppressed tests. Refer to 11.1.4.

11.5.7 The glass content for each test set must be within ±10 percent of the average resin-to-glass ratio for the complete set of six suppressed and six non-suppressed runs. Refer to 12.2.

11.5.8 The filler content for each test of a test set must be within ±5 percent of the average filler content for the complete set of six suppressed and six non-suppressed runs. Refer to 12.2.

11.6 Resin Application Pour Pattern:

11.6.1 To facilitate the distribution of resin across the chopped strand mat, and to provide consistency from test to test, a uniform pour pattern should be used. A typical pour pattern is shown below:
11.6.2 The resin is to be evenly distributed across the entire surface of the chopped strand mat using the resin application roller to achieve a wet look across the surface of the laminate. Pushing excess resin off the reinforcement and onto the Mylar sheet should be avoided. No resin is to be pushed more than 1/2 inch beyond the edge of the glass mat. If excess resin is pushed further from the glass mat, it will void the test run. As part of this process, typical visible air voids are to be eliminated by the rollout process. If the pour pattern is different from the above, it must be recorded and attached to test data sheet 17.1.

12. Data Analysis and Calculations

12.1 Data Analysis:
This test method requires a simple mass balance calculation, no special data analysis is necessary.

12.2 Calculations:
12.2.1 The target glass content (percent) for unfilled resin systems is determined from the specific production parameters being evaluated. In absence of any specific production requirements the target may be set at the tester’s discretion.
12.2.2 Glass content determination (expressed as a per cent):
\% Glass = Glass wt\(\text{(g)}\)/(Glass wt\(\text{(g)}\) + Resin weight \(\text{(g)}\))

12.2.3 Weight of resin required:
Resin weight required = (Glass wt \(\text{(g)}\)/\% glass) - Glass wt \(\text{(g)}\)

12.2.4 Filled resin formulation determination for filled resin systems (e.g. >30 percent filler by weight for a particulate filler, or >1 percent by weight for a lightweight filler, such as hollow microspheres):
\% Resin content = resin weight\(\text{(g)}\)/(Resin weight\(\text{(g)}\) + Glass weight\(\text{(g)}\) + filler weight\(\text{(g)}\))
\% Glass content = glass weight\(\text{(g)}\)/(Resin weight\(\text{(g)}\) + Glass weight\(\text{(g)}\) + filler weight\(\text{(g)}\))
Filler content = filler weight\(\text{(g)}\)/(Resin weight\(\text{(g)}\) + Glass weight\(\text{(g)}\) + filler weight\(\text{(g)}\))

12.2.5 Initiator weight determination:
Initiator weight \(\text{(g)}\) = Resin weight\(\text{(g)}\) \times Initiator %

12.2.6 Emission weight loss determination:
Emissions weight loss \(\text{(g)}\) = Initial resin weight \(\text{(g)}\) - Final resin weight \(\text{(g)}\)

12.2.7 % Emission weight loss:
\% Emission Weight Loss = (Emission weight loss \(\text{(g)}\) / Initial resin weight \(\text{(g)}\)) \times 100

12.2.8 Average % Emission Weight Loss (assuming six test runs):

Figure 11.6 Resin Distribution Diagram
12.2.9 VSE Factor calculation:

\[ \text{VSE Factor} = 1 - \left( \frac{\text{Average } \% \text{ VS Emission Weight Loss}}{\text{Average NVS Emission Weight Loss}} \right) \]

**TABLE 12.1—EXAMPLE CALCULATION**

<table>
<thead>
<tr>
<th>Test #</th>
<th>% VS Weight Loss</th>
<th>% NVS Weight Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.87</td>
<td>10.86</td>
</tr>
<tr>
<td>2</td>
<td>6.76</td>
<td>11.23</td>
</tr>
<tr>
<td>3</td>
<td>5.80</td>
<td>12.02</td>
</tr>
<tr>
<td>4</td>
<td>5.34</td>
<td>11.70</td>
</tr>
<tr>
<td>5</td>
<td>6.11</td>
<td>11.91</td>
</tr>
<tr>
<td>6</td>
<td>6.61</td>
<td>10.63</td>
</tr>
<tr>
<td>Average Weight Loss</td>
<td>6.25</td>
<td>11.39</td>
</tr>
<tr>
<td>VSE Factor</td>
<td></td>
<td>0.4</td>
</tr>
</tbody>
</table>

VSE Factor = 0.45

VSE Factor is used as input into the appropriate equation in Table 1 to this subpart.

Example from Table 1 to this subpart:
Manual Resin Application, 35 percent HAP resin, VSE Factor of 0.45
HAP Emissions with vapor suppressants = \((0.286 \times \% \text{HAP}) - 0.0529 \times 2000 \times (1-(0.5 \times \text{VSE factor}))\)
HAP Emissions with vapor suppressants = \((0.286 \times 0.35) - 0.0529 \times 2000 \times (1-(0.5 \times 0.45))\)
HAP Emissions with vapor suppressants = 73 pounds of HAP emissions per ton of resin.

13. Method Performance

13.1 Bias:
The bias of this test method has not been determined.

13.2 Precision Testing
13.2.1 Subsequent to the initial development of this test protocol by the Composites Fabricators Association, a series of tests were conducted in three different laboratory facilities. The purpose of this round robin testing was to verify the precision of the test method in various laboratories. Each laboratory received a sample of an orthophthalic polyester resin from the same production batch, containing 48 percent styrene by weight. Each testing site was also provided with the same vapor suppressant additive. The suppressant manufacturer specified the percentage level of suppressant additive. The resin manufacturer specified the type and level of initiator required to produce a 20 minute gel time. The target glass content was 30 percent by weight.
13.2.2 Each laboratory independently conducted the VSE test according to this method. A summary of the results is included in Table 13.1.

**TABLE 13.1—ROUND ROBIN TESTING RESULTS**

<table>
<thead>
<tr>
<th>Test Lab 1</th>
<th>Test Lab 2</th>
<th>Test Lab 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>NVS</td>
<td>VS</td>
<td>NVS</td>
</tr>
<tr>
<td>Average percent WT Loss</td>
<td>4.24</td>
<td>1.15</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.095</td>
<td>0.060</td>
</tr>
<tr>
<td>VSE Factor</td>
<td>0.73</td>
<td>0.70</td>
</tr>
</tbody>
</table>

13.3 Comparison to EPA Reference Methods
This test has no corresponding EPA reference method.

14. Pollution Prevention
The sample size used in this method produces a negligible emission of HAP, and has an insignificant impact upon the atmosphere.

15. Waste Management
The spent and waste materials generated during this test are disposed according to required facility procedures, and waste management recommendations on the corresponding material safety data sheets.

16. References and footnotes
16.1 Footnotes:
Balance Enclosure—The purpose of the balance enclosure is to prevent localized air-flow from adversely affecting the laboratory balance. The enclosure may be a simple three-sided box with a top and an open face. The configuration of the enclosure is secondary to the purpose of providing a stable and steady balance reading, free from the effects of airflow, for accurate measurements. The enclosure can be fabricated locally. A typical enclosure is shown in Figure 17.1.
Laboratory Balance—Ohaus Precision Standard Series P/N TS440D or equivalent—Paul N. Gardner Co. 316 NE 1st St. Pompano Beach, FL 33060 or other suppliers.
Stop Watch—Local supply.

4 Thermometer—Mercury thermometer—ASTM No. 21C or equivalent; Digital thermometer—P/N TH–33033 or equivalent—Paul N. Gardner Co. 316 NE 1st St. Pompano Beach, FL 33060 or other suppliers.

5 Aluminum Pan—Local supply.

6 Mylar—Local supply.

7 Double Sided Tape—3M Double Stick Tape or equivalent, local supply.

8 Laboratory Beakers—250 to 400ml capacity—Local laboratory supply.

9 Eye Dropper or Pipette—Local laboratory supply.

10 Disposable Resin Application Roller Source—Wire Handle Roller P/N 205–050–300 or Plastic Handle Roller P/N 215–050–300 or equivalent; ES Manufacturing Inc., 2500 26th Ave. North, St. Petersburg, FL 33713, www.esmfg.com, or other source. Refer to Figure 17.3.

11 Hygrometer or Psychrometer—Model# THWD–1, or equivalent—Part # 975765 by Amprobe Instrument, 630 Merrick Road, P.O. Box 329, Lynbrook, NY 11563, 516–593–5600

12 Insulating Board (Teflon, cardboard, foam board etc.)—Local supply.

13 Laboratory Balance With Digital Output—Ohaus Precision Standard Series P/N TS120S or equivalent—Paul N. Gardner Co. 316 NE 1st St. Pompano Beach, FL 33060 or other suppliers.

14 Chopped Strand Mat—1.5 oz/ft² Sources: Owens Corning Fiberglas—Fiberglas M–723; PPG Industries—ABM HTX; Vetrotex America—M–127 or equivalent.

15 Certificate of Analysis: Resin gel time, as recorded on the resin certificate of analysis, is measured using a laboratory standard gel time procedure. This procedure typically uses a 100 gram cup sample at 77 °F (25 °C), a specific type of initiator and a specified percentage.

16 Roll-out times may vary with resin viscosity or resin additive. The important aspect of this step is to produce the same roll-out time for both the suppressed and non-suppressed samples.

17 While this test can be used with filled resin systems, the test is not designed to determine the effect of the filler on emissions, but rather to measure the effect of the suppressant additive in the resin system. When evaluating a filled system both the non-vapor suppressed and vapor suppressed samples should be formulated with the same type and level of filler.

16.2 References
1. Phase I—Baseline Study Hand Lay-up, CFA, 1996
2. CFA Vapor Suppressant Effectiveness Test Development, 4/3/98, correspondence with Dr. Madeleine Strum, EPA, OAQPS
3. CFA Vapor Suppressant Effectiveness Screening Tests, 4/4/98

17. Data Sheets and Figures
17.1 This data sheet, or a similar data sheet, is used to record the test data for filled, unfilled, suppressed and non-suppressed tests. If additional time is required, the data sheet may be extended.
<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Type</th>
<th>VS (___)</th>
<th>NVS (___)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin</td>
<td>Filled (___)</td>
<td>Unfilled (___)</td>
<td></td>
</tr>
<tr>
<td>Initiator</td>
<td>Initiator, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapor Suppressant</td>
<td>VS, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight of 2 layers of glass, g</td>
<td>Weight of 1st glass layer, g</td>
<td>Weight of 2nd glass layer, g</td>
<td></td>
</tr>
<tr>
<td>Initial Resin Weight, (g)</td>
<td>Time (Min.)</td>
<td>Weight (g)</td>
<td>Temp (°F)</td>
</tr>
<tr>
<td>Glass content, (%)</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Temperature °F:</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Humidity %</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resin Initiator Level, %</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resin gel time, (min.)</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resin filler content, %</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roll out time, (min.)</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time, (min.)</td>
<td>Weight, g</td>
<td>Temp, °F</td>
<td>90</td>
</tr>
</tbody>
</table>
17.2 Data Acceptance Criteria Worksheet:
The following worksheet is used to determine the quality of collected data (i.e., insure the data collected all meets acceptance criteria).

<table>
<thead>
<tr>
<th>Initial</th>
<th>95</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>110</td>
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</tr>
<tr>
<td>10</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>120</td>
<td></td>
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<td>20</td>
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<tr>
<td>25</td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>135</td>
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</tr>
<tr>
<td>35</td>
<td>140</td>
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</tr>
<tr>
<td>40</td>
<td>145</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>155</td>
<td></td>
</tr>
</tbody>
</table>

<p>| Final Time, min. | Final Weight, g. | Final Temp, °F | Final Humidity, % |</p>
<table>
<thead>
<tr>
<th>Test No.</th>
<th>Temperature</th>
<th>Laminate roll out time, min</th>
<th>Relative humidity, %</th>
<th>Resin weight, g</th>
<th>Glass content, %</th>
<th>Resin distribution</th>
<th>Meets criteria Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Delta</td>
<td>Initial</td>
<td>Final</td>
<td>Average</td>
<td>± 2 °F</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
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<tr>
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</tr>
<tr>
<td>11</td>
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</tr>
<tr>
<td>12</td>
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<td></td>
</tr>
</tbody>
</table>

Criteria:........... ± 2 °F ±10% of Average ±15 of Average ±10% of Avg. ±10% of Avg. 1⁄2 inch off mat All Y
17.3 VSE Factor Calculation

<table>
<thead>
<tr>
<th>TABLE 17.3—CALCULATIONS WORKSHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapor suppressed</td>
</tr>
<tr>
<td>Test #</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Average Weight Loss</td>
</tr>
<tr>
<td>VSE Factor</td>
</tr>
</tbody>
</table>

VSE Factor = 1—(% Average Weight Loss$_{VS}$/ % Average Weight Loss$_{NVS}$)

17.4 Figures
Figure 17.1. Typical Balance Enclosure
Figure 17.2. Scale, Plate, Insulating Board, Mylar, Laminate Order
WHAT THIS SUBPART COVERS

§ 63.5980 What is the purpose of this subpart?

This subpart establishes national emission standards for hazardous air pollutants (NESHAP) for rubber tire manufacturing. This subpart also establishes requirements to demonstrate

Figure 17.3. Typical FRP Rollers

Subpart XXXX—National Emissions Standards for Hazardous Air Pollutants: Rubber Tire Manufacturing

Source: 67 FR 45598, July 9, 2002, unless otherwise noted.