

Enforcement Procedures

Emissions Averaging Procedure
(Adopted June 19, 1996)

Ref: Regulation 8, Rule 32: Wood Products Coating, Section 307: Alternate Compliance

6.1 Introduction

Regulation 8, Rule 32 limits VOC levels in wood coatings expressed as both grams per liter, and grams per gram of solids for high solids coatings. 8-32 also provides an alternate compliance option of emissions averaging. Emissions averaging is based on the VOC expressed as grams per gram of solids for high solids stains, and on the VOC expressed as grams per liter for low solids stains and solvents. This procedure set forth in this section provides the for a method of averaging emissions on a grams VOC per gram coating solid basis (or pounds of VOC per pound coating solid basis). This approach basis eliminates bias due to relative film thickness' of different coating technologies and those due to different coating containing water or exempt solvents. Low solids coatings and solvents used in the manufacturing process may be included in the average, but are calculated on the basis of grams VOC per gram liter of coating or solvent material (or pounds VOC per pound gallon of coating or solvent material).

Emissions are quantified for all high solids coatings to be averaged from the amount of coating solids used for each coating in grams (or pounds) multiplied by the VOC content in grams VOC per gram coating solid (or pounds VOC per pound coating solid). Emissions are quantified for all low solids coatings and solvents to be averaged from the volume of low solids coatings and solvents multiplied by the VOC content in grams VOC per liter (or gallon). Information on the solids content and the VOC content is obtained from the coating manufacturer, and is required to be provided.

Emissions from all coatings are compared to the emissions allowance that would result from using all compliant coatings. The emissions from compliant coatings are based on the equivalent grams (or pounds) of coating solids used, and VOC content of compliant coatings translated into grams VOC per gram coating solid (or pounds VOC per pound coating solid). This equivalency assumes a 1200-grams/liter (or 10.0 pounds/gallon) density for coating solids and a 880 gram/liter (or 7.33-pounds/gallon) density for coating solvent. Emissions of coatings used must be no greater than emissions allowed from compliant coatings. Emission reductions from solvent usage reduction directly related to any changes in the manufacturing process are based on the density of solvent used prior to the reduction.

For wood coating facilities, the The averaging requirements and this procedure conform with EPA requirements to ensure 8-32 could be included in the SIP if necessary. EPA requires that emissions from coatings used, when averaged, be 10% less than emissions from compliant coatings. This is stated in the EPA document: "Improving Air Quality with Economic Incentive Programs", U. S. EPA-452/R-01-001, (January 2001) Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations", and is considered "quid pro quo" for the flexibility in choice of coatings inherent in an averaging provision. The EPA In addition, each facility that uses averaging must average their emissions each 24 hours (daily) provisions are applicable to facilities with actual or potential emission of 25 Tons VOC/year or greater.

6.2 Compliance Calculation

$$\frac{E_{CT} + E_{SS} + E_{PC} + E_{HS} + E_F + E_{LS} + E_{WC} + E_S}{L_{CT}(Q_{CT1} + Q_{CT2} + \dots + Q_{CTn}) + L_{SS}(Q_{SS1} + Q_{SS2} + \dots + Q_{SSn}) + L_{PC}(Q_{PC1} + Q_{PC2} + \dots + Q_{PCn}) + L_{HS}(Q_{HS1} + Q_{HS2} + \dots + Q_{HSn}) + L_F(Q_{F1} + Q_{F2} + \dots + Q_{Fn})} \leq 0.9$$

$$\begin{aligned}
 & \cancel{(480 \text{ g/l}^*) (Q_{LS1} + Q_{LS2} + \dots + Q_{LSn}) +} \\
 & \cancel{(480 \text{ g/l}^*) (Q_{WC1} + Q_{WC2} + \dots + Q_{WCn}) +} \\
 & \cancel{S_1(Q_{S1}) + S_2(Q_{S2}) + \dots + S_n(Q_{Sn})] }
 \end{aligned}$$

* ~~or 4.0 lb/gal~~

$$\begin{aligned}
 E_{CS} + E_{CT} + E_{CV} + E_{PP,S,U} + E_{PT} + E_{MCC} + E_{HSS} + E_F + E_{LSS} + E_{T,WC} + E_S \leq \\
 0.9[L_{CS}(Q_{CS1} + Q_{CS2} + \dots + Q_{CSn}) + \\
 L_{CT}(Q_{CT1} + Q_{CT2} + \dots + Q_{CTn}) + \\
 L_{CV}(Q_{CV1} + Q_{CV2} + \dots + Q_{CVn}) + \\
 L_{PP,S,U}(Q_{PP,S,U1} + Q_{PP,S,U2} + \dots + Q_{PP,S,Un}) + \\
 L_{PT}(Q_{PT1} + Q_{PT2} + \dots + Q_{PTn}) + \\
 L_{HSS}(Q_{HSS1} + Q_{HSS2} + \dots + Q_{HSSn}) + \\
 L_F(Q_{F1} + Q_{F2} + \dots + Q_{Fn}) + \\
 L_{LSS}(Q_{LSS1} + Q_{LSS2} + \dots + Q_{LSSn}) + \\
 L_{T,WC}(Q_{T,WC1} + Q_{T,WC2} + \dots + Q_{T,WCn}) + \\
 S_1(Q_{S1}) + S_2(Q_{S2}) + \dots + S_n(Q_{Sn})]
 \end{aligned}$$

where:

- E = VOC emissions in grams (or pounds) for all particular coatings and or solvents used
- Q = quantity of each high solids coating used, expressed in grams (or pounds) of coating solids; or quantity of each low solids ~~stain, washcoat~~ coating or solvent used in liters (or gallons)
- K = grams VOC per gram solid (or pounds VOC per pound solid) for each high solids coating used; or grams VOC per liter of coating or solvent (or pounds VOC per gallon of coating or solvent) for each low solids ~~stain, washcoat~~ coating or solvent used
- L = emission limit from the category of wood products being manufactured (Section 8-302, 303 or 304), expressed in grams (or pounds) VOC per gram (or pound) coating solid for high solids coatings, and grams (or pounds) VOC per liter (or gallon) for low solids coating or solvent. If a facility manufactures more than one category of wood products, emissions averaging is allowed across categories.
- S = solvent VOC in grams per liter (or pounds per gallon) of material for solvents used as part of the manufacturing process prior to averaging
- CS = clear sealers
- CT = clear topcoats
- CV = single application conversion varnishes
- ~~SS~~ = ~~sanding sealers~~
- ~~PC~~ = ~~pigmented coatings~~
- PP,S,U = pigmented primers, sealers, and undercoats
- PT = pigmented topcoats
- MCC = multi-colored coatings
- HSS = high solids stains
- F = fillers
- LSS = low solids stains
- T,WC = toners, wash-coats
- S = solvents

For any category of coating,

$$E = \sum_{i=1}^n (Q_i)(K_i) \quad n = 1, 2, 3 \dots$$

~~Note:—The 0.9 multiplier (above) is only applicable to facilities with actual or potential emissions of at least 25 Tons/year~~

6.3 Regulation 8, Rule 32 Analytical Procedures~~Equivalency Factors~~

VOC is defined in 8-32-234. VOC content is calculated as shown in 8-32-604, 605, and 606.

The calculations and analytical procedures for quantifying VOC content of coatings are found in the Manual of Procedures, Volume III, Laboratory Policies and Procedures; Methods 21, 22, 31, and 41.

<u>Volatile Organic Compound Content (VOC)</u>		
<u>Grams VOC/liter</u>	<u>Pounds VOC/gallon</u>	<u>Grams VOC/gram coating solid</u>
275	2.3	0.33
500	4.2	0.96
550	4.6	1.22
600	5.0	1.57
700	5.8	2.85

~~Note:—Grams VOC/liter of coating and pounds VOC/gallon of coating is minus water and exempt solvent. The calculations and analytical procedures for quantifying VOC content of coatings are found in the Manual of Procedures, Volume III, Laboratory Policies and Procedures; Methods 21, 22, 31, and 41~~

6.4 Sample Calculations

1) A facility wishes to average a high VOC clear topcoat, a compliant VOC clear sealer, a compliant VOC low solids stain, and a low VOC low solids stain. The operator obtains the VOC content of each coating expressed as grams VOC per liter of coating, and grams of solids per liter of coating from the manufacturer, and estimates the relative usage of each product. The operator also uses some high solids stain and some low VOC topcoat, but the VOC contents of these coatings are at their respective limits, so they have no effect on, and therefore are not included in averaging. ~~The facility has actual and potential emissions of less than 25 Tons/year.~~

<u>Product</u>	<u>Grams VOC/liter</u>	<u>Grams solid/liter</u>	<u>Vol % exempt or water</u>	<u>Estimated usage</u>
<u>Clear Topcoat</u>	<u>540*</u>	<u>1500</u>	<u>45</u>	<u>25.0 liters/day</u>
<u>Clear Sealer</u>	<u>250*</u>	<u>350</u>	<u>65</u>	<u>60.0 liters/day</u>
<u>Low Solids Stain 1</u>	<u>115</u>	<u>130</u>	<u>75</u>	<u>7.5 liters/day</u>
<u>Low Solids Stain 2</u>	<u>90</u>	<u>95</u>	<u>60</u>	<u>30.0 liters/day</u>

* - excluding exempt solvents and water for high solids coatings

The clear topcoat contains 45% exempt solvent by volume, so the actual amount of VOC in a liter of clear topcoat is:

$$\text{VOC (lb/gal less water and exempt) = VOC (grams) / [1 liter - H2O (liter) - VOC}_{\text{exempt}} \text{(liter)]}$$

$$540 = X / (1-0.45) \quad X = 297 \text{ grams VOC/liter of material}$$

Clear topcoat VOC in grams per gram of solids is calculated as:

$$297 \text{ grams VOC/liter of material} / 1500 \text{ grams solids/liter of material} = 0.198 \text{ g/g solids}$$

Similarly, the clear sealer contains 65% exempt solvent by volume, so the actual amount of VOC in a liter of clear sealer is:

$$250 = X / (1-0.65) \quad X = 87.5 \text{ grams VOC/liter of material}$$

Clear sealer VOC in grams per gram of solids is calculated as:

$$87.5 \text{ grams VOC/liter of material} / 350 \text{ grams solids/liter of material} = 0.25 \text{ g/g solids}$$

The operator calculates usage (Q) in terms of coating solids for the clear topcoat and the clear sealer and topcoat:

$$Q_{CT} = 25.0 \text{ liters} * 1500 \text{ grams solids/liter} = 37,500 \text{ grams solids/day}$$

$$Q_{CS} = 60.0 \text{ liters} * 350 \text{ grams solids/liter} = 21,000 \text{ grams solids/day}$$

The operator uses the summation equation to calculate total emissions from the use of these coatings:

$$E_{CT} = 0.198 \text{ g VOC/g solid} * 37,500 \text{ g solids} = 7,425 \text{ grams VOC}$$

$$E_{SS} = 0.25 \text{ g VOC/g solid} * 21,000 \text{ g solids} = 5,250 \text{ grams VOC}$$

$$E_{LS} = (115 \text{ g/l} * 7.5 \text{ liters}) + (90 \text{ g/l} * 30.0 \text{ liters}) = 862.5 \text{ g} + 2,700 \text{ g} = 3,562.5 \text{ grams VOC}$$

Using the compliance calculation, the grams of VOC from the high solids coatings plus the grams of VOC from the low solids coatings must be less than the allowance:

$$\frac{7,425 + 5,250 + 3,562.5}{16,237.5 \text{ grams VOC}} \leq 0.9 [(L_{CT} * Q_{CT}) + (L_{CS} * Q_{CS}) + (L_{LSS} * Q_{LSS})]$$

$$\leq 0.9 [(0.35 * 37,500) + (0.36 * 21,000) + (120 * 37.5)]$$

$$16,237.5 \text{ grams VOC} \leq 0.9 (13,125 + 7,560 + 4,500) = 17,563.5 \text{ grams VOC}$$

The total VOC emissions are less than the allowance based on compliant coatings, so the facility is in compliance. The inequality is true, so the facility is in compliance.

1) A facility wishes to average high VOC low solids stain, low VOC low solids stain, low VOC sanding sealer, and a high VOC clear topcoat. The operator obtains the VOC content of each coating—expressed as grams VOC/gram coating solid from the manufacturer and estimates the relative usage for each of these products. The operator also uses some high solids stain and some low VOC topcoat, but the VOC contents of these coatings are at their respective limits, so they are not included in averaging. The facility has actual and potential emissions of less than 25 Tons/year.

Product	VOC (pounds/gallon)	VOC (pounds/pound solid)	Estimated usage
Clear Topcoat	6.10 lb/gal	3.59 lbs/lb solid	65 gallons/mo.
Sanding Sealer	3.20 lb/gal	0.60 lbs/lb solid	155 gallons/mo.
Stain 1	5.83 lb/gal	Not applicable	20 gallons/mo.
Stain 2	1.67 lb/gal	Not applicable	75 gallons/mo.

The topcoat contains no water or exempt solvents, and 1.70 pounds solids/gallon.

The sanding sealer contains 25% exempt solvent by volume, so the actual amount of VOC in a gallon of sealer is 2.4 lb. This is because:

$$\text{VOC (lb/gal less water and exempt)} = \text{VOC (lb)} / [1 \text{ gal} - \text{H}_2\text{O (gal)} - \text{VOC}_{\text{exempt}} \text{ (gal)}]$$

The sanding sealer contains 4.0 pounds solid/gallon. The operator calculates usage (Q) in terms of coating solids for the sanding sealer and topcoat:

$$Q_{CT} = 65 \text{ gallons} * 1.70 \text{ pounds solids/gallon} = 110.5 \text{ pounds solids/mo.}$$

$$Q_{SS} = 155 \text{ gallons} * 4.0 \text{ pounds solids/gallon} = 620.0 \text{ pounds solids/mo.}$$

The operator uses the summation equation to calculate total emissions from the use of these coatings:

$$E_{CT} = 3.59 \text{ lb VOC/lb solid} * 110.5 \text{ lbs solids} = 396.69 \text{ lbs VOC}$$

$$E_{SS} = 0.60 \text{ lb VOC/lb solid} * 620.0 \text{ lbs solids} = 372 \text{ lbs VOC}$$

$$E_{LS} = (5.83 \text{ lb/gal} * 20 \text{ gal}) + (1.67 \text{ lb/gal} * 75 \text{ gal}) = 241.85 \text{ lbs VOC}$$

Using the equivalency table, the pounds of coating solids for the high solids coatings, the gallons of product for the low solids stain and the equation, above:

$$\frac{(396.69 + 372 + 241.85)}{1010.54 \text{ lbs VOC}} \leq (L_{CT} * Q_{CT}) + (L_{SS} * Q_{SS}) + (L_{LS} * Q_{LS})$$

$$\leq (1.22 * 110.5) + (1.22 * 620.0) + (4.0 * 95)$$

$$\leq (134.81 + 756.4 + 380) = 1271.21 \text{ lbs VOC}$$

~~The inequality is true, so the facility is in compliance.~~

2) A facility wishes to average ~~low~~^{high} VOC low solids stain, low VOC solvent wash, a high VOC ~~sanding~~ ^{clear} sealer, a waterborne low VOC clear topcoat and a low VOC pigmented ~~top~~^{coating}. The operator obtains the VOC contents expressed as grams VOC/grams solid for the coatings and the VOC content of the stain and solvent expressed as grams VOC/liter and estimates the usage of each of these products. ~~The facility has emissions of greater than 25 Tons/year.~~

Product	VOC (grams/liter)	VOC (grams/gram solid)	Estimated usage
Clear Topcoat	235 ²⁵⁵ g/l	0.34 0 g/g solid	118.0 liters/ day ^{mo.}
Clear ^{Sanding} Sealer	520 ⁶⁷⁶ g/l	0.38 ^{2.45} g/g solid	68.0 liters/ day ^{mo.}
Pigmented Topc ^{Coating}	270 ⁴²⁰ g/l	0.27 40 g/g solid	11.0 liters/ day ^{mo.}
Low Solids Stain	90 ⁷⁰⁰ g/l	Not applicable	57.0 liters/ day ^{mo.}
Solvent	400 g/l	Not applicable	34.0 liters/ day ^{mo.}

The ~~clear~~ ^{clear} topcoat contains ~~55%~~ water and has ~~315~~⁶⁰ grams solids/liter. The ~~sanding~~ ^{clear} sealer contains ~~1350~~²⁷⁶ grams solids/liter. The pigmented ~~top~~^{coating} has ~~390~~⁴⁰⁵⁰ grams solids/liter. The solvent wash was reformulated from a methyl ethyl ketone wash at 805 g/l.

The operator calculates usage (Q) in terms of coating solids for the topcoat, sanding sealer and pigmented coating.

$$\begin{aligned}
 Q_{CT} &= 118.0 \text{ liters} * \del{315} \text{ grams solids/liter} = \del{37,170} \text{ grams solids/day} \del{mo.} \\
 Q_{CS} &= 68.0 \text{ liters} * \del{1350} \text{ grams solids/liter} = \del{91,800} \text{ grams solids/day} \del{mo.} \\
 Q_{PT} &= 11.0 \text{ liters} * \del{390} \text{ grams solids/liter} = \del{4,290} \text{ grams solids/day} \del{mo.}
 \end{aligned}$$

The operator uses the summation equation to calculate total emissions from the use of these coatings and solvent:

$$\begin{aligned}
 E_{CT} &= 0.34 \text{ g VOC/g solid} * \del{37,170} \text{ g solids} = \del{12,637.8} \text{ grams VOC} \\
 E_{CS} &= 0.38 \text{ g VOC/g solid} * \del{91,800} \text{ g solids} = \del{34,884} \text{ grams VOC} \\
 E_{PT} &= 0.27 \text{ g VOC/g solid} * \del{4,290} \text{ g solids} = \del{1,158.3} \text{ grams VOC} \\
 E_{LSS} &= \del{90} \text{ g VOC/liter} * 57.0 \text{ liters} = \del{5,130} \text{ grams VOC} \\
 E_S &= 400 \text{ g VOC/liter} * 34.0 \text{ liters} = \del{13,600} \text{ grams VOC}
 \end{aligned}$$

Using the ~~compliance calculation, the grams of VOC from the high solids coatings plus the grams of VOC from the low solids coating and solvent must be less than the allowance~~ ~~equivalency table, the grams of coating solids for the high solids coatings, the liters of product for the low solids stain and solvent, the 0.9 multiplier for larger facilities, and the equation, above:~~

$$\begin{aligned}
 (\del{12,637.8} + \del{34,884} + \del{1,158.3} + \del{5,130} + 13,600) &\leq .9 [(L_{CT} * Q_{CT}) + (L_{CS} * Q_{CS}) + \\
 &\quad (L_{PT} * Q_{PT}) + (L_{LSS} * Q_{LSS}) + (S * Q_S)] \\
 \del{67,410.1} \text{ grams VOC} &\leq .9 [(\del{0.35} * \del{37,170}) + (\del{0.36} * \del{91,800}) + (\del{0.25} * \del{4,290}) + (\del{120} * 57.0) + (805 * 34.0)] \\
 \del{67,410.1} \text{ grams VOC} &\leq \del{0.9} [\del{81,340}] \text{ grams VOC} = \del{73,206}
 \end{aligned}$$

The total VOC emissions are less than the allowance based on compliant coatings, so the facility is in compliance. ~~The inequality is true, so the facility is in compliance.~~