Enforcement Procedures

Emissions Averaging Procedure

(Adopted June 19, 1996)

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

6.1 Introduction

The procedure set forth in this section provides 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 basis eliminates bias due to relative film thickness' of different coating technologies and those due to 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 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). Information on the solid 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 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 an 880 gram/liter (or 7.33 pounds/gallon) density for coating solvent. Emissions of coatings used must be no greater than emissions from compliant coatings. Emission reductions from solvent usage reduction directly related to changes in the manufacturing process are based on the density of solvent used prior to the reduction.

For wood coating facilities, the 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 provisions are applicable to facilities with actual or potential emission of 25 Tons VOC/year or greater.

6.2 Compliance Calculation

~~$$E_{CT} + E_{SS} + E_{PC} + E_{HS} + E_{F} + E_{LS} + E_{WC} + E_{S} \leq 0.9[L_{CT}(Q_{CT1} + Q_{CT2} + ...Q_{CTn}) +$$~~
~~$$L_{SS}(Q_{SS1} + Q_{SS2} + ...Q_{SSn}) +$$~~
~~$$L_{PC}(Q_{PC1} + Q_{PC2} + ...Q_{PCn}) +$$~~
~~$$L_{HS}(Q_{HS1} + Q_{HS2} + ...Q_{HSn}) +$$~~
~~$$L_{F}(Q_{F1} + Q_{F2} + ...Q_{Fn}) +$$~~
~~$$(480g/l^{*})(Q_{LS1} + Q_{LS2} + ...Q_{LSn}) +$$~~
~~$$(480g/l^{*})(Q_{WC1} + Q_{WC2} + ...Q_{WCn}) +$$~~
~~$$S_1(Q_{S1}) + S_2Q_{S2} + ...S_nQ_{Sn})]$$~~

~~* or 4.0 lb/gal~~

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

where:

E = VOC emissions in grams (or pounds) for all coatings and 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 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

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 = 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,

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

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 8-32-232. 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.

~~Volatile Organic Compound Content (VOC)~~

~~Grams VOC/liter~~	~~Pounds VOC/gallon~~	~~Grams VOC/gram coating solid~~
~~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 are not included in averaging. The facility has actual and potential emissions of less than 25 Tons/year.

Product	Grams VOC/liter	Grams solid/liter	Vol % exempt or water	Estimated usage
Clear Topcoat	540*	1500	45	250 liters/mo.
Clear Sealer	250*	350	65	600 liters/mo.
Low Solids Stain 1	115	130	75	75 liters/mo.
Low Solids Stain 2	90	95	60	300 liters/mo.

* - excluding exempt solvents and water for high solids coatings

The clear topcoat contains 46% exempt solvent by volume, so the actual amount of VOC in a liter of clear topcoat is:

VOC (lb/gal less water and exempt) = VOC (grams) / [1 liter – H2O (liter) – VOC_{exempt} (liter)]

540 = X / (1-0.45) X = 297 grams VOC/liter of material

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

297 grams VOC/liter of material) / 1500 grams solids/liter of material = 0.198 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) X = 87.5 grams VOC/liter of material

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

87.5 grams VOC/liter of material) / 350 grams solids/liter of material = 0.25 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} = 250 liters * 1500 grams solids/liter = 375,000 grams solids/mo.

Q_{CS} = 600 liters * 350 grams solids/liter = 210,000 grams solids/mo.

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

E_{CT} = 0.198 g VOC/g solid * 375,000 g solids = 74,250 grams VOC

E_{SS} = 0.25 g VOC/g solid * 210,000 g solids = 52,500 grams VOC

E_{LS} = (115 g/l * 75 liters) + (90 g/l * 300 liters) = 8,625 g + 27,000 g = 35,625 grams VOC

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

$$74{,}250 + 52{,}500 + 35{,}625 \leq (L_{CT} * Q_{CT}) + (L_{CS} * Q_{CS}) + (L_{LSS} * Q_{LSS})$$
$$\leq (0.35 * 375{,}000) + (0.36 * 52{,}500) + (120 * 375)$$
$$162{,}375 \text{ grams VOC} \leq (131{,}250 + 18{,}900 + 45{,}000) = 195{,}150 \text{ grams VOC}$$

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:~~

~~$VOC\ (lb/gal\ less\ water\ and\ exempt) = VOC\ (lb) / [1\ gal - H2O\ (gal) - VOC_{exempt}\ (gal)]$~~

~~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 gallons * 1.70 pounds solids/gallon = 110.5 pounds solids/mo.~~
~~Q_{SS} = 155 gallons * 4.0 pounds solids/gallon = 620.0 pounds solids/mo.~~

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

~~E_{CT} = 3.59 lb VOC/lb solid * 110.5 lbs solids = 396.69 lbs VOC~~
~~E_{SS} = 0.60 lb VOC/lb solid * 620.0 lbs solids = 372 lbs VOC~~
~~E_{LS} = (5.83 lb/gal * 20 gal) + (1.67 lb/gal * 75 gal) = 241.85 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:~~

~~$(396.69 + 372 + 241.85) \leq (L_{CT} * Q_{CT}) + (L_{SS} * Q_{SS}) + (L_{LS} * Q_{LS})$~~
~~$\leq (1.22 * 110.5) + (1.22 * 620.0) + (4.0 * 95)$~~
~~$1010.54 \text{ lbs VOC} \leq (134.81 + 756.4 + 380) = 1271.21 \text{ lbs VOC}$~~

~~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 topcoat~~ing~~. 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	0.3~~4~~0 g/g solid	1180 liters/mo.

Clear~~Sanding~~ Sealer	520~~676~~ g/l	0.38~~2.45~~ g/g solid	680 liters/mo.
Pigmented Topc~~C~~oat~~ing~~	270~~420~~ g/l	0.27~~40~~ g/g solid	110 liters/mo.
Low Solids Stain	90~~700~~ g/l	Not applicable	570 liters/mo.
Solvent	400 g/l	Not applicable	340 liters/mo.

The clear topcoat contains 55% water and has 315~~60~~ grams solids/liter. The ~~sanding~~ clear sealer contains 1350~~276~~ grams solids/liter. The pigmented topcoat~~ing~~ has 390~~1050~~ 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.

Q_{CT} = 1180 liters * 315 grams solids/liter = 371,700 grams solids/mo.
Q_{CS} = 680 liters * 1350 grams solids/liter = 918,000 grams solids/mo.
Q_{PT} = 110 liters * 390 grams solids/liter = 42,900 grams solids/mo.

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

E_{CT} = 0.34 g VOC/g solid * 371,700 g solids = 126,378 grams VOC
E_{CS} = 0.38 g VOC/g solid * 918,000 g solids = 348,840 grams VOC
E_{PT} = 0.27 g VOC/g solid * 42,900 g solids = 11,583 grams VOC
E_{LSS} = 90 g VOC/liter * 570 liters = 51,300 grams VOC
E_S = 400 g VOC/liter * 340 liters = 136,000 grams VOC

Using the 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:

(126,378 + 348,840 + 11,583 + 51,300 + 136,000) ≤ .9 [(L_{CT} * Q_{CT}) + (L_{CS}*Q_{CS}) + (L_{PT}*Q_{PT}) + (L_{LSS}*Q_{LSS}) + (S * Q_S)]

≤ .9 [(0.35 * 371,700) + (0.36 * 918,000) + (0.25 * 42,900) + (120 * 570) + (805 * 340)]

674,101 grams VOC ≤ .9 [(130,095 + 330,480 + 10,725+ 68,400 + 273,700)]

674,101 grams VOC ≤ 0.9 [813,400] grams VOC = 732,060

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