

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 provides the method of averaging emissions. This approach eliminates bias due to relative film thicknesses of different coating technologies and those due to different coatings 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 liter of coating or solvent material (or pounds VOC per 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).

Emissions from all coatings are compared to the emissions allowance that would result from using all compliant coatings. 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.

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), and is considered "quid pro quo" for the flexibility in choice of coatings inherent in an averaging provision. In addition, each facility that uses averaging must average their emissions each 24 hours (daily).

6.2 Compliance Calculation

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

where:

E	=	VOC emissions in grams (or pounds) for a particular coating or solvent used
Q	=	quantity of each high solids coating used, expressed in grams (or pounds) of coating solids; or quantity of each low solids 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 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
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 ₁ WC	=	toners, wash-coats
S	=	solvents

For any category of coating,

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

6.3 Regulation 8, Rule 32 Analytical Procedures

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.

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.

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

* - 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:

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

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

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:

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

$$\leq 0.9 [(0.35 * 37,500) + (0.36 * 5,250) + (120 * 37.5)]$$

$$16,237.5 \text{ grams VOC} \leq 0.9 (13,125 + 1,890 + 4,500) = 17,563.5 \text{ grams VOC}$$

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

2) A facility wishes to average low VOC low solids stain, low VOC solvent wash, a high VOC clear sealer, a waterborne low VOC clear topcoat and a low VOC pigmented topcoat. 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.

Product	VOC (grams/liter)	VOC (grams/gram solid)	Estimated usage
Clear Topcoat	235 g/l	0.34 g/g solid	118.0 liters/day
Clear Sealer	520 g/l	0.38 g/g solid	68.0 liters/ day
Pigmented Topcoat	270 g/l	0.27 g/g solid	11.0 liters/ day
Low Solids Stain	90 g/l	Not applicable	57.0 liters/ day
Solvent	400 g/l	Not applicable	34.0 liters/ day

The clear topcoat contains 55% water and has 315 grams solids/liter. The clear sealer contains 1350 grams solids/liter. The pigmented topcoat has 390 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.

$$Q_{CT} = 118.0 \text{ liters} * 315 \text{ grams solids/liter} = 37,170 \text{ grams solids/day}$$

$$Q_{CS} = 68.0 \text{ liters} * 1350 \text{ grams solids/liter} = 91,800 \text{ grams solids/day}$$

$$Q_{PT} = 11.0 \text{ liters} * 390 \text{ grams solids/liter} = 4,290 \text{ grams solids/day}$$

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

$$E_{CT} = 0.34 \text{ g VOC/g solid} * 37,170 \text{ g solids} = 12,637.8 \text{ grams VOC}$$

$$E_{CS} = 0.38 \text{ g VOC/g solid} * 91,800 \text{ g solids} = 34,884 \text{ grams VOC}$$

$$E_{PT} = 0.27 \text{ g VOC/g solid} * 4,290 \text{ g solids} = 1,158.3 \text{ grams VOC}$$

$$E_{LSS} = 90 \text{ g VOC/liter} * 57.0 \text{ liters} = 5,130 \text{ grams VOC}$$

$$E_S = 400 \text{ g VOC/liter} * 34.0 \text{ liters} = 13,600 \text{ grams VOC}$$

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

$$(12,637.8 + 34,884 + 1,158.3 + 5,130 + 13,600) \leq .9 [(L_{CT} * Q_{CT}) + (L_{CS} * Q_{CS}) + (L_{PT} * Q_{PT}) + (L_{LSS} * Q_{LSS}) + (S * Q_S)]$$

$$\leq .9 [(0.35 * 37,170) + (0.36 * 91,800) + (0.25 * 4,290) + (120 * 57.0) + (805 * 34.0)]$$

$$67,410.1 \text{ grams VOC} \leq .9 [(13,009.5 + 33,048 + 1,072.5 + 6,840 + 27,370)]$$

$$67,410.1 \text{ grams VOC} \leq 0.9 [81,340] \text{ grams VOC} = 73,206$$

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