

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF AIR POLLUTION CONTROL

AIR QUALITY PROGRAM POLICIES AND PROCEDURES

TITLE: PROCEDURES FOR DETERMINING COMPLIANCE WITH VOLATILE ORGANIC COMPOUND
EMISSION STANDARDS COVERING SURFACE COATING OPERATIONS

NUMBER: AQP-2

EFFECTIVE DATE: July 1, 1991

APPROVED: Wallace N. Davis

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Executive Director

PURPOSE

The purpose of this document is to prescribe the test methods and procedures for determining compliance with emission standards for volatile organic compounds covering surface coating operations.

BACKGROUND

A. The test methods and procedures outlined in this document are those specified in the U.S. Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards Guideline Series documents. For each specific source type the appropriate EPA guideline document is listed. In cases where the definitions, standards and other provisions of the EPA guideline documents differ from this document or the Regulations for the Control and Abatement of Air Pollution (VR 120-01) [hereinafter the regulations], this document and the regulations shall take precedence. Use of test methods and procedures not specified in this document is acceptable if approved by the department within the context of the provisions of subsection C below.

B. In order for the Commonwealth to fulfill its obligations under the federal Clean Air Act, some provisions of state regulations are required to be approved by the U. S. Environmental Protection Agency (EPA) and when approved those provisions become federally enforceable.

C. In cases where state regulations specify that procedures or methods shall be approved by, acceptable to or determined by the board or other similar phrasing or specifically provide for decisions to be made by the board or department, it may be necessary to have such actions (approvals, determinations, exemptions, exclusions, or decisions) reviewed and confirmed as acceptable or approved by EPA in order to make them federally enforceable.

D. It has been determined, in accordance with EPA regulations and policy, that this document is to be submitted to EPA and upon approval become part of the State Implementation Plan. Accordingly, any amendments to this

document must be approved through the same administrative process.

GENERAL REFERENCES

- A. Regulations for the Control and Abatement of Air Pollution (VR 120-01), § 120-04-03 A and § 120-05-03 A.
- B. "Procedures for Certifying Quantity of Volatile Organic Compounds Emitted by Paint, Ink, and Other Coatings", EPA-450/3-84-019, December, 1984.
- C. "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations," EPA 450/3-88-018, December, 1988.

LOCATION OF REFERENCED DOCUMENTS

The documents referenced above and any others that may be referenced throughout this document are available for viewing at the central office of the department and are otherwise available as indicated below:

- A. Regulations for the Control and Abatement of Air Pollution.

The regulations are available for viewing at any regional office of the department and copies are available upon request from the central office of the department. A nominal fee may be required.

- B. EPA documents.

Copies of the documents may be obtained, for a nominal fee, from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161; (703) 487-4650.

RECISION

This document supersedes any previously issued documents except for regulations relative to this matter.

CONTACT

Richard Olin, Senior Environmental Engineer, Division of Program Development, 804-786-7564 may be contacted about any questions or decisions regarding this document.

DEFINITIONS

As used in this document, all terms not defined herein shall have the meaning given them in the regulations, unless otherwise required by context.

INSTRUCTIONS

I. General.

A. Applicability and designation of affected facility.

These procedures shall be used as applicable to determine compliance with the emission standards for volatile organic compounds from surface coating operations in Rules 4-26 through 4-34.

B. Acceptable control techniques.

Owners of affected facilities shall meet the applicable emission standards using any combination of the following categories of control techniques:

1. Compliant coating (based on coating volatile organic compound content).
2. Add-on control systems (capture and destruction or removal) provided actual capture and destruction efficiency are determined using methods that have been approved by the department.
3. Increased transfer efficiency (improvements in coating application methods) provided baseline transfer efficiency and actual transfer efficiency are determined by methods that have been approved by the department.

C. Determination of applicable standard.

1. For coating application systems, emission standards for volatile organic compounds are generally expressed in terms of pounds of volatile organic compounds per gallon of coating less water and exempt solvents (lb VOC/GCLW) as delivered by the coating applicator. Thus, the standards are based on use of compliant coatings. When compliant coatings are used, compliance with the standards shall be determined according to the procedures in Section III of this document. However, to determine compliance when other categories of control techniques are used, it is necessary to express the standard in terms (i.e., units) applicable to those control techniques.

2. If an owner chooses to use a non-compliant coating (analytical composition greater than the applicable standard in terms of pounds of volatile organic compounds per gallon of coating less water and exempt solvents), a control method specified in subsection B 2 or B 3 of this section shall be used. If an add-on emission control device is used, correct compliance determination requires that the standard be expressed in terms of pounds of volatile organic compounds per gallon of coating solids (lb VOC/GCS). If increased transfer efficiency is used, correct compliance determination requires converting this standard to the equivalent pounds of volatile organic compounds per gallon of solids applied to the product (lb VOC/GSA).

II. Formulas.

- A. Applicable standard in terms of pounds of volatile organic compounds per gallon of coating solids (lb VOC/GCS).

To convert the applicable standard from pounds of volatile organic compounds per gallon of coating less water and exempt solvents (lb VOC/GCLW) to pounds of volatile organic compounds per gallon of coating solids (lb VOC/GCS), a solvent density of 7.36 pounds per gallon shall be used for Rules 4-26 through 4-34. To calculate the standard in terms of lb VOC/GCS, the following formula shall be used:

$$S_{cs} = \frac{S_{clw}}{1 - S_{clw} / 7.36}$$

where:

S_{cs} = standard in lb VOC/GCS.

S_{clw} = standard in lb VOC/GCLW.

- B. Coating formulation volatile organic compound content in terms of pounds of volatile organic compounds per gallon of coating solids (lb VOC/GCS).

To convert the coating formulation from pounds of volatile organic compounds per gallon of coating less water and exempt solvents (lb VOC/GCLW) to pounds of volatile organic compounds per gallon of coating solids (lb VOC/GCS), the density of the coating solvent (not the density of the coating) shall be determined using the appropriate reference method. For multiple volatile organic compounds, a volume weighted average density shall be used according to the procedures specified in the EPA document "Procedures for Certifying Quantity of Volatile Organic Compounds Emitted by Paint, Ink, and Other Coatings", EPA-450/3-84-019, December, 1984. To calculate the coating formulation in terms of lb VOC/GCS, the following formula shall be used:

$$F_{cs} = \frac{F_{clw}}{1 - F_{clw} / Dc}$$

where:

F_{cs} = volatile organic compound content of the coating in lb VOC/GCS.

F_{clw} = volatile organic compound content of the coating in lb VOC/GCLW.

Dc = density of volatile organic compound used (lb VOC/gallon VOC) (note: use a volume weighted average for multiple VOCs).

C. Applicable standard in terms of pounds of volatile organic compounds per gallon of solids applied (lb VOC/GSA).

To convert the standard from pounds of volatile organic compounds per gallon of coating solids (lb VOC/GCS) to pounds of volatile organic compounds per gallon of solids applied (lb VOC/GSA), the baseline transfer efficiency (TE_b) needs to be known. The baseline transfer efficiency shall be determined from common industry practices using compliant coatings in a manner that has been approved by the department. The transfer efficiency used for compliance calculation shall be demonstrated by methods that have been approved by the department. Where more than one transfer efficiency is used for the same type of coating and on the same coating application system (multiple processes), a volume-of-solids weighted average transfer efficiency shall be used. To calculate the standard in terms of lb VOC/GSA, the following formula shall be used:

$$S_{sa} = S_{cs} / TE_b$$

where:

S_{sa} = equivalent standard in lb VOC/GSA.

S_{cs} = equivalent standard in lb VOC/GCS.

TE_b = baseline transfer efficiency in gallon solids applied per gallon coating solids (GSA/GCS) (note: volume fraction = weight fraction).

The baseline transfer efficiency as approved by the department shall be used to determine the applicable standard. The actual transfer efficiency as measured in accordance with subsection C of Section V of this document shall be used to determine compliance.

D. Standards.

Table T-1 presents the standards based on a standard solvent density of 7.36 lb per gallon coating and the established baseline transfer efficiency for certain automobile and light-duty truck topcoat coating operations. Other baseline transfer efficiencies must be approved by the department on an industry-by-industry basis. These procedures shall be used on a case-by-case basis to determine compliance.

TABLE T-1

VOLATILE ORGANIC COMPOUND EMISSION
STANDARDS FOR COATING OPERATIONS
APPLICABLE STANDARDS

Rule No.	Affected Facility	Standard lb/GCLW ^a	Standard lb/GCS ^b	Baseline TE _b ^c	Equivalent lb/GSA ^d
4-26	Large appliances	2.8	4.5	to be established on a case by case basis	
4-27	Magnet wire	1.7	2.2	"	
4-28	Auto & LDT ^e				
	A. prime coat	1.2	1.4	"	
	B. guidecoat	2.8	4.5	"	
	C. topcoat	2.8	4.5	30%	15.1
	D. final repair	4.8	13.8	to be established on a case-by-case basis	
	E. anti-chip	3.0	5.1	"	
	F. anti-chip EP ^f	3.5	6.7	"	
	G. anti-chip VS ^g	2.8	4.5	"	
4-29	Can coating				
	A. base/overvarnish	2.8	4.5	"	
	B. inter.body, exterior ends	4.2	9.8	"	
	C. 3-piece, side seam	5.5	21.8	"	
	D. end seal	3.7	7.4	"	
4-30	Metal coil	2.6	4.0	"	
4-31	Paper & fabrics	2.9	4.8	"	
4-32	Vinyl coating	3.8	7.9	"	
4-33	Metal furniture	3.0	5.1	"	
4-34	Misc metal parts				
	A. clear coating	4.3	10.3	"	
	B. air dried	3.5	6.7	"	
	C. extreme performance	3.5	6.7	"	
	D. other	3.0	5.1	"	

- a. lb/GCLW = pounds volatile organic compound per gallon coating, as used including solvents added, less water and exempt solvents.
- b. lb/GCS = pounds volatile organic compound per gallon of coating solids in coating as used.
- c. TE_b = baseline transfer efficiency, gallons of solids applied per gallon of coating solids used. note: baseline transfer efficiency must be approved by the department on an industry-by-industry basis.
- d. GSA = gallons of solids applied to the product.
- e. LDT = light-duty truck.
- f. EP = extreme performance.
- g. VP = applied to visible surface of main body parts.

III. Determination of compliance based on coating specifications.

A. Compliant coatings.

If each coating line uses compliant coatings, the applicable standard in terms of pounds of volatile organic compounds per gallon of coating less water and exempt solvents (lb VOC/GCLW) shall be used to determine compliance. In this case, the applicable standard applies coating by coating or to the volume weighted average of coatings where the coatings are used on a single coating operation and the coatings are of the same type or perform the same function. In cases where use of compliant coatings is the only control technique used, the applicable standard in pounds of volatile organic compound per gallon of coating solids (lb VOC/GCS) may be used at the owner's option. The volatile organic compound content of the coating, and the amount and density of any solvents added, shall be used to determine compliance. The volatile organic compound content of the coating as applied shall be determined according to the procedures in EPA Reference Method 24 for inks and coatings (using the one-hour bake time) or EPA Reference Method 24A for solvent borne printing inks and related coatings according to the EPA document "Procedures for Certifying Quantity of Volatile Organic Compounds Emitted by Paint, Ink, and Other Coatings," EPA-450/3-84-019, December 1984. Compounds exempted from the definition of volatile organic compounds shall be treated as water.

B. Cure volatiles.

Cure volatile organic compounds can be formed in cure ovens from otherwise non-volatile components in the coating applied. For compliance determination, both cure volatiles and non cure volatiles shall be counted. EPA Reference Method 24 shall be used to determine the amount of potential cure volatiles plus non-cure volatiles per gallon of coating. A facility may demonstrate that cure volatiles actually formed are less than the potential cure volatiles using procedures acceptable to the department. In this case, the non-cure volatile organic compound content may be determined using the manufacturer's formulation data. Since cure volatiles are formed only from coating that is applied and enters cure ovens, the actual transfer efficiency and the coating non-cure formed volatile organic compound content shall be determined to calculate the amount of cure volatiles actually formed per gallon coating used. Transfer efficiency shall be determined in accordance with Section V of this document.

IV. Determination of compliance using add-on control systems.

A. Applicable standard.

Compliance shall be determined based on the applicable standard in terms of pounds of volatile organic compounds per gallon of coating solids (lb VOC/GCS) or in pounds of volatile organic compounds per gallon of solids applied to the product (lb VOC/GSA) if, in the latter case, transfer efficiency is determined in accordance with subsection C of Section V of this document. Applicable standards are given in Table 1 of this document.

B. Calculation of overall control efficiency.

An add-on control system includes both a capture device and a control device. Both the collection efficiency of the capture device (e.g., hood or similar enclosure) and the destruction or removal efficiency of the control device shall be determined using methods that have been approved by the department. Approved procedures and test methods to determine capture efficiency for graphic arts (printing) operations are given in AQP-3. These methods shall be used for other operations where applicable. The overall control efficiency of the add-on control system shall be determined by the following formula:

$$OE = CE \times DRE$$

where:

OE = overall control efficiency (mass fraction).

CE = collection efficiency of the capture device (lb VOC collected/lb VOC used).

DRE = destruction or removal efficiency of the add-on control device.

C. Calculation of required control efficiency.

If a non-compliant coating is used with an add-on control system, the overall control efficiency required to comply with the standard shall be determined by the following formula:

$$OE_{req} = \frac{F_{cs} - S_{cs}}{F_{cs}}$$

where:

F_{cs} = volatile organic compound content of coating in lb VOC/GCS.

S_{cs} = equivalent standard in lb VOC/GCS.

OE_{req} = overall control efficiency required (mass fraction).

The values of F_{cs} and S_{cs} shall be determined according to Section II of this document.

V. Determination of compliance based on increased transfer efficiency.

A. Applicability.

Net volatile organic compound emissions can be reduced by more efficient coating application methods that apply more solids to the product per gallon of coating used. Transfer efficiency is defined as the ratio of the gallons of solids deposited on the product to the gallons of solids in the coating as applied (GSA/GCS). Owners of affected facilities may take credit

for increased transfer efficiency if equivalency with the applicable standard is demonstrated according to the procedures in this document. The actual transfer efficiency used to determine compliance shall be determined in accordance with subsection C of this section. The industry baseline transfer efficiency shall be approved by the department.

B. Required transfer efficiency.

Compliance shall be based on the applicable standard in terms of pounds of volatile organic compounds per gallon of solids applied to the product (lb VOC/GSA) as determined according to the formulas in Section II of this document and using the baseline transfer efficiency approved by the department. The required actual transfer efficiency shall be determined as follows:

$$TE_{req} = \frac{F_{cs}}{S_{sa}}$$

where:

F_{cs} = volatile organic compound content of the coating in lb VOC/GCS.

S_{sa} = equivalent standard in lb VOC/GSA.

TE_{req} = required transfer efficiency.

C. Determination of actual transfer efficiency.

Improved transfer efficiency may be demonstrated based on either mass balance or by direct coating weight or volume measurements. Procedures for the determination of transfer efficiency for automobile and light-duty truck topcoat coating operations at assembly plants are given in the EPA document "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations," EPA 450/3-88-018, December, 1988. For other applications, methods for determining transfer efficiency shall be approved by the department. With the approval of the department, some application methods (such as immersion) may use transfer efficiencies already determined at other facilities.

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