

**SCAQMD METHOD 316A-92****DETERMINATION OF VOLATILE ORGANIC COMPOUNDS (VOC) IN MATERIALS  
USED FOR PIPES AND FITTINGS****1. Principle**

An aliquot of the material is analyzed for VOC by the procedure specified in SCAQMD Method 304. Another portion of the material is applied to a substrate specified by the manufacturer and cured in accordance with Section 4.3.8. After curing, the assembly is heated for one hour at 110°C. The VOC retained and the VOC emitted is then determined. The VOC value for compliance to SCAQMD regulations is dependent upon the amount of VOC retained on the substrate.

**2. Equipment**

- 2.1 Laboratory exhaust hood
- 2.2 Balance, analytical, capable of weighing accurately to 0.1 mg
- 2.3 Pipe cutter, hacksaw, capable of cutting pipes of diameter of 2.5 inches or less
- 2.4 Other equipment: refer to relevant individual methods in SCAQMD Method 304 manual for other equipment needed.
- 2.5 Oven, forced draft, capable of maintaining the temperature at 110°C for at least one hour. Refer to ASTM D2369 for specifications.

**3. Reagents and Materials**

- 3.1 Substrates for currently identified applications:
  - 1/2" diameter PVC, Schedule 40
  - 2" diameter ABS, Schedule 40
  - 3/4" diameter CPVC, Schedule 80
- 3.2 Straight connectors, slip/slip, of the same material as the test pipe. Inner diameter of the straight connector to be the same as outer diameter of the test pipe.

- 3.3 Other reagents and materials as needed in the relevant individual method in SCAQMD Method 304
- 3.4 Container, 1/4 pint with an applicator swab

#### 4. Analytical Procedure

- 4.1 Determination of VOC
  - 4.1.1 The VOC content of the uncured material is determined using SCAQMD Method 304-91. This VOC expressed in percent by weight is  $VOC_S$  as determined in SCAQMD Method 304-91, Section 5.3.
- 4.2 Preparation of the pipe-joint assembly
  - 4.2.1 Cut two 3 1/2 inch pieces of the appropriate pipe.
  - 4.2.2 Clean joint and pipes with paper towel or kimwipes until they are free of dust and any other extraneous material.
  - 4.2.3 Weigh the pipe-joint assembly to the nearest 0.1 mg ( $W_{ai}$ ).
- 4.3 Determination of VOC retained as part of the finished product
  - 4.3.1 Material must be in a 1/4 pint container with an applicator swab.
  - 4.3.2 Wipe clean the material container to remove dust and weigh to the nearest 0.1 mg ( $W_{si}$ ).
  - 4.3.3 Steps 4.3.4 through 4.3.6 must be completed in 2 minutes.
  - 4.3.4 Open the tared material container taking care not to spill any material. Carefully apply without spilling, a smooth uniform coating around the outside edges of both PVC pipes. Similarly apply material to the inside walls of the joint.
  - 4.3.5 Immediately return the applicator brush to the can and close the lid tight.
  - 4.3.6 Complete the assembly by pushing the coated ends of the pipes into the joint.

- 4.3.7 Immediately after application weigh the material container to the nearest 0.1 mg ( $W_{sf}$ ).
  - 4.3.8 Allow the CPVC or PVC assembly to dry for 24 hours at 70° to 85°F under the hood. For the ABS assembly, allow to dry for 48 hours at 70° to 85°F under the hood.
  - 4.3.9 Heat the assembly in the oven at 110°C for 1 hour.
  - 4.3.10 Cool to room temperature in a desiccator.
  - 4.3.11 Weigh the assembly to the nearest 0.1 mg ( $W_{af}$ ).
  - 4.3.12 Repeat steps 4.2 to 4.3.11 six times.
  - 4.3.13 Proceed to Section 5 for calculations.
- 4.4. Determination of VOC emitted by blank pipe (Note: run concurrently with sample analysis)
- 4.4.1 Prepare a pipe-joint assembly as in Section 4.2.
  - 4.4.2 Complete the assembly by pushing the pipes into the joint.
  - 4.4.3 Weigh the pipe-joint assembly to the nearest 0.1 mg ( $W_{bi}$ ) .
  - 4.4.4 Follow Sections 4.3.8 to 4.3.10.
  - 4.4.5 Weigh the assembly to the nearest 0.1 mg ( $W_{bf}$ ).
  - 4.4.6 Repeat steps 4.4.1 to 4.4.5 two times.
  - 4.4.7 Calculate the grams of VOC emitted by the pipe assembly,  $W_b$ , according to Section 5.1.

## 5. Calculations

5.1 Weight loss of each blank pipe,  $W_b$ , in grams/g of pipe:

$$W_b = \frac{(W_{bi} - W_{bf})}{W_{bi}}$$

5.2 Correction value of weight loss due to pipe assembly,  $W_c$ , in grams:

$$W_c = \frac{W_{ai}}{3} \times \sum_{n=1}^3 (W_b)_n$$

5.3 The weight percent total volatiles (TV) emitted for each run:

$$TV = \frac{[(W_s) - (W_{af} - W_{ai}) - W_c] \times 100}{W_s}$$

5.4 The weight percent water and exempt compounds (Exem) in the total volatiles emitted, if applicable:

$$Exem = (EX \times TV)/100$$

5.5 The actual weight percent VOC emitted ( $VOC_{ae}$ ) is:

$$VOC_{ae} = TV - Exem$$

5.6 The weight percent of VOC retained as integral part of the assembly ( $VOC_r$ ) for each run:

$$VOC_r = \frac{(VOC_s - VOC_{ae}) \times 100}{VOC_s}$$

5.7 To convert  $VOC_{ae}$  to total VOC g/L emitted:

$$VOC = VOC_{ae} \times D_m \times 10$$

Note: For equation 5.7, use the average of seven runs from 5.5 for  $VOC_{ae}$ .

5.8 Definition of terms:

$W_{bi}$	=	Initial weight of blank assembly, g, (Section 4.4.3)
$W_{bf}$	=	Final weight of blank assembly, g, (Section 4.4.5)
$W_s$	=	Weight of material used to coat assembly ( $W_{si} - W_{sf}$ ), g
$W_{si}$	=	Initial weight of material container, g, (Section 4.3.2)
$W_{sf}$	=	Weight of material container after application, g, (Section 4.3.7)
$W_{ai}$	=	Initial weight of assembly, g, (Section 4.2.3)
$W_{af}$	=	Weight of assembly after heating, g, (Section 4.3.11)
$D_m$	=	Density of material by SCAQMD Method 304-91, g/mL
$VOC_s$	=	Weight percent VOC obtained by SCAQMD Method 304-91
EX	=	Sum of the weight percent water and weight percent exempt compounds in the material, determined by SCAQMD Method 304-91.

5.9 Determination of the VOC of the material for compliance.

5.9.1 To determine compliance to the requirement of Rule 1168, the VOC value will be calculated as specified by the Rule.

## 6. Precision (For samples that do not contain water or exempt compounds)

6.1 Repeatability (Single Analyst)

6.1.1 The estimated coefficient of variation of results (each the average of seven replicate determinations), obtained by the same analyst on different days is listed in Table 1.

6.1.2 The 95% limit for the difference between two such averages is also listed in Table 1.

6.2 Reproducibility (Multilaboratory)

6.2.1 The estimated coefficient of variation of results (each the average of seven replicate determinations), obtained by analysts in different laboratories is listed in Table 2.

6.2.2 The 95% limit for the difference between two such averages is also listed in Table 2.

Table 1

## Repeatability, (Single Analyst)

Cement Type	Estimated Coefficient of Variation, % relative	Degrees of Freedom	95% limit for difference, % relative
ABS	2.3	14	5.0
CPVC	2.7	14	5.8
PVC	3.4	13	7.3

Table 2

## Reproducibility ( Multilaboratory)

Cement type	Estimated Coefficient of Variation, % relative	Degrees of Freedom	95% limit for difference, % relative
ABS	11.1	5	29
CPVC	9.4	5	24
PVC	6.8	5	17

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This method is used to determine the volatile organic compounds (VOC) in materials used for pipes and fittings. The method is applicable to materials regulated as reactive diluents under rules in Regulation XI.

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