APPENDIX G

PROTOCOLS FOR DETERMINING VOC CAPTURE EFFICIENCY

This Appendix contains protocols, and procedures for use with such protocols, for determining the VOC capture efficiency for the applicable source categories of Section 2 of this text and for other sources when specified by the Director.

An owner or operator may request to use an alternative method or procedure for the determination of VOC capture efficiency which is in accordance with the Guidelines for Determining Capture Efficiency[1] dated January 9, 1994. The Division will consider the request, including an evaluation of the applicability, necessity, and validity of the alternative, and, upon a determination of reasonable certainty of the results of its use, may approve the use of the alternative if such approval does not contravene any other applicable requirement.

Protocol 1a

(1) Principle

a. A temporary total enclosure (TTE) is constructed around the source such that all volatile organic compound emissions not captured by the capture system are collected and exhausted through properly designed stacks or ducts and measured by cited methods.

b. The portion of the emissions entering the control device is simultaneously sampled.

c. A separate simultaneous determination of the background concentration of VOC in the air into the enclosure is made.

(2) Applicable Procedures

a. The TTE is designed according to Method 204.

b. The non-controlled portion of the emissions captured by the TTE are measured by Method 204D.

c. The controlled portion of the emissions are measured at the inlet to the control device by Method 204B or 204C.

d. The background concentration of VOC in the air into the TTE is measured as described in Method 204D.

(3) Quality Assurance

a. Make a preliminary determination of the background concentration of the air to be supplied to the TTE. If the ratio, r_b, of the background concentration to the concentration of air in the enclosure is greater than 0.67, then either provide for dilution of the background air into the enclosure or take measures to decrease the background concentration.

(4) Calculations

The capture efficiency, CE, is computed as follows:

$$CE = \frac{G}{G + F} \times 100$$

where:

CE = capture efficiency, percent

F = total fugitive VOC emissions, from Method 204D, kg

G = total captured VOC emissions, from Method 204B or 204C, kg

Protocol 1c

(1) Principle

An entire building or room which contains the affected facility is used as the enclosure. In this protocol, all volatile organic compound emissions not captured by the capture system will be exhausted through openings in the building or room, and for each opening a properly designed sampling location is prepared. The emission rate is measured at each location by cited methods.

All sources of VOC emissions, e.g., other facilities within the building, are eliminated so that only the affected facility is in operation.

The portion of the emissions entering the control device is simultaneously sampled.

(2) Applicable Procedures

a. The building or room must meet the specifications of Method 204.

b. The non-controlled portions of the emissions exhausted from the building are measured by Method 204E.

c. No compensation for background concentration is made for this protocol.

(3) Quality Assurance [Reserved]

(4) Calculations

The capture efficiency, CE, is computed as follows:

$$CE = \frac{G}{G + F} \times 100$$

where:

CE = capture efficiency, percent

F = total fugitive VOC emissions, from Method 204E, kg

G = total captured VOC emissions, from Method 204B or 204C.

Protocol 1d

(1) Principle

A permanent total enclosure (PTE) is designed such that all VOC emissions from the affected facility are constantly and permanently directed to the control device.

(2) Applicable Procedures

a. The (PTE) is designed and constructed to meet the provision of Method 204 and to ensure constant and permanent exhausting of the gases through the control device.

b. If a (PTE) is installed meeting the criteria of paragraph (2)(a), then the capture efficiency, CE, can be assumed to be 100 percent.

Protocol 2a

(1) Principle

a. A temporary total enclosure, TTE, is constructed around the affected facility such that all volatile organic compound emissions not captured by the capture system are collected and exhausted through properly designed stacks or ducts and measured by cited methods.

b. The total amount of volatile organic compounds (as carbon) contained in all VOC containing materials used by the affected facility is determined.

c. A separate simultaneous determination of the background concentration of VOC in the air into the enclosure is made.

(2) Applicable Procedures

a. The TTE is designed according to Method 204.

b. The non-controlled portion of the emissions captured by the TTE are measured by Method 204D.

c. The total VOC as carbon in the VOC containing materials is measured by Method 204A.

d. The background concentration of VOC in the air into the TTE is measured as described in Method 204D.

(3) Quality Assurance [Same as Protocol 1a]

(4) Calculations

The capture efficiency, CE, is computed as follows:

$$CE = \frac{(L-F)}{L} \times 100$$

where:

CE = capture efficiency, percent

L = total VOC in all VOC containing materials, as carbon, kg

F = total fugitive VOC emissions from Method 204D, kg

Protocol 2c

(1) Principle

An entire building or room which contains the affected facility is used as the enclosure. In this protocol, all volatile organic compound emissions not captured by the capture system will be exhausted through openings in the building or room, and for each opening a properly designed sampling location is prepared. The emission rate is measured at each location by cited methods.

All sources of VOC emissions, e.g., other facilities within the building, are eliminated so that only the affected facility is in operation.

The total amount of volatile organic compounds (as carbon) contained in all VOC containing materials used by the affected facility is determined.

(2) Applicable Procedures

a. The building or room must meet the specifications of Method 204.

b. The non-controlled portion of the emissions exhausted from the building are measured by Method 204E.

c. The total VOC as carbon in the VOC containing materials is measured by Method 204A.

d. No compensation for background concentration is made for this protocol.

(3) Quality Assurance [Reserved]

(4) Calculations

The capture efficiency, CE, is computed as follows:

$$CE = \frac{(L-F)}{L} \times 100$$

where:

CE = capture efficiency, percent

L = total VOC in all VOC containing materials, as carbon, kg

F = total fugitive VOC emissions from Method 204E, kg

Protocol 3

(1) Principle

a. A total material balance is made across the entire affected facility including any control device by measuring the amount of VOC applied or the amount of VOC used (depending on the applicable regulation), and by determining the amount of VOC recovered.

b. (i) The source owner or operator must be able to equate solvent usage with solvent recovery on a 24-hour (daily) basis, unless an alternate procedure under Section

1.2 is approved by the Director. This must be done within 72 hours following each 24-hour period; and

(ii) If the solvent recovery system controls multiple process lines, the source owner or operator must be able to demonstrate that the overall control (i.e., the total recovered solvent VOC divided by the sum of liquid VOC input to all process lines venting to the control system) meets or exceeds the most stringent standard applicable for any process line venting to the control system.

(2) Applicable Procedures

a. Measure the amount of coating used or applied at the coating applicator.

b. Determine the VOC content of all coatings used or applied as follows:

(i) Method 24 is used to determine the VOC content in all inks or coatings. If it is demonstrated to the satisfaction of the Director that formulation data are equivalent to Method 24 results, formulation data may be used. In the event of any inconsistency between a Method 24 test and facility's formulation data, the Method 24 test will govern. For Method 24, the sample must be a 1-liter sample taken into a 1-liter container at a location and time such that the sample will be representative of the ink or coating applied (or used) (i.e., the sample shall include any dilution solvent or other VOC added during the manufacturing process). The container must be tightly sealed immediately after the sample is taken. Any solvent or other VOC added after the sample is taken must be measured and accounted for in the calculations that use Method 24 results.

c. Install, calibrate, maintain and operate according to the manufacturer's specifications, a device that indicates the cumulative amount of VOC recovered by the solvent recovery device over each nominal time period as specified according to (1)(b). The device shall be certified by the manufacturer to be accurate to within 2.0 percent.

d. Measure the amount of VOC recovered.

(3) Calculations

Calculate the overall VOC emissions reduction, R, by the solvent recovery device by equation 1:

$$R = \frac{M_r}{\sum_{i=1}^{n} [W_{oi}\, M_{ci} - RS_i]}$$

where:

R = overall VOC emissions reduction achieved for the duration of the emission test, percent

M_r = total mass of VOC recovered, kg

W_{oi} = weight fraction of VOC in each ink or coating, i, applied (or used) during the test period

M_{ci} = the total mass of each coating, i, applied (or used) at an affected facility during

the test period, kg. This quantity shall be determined at a time and location in the process after all ingredients (including any dilution solvent) have been added to the ink or coating, or appropriate adjustments shall be made to account for any ingredients added after the mass of the ink or coating has been determined.

RS_i = the total mass of VOC retained in the coated base product, kg. RS_i is equal to zero unless the owner or operator determines, for each ink or coating by methods specified or approved by the Director and submits documentation, that the measured value is greater than zero.

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[1]Guidelines For Determining Capture Efficiency, Candace Sorrell, Office of Air Quality Planning and Standards, USEPA, Research Triangle Park, North Carolina; January 9, 1994