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Method 204 - Criteria for and Verification of a Permanent or Temporary Total Enclosure

1. Scope and Application

This procedure is used to determine whether a permanent or temporary enclosure meets the criteria for a total enclosure. An existing building may be used as a temporary or permanent enclosure as long as it meets the appropriate criteria described in this method.

2. Summary of Method

An enclosure is evaluated against a set of criteria. If the criteria are met and if all the exhaust gases from the enclosure are ducted to a control device, then the volatile organic compounds (VOC) capture efficiency (CE) is assumed to be 100 percent, and CE need not be measured. However, if part of the exhaust gas stream is not ducted to a control device, CE must be determined.

3. Definitions

3.1 Natural Draft Opening (NDO). Any permanent opening in the enclosure that remains open during operation of the facility and is not connected to a duct in which a fan is installed.

3.2 Permanent Total Enclosure (PE). A permanently installed enclosure that completely surrounds a source of emissions such that all VOC emissions are captured and contained for discharge to a control device.

3.3 Temporary Total Enclosure (TTE). A temporarily installed enclosure that completely surrounds a source of emissions such that all VOC emissions that are not directed through the control device (*i.e.*, uncaptured) are captured by the enclosure and contained for discharge through ducts that allow for the accurate measurement of the uncaptured VOC emissions.

3.4 Building Enclosure (BE). An existing building that is used as a TTE.

4. Safety

An evaluation of the proposed building materials and the design for the enclosure is recommended to minimize any potential hazards.

5. Criteria for Temporary Total Enclosure

5.1 Any NDO shall be at least four equivalent opening diameters from each VOC emitting point unless otherwise specified by the Administrator.

5.2 Any exhaust point from the enclosure shall be at least four equivalent duct or hood diameters from each NDO.

5.3 The total area of all NDO's shall not exceed 5 percent of the surface area of the enclosure's four walls, floor, and ceiling.

5.4 The average facial velocity (FV) of air through all NDO's shall be at least 3,600 m/hr (200 fpm). The direction of air flow through all NDO's shall be into the enclosure.

5.5 All access doors and windows whose areas are not included in section 5.3 and are not included in the calculation in section 5.4 shall be closed during routine operation of the process.

6. Criteria for a Permanent Total Enclosure

6.1 Same as sections 5.1 and 5.3 through 5.5.

6.2 All VOC emissions must be captured and contained for discharge through a control device.

7. Quality Control

7.1 The success of this method lies in designing the TTE to simulate the conditions that exist without the TTE (i.e., the effect of the TTE on the normal flow patterns around the affected facility or the amount of uncaptured VOC emissions should be minimal). The TTE must enclose the application stations, coating reservoirs, and all areas from the application station to the oven. The oven does not have to be enclosed if it is under negative pressure. The NDO's of the temporary enclosure and an exhaust fan must be properly sized and placed.

7.2 Estimate the ventilation rate of the TTE that best simulates the conditions that exist without the TTE (i.e., the effect of the TTE on the normal flow patterns around the affected facility or the amount of uncaptured VOC emissions should be minimal). Figure 204–1 or the following equation may be used as an aid.

$$CE = \frac{Q_G C_G}{Q_G C_G + Q_F C_F} \quad \text{Eq. 204-1}$$

Measure the concentration (C_G) and flow rate (Q_G) of the captured gas stream, specify a safe concentration (C_F) for the uncaptured gas stream, estimate the CE, and then use the plot in Figure 204–1 or Equation 204–1 to determine the volumetric flow rate of the uncaptured gas stream (Q_F). An exhaust fan that has a variable flow control is desirable.

7.3 Monitor the VOC concentration of the captured gas steam in the duct before the capture device without the TTE. To minimize the effect of temporal variation on the captured emissions, the baseline measurement should be made over as long a time period as practical. However, the process conditions must be the same for the measurement in section 7.5 as they are for this baseline measurement. This may require short measuring times for this quality control check before and after the construction of the TTE.

7.4 After the TTE is constructed, monitor the VOC concentration inside the TTE. This concentration should not continue to increase, and must not exceed the safe level according to Occupational Safety and Health Administration requirements for permissible exposure limits. An increase in VOC concentration indicates poor TTE design.

7.5 Monitor the VOC concentration of the captured gas stream in the duct before the capture device with the TTE. To limit the effect of the TTE on the process, the VOC concentration with and without the TTE must be within 10 percent. If the measurements do not agree, adjust the ventilation rate from the TTE until they agree within 10 percent.

8. Procedure

8.1 Determine the equivalent diameters of the NDO's and determine the distances from each VOC emitting point to all NDO's. Determine the equivalent diameter of each exhaust duct or hood and its distance to all NDO's. Calculate the distances in terms of equivalent diameters. The number of equivalent diameters shall be at least four.

8.2 Measure the total surface area (A_T) of the enclosure and the total area (A_N) of all NDO's in the enclosure. Calculate the NDO to enclosure area ratio (NEAR) as follows:

$$NEAR = \frac{A_N}{A_T} \quad \text{Eq. 204-2}$$

The NEAR must be ≤ 10.05 .

8.3 Measure the volumetric flow rate, corrected to standard conditions, of each gas stream exiting the enclosure through an exhaust duct or hood using EPA Method 2. In some cases (e.g., when the building is the enclosure), it may be necessary to measure the volumetric flow rate, corrected to standard conditions, of each gas stream entering the enclosure through a forced makeup air duct using Method 2. Calculate FV using the following equation:

$$FV = \frac{Q_o - Q_i}{A_N} \quad \text{Eq. 204-3}$$

Where:

Q_o = the sum of the volumetric flow from all gas streams exiting the enclosure through an exhaust duct or hood.

Q_i = the sum of the volumetric flow from all gas streams into the enclosure through a forced makeup air duct; zero, if there is no forced makeup air into the enclosure.

A_N = total area of all NDO's in enclosure.

The FV shall be at least 3,600 m/hr (200 fpm). Alternatively, measure the pressure differential across the enclosure. A pressure drop of 0.013 mm Hg (0.007 in. H₂O) corresponds to an FV of 3,600 m/hr (200 fpm).

8.4 Verify that the direction of air flow through all NDO's is inward. If FV is less than 9,000 m/hr (500 fpm), the continuous inward flow of air shall be verified using streamers, smoke tubes, or tracer gases. Monitor the direction of air flow for at least 1 hour, with checks made no more than 10 minutes apart. If

FV is greater than 9,000 m/hr (500 fpm), the direction of air flow through the NDOs shall be presumed to be inward at all times without verification.

9. Diagrams

