

operating range of the flow meter. Conduct three calibration runs at each of the two selected flow rates. For each run, note the exact quantity of gas as determined by the calibration standard and the gas volume indicated by the flow meter. For each flow rate, calculate the average percent difference of the indicated flow compared to the calibration standard.

10.3 Spectrometer. Follow the calibration requirements specified by the equipment manufacturer for infrared spectrometer measurements and conduct the pretest calibration error test specified in section 8.5.1. Note: if using an FTIR analytical instrument see Method 320, section 10.

10.4 Gas Chromatograph. Follow the pretest calibration requirements specified in section 8.5.1.

10.4 Gas Chromatograph for Ambient Sampling (Optional). For the optional ambient sampling, follow the calibration requirements specified in section 8.5.1 or ASTM E 260 and E 697 and by the equipment manufacturer for gas chromatograph measurements.

11.0 Analytical Procedures

The sample collection and analysis are concurrent for this method (see section 8.0).

12.0 Calculations and Data Analysis

12.1 Estimate MML and Span. The MML is the minimum measurement level. The selection of this level is at the discretion of the tester. However, the MML must be higher than the low-level calibration standard and the tester must be able to measure at this level with a precision of ≤ 10 percent. As an example, select the MML as 10 times the instrument's published detection limit. The detection limit of one instrument is 0.01 parts per million by volume (ppm_v). Therefore, the MML would be 0.10 ppm_v. Select the low-level calibration standard as 0.08 ppm_v. The high-level standard would be four times the low-level standard or 0.32 ppm_v. A reasonable mid-level standard would then be 0.20 ppm_v (halfway between the low-level standard and the high-level standard). Finally, the span value would be approximately 0.40 ppm_v (the high-level value is 80 percent of the span). In this example, the following MML, calibration standards, and span values would apply:

MML = 0.10 ppm_v
Low-level standard = 0.08 ppm_v
Mid-level standard = 0.20 ppm_v
High-level standard = 0.32 ppm_v
Span value = 0.40 ppm_v

12.2 Estimate Tracer Gas Injection Rate for the Given Span. To estimate the minimum and maximum tracer gas injection rate, assume a worst case capture efficiency of 80 percent, and calculate the tracer gas flow rate based on known or measured parameters. To estimate the minimum tracer gas injection rate, assume that the MML concentration (10 times the IR detection limit in this example) is desired at the measurement location. The following equation can be used to estimate the minimum tracer gas injection rate:

$$((Q_{T-MIN} \times 0.8) / Q_E) \times (C_T + 100) \times 10^6 = \text{MML}$$

$$Q_{T-MIN} = 1.25 \times \text{MML} \times (Q_E / C_T) \times 10^{-4}$$

Where:

Q_{T-MIN} = minimum volumetric flow rate of tracer gas injected, scfm

Q_E = volumetric flow rate of exhaust gas, scfm

C_T = Tracer gas (SF₆) concentration in gas blend, percent by volume

MML = minimum measured level, ppm_v = 10 × IR_{DL} (for this example)

IR_{DL} = IR detection limit, ppm_v

Standard conditions: 20 °C, 760 mm Hg.

To estimate the maximum tracer gas injection rate, assume that the span value is desired at the measurement location. The following equation can be used to estimate the maximum tracer gas injection rate:

$$((Q_{T-MAX} \times 0.8) / Q_E) \times (C_T + 100) \times 10^6 = \text{span value}$$

$$Q_{T-MAX} = 1.25 \times \text{span value} \times (Q_E / C_T) \times 10^{-4}$$

Where:

Q_{T-MAX} = maximum volumetric flow rate of tracer gas injected, scfm

Span value = Instrument span value, ppm_v

The following example illustrates this calculation procedure:

Find the range of volumetric flow rate of tracer gas to be injected when the following parameters are known:

Q_E = 60,000 scfm (typical exhaust gas flow rate from a press enclosure)

C_T = 2 percent SF₆ in nitrogen

IR_{DL} = 0.01 ppm_v (per manufacturer's specifications)

MML = 10 × IR_{DL} = 0.10 ppm_v

Span value = 0.40 ppm_v

Q_T = ?

Minimum tracer gas volumetric flow rate:

$$Q_{T-MIN} = 1.25 \times \text{MML} \times (Q_E / C_T) \times 10^{-4}$$

$$Q_{T-MIN} = 1.25 \times 0.10 \times (60,000 / 2) \times 10^{-4} = 0.375 \text{ scfm}$$

Maximum tracer gas volumetric flow rate:

$$Q_{T-MAX} = 1.25 \times \text{span value} \times (Q_E / C_T) \times 10^{-4}$$

$$Q_{T-MAX} = 1.25 \times 0.40 \times (60,000 / 2) \times 10^{-4} = 1.5 \text{ scfm}$$

In this example, the estimated total volumetric flow rate of the two percent SF₆ tracer gas injected through the manifolds in the partial enclosure lies between 0.375 and 1.5 scfm.

12.3 Calibration Error. Calculate the calibration error for the low-level and mid-level calibration gases using the following equation:

$$\text{Err} = |C_{\text{std}} - C_{\text{meas}}| \div C_{\text{std}} \times 100$$

Where:

Err = Calibration error, percent

C_{std} = Low-level or mid-level calibration gas value, ppm_v

C_{meas} = Measured response to low-level or mid-level concentration gas, ppm_v

12.4 Calibration Drift. Calculate the calibration drift for the zero and low-level calibration gases using the following equation:

$$D = |C_{\text{initial}} - C_{\text{final}}| \div C_{\text{span}} \times 100$$

Where:

D = Calibration drift, percent

C_{initial} = Low-level or mid-level calibration gas value measured before test run, ppm_v

C_{final} = Low-level or mid-level calibration gas value measured after test run, ppm_v

C_{span} = Span value, ppm_v

12.5 Calculate Capture Efficiency. The equation to calculate press enclosure capture efficiency is provided below:

$$\text{CE} = (\text{SF}_{6-CD} \div \text{SF}_{6-INJ}) \times 100$$

Where:

CE = capture efficiency

SF_{6-CD} = mass of SF₆ measured at the inlet to the CD

SF_{6-INJ} = mass of SF₆ injected from the tracer source into the PPE

Calculate the CE for each of the initial three test runs. Then, follow the procedures outlined in section 12.6 to calculate the Overall Capture Efficiency.

12.6 Calculate Overall Capture Efficiency.

After calculating the capture efficiency for each of the initial three test runs, follow the procedures in 40 CFR part 63, subpart KK, Appendix A to determine if the results of the testing can be used in determining compliance with the requirements of the proposed rule. There are two methods that can be used: the DQO and LCL methods. The DQO method is described in section 3 of 40 CFR part 63, subpart KK, Appendix A and provides a measure of the precision of the capture efficiency testing conducted. Section 3 of 40 CFR part 63, subpart KK, Appendix A provides an example calculation using results from a facility. If the DQO criteria are met using the first set of three test runs, then the facility can use the average capture efficiency of these test results to determine the capture efficiency of the partial hot press enclosure. If the DQO criteria are not met then the facility can conduct another set of three runs and run the DQO analysis again using the results from the six runs OR the facility can elect to use the LCL approach.

The LCL method is described in section 4 of 40 CFR part 63, subpart KK, Appendix A and provides sources that may be performing much better than their regulatory requirement a screening option by which they can demonstrate compliance. The LCL approach compares the 80 percent lower confidence limit for the mean measured CE value to the applicable regulatory requirement. If the LCL capture efficiency is higher than the applicable limit, then the facility is in initial compliance and would use the LCL capture efficiency as the capture efficiency to determine compliance. If the LCL capture efficiency is lower than the applicable limit, then the facility must perform additional test runs and re-run the DQO or LCL analysis.

13.0 Method Performance

13.1 Measurement System Performance Specifications.

13.1.1 Zero Drift. Less than ± 3 percent of the span value.

13.1.2 Calibration Drift. Less than ± 3 percent of the span value.

13.1.3 Calibration Error. Less than ± 5 percent of the calibration gas value.

13.2 Flow Measurement Specifications. The mass flow, volumetric flow, or critical orifice control meter used should have an accuracy of greater than ± 5 percent at the flow rate used.

13.3 Calibration and Tracer Gas Specifications. The manufacturer of the