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INFORMATION
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Performance parameter	Units [1]	SO_2		O_3		CO		NO_2 (Std. range)	Definitions and test procedures
		Std. range [3]	Lower range [2 3]	Std. range [3]	Lower range [2 3]	Std. range [3]	Lower range [2 3]		
20% of upper range limit.		–	–	–	–	–	–		Sec. 53.23(e)
	Percent [5]	2	2	2	2	1.0	1.0	4	Sec. 53.23(e)
80% of upper range limit.		–	–	–	–	–	–		Sec. 53.23(e)
	Percent [5]	2	2	2	2	1.0	1.0	6	Sec. 53.23(e) Sec. 53.23(e)

[1] To convert from parts per million (ppm) to $\mu g/m^3$ at 25 °C and 760 mm Hg, multiply by M/0.02447, where M is the molecular weight of the gas. Percent means percent of the upper measurement range limit.

[2] Tests for interference equivalent and lag time do not need to be repeated for any lower range provided the test for the standard range shows that the lower range specification (if applicable) is met for each of these test parameters.

[3] For candidate analyzers having automatic or adaptive time constants or smoothing filters, describe their functional nature, and describe and conduct suitable tests to demonstrate their function aspects and verify that performances for calibration, noise, lag, rise, fall times, and precision are within specifications under all applicable conditions. For candidate analyzers with operator-selectable time constants or smoothing filters, conduct calibration, noise, lag, rise, fall times, and precision tests at the highest and lowest settings that are to be included in the FRM or FEM designation.

[4] For nitric oxide interference for the SO_2 UVF method, interference equivalent is ±0.0003 ppm for the lower range.

[5] Standard deviation expressed as percent of the URL.

[80 FR 65460, Oct. 26, 2015]

Table B–2 to Subpart B of Part 53—Test Atmospheres

Test gas	Generation	Verification
Ammonia	Permeation device. Similar to system described in references 1 and 2.	Indophenol method, reference 3.
Carbon dioxide	Cylinder of zero air or nitrogen containing CO_2 as required to obtain the concentration specified in table B–3.	Use NIST-certified standards whenever possible. If NIST standards are not available, obtain 2 standards from independent sources which agree within 2 percent, or obtain one standard and submit it to an independent laboratory for analysis, which must agree within 2 percent of the supplier's nominal analysis.
Carbon monoxide	Cylinder of zero air or nitrogen containing CO as required to obtain the concentration specified in table B–3.	Use an FRM CO analyzer as described in reference 8.
Ethane	Cylinder of zero air or nitrogen containing ethane as required to obtain the concentration specified in table B–3.	Gas chromatography, ASTM D2820, reference 10. Use NIST-traceable gaseous methane or propane standards for calibration.
Ethylene	Cylinder of pre-purified nitrogen containing ethylene as required to obtain the concentration specified in table B–3.	Do.
Hydrogen chloride	Cylinder [1] of pre-purified nitrogen containing approximately 100 ppm of gaseous HCl. Dilute with zero air to concentration specified in table B–3.	Collect samples in bubbler containing distilled water and analyze by the mercuric thiocyanate method, ASTM (D612), p. 29, reference 4.
Hydrogen sulfide	Permeation device system described in references 1 and 2.	Tentative method of analysis for H_2S content of the atmosphere, p. 426, reference 5.
Methane	Cylinder of zero air containing methane as required to obtain the concentration specified in table B–3.	Gas chromatography ASTM D2820, reference 10. Use NIST-traceable methane standards for calibration.
Nitric oxide	Cylinder [1] of pre-purified nitrogen containing approximately 100 ppm NO. Dilute with zero air to required concentration.	Gas phase titration as described in reference 6, section 7.1.
Nitrogen dioxide	1. Gas phase titration as described in reference 6 ... 2. Permeation device, similar to system described in reference 6.	1. Use an FRM NO_2 analyzer calibrated with a gravimetrically calibrated permeation device. 2. Use an FRM NO_2 analyzer calibrated by gas-phase titration as described in reference 6.
Ozone	Calibrated ozone generator as described in reference 9.	Use an FEM ozone analyzer calibrated as described in reference 9.
Sulfur dioxide	1. Permeation device as described in references 1 and 2. 2. Dynamic dilution of a cylinder containing approximately 100 ppm SO_2 as described in Reference 7.	Use an SO_2 FRM or FEM analyzer as described in reference 7.
Water	Pass zero air through distilled water at a fixed known temperature between 20° and 30 °C such that the air stream becomes saturated. Dilute with zero air to concentration specified in table B–3.	Measure relative humidity by means of a dew-point indicator, calibrated electrolytic or piezo electric hygrometer, or wet/dry bulb thermometer.

Test gas	Generation	Verification
Xylene	Cylinder of pre-purified nitrogen containing 100 ppm xylene. Dilute with zero air to concentration specified in table B–3.	Use NIST-certified standards whenever possible. If NIST standards are not available, obtain 2 standards from independent sources which agree within 2 percent, or obtain one standard and submit it to an independent laboratory for analysis, which must agree within 2 percent of the supplier's nominal analysis.
Zero air	1. Ambient air purified by appropriate scrubbers or other devices such that it is free of contaminants likely to cause a detectable response on the analyzer. 2. Cylinder of compressed zero air certified by the supplier or an independent laboratory to be free of contaminants likely to cause a detectable response on the analyzer.	

[1] Use stainless steel pressure regulator dedicated to the pollutant measured.

Reference 1. O'Keefe, A. E., and Ortaman, G. C. ''Primary Standards for Trace Gas Analysis,'' *Anal. Chem.* 38, 760 (1966).

Reference 2. Scaringelli, F. P., A. E. . Rosenberg, E*, and Bell, J. P., ''Primary Standards for Trace Gas Analysis.'' *Anal. Chem.* 42, 871 (1970).

Reference 3. ''Tentative Method of Analysis for Ammonia in the Atmosphere (Indophenol Method)'', *Health Lab Sciences,* vol. 10, No. 2, 115–118, April 1973.

Reference 4. 1973 Annual Book of ASTM Standards, American Society for Testing and Materials, 1916 Race St., Philadelphia, PA.

Reference 5. *Methods for Air Sampling and Analysis,* Intersociety Committee, 1972, American Public Health Association, 1015.

Reference 6. 40 CFR 50 Appendix F, ''Measurement Principle and Calibration Principle for the Measurement of Nitrogen Dioxide in the Atmosphere (Gas Phase Chemiluminescence).''

Reference 7. 40 CFR 50 Appendix A–1, ''Measurement Principle and Calibration Procedure for the Measurement of Sulfur Dioxide in the Atmosphere (Ultraviolet Fluorscence).''

Reference 8. 40 CFR 50 Appendix C, ''Measurement Principle and Calibration Procedure for the Measurement of Carbon Monoxide in the Atmosphere (Non-Dispersive Infrared Photometry)''.

Reference 9. 40 CFR 50 Appendix D, ''Measurement Principle and Calibration Procedure for the Measurement of Ozone in the Atmosphere''.

Reference 10. ''Standard Test Method for C, through C5 Hydrocarbons in the Atmosphere by Gas Chromatography'', D 2820, 1987 Annual Book of Aston Standards, vol 11.03, American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.