Designation: D3249 – 95 (Reapproved 2005)

Standard Practice for General Ambient Air Analyzer Procedures[1]

This standard is issued under the fixed designation D3249; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This practice is a general guide for ambient air analyzers used in determining air quality.

1.2 The actual method, or analyzer chosen, depends on the ultimate aim of the user: whether it is for regulatory compliance, process monitoring, or to alert the user of adverse trends. If the method or analyzer is to be used for federal or local compliance, it is recommended that the method published or referenced in the regulations be used in conjunction with this and other ASTM methods.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

D1357 Practice for Planning the Sampling of the Ambient Atmosphere

D3609 Practice for Calibration Techniques Using Permeation Tubes

D3670 Guide for Determination of Precision and Bias of Methods of Committee D22

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E200 Practice for Preparation, Standardization, and Storage of Standard and Reagent Solutions for Chemical Analysis

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this practice other than those following, refer to Terminology D1356.

3.1.2 *analyzer*—the instrumental equipment necessary to perform automatic analysis of ambient air through the use of physical and chemical properties and giving either cyclic or continuous output signal.

3.1.2.1 *analyzer system*—all sampling, analyzing, and readout instrumentation required to perform ambient air quality analysis automatically.

3.1.2.2 *sample system*—equipment necessary to provide the analyzer with a continuous representative sample.

3.1.2.3 *readout instrumentation*—output meters, recorder, or data acquisition system for monitoring analytical results.

3.1.3 *full scale*—the maximum measuring limit for a given range of an analyzer.

3.1.4 *interference*—an undesired output caused by a substance or substances other than the one being measured. The effect of interfering substance(s), on the measurement of interest, shall be expressed as: (±) percentage change of measurement compared with the molar amount of the interferent. If the interference is nonlinear, an algebraic expression should be developed (or curve plotted) to show this varying effect.

3.1.5 *lag time*—the time interval from a step change in the input concentration at the analyzer inlet to the first corresponding change in analyzer signal readout.

3.1.6 *linearity*—the maximum deviation between an actual analyzer reading and the reading predicted by a straight line drawn between upper and lower calibration points. This deviation is expressed as a percentage of full scale.

3.1.7 *minimum detection limit*—the smallest input concentration that can be determined as the concentration approaches zero.

3.1.8 *noise*—random deviations from a mean output not caused by sample concentration changes.

3.1.9 *operating humidity range of analyzer*—the range of ambient relative humidity of air surrounding the analyzer, over which the analyzer will meet all performance specifications.

[1] This practice is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.03 on Ambient Atmospheres and Source Emissions.

Current edition approved Oct. 1, 2005. Published January 2006. Originally approved in 1973. Last previous edition approved in 2000 as D3249 - 95(2000). DOI: 10.1520/D3249-95R05.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.9.1 *operating humidity range of sample*—the range of ambient relative humidity of air which passes through the analyzer's sensing system, over which the monitor will meet all performance specifications.

3.1.10 *operational period*—the period of time over which the analyzer can be expected to operate unattended within specifications.

3.1.11 *operating temperature range of analyzer*—the range of ambient temperatures of air surrounding the analyzer, over which the monitor will meet all performance specifications.

3.1.11.1 *operating temperature range of sample*—the range of ambient temperatures of air, which passes through the analyzer's sensing system, over which the analyzer will meet all performance specifications.

3.1.12 *output*—a signal that is related to the measurement, and intended for connection to a readout or data acquisition device. Usually this is an electrical signal expressed as millivolts or milliamperes full scale at a given impedance.

3.1.13 *precision*—see Practice D3670.

3.1.13.1 *repeatability*—a measure of the precision of the analyzer to repeat its results on independent introductions of the same sample at different time intervals. This is that difference between two such single instrument results, obtained during a stated time interval, that would be exceeded in the long run in only one case in twenty when the analyzer is operating normally.

3.1.13.2 *reproducibility*—a measure of the precision of different analyzers to repeat results on the same sample.

3.1.14 *range*—the concentration region between the minimum and maximum measurable limits.

3.1.15 *response time*—the time interval from a step change in the input concentration at the analyzer inlet to an output reading of 90 % of the ultimate reading.

3.1.16 *rise time*—response time minus lag time.

3.1.17 *span drift*—the change in analyzer output over a stated time period, usually 24 h of unadjusted continuous operation, when the input concentration is at a constant, stated upscale value. Span drift is usually expressed as a percentage change of full scale over a 24-h operational period.

3.1.18 *zero drift*—the change in analyzer output over a stated time period of unadjusted continuous operation when the input concentration is zero; usually expressed as a percentage change of full scale over a 24-h operational period.

4. Summary of Practice

4.1 A procedure for ambient air analyzer practices has been outlined. It presents definitions and terms, sampling information, calibration techniques, methods for validating results, and general comments related to ambient air analyzer methods of analysis. This is intended to be a common reference method which can be applied to all automatic analyzers in this category.

5. Significance and Use

5.1 The significance of this practice is adequately covered in Section 1.

6. Hazards

6.1 Each analyzer installation should be given a thorough safety engineering study.[3]

6.2 Electrically the analyzer system as well as the individual components shall meet all code requirements for the particular area classification.

6.2.1 All analyzers using 120-V, a-c, 60-Hz, 3-wire systems should observe proper polarity and should not use mechanical adapters for 2-wire outlets.

6.2.2 The neutral side of the power supply at the analyzer should be checked to see that it is at ground potential.

6.2.3 The analyzer's ground connection should be checked to earth ground for proper continuity.

6.2.4 Any analyzer containing electrically heated sections should have a temperature-limit device.

6.2.5 The analyzer, and any related electrical equipment (the system), should have a power cut-off switch, and a fuse or breaker, on the "hot" side of the line(s) of each device.

6.3 Full consideration must be given to safe disposal of the analyzer's spent samples and reagents.

6.4 Pressure relief valves, if applicable, shall be provided to protect both the analyzer and analyzer system.

6.5 Precautions should be taken when using cylinders containing gases or liquids under pressure. Helpful guidance may be obtained from Ref **(1)**, **(2)**, **(3)**, **(4)**, and **(5)**.[4]

6.5.1 Gas cylinders must be fastened to a rigid structure and not exposed to direct sun light or heat.

6.5.2 Special safety precautions should be taken when using or storing combustible or toxic gases to ensure that the system is safe and free from leaks.

7. Installation of Analyzer System

7.1 Assure that information required for installation and operation of the analyzer system is supplied by the manufacturer.

7.2 Study operational data and design parameters furnished by the supplier before installation.

7.3 Review all sample requirements with the equipment supplier. The supplier must completely understand the application and work closely with the user and installer. It is absolutely necessary to define carefully all conditions of intended operation, components in the atmosphere to be analyzed, and expected variations in sample composition.

7.4 Choose materials of construction in contact with the ambient air sample to be analyzed to prevent reaction of materials with the sample, sorption of components from the sample, and entrance of contaminants through infusion or diffusion **(6)**, **(7)**, **(8)**, **(9)**.

[3] The user, equipment supplier, and installer should be familiar with requirements of the National Electrical Code, any local applicable electrical code, U.L. Safety Codes, and the Occupational Safety & Health Standards (Federal Register, Vol 36, No. 105, Part II, May 29, 1971). Helpful guidance may also be obtained from API RP500, "Classification of Areas for Electrical Installations in Petroleum Refineries;" ISA RP12.1, "Electrical Instruments in Hazardous Atmospheres;" ISA RP12.2, "Intrinsically Safe and Nonincendive Electrical Instruments;" ISA RP12.4, "Instrument Purging for Reduction of Hazardous Area Classification;" and AP RP550, "Installation of Refinery Instruments and Control Systems, Part II."

[4] The boldface numbers in parentheses may be found in the Reference section at the end of this method.