



Standard Practice for Measurement of Metals in Workplace Atmosphere by Flame Atomic Absorption Spectrophotometry¹

This standard is issued under the fixed designation D 4185; 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.

ε¹ NOTE—Keywords added to Section 14 editorially in October 2001.

1. Scope

1.1 This practice covers the collection, dissolution, and determination of trace metals in workplace atmospheres, by atomic absorption spectrophotometry.

1.2 The sensitivity, detection limit, and optimum working concentration for 23 metals are given in Table 1.

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.* (Specific safety precautionary statements are given in Section 9.)

2. Referenced Documents

2.1 *ASTM Standards:*

D 1193 Specification for Reagent Water²

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres³

D 1357 Practice for Planning the Sampling of the Ambient Atmosphere³

D 3195 Practice for Rotameter Calibration³

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this practice, refer to Terminology D 1356.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *blank signal*—that signal which results from all added reagents and a clean membrane filter ashed exactly as the samples.

3.2.2 *detection limit*—that concentration of a given element which produces a signal three times the standard deviation of the blank signal.

3.2.3 *working range for an analytical precision better than 3 %*—the range of sample concentrations that will absorb 10 to 70 % of the incident radiation (0.05 to 0.52 absorbance unit).

NOTE 1—Values for detection limit may vary from instrument to instrument.

4. Summary of Practice

4.1 The samples are collected on membrane filters and treated with nitric acid to destroy the organic matrix and to dissolve the metals present. The analysis is subsequently made by flame atomic absorption spectrophotometry (AAS).

4.2 Samples and standards are aspirated into an appropriate AAS flame. A hollow cathode or electrodeless discharge lamp for the metal being determined provides a source of characteristic radiation energy for that particular metal. The absorption of this characteristic energy by the atoms of interest in the flame is related to the concentration of the metal in the aspirated sample. The flame and operating conditions for each element are listed in Table 2.

5. Significance and Use

5.1 Exposure to some metal-containing particulates has been demonstrated to cause dermatitis, skin ulcers, eye problems, chemical pneumonitis, and other physical disorders (1).⁴

5.2 AAS is capable of quantitatively determining most metals in air samples at the levels required by federal, state, and local occupational health and air pollution regulations.

6. Interferences

6.1 In AAS the occurrence of interferences is less common than in many other analytical techniques. Interferences can occur, however, and when encountered are corrected for as indicated in the following sections. The known interferences and correction methods for each metal are indicated in Table 2. The methods of standard additions and background monitoring and correction (2-5) are used to identify the presence of an

¹ This practice is under the jurisdiction of ASTM Committee D22 on Sampling and Analysis of Atmospheres and are the direct responsibility of Subcommittee D22.04 on Workplace Atmospheres.

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² *Annual Book of ASTM Standards*, Vol 11.01.

³ *Annual Book of ASTM Standards*, Vol 11.03.

⁴ Boldface numbers in parentheses refer to the list of references appended to these methods.