



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

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1. Scope

1.1 This practice covers the collection, dissolution, and determination of trace metals in workplace atmospheres, by flame 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:*²

[D1193 Specification for Reagent Water](#)

[D1356 Terminology Relating to Sampling and Analysis of Atmospheres](#)

[D1357 Practice for Planning the Sampling of the Ambient Atmosphere](#)

[D3195 Practice for Rotameter Calibration](#)

[D5337 Practice for Flow Rate Adjustment of Personal Sampling Pumps](#)

[D7035 Test Method for Determination of Metals and Metalloids in Airborne Particulate Matter by Inductively Coupled Plasma Atomic Emission Spectrometry \(ICP-AES\)](#)

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology [D1356](#).

3.2 *Definitions of Terms Specific to This Standard:*

¹ This practice is under the jurisdiction of ASTM Committee [D22](#) on Air Quality and is the direct responsibility of Subcommittee [D22.04](#) on Workplace Air Quality.

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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.

3.2.1 *blank signal*—that signal which results from all added reagents and a clean membrane filter prepared and analyzed exactly in the same way as the samples.

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

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

4. Summary of Practice

4.1 Workplace air 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 The health of workers in many industries is at risk through exposure by inhalation to toxic metals. Industrial hygienists and other public health professionals need to determine the effectiveness of measures taken to control workers' exposures, and this is generally achieved by making workplace air measurements. Exposure to some metal-containing particles has been demonstrated to cause dermatitis, skin ulcers, eye problems, chemical pneumonitis, and other physical disorders ([1](#)).³

5.2 AAS is capable of quantitatively determining most metals in air samples at the levels required by federal, state,

³ Boldface numbers in parentheses refer to the list of references appended to these methods.