



Standard Practice for Measuring Elements in Water by Flame Atomic Absorption Spectrophotometry¹

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1. Scope

1.1 This practice covers general considerations for the quantitative determination of elements in water and waste water by flame atomic absorption spectrophotometry. Flame atomic absorption spectrophotometry is simple, rapid, and applicable to a large number of elements in drinking water, surface waters, and domestic and industrial wastes. While some waters may be analyzed directly, others will require pretreatment.

1.2 Detection limits, sensitivity, and optimum ranges of the elements will vary with the various makes and models of satisfactory atomic absorption spectrometers. The actual concentration ranges measurable by direct aspiration are given in the specific test method for each element of interest. In the majority of instances the concentration range may be extended lower by use of electrothermal atomization and conversely extended upwards by using a less sensitive wavelength or rotating the burner head. Detection limits by direct aspiration may also be extended through sample concentration, solvent extraction techniques, or both. Where direct aspiration atomic absorption techniques do not provide adequate sensitivity, the analyst is referred to Practice D 3919 or specialized procedures such as the gaseous hydride method for arsenic (Test Methods D 2972) and selenium (Test Methods D 3859), and the cold vapor technique for mercury (Test Method D 3223).

1.3 Because of the differences among various makes and models of satisfactory instruments, no detailed operating instructions can be provided. Instead the analyst should follow the instructions provided by the manufacturer of a particular instrument.

1.4 *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 9.

2. Referenced Documents

2.1 ASTM Standards:

- D 1129 Terminology Relating to Water²
- D 1192 Specification for Equipment for Sampling Water and Steam in Closed Conduits²
- D 1193 Specification for Reagent Water²
- D 2972 Test Methods for Arsenic in Water²
- D 3223 Test Method for Total Mercury in Water²
- D 3370 Practices for Sampling Water from Closed Conduits²
- D 3859 Test Methods for Selenium in Water²
- D 3919 Practice for Measuring Trace Elements in Water by Graphite Furnace Atomic Absorption Spectrophotometry²
- D 4453 Practice for Handling of Ultra-Pure Water Samples²
- E 178 Practice for Dealing with Outlying Observations³
- E 520 Practice for Describing Detectors in Emission and Absorption Spectroscopy⁴
- E 863 Practice for Describing Flame Atomic Absorption Spectroscopy Equipment⁴

3. Terminology

3.1 Definitions:

3.1.1 For definition of terms used in this practice, refer to Terminology D 1129.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *absorbance*, A , n —the logarithm to the base 10 of the reciprocal of the transmittance (T). $A = \log_{10}(1/T) = -\log_{10} T$.

3.2.2 *absorptivity*, a , n —the absorbance (A) divided by the product of the sample path length (b) and the concentration (c). $a = A/bc$.

3.2.3 *atomic absorption*, a , n —the absorption of electromagnetic radiation by an atom resulting in the elevation of electrons from their ground states to excited states. Atomic absorption spectrophotometry involves the measurement of light absorbed by atoms of interest as a function of the concentration of those atoms in a particular solution.

3.2.4 *detection limit*, DL , n —a function of the sensitivity and the signal to noise ratio in the analysis of a specific element for a given set of parameters. The detection limit is determined

¹ This practice is under the jurisdiction of ASTM Committee D-19 on Water and is the direct responsibility of Subcommittee D 19.05 on Inorganic Constituents in Water.

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² Annual Book of ASTM Standards, Vol 11.01.

³ Annual Book of ASTM Standards, Vol 14.02.

⁴ Annual Book of ASTM Standards, Vol 03.06.