



# Standard Test Method for Barium in Water, Atomic Absorption Spectrophotometry, Graphite Furnace<sup>1</sup>

This standard is issued under the fixed designation D 4382; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the determination of dissolved and total recoverable barium in most waters and wastewaters.

1.2 This test method was evaluated in the range from 33.5 to 132  $\mu\text{g/L}$  of barium. The range can be increased or decreased by varying the volume of sample injected or the instrumental settings. High concentrations may be diluted but preferably should be analyzed by direct aspiration atomic absorption spectrophotometry.

1.3 This test method has been used successfully with waste treatment plant effluent water, lake water, filtered tap water, and well water. It is the responsibility of the analyst to determine the suitability of the test method for other matrices.

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.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

- D 858 Test Methods for Manganese in Water<sup>2</sup>
- D 1068 Test Methods for Iron in Water<sup>2</sup>
- D 1129 Terminology Relating to Water<sup>2</sup>
- D 1193 Specification for Reagent Water<sup>2</sup>
- D 1687 Test Methods for Chromium in Water<sup>2</sup>
- D 1688 Test Methods for Copper in Water<sup>2</sup>
- D 1886 Test Methods for Nickel in Water<sup>2</sup>
- D 2972 Test Methods for Arsenic in Water<sup>2</sup>
- D 3373 Test Method for Vanadium in Water<sup>2</sup>
- D 3557 Test Methods for Cadmium in Water<sup>2</sup>
- D 3558 Test Methods for Cobalt in Water<sup>2</sup>
- D 3559 Test Methods for Lead in Water<sup>2</sup>
- D 3859 Test Methods for Selenium in Water<sup>2</sup>
- D 3866 Test Methods for Silver in Water<sup>2</sup>
- D 3919 Practice for Measuring Trace Elements in Water by Graphite Furnace Atomic Absorption Spectrophotometry<sup>2</sup>
- D 4691 Practice for Measuring Elements in Water by Flame

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-19 on Water and is the direct responsibility of Subcommittee D19.05 on Inorganic Constituents in Water.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 11.01.

Atomic Absorption Spectrophotometry<sup>2</sup>  
D 4841 Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents<sup>2</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology D 1129.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *total recoverable barium*—an arbitrary analytical term relating to the recoverable forms of barium that are determinable by the digestion method which is included in this test method.

## 4. Summary of Test Method

4.1 Barium is determined by an atomic absorption spectrophotometer used in conjunction with a graphite furnace. A sample is placed in a graphite tube, evaporated to dryness, charred (pyrolyzed or ashed), and atomized. The absorption signal produced during atomization may be recorded and compared with values obtained from standards that have been carried through the same process. This facilitates interpolation of the level of barium in the solution being analyzed. Since the graphite furnace uses the sample much more efficiently than flame atomization, the detection of low concentrations in small sample volumes is possible.

NOTE 1—The same graphite furnace procedure may be applicable to determination of arsenic (see Test Methods D 2972), cadmium (see Test Methods D 3557), chromium (see Test Methods D 1687), cobalt (see Test Methods D 3558), copper (see Test Methods D 1688), iron (see Test Methods D 1068), lead (see Test Methods D 3559), manganese (see Test Methods D 858), nickel (see Test Methods D 1886), selenium (see Test Methods D 3859), and silver (see Test Methods D 3866).

4.2 Dissolved barium is determined on a sample filtered through a 0.45- $\mu\text{m}$  membrane filter. The definition of dissolved barium is arbitrary since very fine crystals of barium sulfate may pass through the membrane filter.

4.3 Total recoverable barium is determined following acid digestion and filtration. Because chlorides interfere with furnace procedures for some metals, the use of hydrochloric acid in any digestion or solubilization step is to be avoided. If suspended material is not present, this digestion and filtration may be omitted. The holding time for the samples may be calculated in accordance with Practice D 4841.