



Standard Practice for Sample Digestion Using Closed Vessel Microwave Heating Technique for the Determination of Total Metals in Water¹

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1. Scope

1.1 This practice covers the general considerations for quantitative sample digestion for total metals in water using closed vessel microwave heating technique. This practice is applicable to surface, saline, domestic, and industrial wastewater.

1.2 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 the particular instrument.

1.3 This practice can be used with the following ASTM standards, providing the user determines precision and bias based on this digestion practice: Test Methods D 857, Test Methods D 858, Test Methods D 1068, Specification D 1192, Test Methods D 1687, Test Methods D 1688, Test Methods D 1691, Test Methods D 1886, Practices D 3370, Test Methods D 3557, Test Methods D 3559, Practice D 3919, Test Methods D 4190, Practice D 4453, and Practice D 4691.

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 857 Test Methods for Aluminum in Water²
- D 858 Test Methods for Manganese in Water²
- D 1068 Test Methods for Iron in Water²
- 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 1687 Test Methods for Chromium in Water²
- D 1688 Test Methods for Copper in Water²
- D 1691 Test Methods for Zinc in Water²

D 1886 Test Methods for Nickel in Water²

D 3370 Practices for Sampling Water from Closed Conduits²

D 3557 Test Methods for Cadmium in Water²

D 3559 Test Methods for Lead in Water²

D 3856 Guide for Good Laboratory Practices in Laboratories Engaged in Sampling and Analysis of Water²

D 3919 Practice for Measuring Trace Elements in Water by Graphite Furnace Atomic Absorption Spectrophotometry²

D 4190 Test Methods for Elements in Water by Direct-Current Argon Plasma Atomic Emission Spectroscopy²

D 4453 Practice for Handling of Ultra-Pure Water Samples²

D 4691 Practice for Measuring Elements in Water by Flame Atomic Absorption Spectrophotometry²

2.2 U.S. Code of Federal Regulations:

CFR 1.030.10 Code of Federal Regulations, Volume 21³

2.3 Federal Communications Commission Standard:

Code of Federal Regulations, Volume 47, FCC Rule Part 18³

2.4 U.S. EPA Method:

U.S. EPA Method: Methods for Chemical Analysis of Water and Waste—March 1979, “Total Metals Digestion Procedure” 4.1.3, page Metals 6⁴

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology D 1129.

4. Summary of Practices

4.1 A representative aliquot of a homogeneous sample is digested with acid in a closed microwave transparent vessel, using microwave heating. The digestate or a filtered digestate is then analyzed by direct aspiration or injection by flame atomic absorption spectrophotometry (FAAS), inductively coupled plasma emission techniques (ICP), direct current plasma emission techniques (DCP), or graphite furnace atomic absorption spectrophotometry (GFAAS), or a combination of methods.

¹ This practice 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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² Annual Book of ASTM Standards, Vol 11.01.

³ Available from Office of the Federal Register, National Archives Records Administration, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20401.

⁴ Available from National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161.