



Standard Test Method for Isotopic Uranium in Water by Radiochemistry¹

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1. Scope

1.1 This test method covers the determination of alpha-particle-emitting isotopes of uranium in water by means of chemical separations and alpha pulse-height analysis (also known as alpha-particle spectrometry). Uranium is chemically separated from a water sample by coprecipitation with ferrous hydroxide, anion exchange, and electrodeposition. The test method applies to soluble uranium as well as to any uranium that might be present in suspended matter in the water sample. This test method is applicable for uranium processing effluents as well as substitute ocean water. When suspended matter is present, an acid dissolution step is added to assure that all of the uranium dissolves. It is the user's responsibility to ensure the validity of this test method for waters of untested matrices.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 warning statements are given in Section 9.

2. Referenced Documents

2.1 ASTM Standards:²

[C859 Terminology Relating to Nuclear Materials](#)

[C1163 Practice for Mounting Actinides for Alpha Spectrometry Using Neodymium Fluoride](#)

[D1066 Practice for Sampling Steam](#)

[D1129 Terminology Relating to Water](#)

[D1192 Guide for Equipment for Sampling Water and Steam](#)

[in Closed Conduits \(Withdrawn 2003\)](#)³

[D1193 Specification for Reagent Water](#)

[D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water](#)

[D3084 Practice for Alpha-Particle Spectrometry of Water](#)

[D3370 Practices for Sampling Water from Closed Conduits](#)

[D3648 Practices for the Measurement of Radioactivity](#)

[D5847 Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis](#)

[D7282 Practice for Set-up, Calibration, and Quality Control of Instruments Used for Radioactivity Measurements](#)

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminologies [C859](#) and [D1129](#). For terms not included in these reference may be made to other published glossaries.^{4,5}

4. Summary of Test Method

4.1 The water sample to be analyzed is acidified and ²³²U is added to serve as an isotopic tracer before any additional operations are performed. If the sample is a seawater sample, or if it contains carbonate or bicarbonate ions, the sample must be boiled under acidic conditions to convert these ions to carbon dioxide gas which is then expelled from the solution. Carbonate ions must not be present during the precipitation step because they complex the uranium and prevent its coprecipitation. The uranium is coprecipitated from the sample with ferrous hydroxide. This precipitate is dissolved in concentrated hydrochloric acid, or is subjected to an acid dissolution with concentrated nitric and hydrofluoric acids if the hydrochloric acid fails to dissolve the precipitate.

4.2 The uranium is separated from other radionuclides by adsorption on anion-exchange resin from 8 *M* hydrochloric acid, followed by elution with 0.1 *M* hydrochloric acid. The uranium is electrodeposited onto a stainless steel disk. Isotopic uranium radioactivities are measured by alpha pulse-height

¹ This test method is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.04 on Methods of Radiochemical Analysis.

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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 The last approved version of this historical standard is referenced on www.astm.org.

⁴ Parker, S. P., ed., *Dictionary of Chemical Terms*, McGraw-Hill Book Co., New York, NY, 1985.

⁵ IUPAC, "Glossary of Terms Used in Nuclear Analytical Chemistry," *Pure and Applied Chemistry*, Vol 54, 1982, pp. 1533–1554.