



Standard Test Method for Low-Level Analysis of Iodine Radioisotopes in Water¹

This standard is issued under the fixed designation D4785; 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 (ε) indicates an editorial change since the last revision or reapproval.

^{ε1} NOTE—Warning notes were editorially updated throughout in June 2013.

1. Scope

1.1 This test method covers the quantification of low levels of radioactive iodine in water by means of chemical separation and counting with a high-resolution gamma ray detector. Iodine is chemically separated from a 4-L water sample using ion exchange and solvent extraction and is then precipitated as cuprous iodide for counting.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses are provided for information purposes only.

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.* For specific hazard statements, see 8.17, 8.18, 8.19, Section 9, and 13.2.11.

2. Referenced Documents

2.1 *ASTM Standards:*²

D1129 Terminology Relating to Water

D1193 Specification for Reagent Water

D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water

D3370 Practices for Sampling Water from Closed Conduits

D3648 Practices for the Measurement of Radioactivity

D3649 Practice for High-Resolution Gamma-Ray Spectrometry of Water

D5847 Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis

D3856 Guide for Management Systems in Laboratories Engaged in Analysis of Water

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. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D1129.

4. Summary of Test Method

4.1 Sodium iodide is added as a carrier prior to performing any chemical separations. The samples undergo an oxidation-reduction process to ensure exchange between the carrier and the radioactive iodide. Hydroxylamine hydrochloride and sodium bisulfite are added to convert all the iodine to iodide which is then removed by anion exchange. Subsequent elution of the iodide is followed by oxidation-reduction to elemental iodine. The elemental iodine is purified by solvent extraction, reduced to iodide, and precipitated as cuprous iodide. The chemical recovery is determined from the recovery of the iodide carrier.

5. Significance and Use

5.1 This test method was developed for measuring low levels of radioactive iodine in water. The results of the test may be used to determine if the concentration of several radioisotopes of iodine in the sample exceeds the regulatory statutes for drinking water. With a suitable counting technique, sample size, and counting time, a detection limit of less than 0.037 Bq/L (1 pCi/L) is attainable by gamma-ray spectroscopy. This method was tested for ¹³¹I. Other iodine radioisotopes should behave in an identical manner in this procedure. However, other iodine radioisotopes have not been tested according to Practice D2777. The user of this method is responsible for determining applicability, bias, and precision for the measurement of other iodine radioisotopes using this method.

5.2 This procedure addresses the analysis of iodine radioisotopes with half-lives greater than 2 hours, which include ¹²¹I, ¹²³I, ¹²⁴I, ¹²⁵I, ¹²⁶I, ¹²⁹I, ¹³⁰I, ¹³¹I, ¹³²I, ¹³³I, and ¹³⁵I.

6. Interferences

6.1 Stable iodine in the sample will interfere with the chemical recovery determination. One milligram of ambient iodine would produce a bias of about –4 %.