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## Standard Test Methods for Radioactive Iodine in Water<sup>1</sup>

This standard is issued under the fixed designation D 2334; 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.

<sup>E1</sup> NOTE—Paragraph 13.3 was corrected editorially in September 1990.

### 1. Scope

1.1 These test methods cover the determination of radioactive iodine in water in concentrations greater than 100 pCi/L. Concentration of the sample can increase the sensitivity of the test methods. The test methods are given as follows:

|                                        | Sections |
|----------------------------------------|----------|
| Test Method A (Heterogeneous Exchange) | 8 to 14  |
| Test Method B (Distillation)           | 15 to 21 |
| Test Method C (Solvent Extraction)     | 22 to 28 |

1.2 These test methods may be used for absolute measurements by calibrating the nuclear radiation detector with appropriate radioactive standards, or for relative measurements by comparing measurements with each other. The choices of test methods are limited by radiation detector and the count time for the determination of iodine isotopes of mass 129, 131, 132, 133, 134, and 135 which are fission products. The decay characteristics of the radioiodine isotopes are shown in Appendix X1. The isotopes of mass 124, 125, 126, and 130, which are not fission products, will interfere, if present, unless a high-resolution, high-purity, intrinsic germanium, or lithium-drifted germanium detector is used for the measurement; however, these isotopes are rarely encountered.

1.3 This test method does not meet the current requirements of Practice D 2777.

1.4 It is the user's responsibility to ensure the validity of these test methods for waters of untested matrices.

1.5 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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 1129 Definitions of Terms Relating to Water<sup>2</sup>

D 1192 Specification for Equipment for Sampling Water and Steam<sup>2</sup>

D 1193 Specification for Reagent Water<sup>2</sup>

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D-19 on Water and are the direct responsibility of Subcommittee D19.04 on Method of Radiochemical Analysis.

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

D 1890 Test Method for Beta Particle Radioactivity of Water<sup>3</sup>

D 2777 Practice for Determination of Precision and Bias of Applicable Methods of Committee D-19 on Water<sup>2</sup>

D 3370 Practices for Sampling Water<sup>2</sup>

D 3649 Practice for High-Resolution Gamma-Ray Spectrometry of Water<sup>3</sup>

### 3. Definitions

3.1 For definitions of terms used in these test methods, refer to Definitions D 1129.

### 4. Counting Instruments and Counting

4.1 *Beta Particle Counter*, usually a proportional or Geiger-Müller detector, connected to appropriate amplifier, pulse-height discriminator, scaler, and register. Refer to Test Method D 1890.

4.2 Gamma ray spectrometer consisting of the following components:

4.2.1 Preferably a high-resolution, high-purity germanium (HpGe), or lithium-drifted germanium (Ge(Li)) detector. For analyses that do not require high resolution, a sodium iodide (Na(Tl)) detector may be used. Associated electronics including a power supply and amplifier are also required. Refer to Practice D 3649. Typical gamma ray spectra are shown in reports by Heath.<sup>4</sup>

4.2.2 Multichannel analyzer with associated readout devices. A minimum of 2048 channels is recommended for high-resolution gamma spectrometry.

4.2.3 A high-resolution gamma spectrometer is recommended when analyzing a fresh mixture of fission products which may contain all of the isotopes listed in Table X1.1.

4.3 The counting techniques are common to all three test methods. The silver iodide precipitate may be counted with a beta particle or gamma detector. A gamma spectrometer is preferred when isotopic identifications are necessary and is required when making absolute measurements when more than one iodine isotope is present. For Test Methods B and C, the carbon tetrachloride or aqueous solution of the purified iodine isotopes may be counted directly with the gamma counter or spectrometer. Yield determinations can then be made after counting. Corrections are made for counter dead time, background count, and radioactive decay from sampling time. For absolute counting, the observed

<sup>3</sup> Annual Book of ASTM Standards, Vol 11.02.

<sup>4</sup> Heath, R. L., *Gamma Ray Spectrum Catalog, Ge(Li) and Si(Li) Spectrometry*, ANCR-1000-2.