



Designation: D4922 – 21

Standard Test Method for Determination of Radioactive Iron in Water¹

This standard is issued under the fixed designation D4922; 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.

1. Scope

1.1 This test method covers the determination of ⁵⁵Fe in the presence of ⁵⁹Fe by liquid scintillation counting. The *a-priori* minimum detectable concentration for this test method is 7.4 Bq/L.²

1.2 This test method was developed principally for the quantitative determination of ⁵⁵Fe. However, after proper calibration of the liquid scintillation counter with reference standards of each nuclide, ⁵⁹Fe may also be quantified.

1.3 This test method was used successfully with Type III reagent water conforming to Specification D1193. It is the responsibility of the user to ensure the validity of this test method for waters of untested 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For a specific hazard statement, see Section 9.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:³

D1068 Test Methods for Iron in Water

D1129 Terminology Relating to Water

D1193 Specification for Reagent 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 Currie, L., "Limits for Qualitative Detection and Quantitative Determination," *Analytical Chemistry*, Vol. 40, 1968, pp. 586–593.

³ 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.

D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water
D3370 Practices for Sampling Water from Flowing Process Streams
D5847 Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis
D7282 Practice for Setup, Calibration, and Quality Control of Instruments Used for Radioactivity Measurements
D7902 Terminology for Radiochemical Analyses

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminologies D1129 and D7902. For terms not defined in this test method or in Terminologies D1129 or D7902, refer to other published glossaries.⁴

4. Summary of Test Method

4.1 This test method describes the effective separation of iron from the interfering cations of manganese, cobalt, zirconium, niobium, and cesium by anion exchange using acid washes of various molarities. Subsequent elution of the iron is followed by phosphate precipitation to remove any residual zinc. The iron phosphate precipitate is dissolved in phosphoric acid and water and mixed with liquid scintillation cocktail. The chemical yield is determined by the recovery of iron carrier using atomic absorption spectrophotometry. Alternatively, any procedure described in Test Methods D1068 may be used, but this will need to be validated by the user prior to reporting sample results.

5. Significance and Use

5.1 Fe-55 is formed in reactor coolant systems of nuclear reactors by activation of stable iron. The ⁵⁵Fe is not completely removed by waste processing systems and some is released to the environment by means of normal waste liquid discharges. Power plants are required to monitor these discharges for ⁵⁵Fe as well as other radionuclides.

5.2 This technique effectively removes other activation and fission products such as isotopes of iodine, zinc, manganese,

⁴ "American National Standard Glossary of Terms," *Nuclear Science and Technology (ANSI N1.1)*, American National Standards Institute, 1430 Broadway, New York, NY 10018.