



Standard Test Method for Determination of Low Concentrations of Uranium in Oils and Organic Liquids by X-ray Fluorescence¹

This standard is issued under the fixed designation C 1343; 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 steps necessary for the preparation and analysis by X-ray fluorescence (XRF) of oils and organic solutions containing uranium.

1.2 The procedure is valid for those solutions containing 20 to 2000 µg uranium/mL as presented to the spectrometer.

1.3 This test method requires the use of an appropriate internal standard. Care must be taken to ascertain that samples analyzed by this test method do not contain the internal standard or that this contamination, whenever present, has been corrected for mathematically. Such corrections are not addressed in this procedure. Care must be taken that the internal standard and sample medium are compatible; that is, samples must be miscible with tri-*n*-butyl phosphate (TBP) and must not remove the internal standard from solution. Alternatively, a scatter line may be used as the internal standard.²

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *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 precautionary statements are given in Section 9 and Note 2.

2. Referenced Documents

2.1 ASTM Standards:

C 982 Guide for Selecting Components for Energy-Dispersive X-Ray Fluorescence (XRF) Systems³

C 1118 Guide for Selecting Components for Wavelength-Dispersive X-Ray Fluorescence (XRF) Systems³

D 1193 Specification for Reagent Water⁴

E 135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials⁵

2.2 NIST Document:

NBS Handbook 111, *Radiation Safety for X-ray Diffraction and X-ray Fluorescence Analysis Equipment*⁶

3. Terminology

3.1 *Definitions*—See definitions in Terminology E 135.

4. Summary of Test Method

4.1 Solution standards containing 20 µg uranium/mL to 2000 µg uranium/mL and an internal standard are placed in a liquid sample holder of an X-ray spectrometer and exposed to an X-ray beam capable of exciting the uranium L-α emission line and the appropriate internal standard line. The intensities generated are measured by an appropriate detector. The intensity ratio values obtained from these data are used to calibrate the X-ray analyzer. Samples are prepared having a similar matrix to fit the calibration range and measured using the same analytical parameters.

NOTE 1—Yttrium, strontium, and bromine K-α and thorium L-α lines have been used successfully as internal standard lines. Explanation of the internal standard method of analysis is outside the scope of this test method and is found in several sources.^{7,8}

5. Significance and Use

5.1 This test method is applicable to organic solutions containing 20 to 2000 µg uranium/mL of solution presented to the spectrometer.

5.2 Either wavelength-dispersive or energy-dispersive XRF systems may be used, provided that the software accompanying the system is able to accommodate the use of internal standards.

6. Interferences

6.1 This test method requires the use of an internal standard. Care must be taken that the samples analyzed by this test method do not contain the internal standard or chemicals that would remove the internal standard from solution. The samples must also be miscible with TBP.

¹ This test method is under the jurisdiction of ASTM Committee C-26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.05 on Methods of Test.

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² Andermann, G., and Kemp, J. W., "Scattered X-rays as Internal Standards in X-ray Spectroscopy," *Analytical Chemistry*, Vol 20, No. 8, 1958.

³ *Annual Book of ASTM Standards*, Vol 12.01.

⁴ *Annual Book of ASTM Standards*, Vol 11.01.

⁵ *Annual Book of ASTM Standards*, Vol 03.05.

⁶ Available from U.S. Department of Commerce, National Institute of Standards and Technology, Gaithersburg, MD 20899.

⁷ Bertin, E. P., *Introduction to X-ray Spectrometric Analysis*, Plenum Press, New York and London, 1978.

⁸ Tertian, R., and Claisse, F., *Principles of Quantitative X-ray Fluorescence Analysis*, Heyden & Son, London, Philadelphia, and Rheine, 1982.