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Standard Guide for Characterization of Spent Nuclear Fuel in Support of Interim Storage, Transportation and Geologic Repository Disposal¹

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1. Scope

1.1 This guide provides guidance for the types and extent of testing that would be involved in characterizing the physical and chemical nature of spent nuclear fuel (SNF) in support of its interim storage, transport, and disposal in a geologic repository. This guide applies primarily to commercial light water reactor (LWR) spent fuel and spent fuel from weapons production, although the individual tests/analyses may be used as applicable to other spent fuels such as those from research and test reactors and mixed oxide (MOX) spent fuel. The testing is designed to provide information that supports the design, safety analysis, and performance assessment of a geologic repository for the ultimate disposal of the SNF.

1.2 The testing described includes characterization of such physical attributes as physical appearance, weight, density, shape/geometry, degree, and type of SNF cladding damage. The testing described also includes the measurement/examination of such chemical attributes as radionuclide content, microstructure, and corrosion product content, and such environmental response characteristics as drying rates, oxidation rates (in dry air, water vapor, and liquid water), ignition temperature, and dissolution/degradation rates. Not all of the characterization tests described herein must necessarily be performed for any given analysis of SNF performance for interim storage, transportation, or geological repository disposal, particularly in areas where an extensive body of literature already exists for the parameter of interest in the specific service condition.

1.3 It is assumed in formulating the SNF characterization activities in this guide that the SNF has been stored in an interim storage facility at some time between reactor discharge and dry transport to a repository. The SNF may have been stored either wet (for example, a spent fuel pool), or dry (for example, an independent spent fuel storage installation (ISFSI)), or both, and that the manner of interim storage may affect the SNF characteristics.

¹ This guide is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.13 on Spent Fuel and High Level Waste.

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

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.*

1.6 *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:²

- C170/C170M Test Method for Compressive Strength of Dimension Stone
- C696 Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Uranium Dioxide Powders and Pellets
- C698 Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Mixed Oxides ((U, Pu)O₂)
- C859 Terminology Relating to Nuclear Materials
- C1174 Practice for Prediction of the Long-Term Behavior of Materials, Including Waste Forms, Used in Engineered Barrier Systems (EBS) for Geological Disposal of High-Level Radioactive Waste
- C1380 Test Method for the Determination of Uranium Content and Isotopic Composition by Isotope Dilution Mass Spectrometry
- C1413 Test Method for Isotopic Analysis of Hydrolyzed Uranium Hexafluoride and Uranyl Nitrate Solutions by Thermal Ionization Mass Spectrometry
- C1454 Guide for Pyrophoricity/Combustibility Testing in

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.