



Standard Guide for Evaluation of Materials Used in Extended Service of Interim Spent Nuclear Fuel Dry Storage Systems¹

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1. Scope

1.1 Part of the total inventory of commercial spent nuclear fuel (SNF) is stored in dry cask storage systems (DCSS) under licenses granted by the U.S. Nuclear Regulatory Commission (NRC). The purpose of this guide is to provide information to assist in supporting the renewal of these licenses, safely and without removal of the SNF from its licensed confinement, for periods beyond those governed by the term of the original license. This guide provides information on materials behavior under conditions that may be important to safety evaluations for the extended service of the renewal period. This guide is written for DCSS containing light water reactor (LWR) fuel that is clad in zirconium alloy material and stored in accordance with the Code of Federal Regulations (CFR), at an independent spent-fuel storage installation (ISFSI). The components of an ISFSI, addressed in this document, include the commercial SNF, canister, cask, and all parts of the storage installation including the ISFSI pad. The language of this guide is based, in part, on the requirements for a dry SNF storage license that is granted, by the U.S. Nuclear Regulatory Commission (NRC), for up to 20 years. Although government regulations may differ for various nations, the guidance on materials properties and behavior given here is expected to have broad applicability.

1.2 This guide addresses many of the factors affecting the time-dependent behavior of materials under ISFSI service [10 CFR Part 72.42]. These factors are those regarded to be important to performance, in license extension, beyond the currently licensed 20-year period. Examples of these factors are given in this guide and they include materials alterations or environmental conditions for components of an ISFSI system that, over time, could have significance related to safety. For purposes of this guide, a license period of an additional 20 to 80 years is assumed.

1.3 This guide addresses the determination of the conditions of the spent fuel and storage cask materials at the end of the initial 20-year license period as the result of normal events and conditions. However, the guide also addresses the analysis of potential spent fuel and cask materials degradation as the result

of off-normal, and accident-level events and conditions that may occur during any period.

1.4 This guide provides information on materials behavior to support continuing compliance with the safety criteria, which are part of the regulatory basis, for licensed storage of SNF at an ISFSI. The safety functions addressed and discussed in this standard guide include thermal performance, radiological protection, confinement, sub-criticality, and retrievability. The regulatory basis includes 10 CFR Part 72 and supporting regulatory guides of the U.S. Nuclear Regulatory Commission. The requirements set forth in these documents indicate that the following items were considered in the original licensing decisions: properties of materials, design considerations for normal and off-normal service, operational and natural events, and the bases for the original calculations. These items may require reconsideration of the safety-related arguments that demonstrate how the systems continue to satisfy the regulatory requirements. Further, to ensure continued safe operation, the performance of materials must be justified in relation to the effects of time, temperature, radiation field, and environmental conditions of normal and off-normal service. Arguments for long-term performance must account for materials alterations (especially degradations) that are expected during the service periods, which include the periods of the initial license and of the license renewal. This guide pertains only to structures, systems, and components important to safety during extended storage period and during retrieval functions, including transport and transfer operations. Materials information that pertains to safety functions, including retrieval functions, is pertinent to current regulations and to license renewal process, and this information is the focus of the guide. This guide is not intended to supplant the existing regulatory process.

2. Referenced Documents

2.1 ASTM Standards:

- C 33 Specification for Concrete Aggregates²
- C 227 Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)²
- C 295 Practice for Petrographic Examination of Aggregates for Concrete²

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 Repository Waste. Current edition approved Feb 10, 2003. Published March 2003.

² *Annual Book of ASTM Standards*, Vol 04.02.