

**Division of Spent Fuel Management
Interim Staff Guidance – 2, Revision 2**

Issue: Fuel Retrievability in Spent Fuel Storage Applications

Introduction:

This Interim Staff Guidance (ISG) provides guidance to the staff for determining whether storage systems seeking approval under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 72 (Ref. 1), “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste” are designed to allow ready retrieval of spent fuel. The Nuclear Regulatory Commission (NRC) inspectors should verify licensee’s compliance with 10 CFR 72.122(l) using this guidance and inspection procedure (IP)-60854 and IP-60855 (Ref. 2 and Ref. 3). This ISG does not apply to systems seeking approval under 10 CFR Part 71, “Packaging and Transportation of Radioactive Material” (Ref. 4). This guidance is not a regulation or a requirement, and it addresses only one acceptable way of meeting the regulation. A background section is included in Appendix A.

Regulatory Basis

The regulations for safe storage of spent nuclear fuel for licensees are set forth in 10 CFR Part 72, and the specific regulation regarding retrievability is found in 10 CFR 72.122(l), which requires that “storage systems must be designed to allow ready retrieval of spent fuel, high-level radioactive waste, and reactor-related greater than class C [GTCC] waste for further processing or disposal.” This requirement that the system be designed to allow for ready retrieval applies to the initial design, amendments to the design, and in license renewal, to the aging management of the design. The retrievability requirement is only applicable during normal and off-normal conditions and does not apply to accident conditions (Ref. 5). Additionally, while the majority of currently licensed independent spent fuel storage installations (ISFSIs) utilize dry cask storage, the requirement for retrievability applies to all general-licensed and specific-licensed ISFSIs, including wet storage ISFSIs.

Applicability:

This guidance applies to reviews of ISFSI applications and dry storage systems conducted in accordance with NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems" (Ref. 6), NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities" (Ref. 7), or NUREG-1927, “Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel” (Ref. 8 and 9).

This revision of ISG-2 supersedes the definition of retrievability stated in the above Standard Review Plans and applicable ISGs. In addition, this revision supersedes the previous revision of ISG-2 Rev. 1 (Ref. 10), in its entirety.

Technical Review Guidance

Under this revised guidance, ready retrieval is defined as “the ability to safely remove, with no operational safety problems, the spent fuel from storage for further processing or disposal.” In order to demonstrate the ability for ready retrieval, a licensee should be able to demonstrate the ability to do one or a combination of the following, safely and with no operational safety problems:

- A. remove individual or canned spent fuel assemblies from wet or dry storage,
- B. remove a canister loaded with spent fuel assemblies from a storage cask/overpack,
- C. remove a cask loaded with spent fuel assemblies from the storage location;

The NRC’s licensing reviews and inspection oversight of the design, fabrication, construction, and operation of an ISFSI, ensure that the requirements of 10 CFR Part 72, including retrievability, are maintained during the initial storage period. As spent fuel storage continues beyond the initial NRC-approved period of operation, NRC’s storage regulations require that renewal applications contain revised technical requirements and operating conditions (fuel storage, surveillance and maintenance, and other requirements) for the ISFSI that address aging mechanisms and aging effects that could affect structures, systems, and components relied upon for the safe storage of spent fuel. The renewal application must include (1) time-limited aging analyses (TLAAs), if applicable, that demonstrate that structures, systems, and components important to safety will continue to perform their intended function for the requested period of extended operation, and (2) aging management programs (AMPs) for management of issues associated with aging that could adversely affect structures, systems, and components important to safety.

In order to verify that the 10 CFR 72.122(l) retrievability requirement is met for all applicants for an initial ISFSI license or applicants for an ISFSI license amendment, the reviewer should ensure there is reasonable assurance that the storage system is designed to allow ready retrieval by one or a combination of the options identified above as A, B, or C. For a dry storage system, this demonstration can include known and controlled fuel selection, limits on the loading temperature, known atmospheric environment, and transfer cask or canister temperature control (Ref. 11 and 12). Additionally, the reviewer should verify for all types of storage systems that the application identifies the structures, systems, and components (SSCs) important to safety and any subcomponents which may impact these SSCs that are relied upon for ready retrieval. The reviewer should further verify that the Technical Specifications included in the application will ensure that SSCs relied upon for ready retrieval are maintained.

If an applicant for an initial ISFSI license or applicants for an ISFSI license amendment relies on Option A to demonstrate ready retrieval, the reviewer should also ensure that the applicant has demonstrated that the fuel assemblies will remain structurally sound (i.e., no gross degradation), and thus will be removable. Alternatively, in the case of a structurally-unsound assembly or an assembly that has rods with breaches greater than a pinhole leak or a hairline crack (i.e., gross ruptures that could lead to release of fuel particulates per ISG-1 Rev. 2 (Ref. 12)), the reviewer should ensure that the applicant has demonstrated that the fuel assembly would be placed inside a secondary container (described in ISG-1 as a “can for damaged fuel”) that confines the fuel particulate to a known volume, and that removal of the secondary container does not pose operational

safety problems.

Additionally, if an applicant for an initial dry storage ISFSI license or an applicant for an ISFSI license amendment relies upon Option A to demonstrate ready retrieval, then it is likely the storage cask/canister will, at some point, need to be moved from the storage location to a location where the spent fuel assemblies can be removed from the cask/canister. Therefore, in those instances where a cask/canister will have to be moved, the reviewer should ensure that an applicant relying upon Option A for the demonstration of ready retrieval, in addition to the demonstration under Option A, has also demonstrated ready retrieval under Option B or Option C. This is consistent with the previous guidance on fuel retrievability.

If an applicant for an initial ISFSI license or an applicant for an ISFSI license amendment relies upon Option B or Option C to demonstrate ready retrieval, the applicant should also address the storage system's continued ability to ensure ready retrieval. One possible approach would be for the applicant to implement a program designed to identify, monitor, and mitigate possible degradation that could impact the intended function of the dry storage system's SSCs and subcomponents that are relied upon for compliance with the retrievability requirements.

For applicants for renewal of an ISFSI license, in order to verify that the 10 CFR 72.122(l) retrievability requirement is met, the reviewer should ensure that the approved design bases for the item being relied upon in the option(s) chosen (fuel assembly, cask, or canister) to demonstrate ready retrieval, including any programs implemented, has not been altered. Additionally, the reviewer should ensure that the AMPs and TLAAs provide reasonable assurance that the approved design bases will be maintained during the period of extended operation. This includes reviewing operating experience for incident-free storage, including inspections and analyses performed during the initial storage period for ensuring SSCs relied upon for ready retrieval were maintained. The reviewer should refer to Draft NUREG-1927, Rev. 1 (Ref. 8) for additional guidance.

Recommendation:

This ISG recommends the following definition to be used by staff when evaluating Part 72 applications:

Ready retrieval: The ability to safely remove, with no operational safety problems, the spent fuel from storage for further processing or disposal.

Acceptable means for removing the spent fuel from storage includes the ability to do one or a combination of the following:

- A. remove individual or canned spent fuel assemblies from wet or dry storage,
- B. remove a canister loaded with spent fuel assemblies from a storage cask/overpack,
- C. remove a cask loaded with spent fuel assemblies from the storage location.

The staff recommends the definitions for ready retrieval be incorporated into NUREG-1536, NUREG-1567, and NUREG-1927. These definitions do not necessitate any actions for currently approved storage systems.

Appendix A

This Appendix is provided to give insight on the history and evolution of the regulatory requirement of fuel retrievability.

Section 141(b)(1)(C) of the Nuclear Waste Policy Act (NWP) of 1982, as amended (Ref. 13), requires that each monitored retrievable storage (MRS) facility be designed "...to provide for the ready retrieval of such spent fuel and waste for further processing or disposal." The Nuclear Regulatory Commission (NRC) codified this portion of the NWP in its 1988 final rulemaking "Licensing Requirements for the Independent Spent Fuel Storage of Spent Nuclear Fuel and High-Level Radioactive Waste" (Ref. 14), which added MRSs to the scope of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 72 and required retrievability for all independent spent fuel storage installations (ISFSIs), 10 CFR 72.122(l).

For general and specific licensees, the regulation regarding retrievability is 10 CFR 72.122(l), which requires that "storage systems must be designed to allow ready retrieval of spent fuel, high-level radioactive waste, and reactor-related greater than class C (GTCC) waste for further processing or disposal." It is supported by 10 CFR 72.122 (h)(1), which requires that, for confinement barriers and systems, "The spent fuel cladding must be protected during storage against degradation that leads to gross ruptures or the fuel must be otherwise confined such that degradation of the fuel during storage will not pose operational safety problems with respect to its removal from storage. This may be accomplished by canning of consolidated fuel rods or unconsolidated assemblies or other means as appropriate." For certificate of compliance (CoC) holders, the regulation to promote the design consideration of retrievability is set forth in 10 CFR 72.236(m), which states that, "To the extent practicable in the design of spent fuel storage casks, consideration should be given to compatibility with removal of the stored spent fuel from a reactor site, transportation, and ultimate disposition by the Department of Energy."

Additionally, the U.S. Nuclear Regulatory Commission (NRC) has previously recognized that "in the interest of decreasing radiation exposures, storage casks should be designed to be compatible with transportation and Department of Energy [DOE] design criteria to the extent practicable... to the extent that cask designers can avoid return of the spent fuel from dry cask storage to reactor basins for transfer to a transport cask before moving it off site for disposal" (Ref. 15).

The previous position on retrievability, as delineated in interim staff guidance (ISG) - 2, Rev. 1 (Ref. 10), defined ready retrieval as "the ability to move a canister containing spent fuel to either a transportation package or to a location where the spent fuel can be removed. Ready retrieval also meant maintaining the ability to handle individual or canned spent fuel assemblies by the use of normal means."

The guidance of retrievability in ISG-2, Rev. 1 was developed at a time when an operating repository was anticipated in the near future. As of 2015, the duration of spent fuel storage at an ISFSI or MRS remains uncertain. Therefore, the staff re-assessed the regulatory necessity and practical impact of maintaining the ability to handle an individual fuel assembly from the canister or cask by normal means as part of the guidance on retrievability.

The NRC's licensing reviews and inspection oversight of the design, fabrication, construction, and operation of an ISFSI, ensures safety and retrievability requirements of 10 CFR Part 72 are maintained during the initial storage period. As spent fuel storage continues beyond the initial NRC-approved period of operation, NRC's storage regulations require that renewal applications contain revised technical requirements and operating conditions (fuel storage, surveillance and maintenance, and other requirements) for the ISFSI or dry storage system that address aging mechanisms and aging effects that could affect structures, systems, and components relied upon for the safe storage of spent fuel. The renewal application must include (1) time-limited aging analyses (TLAAs), if applicable, that demonstrate that structures, systems, and components important to safety will continue to perform their intended function for the requested period of extended operation, and (2) aging management programs (AMPs) for management of issues associated with aging that could adversely affect structures, systems, and components important to safety.

Under the guidance of ISG-2, Rev. 1, if a licensee's ability to demonstrate ready retrieval relies on the handling of each individual fuel assembly from a canister or cask by normal means, then periodic monitoring or inspections may be required to verify the condition of the fuel and the internal components of the storage system. Because of the difficulties in accessing the spent fuel and the interior components of some storage systems, inspection, monitoring, and remediation may involve opening the storage system. Opening a storage system would not only be labor intensive, but more importantly, would expose workers to additional dose and, particularly for welded canisters, may require breaching and reestablishing the confinement boundary with no additional safety benefit. Additionally, it is not current practice to open the storage system to verify fuel condition.

Consistent with the staff's ongoing work conducting a review of the regulatory framework for spent fuel storage and transportation (see COMSECY-10-0007, Ref. 16), the staff began exploring alternatives to the guidance on the application of ready retrieval. The staff's review has centered on redefining the first part of the guidance on ready retrieval (i.e., the ability of the fuel assemblies to be removed from a canister or cask by normal means), but maintaining the second part (i.e., the ability of the canister or cask to be removed from the storage location). By redefining the first part of the guidance (i.e., the ability to remove the individual spent fuel assemblies or canned assemblies by normal means) and providing alternatives, the spent fuel would still be retrieved safely and be readied for transportation consistent with the law and regulations. This way, the spent fuel dry storage confinement continues to be maintained without the potential negative impacts associated with opening the storage system.

In an effort to engage stakeholders in this discussion, staff held two public meetings on July 27, 2011, and August 16, 2012, to solicit stakeholder feedback on these topics (Ref. 17 and 18). Additionally, in January 2013, NRC issued a *Federal Register* notice (Ref. 19) requesting public comment on several topics, including retrievability. The NRC received 18 sets of comments on the *Federal Register* notice (Ref. 20). Staff work in this area had been delayed until recently due to higher priority work, such as work on the storage renewal regulatory framework and high burnup fuel related activities. Therefore, the staff held a public meeting on July 29, 2015, to provide an update on the staff's work on this issue (Ref. 21).

In addition to the public dialogue, the staff has also considered how dry storage of spent nuclear fuel is implemented in other countries, and international guidance for spent fuel storage. Staff has participated in several multilateral working groups related to extended spent fuel storage. Staff reviewed the International Atomic Energy Agency's Specific Safety Guide No. SSG-15, "Storage of Spent Nuclear Fuel" (Ref. 22). This guide is consistent with the current position of retrievability and will remain consistent with planned changes.

This updated guidance, draft ISG-2, Rev. 2, presents a the practical approach for implementation of fuel retrievability that will continue to protect public health and safety while reducing the negative impacts associated with the approach established in ISG-2, Rev.1.

References:

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