

NRC's Regulatory Readiness for Oversight of Large-Scale Commercial
Transportation of Spent Nuclear Fuel

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Acronyms

Acronym	Full Term
10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Documents Access and Management System
CISF	consolidated interim storage facility
CoC	Certificate of Compliance
CFR	<i>Code of Federal Regulations</i>
CTE	Changes, Tests, and Experiments
DHS	U.S. Department of Homeland Security
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DSS	dry storage system
EIS	environmental impact statement
HLW	high-level waste (radioactive)
IMC	Inspection Manual Chapter
IP	inspection procedure
ISFSI	independent spent fuel storage installation
ISG	interim staff guidance
MOU	memoranda of understanding
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
NRF	National Response Framework
NRIA	Nuclear/Radiological Incident Annex
NWPA	Nuclear Waste Policy Act of 1982
RG	regulatory guide
SNF	spent nuclear fuel
SSNM	strategic special nuclear material spent nuclear fuel
U.S.	United States
WG	working group

I. Introduction

Spent nuclear fuel (SNF) from commercial nuclear power plants is currently stored at 75 locations in the United States, primarily at operating or decommissioned plant sites. The fuel is stored in spent fuel pools and in dry storage systems (DSSs) in casks. More than one third of the U.S. inventory of commercial SNF is now in dry storage in approximately 3,300 casks at independent spent fuel storage installations (ISFSIs). Applications to construct and operate consolidated interim storage facilities (CISFs) in Andrews County, Texas and Lea County, New Mexico have been submitted by Interim Storage Partners, LLC (ISP) and Holtec International (Holtec), respectively. The NRC issued a license to ISP in September 2021 (Volume 86 of the *Federal Register*, page 51926 (86 FR 51926)). A licensing decision on the Holtec application remains pending.¹ The construction and operation of one or both of these new CISFs could lead to large-scale commercial transportation of SNF from the existing ISFSIs.

The United States has previously evaluated large-scale transportation of SNF in the context of shipments to a geologic repository for SNF and high-level radioactive waste. Under the Nuclear Waste Policy Act of 1982, as amended (NWPA), the U.S. Department of Energy (DOE) is responsible for the construction and operation of a geologic repository, including transportation of commercial SNF to a repository. Under its NWPA authority, DOE performed multiple studies in support of a transportation campaign, including an assessment of environmental impacts. DOE also established the National Transportation Stakeholders Forum, which includes four State regional groups and one Tribal advisory group, to share information and coordinate efforts on transportation. Although DOE is not currently developing a geologic repository, the U.S. national policy for disposition of SNF remains disposal in a permanent geologic repository, and DOE continues to support these transportation groups and to perform other technical work on SNF transportation. The NRC also continues to be engaged with these stakeholder groups and actively participates in their periodic meetings.

Earlier evaluations of SNF transportation include a 2006 report by the National Research Council of the National Academies, titled “Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States,” which considered SNF transportation by DOE under the NWPA. While the report was primarily focused on DOE’s program for transporting SNF to a geologic repository, the report also considered the shipment of SNF to a private interim storage facility. The report concluded that there are no fundamental technical barriers to the safe transport of SNF, and that the transport of SNF is a low-radiological-risk activity with manageable safety, health, and environmental consequences when conducted with strict adherence to existing regulations.

In anticipation of a possible national campaign for commercial transportation of SNF to one or more CISFs, the NRC conducted an in-depth holistic review of its regulatory programs and its readiness to perform its oversight role in the transportation campaign. The assessment

¹ Additional information on the ISP and Holtec CISF applications is available on the NRC public website at <https://www.nrc.gov/waste/spent-fuel-storage/cis.html>. The ISP final safety evaluation report that documents the NRC’s safety and security reviews is available (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21188A101); as is the final environmental impact statement (EIS) (ADAMS Accession No. ML21209A955). A draft EIS for the proposed Holtec CISF is also available (Accession No. ML20069G420).

reviewed the regulatory framework of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71, “Packaging and transportation of radioactive material,” 10 CFR Part 72, “Licensing requirements for the independent storage of spent nuclear fuel, high-level radioactive waste, and reactor-related greater than Class C waste,” and 10 CFR Part 73, “Physical protection of plants and materials,” as well as guidance and procedures for licensing, inspection, and other regulatory functions, including communication and outreach. The assessment aimed to verify agency readiness and to identify and recommend potential enhancements to further ensure a transparent, robust, and efficient regulatory framework for commercial transportation of SNF.

A transportation readiness working group (WG), with staff from the NRC Office of Nuclear Material Safety and Safeguards, Office of Nuclear Security and Incident Response, and Office of the General Counsel, was assembled to review:

- the adequacy of existing regulations, guidance, and procedures related to the safety and security of SNF transportation
- specific information needs for NRC actions, and the availability of information on current and projected SNF inventories and transportation routes
- the oversight role of the NRC; the respective roles of other Federal agencies, States, and Indian Tribes (Tribes); and industry responsibilities in the transportation campaign
- coordination, communication, and outreach to NRC Federal partners, States, Tribes, and the public

This report documents the results of the above assessments, including WG conclusions and recommendations. Appendix A provides descriptions of the individual assessments; Appendix B discusses the roles and responsibilities of the Federal agencies, States, and Tribes in the regulatory oversight of SNF transportation; and Appendix C gives information about selected studies and reports pertaining to SNF transport.

II. Assessment Areas

The WG review covered the following 19 assessment areas:

- (1) regulations and guidance for packaging and transportation
- (2) regulations and guidance for storage
- (3) 10 CFR 72.48, “Changes, tests, and experiments” (CTEs)
- (4) regulations and guidance for security
- (5) loading of SNF for storage and transportation
- (6) safety and risk evaluations
- (7) environmental reviews
- (8) prior regulatory assessments
- (9) prior experience in large-scale SNF transport

- (10) DOE-transported versus commercially transported spent nuclear fuel
- (11) communication and outreach planning
- (12) specific information needs
- (13) current state of SNF to be shipped
- (14) interagency agreements for oversight of SNF transportation
- (15) status of transport fleet
- (16) route approval process
- (17) safety oversight before and during transport
- (18) security oversight before and during transport
- (19) provisions for inspections upon receipt of SNF packages

Both CISFs license applications propose shipping SNF nationally by rail. The WG focused primarily on shipments by rail but also considered other transportation modes.² Detailed discussions of the individual assessment areas are provided in Appendix A.

III. Overview of the Assessment Results

Overall, the NRC has a comprehensive and established regulatory framework for the transportation of SNF that provides reasonable assurance of adequate protection of public health and safety and the environment and promotes the common defense and security. Over the years, the NRC has continued to assess and improve its regulations and regulatory oversight to ensure the continued safe and secure transportation of radioactive material, including SNF, to harmonize with changes in international standards and to reflect the results of technical studies and reports on the safety and security of radioactive material.

The WG determined the NRC regulatory framework aligns well with those of other Federal agencies with responsibilities for SNF transportation, primarily the U.S. Department of Transportation (DOT) and the U.S. Department of Homeland Security (DHS). While DOE does not have a primary role in the commercial transportation of SNF to a private facility, its research and development activities concerning SNF transport could benefit preparedness for commercial transportation of SNF. The NRC has a well-established and strong working relationship with these Federal agencies.

Based on the assessment results the WG:

- verified that the existing regulations and regulatory framework for SNF transportation are adequate for protection of public health and safety and the environment, and the security of commercial shipments of SNF.

² For the purposes of this assessment, the WG assumed that the potential shipments would involve SNF in existing transportable storage systems, and SNF assemblies would not be repackaged for shipment (i.e., there would be no additional handling of SNF already in dry storage other than to reconfigure it for transportation).

- described the roles and responsibilities of the different agencies and developed a roadmap for oversight of SNF transportation.
- identified and recommended specific enhancements to increase the efficiency of the regulatory oversight of large-scale SNF transportation by the NRC.
- identified areas that may require future direction from the Commission.
- identified information needs to support NRC's oversight of the transportation campaign.

Verified Readiness

The WG verified NRC readiness and did not identify any need for enhancements in the topical areas 1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, and 16, as listed in Section II of this report. In the other areas (4, 11, 17, 18, and 19), the WG recommended enhancements or other potentially useful improvements, as discussed in Sections IV, V, and VI.

Roles and Responsibilities

The WG compiled information and verified the roles and responsibilities for regulatory oversight by the NRC and other Federal agencies as well as the supporting activities along the transportation routes by the States and Tribes (Appendix B). In addition, the WG developed an oversight roadmap provided in Section VII.

Recommended Enhancements

The WG recommended six specific enhancements and other improvements to increase the efficiency and effectiveness of the NRC's regulatory oversight of SNF transportation (Section IV). The enhancements are related to the inspection guidance and procedures, as well as external communication and outreach.

Areas Potentially Requiring Commission Direction

The WG identified three areas that may require future direction from the Commission (Section V). None of these require immediate Commission action and staff will prioritize and schedule any future Commission papers accordingly: (i) Tribal interest in having increased interaction and engagement with NRC; (ii) considerations for the limited amount of stored SNF that has decreased total external radiation levels below the exemption value in 10 CFR 73.6(b); and (iii) review and possible update of the 1984 NRC policy statement about its role in responding to accidents and incidents related to the transportation of nuclear materials.

Information Needs

The WG identified potentially useful information that could help the NRC in its implementation of an effective oversight program (Section VI).

IV. Recommended Enhancements

Through its assessments, the WG identified and recommends six specific enhancements, which fall into three areas: security (including security inspection guidance and procedures), safety (including safety inspection guidance and procedures), and communication and outreach activities. The enhancements are as follows:

- Enhancement 1: Create new or enhance existing safety inspection procedures (IPs)
- Enhancement 2: Create new or enhance existing security IPs

- Enhancement 3: Develop guidance for scheduling inspections
- Enhancement 4: Enhance the qualification and training requirements for inspectors
- Enhancement 5: Develop new or enhance existing Inspection Manual Chapters (IMCs)
- Enhancement 6: Develop a communication strategy and outreach plan

The WG determined that implementing these enhancements would improve the NRC's efficiency and effectiveness in carrying out its oversight responsibilities in the national SNF transportation campaign.

Following are summaries and descriptions of the individual enhancements. The WG recommends that the above enhancements be completed before a transportation campaign begins.

Enhancement 1: Create new or enhance existing safety inspection procedures

The NRC verifies licensees' compliance with safety regulations through its inspection program, implemented through IPs. Currently, no single IP addresses the safety oversight of SNF packages being prepared for shipment; rather, various IPs contain guidance for the oversight of transportation of nuclear materials in general. These IPs are not specifically written for SNF transportation package oversight but can be applied for that purpose. The WG evaluated all applicable IPs against several inspection focus areas, including facility modifications and evaluations, package changes, package contents, package loading, shipment preparation and records, intermodal transfer, management controls, and receipt inspection. The WG determined procedure adequacy for each focus area qualitatively. The WG determined that additional guidance specifically for shipments of SNF (as opposed to the guidance on general nuclear materials in the current IPs) would facilitate oversight. Additionally, because the requirements and guidance for a complete inspection are segmented across various IPs, the existing IPs for the safety inspection of SNF shipments being prepared for transportation at an originating location and for receipt at a destination facility are not optimal for efficient use in a large-scale shipping campaign. As such, the staff should develop new IPs, or enhance existing IPs, to do the following:

- Combine aspects of IP 60854, "Preoperational Testing of an Independent Spent Fuel Storage Installation," and IP 60855, "Operation of an Independent Spent Fuel Storage Installation," but modify the transportation guidance in the focus areas of facility modification, package changes, package contents, and package loading.
- Combine guidance in IP 71124.08, "Radioactive Solid Waste Processing and Radioactive Material Handling, Storage, and Transportation," and IP 86740, "Inspection of Transportation Activities," for shipment preparation and management controls.
- Provide new guidance for intermodal transfer.
- Provide guidance for receipt inspections (alternatively, this guidance should appear within the IP for a CISF).
- Define an adequate level of effort (number of hours) for onsite inspection.

The WG recommends the creation of new IPs, or enhancement of existing IPs, as needed, for more effective and consistent safety inspections of SNF shipments, both at the point of origin and at the destination of each shipment.

Enhancement 2: Create new or enhance existing security inspection procedures

As previously noted, SNF is currently stored at both operating and decommissioned plant sites. Guidance for security inspections of these two types of sites is in different IPs and different IMCs. None of the existing IMCs provides a holistic IP for SNF transportation security. The WG recommends reviewing and aligning the applicable IMCs, either by creating new or updating the existing IPs, to ensure a uniform approach to these inspections. The updated inspection guidance should also reflect any changes necessary following the evaluation of requirements for transportation of packages with older SNF content that do not meet the exemption criterion in 10 CFR 73.6(b) and do not fall within the scope of 10 CFR 73.37 (discussed further in Section V).

Because the existing transportation security inspection guidance and procedures are not optimal for efficient use in a large-scale shipping campaign, the NRC staff should do the following:

- Combine or enhance the following transportation security IPs (which are not publicly available):
 - IP 81310, “Physical Protection of Shipments of Irradiated Fuel”
 - IP 81810, “Protection of Safeguards Information”
 - IP 81402, “Reports of Safeguards Events”
- Develop a checklist for inspectors to coordinate safety and security inspections of SNF shipments.

The WG recommends updating the above IPs, as needed, to improve coordination within the SNF transportation security inspection program.

Enhancement 3: Develop guidance for frequency and scheduling of inspections

IPs for the transportation of nuclear materials are currently performed with varying frequencies dependent upon facility type. As noted in Enhancement 1, current safety IPs are structured generically for all nuclear material transportation, not specifically for SNF transportation. For example, IMC 2202, “Security Inspection Program for Decommissioning Nuclear Power Reactors,” states that security inspections are performed on an “as needed” basis, which is not optimal for a large-scale shipping campaign. Because existing guidance on the frequency of safety and security inspections for the transportation of SNF was not intended for a large-scale shipping campaign, the WG recommends that the NRC staff develop inspection frequencies for such transportation.

The WG reviewed the ISFSI inspection program to determine whether its approach to determining the timing and frequency of ISFSI inspections could be adopted for SNF transportation inspections. The WG determined that this model would provide the necessary balance of consistency and flexibility for SNF transportation inspection frequency. The WG recommends that SNF transportation inspections be performed at sites that are actively performing transportation activities. An initial inspection should set the baseline for future inspections. A routine inspection frequency should be established, with flexibility for modifying the frequency based upon the frequency of shipments made by the licensee, operational experience, and relevant risk information. Criteria should be established for conducting reactive

inspections following indications of possible degraded performance or transportation events.

The WG recognizes that shipping schedules remain highly uncertain. SNF could be transported in a single campaign or transported infrequently. The WG determined that some flexibility in inspection frequency would be beneficial; however, regardless of the facility type, inspections should be performed with a consistent frequency.

The WG recommends development of guidance to support an integrated, risk-informed schedule for safety and security inspections of SNF shipment activities.

Enhancement 4: Enhance qualification and training requirements for inspectors

The previously noted enhancements to inspection documents will require new or refresher training for inspectors. The staff should revise the following IMC guidance documents to incorporate additional training requirements on the revised IPs:

- IMC 1246, Appendix B3, “Training Requirements and Qualification Journal for Independent Spent Fuel Storage Installation Inspector”
- IMC 1248, Appendix F, “Training Requirements and Qualification Journal for Decommissioning Inspectors”
- IMC 1245, Appendix C3, “Health Physics Inspector Technical Proficiency Training and Qualification Journal”

These revisions can guide supplemental training for staff performing SNF transportation safety inspections.

The WG evaluated the existing manuals that provide inspector qualification guidance against the safety inspection focus areas discussed above in Enhancement 1. The WG determined the adequacy of the qualification manuals for each focus area qualitatively. The WG concluded that no single qualification manual on its own provides complete training for safety oversight of SNF transportation activities. However, the qualification manuals IMC 1246, Appendix B3; IMC 1248, Appendix F; and IMC 1245, Appendix C3, are adequate, with only minor enhancement or supplemental training needed to address any changes from those recommended in Enhancement 1. Similarly, the WG recommends the staff review and update the qualification documents for transportation security guidance as needed to reflect changes in the security inspection procedures for transportation of SNF as recommended in Enhancement 2.

The WG recommends enhancing the qualification and training requirements for inspectors performing SNF transportation safety and security inspections.

Enhancement 5: Develop new or enhance existing Inspection Manual Chapters

This enhancement calls for revising existing IMCs or developing new IMCs for safety and security inspection programs to incorporate the IP revisions in Enhancements 1–4.

IMC 0040, “Preparing, Revising, and Issuing Documents for the NRC Inspection Manual,” defines an IMC as a document containing written administrative or inspection program statements of policy. IMCs state the purpose, objectives, definitions, responsibilities, authorities, and basic requirements for inspection programs. An IMC for an inspection program

defines the program through a list of IPs, which is normally appended to the IMC. Some IPs, for example security IPs, may be non-public and thus not appended to the IMC.

The NRC staff will perform inspections of licensees' facilities before SNF shipment, consistent with the inspection guidance in:

- IMC 2515, "Light-Water Reactor Inspection Program—Operations Phase"
- IMC 2561, "Decommissioning Power Reactor Inspection Program"
- IMC 2690, "Inspection Program for Storage of Spent Reactor Fuel and Reactor-Related Greater-than-Class-C Waste at Independent Spent Fuel Storage Installations and for 10 CFR Part 71 Transportation Packagings"
- IMC 2201, "Security Inspection Program for Operating Commercial Nuclear Power Reactors"
- IMC 2202, "Security Inspection Program for Decommissioning Nuclear Power Reactors"
- IMC 2681, "Physical Protection and Transport of Special Nuclear Material and Irradiated Fuel Inspections of Fuel Facilities"

As stated in other sections of this report, the WG recommends enhancements for (1) safety and security IPs (Enhancements 1 and 2), (2) inspection frequencies (Enhancement 3), and (3) inspector qualifications (Enhancement 4).

The WG recommends updating the above IMCs or creating a new IMC so that the revised IPs reflect recommended Enhancements 1–4.

Enhancement 6: Develop a communication strategy and outreach plan

The commercial transportation of SNF is a highly visible activity of great interest to NRC partners and stakeholders. Partners and stakeholders include Congress, Federal agencies, potentially affected States and Tribes, NRC licensees, and the public. Partners and stakeholders seek assurance that there is adequate government oversight to ensure public health and safety, security, and environmental protection throughout the transportation campaign. Since 1977, the NRC has completed numerous studies of potential hazards, accident conditions, and the robustness of SNF transportation packages. These studies, provided in Appendix C, continue to demonstrate that the risk of radiation exposure or radiological release during transportation is very low, which is confirmed by the strong safety record of SNF transportation in the United States and elsewhere. Nonetheless, much public concern remains about SNF transportation.

Although the responsibility for safe and secure transportation of SNF ultimately resides with NRC licensees, the NRC and other Federal agencies, States, and Tribes also have roles and responsibilities related to SNF transport. To increase transparency and better communicate with NRC partners and stakeholders, the WG recommends increased communications and outreach concerning SNF transport. A communication and outreach plan would build on existing interagency agreements and memoranda of understanding (MOUs) and take advantage of existing communication venues and forums. Outreach should use available communication tools, including the NRC website, social media, and virtual interactions, as well as traditional meetings and presentations.

The WG recommends development of an integrated communications strategy and outreach plan to cover all aspects of commercial transportation of SNF, including the roles and responsibilities of the NRC and other agencies, the safety record of previous shipments, technical studies on transportation hazards and risks, and responses to public questions.

V. Areas Potentially Requiring Commission Direction

The WG identified three areas that may require future Commission direction. These are: Tribal concerns, transportation of packages with older SNF content, and the NRC's 1984 policy statement related to the transportation of radioactive materials, including SNF.

Tribal Interest in Having Increased Interaction and Engagement with NRC on SNF Transportation

Tribes along transportation routes will be involved as necessary and appropriate to support transportation oversight activities at the local level. Tribal involvement may range from awareness of shipment schedules to providing local first-response support in the event of accidents or other off-normal conditions during transport. Commercial shipments of SNF to a CISF are not subject to the same conditions for Tribal engagement as those directed by the NWPA for DOE shipments to a geologic repository.

The NRC's regulations require that NRC licensees provide advance notification to States prior to the shipment of SNF through or across the boundary of any State (10 CFR 73.37 and 10 CFR 71.97). Federally recognized Tribes may opt in to receive advance notification prior to the shipment of SNF within or across the reservation boundary, similar to the advance notification provided to the States by licensees. In accordance with the NRC's Tribal Policy Statement (82 FR 2402; January 9, 2017), the NRC will consult with Tribal governments on the transportation of SNF. As part of ongoing outreach and communications, the NRC is exploring other methods to enhance coordination with Tribes. The staff may request Commission action to update the existing regulations, if needed, sometime in the future.

Transportation of Packages with Older Spent Nuclear Fuel Content

The WG identified a need to further evaluate the potential for, and consequences of, certain packages with older SNF content that may not meet the exemption criterion in 10 CFR 73.6(b). 10 CFR 73.6(b) provides an exemption from certain physical security requirements for "[s]pecial nuclear material which is not readily separable from other radioactive material and which has a total external radiation level in excess of 1 Gray (100 Rad) per hour at a distance of 1 meter (3.3 feet) from any accessible surface without intervening shielding."

As SNF ages, its emitted radiation decreases as shorter-lived fission products decay. Transportation packages with older SNF content that do not meet the total external radiation level specified in the above provision could be subject to the security transportation requirements for Category I strategic special nuclear material (SSNM) found in 10 CFR 73.20, "General performance objective and requirements," and 10 CFR 73.25–73.27, rather than those for higher activity irradiated fuel as provided in 10 CFR 73.37, "Requirements for physical protection of irradiated reactor fuel in transit."

Based on currently available information, the WG estimates that fewer than 10 percent of the existing loaded storage casks may not meet the total external radiation level provision in 10 CFR 73.6(b) when configured for transportation, and that percentage will remain low for many years because of the estimated low rate of fuel decay. The security requirements for

transportation packages that fall into this category will need further evaluation before they can be transported.

Depending on the outcome of those evaluations, the NRC has several regulatory tools for resolving this situation, including revision of guidance, case-specific exemptions, case-specific orders, or rulemaking. The agency will choose the appropriate resolution to provide reasonable assurance of adequate protection of all shipments of SNF. Since most existing storage casks are well within the radiation levels in 10 CFR 73.6(b), resolution of this issue should not affect near-term SNF transportation planning.

Based on the above, the WG determined there is a need for continued evaluation to resolve issues related to security requirements for certain packages with older SNF content that may not meet the exemption criterion in 10 CFR 73.6(b) and do not fall within the scope of 10 CFR 73.37. Furthermore, the WG recommends that following the resolution of issues related to security requirements for packages with older SNF, staff review and update NUREG-0561, Revision 2, "Physical Protection of Shipments of Irradiated Reactor Fuel," as necessary.

Updating the 1984 NRC Policy Statement Related to Radioactive Material Transport

The NRC issued a policy statement on transportation in the *Federal Register*, "NRC Response to Accidents Occurring During the Transportation of Radioactive Material," on March 29, 1984 (49 FR 12335). Since then, the United States has created the National Response Framework (NRF), which includes the Nuclear/Radiological Incident Annex (NRIA). The NRF provides foundational emergency management doctrine for the Nation's responses to all types of incidents. The NRIA describes the policies, situations, operational concepts and responsibilities of the Federal departments and agencies, including the NRC, governing the immediate response and short-term recovery activities for incidents involving release of radioactive material.

Based on the above, the WG determined there is a need to consider an update to the transportation policy statement to acknowledge these changes in Federal policy.

VI. Information Needs

The WG identified the following information that may be necessary to support oversight of SNF transportation:

- national transportation campaign contacts
- schedules for shipments from existing storage locations to the CISFs if they are licensed and constructed
- estimates of the number of 10 CFR 72.48 CTEs performed on dual-purpose storage and transportation casks by licensees and Certificate of Compliance (CoC) holders, particularly CTEs that would require NRC approval under 10 CFR 71.107 (see assessment 3 in Appendix A).
- CoC holders' certificate renewal and amendment requests under Part 71
- CoC holders' revision submittal schedules
- specific SNF assemblies currently loaded in individual casks

- “Used Nuclear Fuel—Storage, Transportation and Disposal Analysis Resource and Data System (UNF-ST&DARDS)” unified database from DOE
- U.S. Coast Guard security policies for a nationwide SNF transportation campaign, if any shipments are expected to include maritime transport under Coast Guard jurisdiction

VII. Oversight Roadmap

This section provides a roadmap developed by the WG that describes:

- oversight roles and responsibilities of the NRC and the other Federal agencies;
- involvement by the States, Tribes, and local communities along transportation routes;
- advance preparations for the transportation campaign oversight; and
- inspection and other regulatory oversight activities at the point of origin, during transport, and at the new destination storage facility.

Roles and Responsibilities

Oversight of SNF transportation between storage sites involves coordination among multiple Federal agencies, principally the NRC, DOT, and DHS. In addition to the Federal agencies, States, Tribes, and local communities are also involved along SNF transportation routes. Appendix B provides more detail on the roles and responsibilities of Federal agencies and involvement by States and Tribes along transportation routes. The WG reviewed and verified the roles of those involved and the existing interagency agreements and memoranda of understanding (MOU) that lay out the roles, responsibilities, and coordination necessary among Federal agencies for SNF transport.

Specifically, the WG reviewed the 1979 MOU with DOT (44 FR 38690; July 2, 1979), and the 2015 MOU with DHS and DOT (ADAMS Accession No. ML15057A336). The WG also reviewed two DHS (FEMA) documents described in Section V of this report, including the NRF (<https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response>) and the NRIA (https://www.fema.gov/sites/default/files/2020-07/fema_incident-annex_nuclear-radiological.pdf). The WG determined that coordination between Federal and non-Federal partners is critical for success.

The following is an overview of the oversight roles and responsibilities of the NRC and other agencies:

In addition to establishing and maintaining the regulations for transportation packages and transportation security, the NRC’s principal responsibilities for transportation of SNF fall into four areas:

- (1) certification and inspection of transportation packages under 10 CFR Part 71;
- (2) oversight of activities at licensee sites in preparing and receiving shipments under 10 CFR Part 50, “Domestic licensing of production and utilization facilities,” 10 CFR Part 52, “Licenses, certifications, and approvals for nuclear power plants,” and 10 CFR Part 72;
- (3) review and approval of routes for shipments under 10 CFR Part 73; and
- (4) coordination with other Federal agencies, and communications with other Federal partners, States, Tribes, the public, and other stakeholders.

DOT is responsible for transportation regulations and for oversight of SNF shipments while in transit, as part of its overall program for transport of hazardous materials. DHS is broadly responsible for security and event response functions related to SNF transportation.

In 2020, the DHS, in collaboration with the NRC, established a working group for transportation security for commercial transportation of SNF. This DHS working group operates under the Nuclear Sector Government Coordinating Council and the DHS Critical Infrastructure Partnership Advisory Council. This DHS working group provides a forum for members of the Nuclear Sector Government Coordinating Council to share information about the commercial transportation of SNF. The WG noted that a national transportation campaign for transportation of SNF presents opportunities to enhance coordination and communication among Federal agencies. Several mechanisms exist to facilitate coordination, including the National Response Center and other response frameworks within DHS and the Federal Emergency Management Agency.

Involvement by States and Tribes

States and Tribes along transportation routes will be involved as necessary and appropriate to support transportation oversight activities at the local level. This involvement ranges from awareness of shipment schedules to providing local first response support in the event of incidents or other off-normal conditions along the transportation routes.

As noted elsewhere in this report (Appendix B), NRC licensees and shippers are required to notify States as well as Tribes that have elected to receive such notifications in advance of SNF shipments across their jurisdictions.

Advance Preparations

To ensure readiness and improved efficiency, the following preparations should be completed before the projected start date for any shipments:

- Complete revisions of IPs, IMCs, and guidance as recommended.
- Ensure that inspectors are trained and qualified on the updated procedures and guidance.
- Prepare an integrated communications strategy and outreach plan for communication with Federal agencies, States, Tribes, licensees, and the public.
- Compile for easy access available information that will facilitate oversight of SNF transportation, including contact information for other agencies, loading information for casks in storage, and current certificates and amendments for DSSs and transportation packages.
- Obtain shipping schedules and routes from licensees when available.
- Ensure that licensees are aware of the requirements for advance notification and use of pre-approved routes for shipments.
- With DHS and DOT, coordinate with State, Tribal, and local authorities along approved routes on the roles and responsibilities for any incidents or off-normal conditions during transportation.

- Implement the outreach plan to inform the public and affirm relationships with partners.
- Allocate and budget suitable resources for the above preparations.

Inspection and Other Regulatory Oversight Activities

The following is a discussion of oversight activities to be performed prior to shipments, along the transportation route, and at the destination site.

Oversight Activities Prior to Shipments

- The NRC inspects operations at the point of origin that move SNF from the storage configuration to the transportation configuration. NRC inspections also confirm that the transportation package and package content specifications meet the safety and security requirements for shipment.
- The NRC ensures that required advance notifications of shipments are issued.
- The NRC supports DOT oversight through the review and approval of the planned transportation routes.

Oversight Activities during Transport (along the transportation route)

- During transportation, DOT has the primary responsibility for oversight of shipments by rail and road, through its Federal Railroad Administration, Federal Motor Carrier Safety Administration, and Pipeline and Hazardous Material Safety Administration. DHS, through the U.S. Coast Guard, is responsible for maritime safety requirements for vessels and port facilities.
- The NRC has oversight of security during transport in accordance with 10 CFR Part 73.
- DOT and DHS, as appropriate, are responsible for coordinating responses to accidents or other off-normal conditions during transportation with State, Tribal, and local authorities. In most cases, State, Tribal, or local agencies are the first to respond to a transportation accident or other event and then notify the appropriate Federal agency.

Oversight Activities at the Destination Storage Site (new CISF)

NRC inspections confirm that the licensee is following its procedures to verify the condition of the shipment, and that the received material can be placed in storage. NRC inspections also oversee the operations that place the material into the new storage configuration.

VIII. Summary of Conclusions and Recommendations

Conclusions

The WG's assessment led to the following conclusions:

- The NRC's established regulatory framework is comprehensive and meets the agency mission of providing reasonable assurance of adequate protection of public health and safety and the environment and promoting the common defense and security as it relates to the transportation of SNF.

- The NRC's regulatory framework aligns well with those Federal agencies with responsibilities for SNF transportation, primarily DOT and DHS.
- The WG has not identified any rulemaking needed at this time but recommends enhancements to guidance and inspection documents as discussed. The staff will follow established NRC processes for any longer-term issues identified during implementation of the recommendations that may require rulemaking or other Commission attention.
- The Federal agencies have well-established and strong working relationships for oversight of transportation of radioactive material, including SNF. NRC has formal agreements (MOUs) with both the DOT and DHS.
- The NRC and the other Federal agencies continue to participate in stakeholder groups to promote transparency and share information in support of safe and secure transportation of radioactive material, including SNF.
- DOE continues to perform research and development activities in the area of SNF transport, which can help inform oversight of SNF transportation.
- The historical record shows that radioactive material, including SNF, has been transported worldwide safely and securely and at very low risk to public health and the environment, and that it can be transported safely and securely in the future.
- The NRC has continued to assess and improve its regulations and regulatory oversight to ensure the continued safe and secure transportation of radioactive material, including SNF, to harmonize with changes in international standards and to reflect the results of technical studies and reports on the safety and security of radioactive material.

Consolidated WG Recommendations

- Evaluate and develop a path for resolution of issues related to the security requirements for certain packages with older SNF content that may not meet the exemption criterion in 10 CFR 73.6(b) and fall outside the scope of 10 CFR 73.37. Update NUREG-0561, Revision 2, as necessary, to reflect the resolution of these issues.
- Develop and implement a comprehensive communication plan to share information with the public and promote coordination among Federal agencies, States, Tribes, and other partners.
- Create new IPs or update the existing IPs for more effective and consistent safety and security inspections of SNF shipments.
- Update IMCs (IMC 2515, IMC 2201, IMC 2202, IMC 2561, IMC 2681, and IMC 2690) or create a new IMC specifically for the revised IPs, to enhance safety and security inspections and reflect the recommendations of this report.
- Develop or update guidance to support an integrated, risk-informed schedule for safety and security inspections of SNF shipment activities.
- Update the qualification and training requirements for performing inspections of SNF transportation activities, considering the recommended enhancements in this report.

- Compile available information that will facilitate oversight of transportation, such as loading information for storage casks, certificate information for storage and transportation systems, and proposed shipping routes and schedules.
- Consider requesting that the Commission update the policy statement on transportation, which was issued in 1984, to include mention of the NRIA and the NRF.

Appendix A: Assessment Areas

The working group (WG) conducted a holistic review of the U.S. Nuclear Regulatory Commission (NRC) regulatory programs and the NRC's readiness to perform its oversight role in spent nuclear fuel (SNF) transportation. The review covered the following 19 assessment areas:

- (1) regulations and guidance for packaging and transportation
- (2) regulations and guidance for storage
- (3) 10 CFR 72.48, "Changes, tests, and experiments" (CTEs)
- (4) regulations and guidance for security
- (5) loading of SNF for storage and transportation
- (6) safety and risk evaluations
- (7) environmental reviews
- (8) prior regulatory assessments
- (9) prior experience in large-scale SNF transport
- (10) DOE-transported versus commercially transported SNF
- (11) communication and outreach planning
- (12) specific information needs
- (13) current state of SNF to be shipped
- (14) interagency agreements for oversight of SNF transportation
- (15) status of transport fleet
- (16) route approval process
- (17) safety oversight before and during transport
- (18) security oversight before and during transport
- (19) provisions for inspections upon receipt of SNF packages

This appendix gives brief descriptions of the scope, focus, and results of each assessment area.

(1) Regulations and Guidance for Packaging and Transportation

This assessment area focused on the NRC's existing regulations and guidance on the safety of SNF transportation in the United States, as well as the implementation experience of the regulations to date.

The assessment area covered the following regulations and guidance documents:

- 10 CFR Part 71, “Packaging and transportation of radioactive material”
- NUREG-1617, “Standard Review Plan for Transportation Packages for Spent Nuclear Fuel,” issued March 2000
- NUREG-2215, “Standard Review Plan for Spent Fuel DSSs and Facilities,” issued April 2020
- NUREG-2216, “Standard Review Plan for Transportation Packages for Spent Fuel and Radioactive Material: Final Report,” issued August 2020

When packaging and transporting radioactive material, licensees must follow the transportation regulations of both the U.S. Department of Transportation (DOT) in Title 49 of the *Code of Federal Regulations* (49 CFR) and the NRC in Title 10 of the CFR. Collectively, these regulations support the safe packaging and transportation of radioactive material, from the smallest quantities (e.g., laboratory samples) to the largest quantities (e.g., fissile material and Type B quantities of radioactive material, including SNF; see 10 CFR 71.4 for Type A and Type B package definitions). Through the NRC/DOT memorandum of understanding (MOU) (44 FR 38690; July 2, 1979), the two agencies co-regulate packaging and transportation of radioactive material. DOT is the lead agency for regulating the packaging and transport of nine classes of hazardous material, including Class 7 material (radioactive material in Type A quantities or less, low specific activity material, and surface-contaminated objects). The NRC is the lead agency for regulating the packaging and transportation of fissile material and quantities of licensed material in excess of a Type A quantity.

The regulations in 10 CFR Part 71 establish the requirements for packaging, preparation for shipment, and transportation of licensed material. These regulations apply to any licensee authorized to receive, possess, use, or transfer licensed material, and to any licensee that delivers licensed material to a carrier for transport, or transports licensed material outside the site of usage or on public highways. Additionally, 10 CFR Part 71 establishes the procedures and standards for NRC approval of packaging and shipping procedures for fissile material and for quantities of licensed material in excess of a Type A quantity (i.e., a Type B quantity). Use of the NRC-approved packages must be in accordance with 10 CFR 71.17 (“General license: NRC-approved package”). Packages currently approved for transportation of Type B quantities of radioactive material are listed at <https://rampac.energy.gov>.

Over the years, the NRC has also issued guidance (e.g., regulatory guides (RGs) and interim staff guidance (ISGs)) to assist applicants, licensees, and staff reviewing packaging applications. Many of these RGs and ISGs were incorporated into NUREG-2216.

This assessment did not identify any specific enhancements to the existing regulatory framework or practice for SNF transportation as being necessary at present. The WG concluded that the NRC’s existing regulations and guidance are sufficient to provide adequate protection of public health and safety and the environment during transportation of SNF. Many years of oversight and safe transport have demonstrated the effectiveness of the NRC’s regulations and guidance. Not a single fatality has occurred in the United States to date due to radiation exposure as a result of transporting radioactive material in an NRC-approved package.

(2) Regulations and Guidance for Storage

This assessment area focused on the NRC's existing regulations and guidance on the safety of SNF storage in the United States, as well as the implementation experience of the regulations to date.

The regulations in 10 CFR Part 72, "Licensing requirements for the independent storage of spent nuclear fuel, high-level radioactive waste, and reactor-related greater than Class C waste," establish requirements, procedures, and criteria for the issuance of licenses to receive, transfer, and possess power reactor spent fuel, power reactor greater than Class C waste, and other radioactive material associated with spent fuel storage at an independent spent fuel storage installation (ISFSI), as well as the terms and conditions under which the Commission will issue these licenses. The overarching goal of 10 CFR Part 72 is to protect members of the public and the environment from the effects of radiation from SNF while in storage at an ISFSI. The requirements in 10 CFR Part 72 complement other 10 CFR parts and work in conjunction with them. Since it was issued, the NRC has made many modifications to 10 CFR Part 72. This included the addition of a general license for facilities licensed to operate under 10 CFR Part 50, "Domestic licensing of production and utilization facilities"; the addition of the requirements that allow licensees and Certificate of Compliance (CoC) holders to make CTEs without NRC review provided they meet specific evaluation criteria; changes in the licensed term of operation for ISFSIs; and changes to the general license process to allow the revision of existing amendments.

The NRC has issued several guidance documents to support the implementation of 10 CFR Part 72, including, but not limited to, information notices, bulletins, administrative letters, ISG documents, NUREGs, RGs, and regulatory issue summaries. The NRC previously included guidance for NRC license and CoC review in NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems"; NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities"; and various spent fuel storage and transportation ISG documents. The NRC recently published NUREG-2215, which consolidated existing guidance for the staff's use when reviewing applications for NRC licenses and CoCs for spent fuel DSSs and facilities.

This assessment did not identify any specific enhancements needed for 10 CFR Part 72 and its associated guidance. The WG concluded that the regulatory requirements in 10 CFR Part 72 provide a robust foundation for safety and have been modified appropriately over time. The NRC has significant experience in the oversight of ISFSIs and implements a robust licensing and inspection program to ensure continued safety and compliance with 10 CFR Part 72. Over four decades of operational experience show that SNF can be safely loaded, handled, unloaded, and stored. This experience includes the loading of approximately 3,300 casks containing over 125,000 fuel assemblies at ISFSIs at 75 sites within the United States.

(3) 10 CFR 72.48, “Changes, Tests, and Experiments”

This assessment area focused on the NRC’s existing regulations and guidance on the flexibility that licensees and certificate holders have to make certain CTEs to storage (10 CFR Part 72) and transportation (10 CFR Part 71) packaging without prior NRC approval.

The regulations in 10 CFR 72.48 establish the conditions under which an ISFSI licensee or a spent fuel storage cask CoC holder may make CTEs without prior NRC approval. Before implementation, however, proposed CTEs that meet certain criteria in the regulations must be reviewed and approved by the NRC. Thus, 10 CFR 72.48 provides a threshold for regulatory review—not the final determination of safety—for proposed activities. The Nuclear Energy Institute published guidance for the consistent application of 10 CFR 72.48 evaluations for licensees and CoC holders; the NRC has endorsed this guidance in RG 3.72, “Guidance for Implementation of 10 CFR 72.48, ‘Changes, Tests, and Experiments.’”

While 10 CFR 71.107, “Package design control,” provides some flexibility for design changes to transportation packaging, it is not the same flexibility as allowed under 10 CFR 72.48. CTEs made to a dual-purpose storage and transportation cask, or to other multipurpose storage systems, under 10 CFR 72.48 may require a CoC amendment under 10 CFR Part 71 before shipment. NUREG-2216 clarifies the degree of flexibility allowed in package design changes, including changes in contents and in package operations, without prior NRC approval.

Because 10 CFR Part 71 does not provide the same flexibility as 10 CFR 72.48, CoC amendment requests can be expected in advance of SNF shipments. To prepare sufficient oversight, licensing, and inspection resources for a large-scale transportation campaign, it must be understood how many CTEs will require a 10 CFR Part 71 CoC amendment. CTEs that do not require 10 CFR Part 71 CoC approval will still require inspection resources to verify the adequacy of the licensee’s or CoC holder’s conclusions. CTEs that do require 10 CFR Part 71 CoC approval will require licensing action. The NRC performs oversight of 10 CFR 72.48 and 10 CFR 71.107 through IP 60857, “Review of 10 CFR 72.48 Evaluations,” and IP 86001, “Design, Fabrication, Testing, and Maintenance of Transportation Packagings,” respectively.

This assessment did not identify any specific enhancements. The WG recommends the NRC coordinate with the industry to obtain estimates of the number of 10 CFR 72.48 CTEs performed by licensees and CoC holders, particularly CTEs that would require NRC approval under 10 CFR 71.107 (Section VI, Information Needs).

(4) Regulations and Guidance for Security

This assessment area focused on the NRC’s security regulations and guidance for licensees and certificate holders involved in the transportation of SNF. The security requirements for SNF transportation depend on the quantity and radioactivity of the material being transported, including those criteria in 10 CFR 73.6 which apply to SNF. The WG compared and evaluated the adequacy of various security requirements, including, but not limited to, the regulations cited in Table A-1. Additionally, the WG examined the existing Inspection Manual Chapters (IMCs), which provide information about the IPs for different licensee activities. Table A-1 details the security requirements for two characterizations of SNF.

Table A-1 Applicable SNF Transportation Security Regulations

SNF radiation levels at 1 m unshielded	SNF shipment \leq 1 Gray/hr with SSNM	SNF shipment $>$ 1 Gray/hr, $>$ 100 g
Applicable SNF transport security regulations	10 CFR 73.20 and 10 CFR 73.25–27	10 CFR 73.37

Shipments of SNF from a nuclear power plant or ISFSI to a consolidated interim storage facility (CISF) are expected to exceed 100 grams (g) in weight of SNF, and the radiation levels are expected to exceed 1 Gray per hour (Gray/hr) at a distance of 1 meter (m), unshielded. Therefore, the transport security requirements in 10 CFR 73.37, “Requirements for physical protection of irradiated reactor fuel in transit,” will apply. However, a limited number of existing storage casks loaded with older SNF may fall below the self-protection threshold (1 Gray/hr at 1 m, unshielded) and thus be outside the scope of 10 CFR 73.37 and the exemption criterion in 10 CFR 73.6(b). To address this concern, some licensees may need to ship such casks under the Category I strategic special nuclear material (SSNM) transport security requirements (10 CFR 73.20 and 10 CFR 73.25–27).

The Category I SSNM transport security requirements are intended for the transport of material such as high enriched uranium or plutonium in quantities greater than 2 kilograms (kg) in “attractive form.” The WG is of the opinion that the Commission did not anticipate or intend for SNF transport to be conducted under the Category I SSNM transport security requirements. The NRC should explore alternatives to the Category I SSNM transport security requirements for SNF transport, while maintaining appropriate assurance of security and protection.

Regarding inspections, the WG determined that none of the currently existing IMCs provides a holistic IP for SNF transportation security. There are currently two IMCs that could provide a template for a future SNF security inspection program: (1) IMC 2681, “Physical Protection and Transportation of Special Nuclear Material and Irradiated Fuel Inspections of Fuel Facilities,” and (2) IMC 2600, “Fuel Cycle Facility Operational Safety and Safeguards Inspection Program.”

Based on this assessment, the WG identified a need to evaluate the potential transportation of packages with older SNF content that do not meet the exemption criterion in 10 CFR 73.6(b) and do not fall within the scope of 10 CFR 73.37 (Section V). The WG also identified opportunities to revise or develop new IPs and IMCs to address security inspections (Section IV, Enhancements 2–5). The IMCs should provide guidance for security oversight of SNF transportation, including the following information:

- purpose, objectives, definitions
- responsibilities, authorities, and basic requirements for the SNF transportation security inspection program
- a list of IPs and the frequency of each IP
- references to the training requirements for the inspectors implementing the program

- an estimate of resources needed for IMC implementation

Other potentially useful revisions may include the following:

- Update NUREG-0561, Revision 2, “Physical Protection of Shipments of Irradiated Reactor Fuel,” issued April 2013, as necessary following the resolution of issues related to security requirements for packages with older SNF content that may not meet the exemption criterion in 10 CFR 73.6(b) and do not fall within the scope of 10 CFR 73.37.
- If needed, adjust existing inspection documents, including IPs, for the transport of some SNF as SSNM (under the Category I SSNM transport security requirements).

(5) Loading of SNF for Storage and Transportation

This assessment area focused on the loading of SNF for storage and transportation. Loading of spent fuel must be performed safely and in accordance with written procedures. Specifically, 10 CFR 72.150, “Instructions, procedures, and drawings” (for storage), and 10 CFR 71.111, “Instructions, procedures, and drawings” (for transport), state the following:

The licensee, [certificate holder, and applicant for a CoC] shall prescribe activities affecting quality by documented instructions, procedures, or drawings of a type appropriate to the circumstances and shall require that these instructions, procedures, and drawings be followed. The instructions, procedures, and drawings must include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

Loading activities are specific to the dry storage system (DSS), dry storage facility, or transportation package in question; consequently, the regulations do not contain requirements for specific activities. Rather, detailed procedures are developed according to the design basis of the CoC, as well as specific requirements within the regulations. The standard review plans for storage and transportation (i.e., NUREG-2215 and NUREG-2216, respectively) provide additional information on staff review of loading of spent fuel into casks or packages for storage or transport.

The oversight by the NRC for loading of storage casks and transportation packages is performed primarily by NRC inspectors who observe these activities in the field. Inspections of a DSS occur regularly throughout the life cycle of the system, from fabrication of the various DSS components to installation of the system at an ISFSI, “dry runs” of the loading and handling, the actual loading of the system with SNF, and placement of a loaded cask at an ISFSI. These inspections are performed by a combination of NRC regional and headquarters-based inspectors.

This assessment did not identify any enhancements for SNF loading in casks for storage and transportation. However, for a large-scale national transportation campaign, additional resources may be required for inspection.

(6) Safety and Risk Evaluations

This assessment area focused on the various studies and reports the NRC has conducted or documented on transportation safety over the years. Since 1977, the NRC has published several NUREGs documenting studies it has performed to support its regulatory oversight of the transportation of Type B quantities of radioactive material, including SNF. The topics of these

studies included (1) risk to the public from transportation of radioactive material, (2) shipping container response to highway and railway accident conditions, (3) SNF shipment risk estimates, (4) an SNF transportation risk assessment, and (5) an assessment of transportation accidents involving severe fires. These studies generally demonstrated that the risk to the public from transportation of SNF is low. They also confirmed that the NRC's transportation regulations are adequate to protect public health and safety and the environment, and that when the transportation regulations are followed and the CoC requirements for the Type B package are met, safety during transportation is ensured.

The WG considered the following studies and reports in its review:

- NUREG-0170, Volume 1, "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes," issued December 1977 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12192A283, ML022590348, ML022590370)
- NUREG/CR-4829, Volume 1, "Shipping Container Response to Severe Highway and Railway Accident Conditions," issued February 1987 (ADAMS Accession Nos. ML070810403 and ML070810404)
- NUREG/CR-6672, Volume 1, "Reexamination of Spent Fuel Shipment Risk Estimates," issued March 2000 (ADAMS Accession No. ML003698324)
- NUREG-2125, "Spent Fuel Transportation Risk Assessment," issued January 2014 (ADAMS Accession No. ML14031A323)
- NUREG-0725, Revision 15, "Public Information Circular for Shipments of Irradiated Reactor Fuel," issued May 2010 (ADAMS Accession No. ML101390089)
- NUREG/BR-0111, "Transporting Spent Fuel—Protection Provided Against Severe Highway and Railroad Accidents," issued March 1987 (ADAMS Accession No. ML012360032)
- NUREG/CR-7209, "A Compendium of Spent Fuel Transportation Package Response Analyses to Severe Fire Accident Scenarios," issued March 2017 (ADAMS Accession No. ML17066A101)

This assessment did not identify any enhancements or other improvements needed. The transportation regulations, when applied to the transportation of commercial SNF, adequately protect public health and safety and the environment. The adequacy of the regulations is demonstrated by the NRC's studies and experience of radioactive material transportation over the years.

(7) Environmental Reviews

This assessment area focused on the NRC's regulations governing environmental reviews, which are found in 10 CFR Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions." The regulations in 10 CFR 51.20(b)(9) require the preparation of an environmental impact statement (EIS) for the issuance of a license pursuant to 10 CFR Part 72 for the storage of SNF at an ISFSI at a site not occupied by a nuclear power reactor. The approval of package designs for packages to be used for the transportation of licensed material is categorically excluded from actions requiring an environmental assessment,

in accordance with 10 CFR 51.22(c)(13). The review and approval of transportation routes pursuant to 10 CFR 73.37(a) is subject to a categorical exclusion in 10 CFR 51.22(c)(12). NUREG-1748, “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs,” issued August 2003, contains guidance for complying with the NRC’s environmental regulations. While the guidance is generic (i.e., written to inform environmental reviews of all programs within the Office of Nuclear Material Safety and Safeguards (NMSS)), it is comprehensive and applicable to SNF storage and transportation. Notably, NUREG-1748 includes guidance specific to the consideration of transportation effects in environmental reviews.

This assessment did not identify any specific enhancements or other improvements needed for the regulations on environmental impact assessments or for the implementation of these regulations. The WG concluded that the staff has frequently used the existing guidance in NUREG-1748 to perform environmental reviews involving SNF storage and transportation. Most recently the guidance was used in the development of the EISs for the Holtec and Interim Storage Partners proposed CISFs. NUREG-1748 was also used in the review and evaluation of DOE’s Yucca Mountain EIS. Because there is a nearly two-decade history of successful use of this guidance, including its use for significant proposed actions such as CISFs and a geologic repository, the WG concluded that the regulations and related guidance are adequate.

(8) Prior Regulatory Assessments

This assessment area reviewed previously performed NRC regulatory assessments to evaluate the readiness of the current transportation inspection program for SNF. Specifically, the WG performed a detailed review of a 2019 assessment of the readiness of the transportation inspection program performed by NMSS staff in the Inspections and Operations Branch of the Division of Fuel Management. The 2019 assessment concluded the following:

- Commercial SNF will be shipped from three different types of facilities under three different NRC business lines:
 - away-from-reactor ISFSIs
 - decommissioning power reactors
 - operating power reactors
- The transportation IPs for each type of facility adequately cover the activities necessary for a Type B shipment.
- Topics unique to SNF, such as 10 CFR 72.48 change reconciliation and the choice of storage-only versus dual or multipurpose storage systems, should be considered for addition to the current transportation IPs.
- Supplemental inspector training should also be considered.
- Alternatively, a specialized “Tiger Team” of SNF transportation inspectors could be trained and qualified to perform inspections at all licensee facilities using a specific SNF transportation IP. This option would include a documented training and qualification program.

This assessment did not identify any specific enhancements in this area. The WG agrees with the above conclusions and used the results of its reviews of previous assessments by the staff to inform some of the other assessment areas described in this report, including

assessment area 3 (CTEs under 10 CFR 72.48) and assessment area 17 (Safety Oversight before and during Transport). The WG notes, however, that the existing transportation IPs focus on Type B shipments of radioactive material not including SNF. Therefore, the WG recommends enhancement of these IPs, as further discussed in assessment area 17.

(9) Prior Experience in Large-Scale SNF Transport

This assessment area focused on prior experience in large-scale SNF transportation. The United States does not currently perform commercial transportation of SNF on a large scale; however, it has historically performed small-scale transportation campaigns. In any case, there is extensive experience worldwide, both within and outside the United States, in safely transporting SNF.

On August 31, 2016, DOE issued “A Historical Review of the Safe Transport of Spent Nuclear Fuel,” FCRD-NFST-2016-000474, Revision 1, which contains a review of publicly available information on SNF transportation worldwide. That review indicates that between 1962 and 2016, at least 25,400 shipments of SNF have been made worldwide; and shipments within and into the United States account for 10 to 17 percent of this total. This includes the NRC’s data from NUREG-0725, which provides descriptive statistics on the NRC-regulated shipments that occurred from 1979 to 2007 (i.e., shipments of academic, industrial, and utility irradiated reactor fuel).

Based on the above, there is extensive experience worldwide, including in the United States, of safely transporting SNF. A review of publicly available information on SNF transportation worldwide shows that SNF shipments were undertaken without any injury or loss of life caused by the radioactive nature of the material transported. The WG concluded that transportation of SNF has been accomplished routinely and safely in many countries around the world, including the United States, for decades, and did not identify any recommended enhancements based on prior experience with large-scale SNF transportation.

(10) U.S. Department of Energy-Transported Versus Commercially Transported SNF

This assessment area focused on the regulatory and statutory differences between SNF transport by the U.S. Department of Energy (DOE) under the Nuclear Waste Policy Act (NWPA), 42 U.S.C. 10101 et seq., and commercially transported SNF outside the purview of that Act. Differences include (1) whether shipments would be subject to the Standard Contract under Section 302 of the NWPA, (2) funding availability for training public safety officials of local governments and Indian Tribes (Tribes) through whose jurisdiction SNF would be transported, (3) route approval, and (4) certain security requirements.

This assessment identified no recommended enhancements in this area. Clarification and explanation of the different requirements and responsibilities are included as part of the public outreach plan.

(11) Communication and Outreach Planning

This assessment area focused on evaluating the NRC's existing communication and outreach practices with stakeholders and partners, including DOT and other Federal agencies responsible for oversight of SNF transportation, States, Tribes, NRC licensees, and the public.

The purpose of this assessment area was to identify and leverage communication practices that are working well, to identify other practices that may be improved or enhanced, and to ensure that all practices are effective, efficient, open, and transparent in communicating the following:

- the NRC's regulatory role in protecting public health and safety and the environment, and its responsibilities for safe and secure SNF transportation
- the NRC's record of ensuring safety and security in the packaging and transportation of SNF
- the stability of NRC's regulations on SNF transportation package design
- the NRC's readiness to fulfill its regulatory oversight role and responsibilities in a national transportation campaign for SNF
- the differences between commercial shipments and shipments by DOE

This assessment identified a need to improve communication and outreach with stakeholders (Enhancement 6 in Section IV of the main report).

(12) Specific Information Needs

This assessment area focused on evaluating information needs relevant to the NRC's oversight role in a national SNF transportation campaign. The assessment identified the following information that may be necessary to support oversight of SNF transportation:

- national transportation campaign contacts
- schedules for shipments from existing storage locations to the CISFs if they are licensed and constructed
- number of CTEs performed on storage systems by licensees and CoC holders under 10 CFR 72.48, particularly CTEs requiring NRC approval under 10 CFR 71.107, "Package design control"
- CoC holders' certificate renewal and amendment requests under Part 71
- CoC holders' revision submittal schedules
- specific SNF assemblies currently loaded in individual casks
- "Used Nuclear Fuel—Storage, Transportation and Disposal Analysis Resource and Data System (UNF-ST&DARDS)" unified database, from DOE
- U.S. Coast Guard security policies for a nationwide SNF transportation campaign, if any shipments are expected to include maritime transport under Coast Guard jurisdiction

(13) Current State of SNF to Be Shipped

This assessment area focused on the current state of SNF to be shipped, site access at current storage locations, and availability and readiness of equipment for loading and transporting SNF.

Work by DOE has addressed access at 16 existing storage sites, including decommissioned reactor sites (U.S. Department of Energy, “Nuclear Power Plant Infrastructure Evaluations for Removal of Spent Nuclear Fuel, 2021”).

Access and transport modes for individual sites will need to be evaluated by the licensee and shipper as specific shipping plans and transport routes are developed.

The WG did not identify any recommended enhancements in any of the areas covered by this assessment. Information is available on the transportation packages to be used in SNF transportation. The following information is also available to support regulatory oversight:

- inventory of in-use storage casks by location at existing sites
- availability of transportation packages
- loading records for transportation packages
- status of infrastructure for rail, heavy-haul truck, maritime, and intermodal and multimodal transportation of SNF at the points of origin
- availability of loading equipment and other cask handling equipment at the ISFSI sites

As noted in the related assessment area (5), the frequency and number of future amendment requests to certified transportation package designs should be estimated, so that the NRC can properly assess its resource and budget projections. Otherwise, this assessment did not identify the need for any enhancements.

(14) Interagency Agreements for Oversight of Spent Nuclear Fuel Transportation

This assessment area focused on reviewing existing interagency agreements and MOUs that lay out the roles, responsibilities, and coordination necessary among Federal agencies involved in SNF transport. Specifically, the WG reviewed the 1979 MOU with DOT (44 FR 38690: July 2, 1979), the 2015 MOU with the U.S. Department of Homeland Security and DOT (ADAMS Accession No. ML15057A336), and the Nuclear/Radiological Incident Annex to the National Response Framework.

This assessment identified no recommended enhancements associated with these documents. The WG determined that each agency’s roles and responsibilities for SNF transport are adequately defined. Additional information on the roles and responsibilities for SNF transport is provided in Appendix B.

(15) Status of Transport Fleet

In this area of the assessment, the WG examined the status of the transport vehicles, including road and rail vehicles, available to transport SNF. It also examined maritime security requirements related to possible maritime transport of SNF. The availability of transport

vehicles is a logistical rather than a regulatory issue; however, this information may inform NRC inspection planning.

If a CISF is licensed and constructed, as the time approaches for shipments to begin, logistical information on the transport fleet will be more readily available. The NRC will gather information from transportation route review submissions, conversations with external working groups, and other formal and informal means of communication. This information is not critical to the NRC's ability to carry out its regulatory responsibilities, and its compilation does not necessitate a significant investment of resources.

This assessment identified no recommended enhancements in this area. Consolidated information specifically on the status of the transport fleet and equipment for SNF transportation is not currently available. Such information would help the NRC identify potential logistical constraints for SNF transportation and determine the timing and resources needed for inspections. The NRC anticipates that such information will be available in time to properly schedule inspections.

(16) Route Approval Process

As stated in NUREG-0561, Revision 2, 10 CFR 73.37(b)(1)(vi) requires the licensee to obtain advance NRC approval for the planned road and rail routes over which SNF is to be transported, as well as for any U.S. ports where a vessel carrying an SNF shipment is scheduled to dock. The NRC expects licensees to submit applications for route approvals at least six months before the planned date of the shipment to allow the staff adequate time to review and approve the requested route.

In 10 CFR 73.37(b)(1)(vi), the NRC requires that routes used for transporting SNF comply with applicable DOT regulations in 49 CFR, particularly those identified in 10 CFR 71.5, "Transportation of licensed material." For shipments by rail, DOT requirements for the security of radioactive material shipments appear in 49 CFR Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans"; 49 CFR Part 174, "Carriage by Rail"; and 49 CFR Part 209, "Railroad Safety Enforcement Procedures." For shipments by road, DOT requirements for the security of radioactive material shipments appear in 49 CFR Part 172, Subpart I, "Safety and Security Plans," and in Subpart D, "Routing of Class 7 (Radioactive) Materials," of 49 CFR Part 397, "Transportation of Hazardous Materials; Driving and Parking Rules." The regulations direct the motor carrier to, among other things, ensure that the motor vehicle is operated on routes that minimize radiological risk and document the route plan and provide a copy to the driver and shipper before departure, in accordance with 49 CFR Part 397, Subpart D.

The NRC staff does not receive the proposed routes until the licensee has conducted a route review, as described in NUREG-0561, Revision 2, and submitted the route for NRC review and approval. At that time, the staff can see the routes, potential safe havens for road transport, and staging locations.

This assessment identified no recommended enhancements in this area. The route approval process is currently guided by NUREG-0561, Revision 2. Updates may be required in the future to reflect any decisions made regarding the transportation of packages with older SNF.

(17) Safety Oversight before and during Transport

The NRC verifies licensees' compliance with safety regulations through its inspection program, using the IPs provided in the IMCs. Currently, no single IMC addresses the safety oversight of SNF transportation; rather, various IMCs contain guidance for the oversight of transportation of nuclear material in general, which may be used for SNF transportation. The WG determined that commercial SNF will be shipped from three types of facilities:

- (1) operating power reactors
- (2) decommissioning power reactors
- (3) away-from-reactor ISFSIs

Different inspectors inspect each of these facility types, using the IPs in the appropriate IMCs.

Below are summaries and results of the completed assessments related to the inspection program, covering IPs, inspection frequency, inspector qualification, and IMC guidance.

Inspection Procedures

To properly assess the adequacy of the technical content of existing IPs, the WG first identified the safety-inspectable items within the NRC's regulatory jurisdiction, then grouped them into the following inspection focus areas:

- facility modifications and evaluations
- package changes
- package contents
- package loading
- shipment preparation and records
- intermodal transfer
- management controls
- receipt inspection

The WG evaluated the existing IPs against these focus areas. It determined procedure adequacy for each inspection focus area qualitatively. The WG concluded that it would be beneficial to create new IPs or enhance the existing IPs for the safety inspection of SNF transportation (Enhancement 1 in the main report). The new or enhanced IPs should combine aspects of IP 60854, "Preoperational Testing of an Independent Spent Fuel Storage Installation," and IP 60855, "Operation of an Independent Spent Fuel Storage Installation," but modify the guidance for the focus areas of facility modification, package changes, package contents, and package loading. The new or enhanced IPs should combine the guidance in IP 71124.08, "Radioactive Solid Waste Processing and Radioactive Material Handling, Storage, and Transportation," and IP 86740, "Inspection of Transportation Activities," for shipment preparation and management controls and they should provide new guidance for intermodal transfer. They should also provide guidance for receipt inspections, or this guidance should appear in the IP for a CISF.

The IPs should define an adequate level of effort (hours) for onsite inspection, based on the scope of inspection.

Inspection Frequency

From a review of the current inspection programs, the WG determined that transportation safety inspections under IMC 2515 are performed biennially, and transportation safety inspections

under IMC 2561 are performed annually. No transportation safety inspections are performed under IMC 2690, "Inspection Program for Storage of Spent Reactor Fuel and Reactor-Related Greater-Than-Class-C at Independent Spent Fuel Storage Installations and for 10 CFR Part 71 Transportation Packagings."

Additionally, the WG reviewed the ISFSI inspection program of IMC 2690 to see whether its approach to determining the timing and frequency of ISFSI inspections could be adapted to transportation safety inspections.

The WG concluded that it would be beneficial to change the frequency of SNF transportation safety inspections, following the approach in IMC 2690 for ISFSI inspections. Specifically, transportation safety inspections should be performed only at sites involved in transportation activities. A pre-operational inspection should set the baseline for future inspections. A routine inspection frequency should be established, with flexibility for modifying the frequency based upon the frequency with which the licensee makes shipments (Enhancement 3 in the main report).

Inspector Qualifications

The WG evaluated the existing inspector qualification manuals for SNF transportation against the safety inspection focus areas identified above. The WG determined the adequacy of the qualification manuals for each focus area qualitatively.

The WG recommends enhancing the qualification and training requirements for inspectors (Enhancement 4 in the main report). The WG concluded that no single qualification manual on its own provides enough training for safety oversight of SNF transportation. However, IMC 1246, Appendix B3, "Training Requirements and Qualification Journal for Independent Spent Fuel Storage Installation Inspector;" IMC 1248, Appendix F, "Training Requirements and Qualification Journal for Decommissioning Inspectors;" and IMC 1245, Appendix C3, "Health Physics Inspector Technical Proficiency Training and Qualification Journal," are adequate with only minor supplemental training. Regardless of the approach used, the WG noted that the responsibility of which office/region is performing the inspection should also be clarified.

Inspection Manual Chapters

As discussed above, the WG assessed and identified enhancements for several elements of the IMCs related to SNF transportation: the IPs performed, inspection frequencies, and inspector qualification (Enhancements 1, 3, and 4, respectively, in the main report). The WG also assessed whether the existing applicable IMCs provided adequate guidance to combine these elements into an effective and consistent inspection program.

The WG concluded that it would be beneficial to revise the following safety IMCs (Enhancement 5 in the main report): IMC 2515, IMC 2561, and IMC 2690. Another option would be to develop a new IMC that describes the purpose, objectives, definitions, responsibilities, authorities, and basic requirements for SNF transportation safety inspections.

(18) Security Oversight before and during Transport

This assessment focused on the security inspection of SNF casks being offered for transport and covered in the existing NRC inspection program, including:

- existing NRC regional IPs
- security IP guidance on topics such as: facility security modifications and considerations for compensatory measures during the loading of SNF, and intermodal transfer.

The NRC verifies licensees' compliance with security regulations through its inspection program, using the IPs. Currently, no single IP covers the security oversight of SNF transportation. Rather, various IPs contain guidance for the oversight of transportation of nuclear material in general, which can be applied to the oversight of SNF transportation. The WG identified one enhancement: the development of a new IP for the security oversight of SNF transportation (Enhancement 2 in the main report).

The IP should provide new guidance for the security of intermodal transfer. It should provide guidance for receipt inspections, or this guidance should appear in the IP for a CISF. The IP should define an adequate level of effort (hours) for inspection, based on the scope of inspection.

A new IMC should be developed that describes the purpose, objectives, definitions, responsibilities, authorities, and basic requirements for the SNF transportation security inspection program. The IMC should provide a list of IPs and their frequencies and should also describe or provide a reference to the training requirements for the inspectors implementing the program.

(19) Provisions for Inspections upon Receipt of SNF Packages

This assessment focused on inspections performed upon receipt of SNF packages, based on the IMCs, to verify licensees' compliance with safety regulations. The standard review plans for storage and transportation (i.e., NUREG-2215 and NUREG-2216, respectively) provide pertinent guidance, and CISF vendors account for the applicable regulatory requirements in the operating procedures for their proposed designs.

The WG identified one enhancement in this area, to create IPs for receipt inspections or provide guidance on receipt inspections within the IP for a CISF (Enhancement 1). The ISFSI inspection enhancement effort (ADAMS Accession No. ML20045D870) identified the need for such IPs and efforts are currently underway to address this.

Appendix B: Roles and Responsibilities

Oversight of commercial spent nuclear fuel (SNF) transportation in the United States involves coordination among multiple Federal agencies, principally the U.S. Nuclear Regulatory Commission (NRC), the U.S. Department of Transportation (DOT), and the U.S. Department of Homeland Security (DHS). Within DOT, the Pipeline and Hazardous Materials Safety Administration, Federal Railroad Administration, and Federal Motor Carrier Safety Administration have important roles related to SNF transportation, while the U.S. Coast Guard and Federal Emergency Management Agency have roles within DHS. Outside of the Federal agencies, States, Indian Tribes (Tribes), and local governments are also involved along SNF transportation routes. In addition, the U.S. Department of Energy (DOE), while having no direct role in SNF shipments between commercial sites, has the ultimate responsibility for the final disposition of commercial SNF, in accordance with the Nuclear Waste Policy Act of 1982, as amended (NWPA). As a result, DOE has ongoing research and development efforts related to SNF transportation.

This appendix summarizes the respective roles of the NRC and other Federal agencies, as well as existing interagency agreements that serve to further cooperation and collaboration on the regulatory oversight of commercial SNF transportation. The appendix also discusses engagements with States, Tribes, and local governments along transportation routes.

U.S. Nuclear Regulatory Commission

In addition to establishing and maintaining the regulations for transportation packages in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71, "Packaging and transportation of radioactive material" and the transportation security regulations in 10 CFR Part 73, "Physical protection of plants and materials," the NRC's principal responsibilities for regulatory oversight of SNF transportation include the following four areas:

- (1) certification of transportation packages in accordance with 10 CFR Part 71;
- (2) oversight of shipments being prepared or received at licensee sites under 10 CFR Part 50, "Domestic licensing of production and utilization facilities," and 10 CFR Part 72, "Licensing requirements for the independent storage of spent nuclear fuel, high-level radioactive waste, and reactor-related greater than Class C waste";
- (3) review and approval of security plans and routes for shipments under 10 CFR Part 73; and
- (4) coordination with other Federal agencies, other partners, stakeholders, and the public.

More specifically, the NRC:

- reviews and approves designs for fissile material and Type B transportation packages.
- oversees licensee activities related to transportation.
- develops and establishes package design standards for SNF transportation (10 CFR Part 71).
- develops and establishes physical security requirements for SNF transportation (10 CFR Part 73); reviews and approves SNF transportation routes.

- evaluates, approves, and authorizes for use transportation package designs and issues certificates of compliance.
- requires licensees to notify and coordinate with States, participating Tribes, and local law enforcement before transport.
- inspects and oversees certificate holders, package fabricators, and licensee shippers.
- meets with Federal, State, and Tribal governments to discuss SNF transportation.

U.S. Department of Transportation

The DOT is responsible for regulating the safe and secure transportation of hazardous materials in commerce, including SNF, and performs the following specific activities:

- develops and enforces regulations and standards for transporting hazardous materials, including Class 7 (radioactive) material (i.e., excepted quantities, Type A quantities, low specific activity material, surface-contaminated objects);
- oversees vehicle safety, routing, shipping papers, hazard communications (i.e., markings, labels, placards), emergency response, and shipper training; and
- regulates carriers and modes of transport (rail, road, air, water).

Interactions between the NRC and DOT

The NRC and DOT coregulate the commercial transportation of radioactive material, including commercial SNF. The NRC/DOT memorandum of understanding, issued in 1979, delineates each agency's responsibilities (Volume 44 of the *Federal Register*, page 38690 (44 FR 38690; July 2, 1979)).

Specifically, the NRC interacts with the following DOT Administrations that have a role in SNF transportation:

- Pipeline and Hazardous Materials Safety Administration
 - develops and enforces standards for transporting hazardous materials in commerce, including Class 7 (radioactive) material (i.e., excepted quantities, Type A quantities, low-specific-activity material, surface-contaminated objects).
 - oversees vehicle safety, radiation and contamination thresholds, routing, shipping papers, hazard communications (i.e., markings, labels, placards) emergency response, and shipper training.
 - regulates carriers and modes of transport (rail, road, air, water).
- Federal Railroad Administration
 - develops and enforces standards for transporting hazardous materials by rail.
 - establishes additional standards for transportation of high-level radioactive material, including SNF.

- maintains the Safety Compliance Oversight Plan to support large-scale SNF transportation by rail.
- enforces DOT’s additional security requirements for rail transport of high-activity radioactive material, including SNF, as required by Title 49 of the *Code of Federal Regulations* (49 CFR) 172.820, “Additional planning requirements for transportation by rail.”
- works closely with the NRC and DHS on security requirements for rail transport of SNF.
- performs several oversight roles, including package preparation, pre-transportation inspection, shipper, offeror/contractor training overview, en-route inspection, and post-transport inspection.
- conducts coordinated site visits with DOE and State and Tribal Partners of decommissioning/shut down sites for potential shipping campaign strategies.
- Federal Motor Carrier Safety Administration
 - develops and enforces standards and regulations for interstate motor carriers of property and passengers.
 - develops and enforces standards for transporting hazardous materials by highway, including regulatory implementation and oversight of hazardous materials safety permitted interstate and intrastate motor carriers, as required by 49 CFR Part 385 Subpart E.
 - works with State partners in the Motor Carrier Safety Assistance Program and the Commercial Vehicle Safety Alliance’s (CVSA) Level VI Inspections of transuranic wastes and highway route-controlled quantities of Class 7 (radioactive) material.
 - maintains the National Highway Route Registry for highway transport of radioactive and non-radioactive hazardous materials.

U.S. Department of Homeland Security

The NRC interacts with the following DHS offices, which are broadly responsible for security and event response functions and are involved in SNF transportation as described:

- U.S. Coast Guard
 - is the lead agency for shipments of hazardous materials through the lakes and rivers in the U.S. and the Intracoastal Waterway.
 - develops and enforces standards for maritime transport of hazardous materials, including Class 7 (radioactive) material (i.e., excepted quantities, Type A, Low Specific Activity Material, Surface Contaminated Objects).
 - enforces additional requirements for vessel transport as required by 49 CFR Part 176 and specifically Subpart M for radioactive materials.

- manages the U.S. Environmental Protection Agency’s National Response Center, which is the designated Federal point of contact for reporting oil, chemical, radiological, biological, and etiological discharges into the environment, anywhere in the United States or its territories.
- Federal Emergency Management Agency
 - supports citizens and first responders in accidents and disasters.
 - directs the organization of national-level responses to all events (e.g., in accordance with the Nuclear/Radiological Incident Annex to the National Response Framework).

U.S. Department of Energy (DOE)

The NWPA assigned DOE the responsibility for the ultimate disposal of commercial SNF and defense high-level radioactive waste (HLW) in a deep geologic repository. The NWPA established requirements for DOE-directed shipments of SNF and HLW to a repository or a monitored retrievable storage site, including advance shipment notifications and financial support for training to the States and Tribes through whose jurisdictions DOE plans to transport SNF and HLW. Those NWPA conditions do not apply to commercial transportation of SNF to a commercial CISF. DOE’s ongoing efforts to support eventual transportation of SNF under the NWPA include:

- continued engagement with State and Tribal partners, through the DOE’s National Transportation Stakeholders Forum, participating State Regional Groups, and the Tribal Radioactive Materials Transportation Committee
- development of specialty railcars for SNF shipments
- assessments of on-site and near-site transportation infrastructure at commercial nuclear power plant sites currently storing SNF as well as the Morris Independent Spent Fuel Storage Installation
- development of analysis tools for shipment routes and potential environmental impacts
- updates to DOE systems analysis capabilities and SNF inventory information

Involvement by States and Tribes

States and Tribes along transportation routes will be involved as necessary and appropriate to support transportation oversight activities at the local level, especially the implementation of emergency response plans. This involvement ranges from awareness of shipment schedules to providing local first-response support in the event of accidents or other off-normal conditions during transport (in some cases, local governments may provide first-response functions, in coordination with State and Federal officials). Commercial shipments of SNF to a CISF are not subject to the same conditions for State and Tribal engagement as those that the NWPA requires for DOE-directed shipments to a repository.

The NRC’s regulations require that NRC licensees provide advance notification to States prior to the shipment of SNF through or across the boundary of any State. Federally recognized Tribes may opt in to receive advance notification prior to the shipment of SNF within or across the reservation boundary. As part of ongoing outreach and communications, the NRC is

exploring additional methods of coordination with States, Tribes, and local governments, beyond what is required by the regulations. In accordance with the NRC's Tribal Policy Statement (82 FR 2402; January 9, 2017), the NRC will consult with Tribal governments on the transportation of SNF.

Appendix C: Selected Transportation Studies and Reports

Since 1977, the U.S. Nuclear Regulatory Commission (NRC) has performed and documented studies to support its regulatory oversight of the transportation of radioactive material, including spent nuclear fuel (SNF). These studies covered the following topics:

- environmental impacts of radioactive material transportation
- safety and risk assessments for SNF transportation
- shipping container response to highway and railway accident conditions, including potential severe fires
- physical protection of SNF shipments

These studies concluded the following:

- SNF poses little risk to public health and safety and the environment.
- The NRC's transportation regulations are adequate to protect public health and safety and the environment.
- When transportation regulations are followed and the requirements of the certificate of compliance for the Type B package are met, safety during transportation is ensured.

The NRC studies and reports are available in the NRC's Agencywide Documents Access and Management System (ADAMS) at the given accession numbers:

- NUREG-0170, Volume 1, "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes," issued December 1977 (ADAMS Accession Nos. ML12192A283, ML022590348, ML022590370)
- NUREG/CR-4829, "Shipping Container Response to Severe Highway and Railway Accident Conditions," issued February 1987 (ADAMS Accession Nos. ML070810403 and ML070810404)
- NUREG/CR-6672, "Reexamination of Spent Fuel Shipment Risk Estimates," issued March 2000 (ADAMS Accession No. ML003698324)
- NUREG/CR-6886, Revision 2, "Spent Fuel Transportation Package Response to the Baltimore Tunnel Fire Scenario," issued February 2009 (ADAMS Accession No. ML090570742)
- NUREG-2125, "Spent Fuel Transportation Risk Assessment," issued January 2014 (ADAMS Accession No. ML13249A329)
- NUREG-0725, Revision 15, "Public Information Circular for Shipments of Irradiated Reactor Fuel," issued May 2010 (ADAMS Accession No. ML101390089)
- NUREG/BR-0111, "Transporting Spent Fuel—Protection Provided Against Severe Highway and Railroad Accidents," issued March 1987 (ADAMS Accession No. ML012360032)

- NUREG/CR-7209, “A Compendium of Spent Fuel Transportation Package Response Analyses to Severe Fire Accident Scenarios,” issued March 2017 (ADAMS Accession No. ML17066A101)
- NUREG/BR-0292, Revision 2, “Safety of Spent Fuel Transportation,” issued February 2017 (ADAMS Accession No. ML17038A460)
- NUREG-0561, Revision 2, “Physical Protection of Shipments of Irradiated Reactor Fuel,” issued April 2013 (ADAMS Accession No. ML13120A230)

Two other notable reports address transportation topics for SNF in the United States:

- National Academy of Sciences, “Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States,” issued 2006. Available at <https://www.nap.edu/catalog/11538/going-the-distance-the-safe-transport-of-spent-nuclear-fuel>
- U.S. Department of Energy, “Nuclear Power Plant Infrastructure Evaluations for Removal of Spent Nuclear Fuel,” issued 2021 (updated version of the 2017 report, “Preliminary Evaluation of Removing Used Nuclear Fuel from Shutdown Sites”; describes the site and near-site transportation infrastructure for removing SNF from 16 nuclear power plants that have been evaluated since 2012). Available at <https://www.energy.gov/ne/articles/nuclear-power-plant-infrastructure-evaluations-removal-spent-nuclear-fuel#:~:text=Nuclear%20Power%20Plant%20Infrastructure%20Evaluations%20for%20Removal%20of,is%20a%202021%20update%20of%20the%202017%20report>.