

# Summary of the Regulatory Framework for Transportation of Commercial Used Nuclear Fuel

By the U.S. Department of Energy to a Federal Storage or Disposal Facility Under the Nuclear Waste Policy Act



U.S. DEPARTMENT  
of **ENERGY** | Office of  
Nuclear Energy

*Spent Fuel and High-Level Waste Disposition*

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# General Overview of Regulatory Roles and Responsibilities

Both the U.S. Department of Energy (DOE or Department) and the U.S. Nuclear Regulatory Commission (NRC) derive authority from the Atomic Energy Act of 1954, as amended (AEA), to regulate activities involving radioactive materials. DOE has broad authority under the AEA to regulate activities involving radioactive materials

undertaken by the Department or on its behalf, including transportation of radioactive materials, except as otherwise provided by law. The NRC licenses and regulates commercial activities involving radioactive materials, including operation of commercial nuclear power plants, storage and disposal of commercial radioactive waste and used nuclear fuel (UNF)<sup>1</sup>, and certain aspects of commercial transportation of licensed radioactive materials. In addition, the NRC has licensing and regulatory authority for certain limited DOE facilities, such as facilities for storage or disposal of high-level radioactive waste (HLW) or UNF. The U.S. Department of Transportation (DOT) regulates the safety and security of transportation of all hazardous materials in

commerce in the U.S., including radioactive materials. Thus, DOT and NRC jointly regulate commercial transportation of licensed radioactive materials in the U.S. DOT and NRC have in place a memorandum of understanding (MOU) laying out some of their respective areas for regulating such transport.<sup>2</sup> DOT regulates, for example, labeling and marking of packages and vehicles; mechanical conditions and tie-down requirements for carrier equipment; qualifications and training for carrier personnel; procedures for loading, unloading, handling, and storage during transit; and requirements for identifying, analyzing, and selecting routes. The NRC establishes safety standards for the design and performance of fissile material packages and for Type B packages,



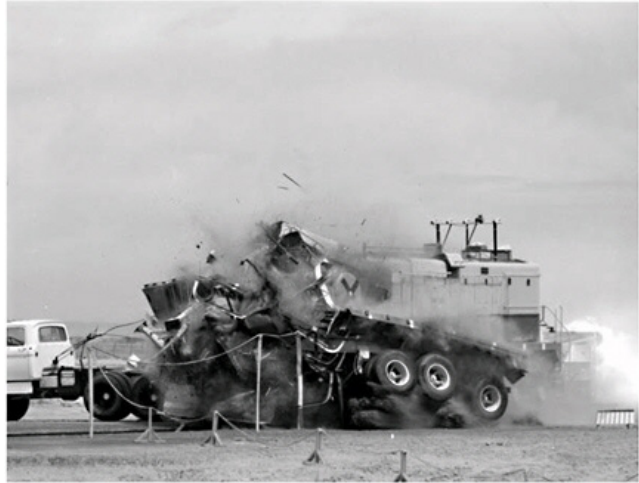
An independent spent fuel storage installation at the Maine Yankee nuclear power plant.  
*Photo credit: The Yankee Companies.*

<sup>1</sup> The term “used nuclear fuel” is intended to be synonymous with the term “spent nuclear fuel” as used and defined in the Nuclear Waste Policy Act of 1982, as amended, and the Standard Contract for the Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (10 CFR Part 961).

<sup>2</sup> Memorandum of Understanding, Transportation of Radioactive Materials, 44 Fed. Reg. 38690 (July 2, 1979).

which are packages for quantities of materials with higher levels of radioactivity (i.e., those exceeding Type A limits<sup>3</sup>), including standards for structural integrity, criticality control, containment of radioactive material, shielding, protection against internal overheating, and quality assurance of packaging design, testing, maintenance, and use. The NRC also evaluates applications for approval (or certification) of package designs against its safety standards and conducts inspections to ensure that packages are designed, fabricated, used, and maintained in accordance with the requirements. In addition, the NRC establishes security requirements for physical protection of UNF in transit, such as requirements for communications protocols, redundant communications capabilities, secure shipment tracking, safeguarding of shipment information, armed escorts, and advance shipment notifications to Tribes and States.

In most cases that do not involve national security, DOE typically uses commercial carriers for its shipments and does not exercise its AEA authority. Such shipments by commercial carriers generally are subject to regulation by DOT and NRC, as appropriate. Certain DOE shipments of radioactive materials, such as those involving national security and those conducted by Federal employees, are regulated by DOE under its AEA authority. Regardless, in those situations where DOE exercises its AEA authority to regulate shipments undertaken by or on behalf of the Department, DOE shipments are required to be conducted in a manner that achieves an equivalent level of safety and security to that required by DOT and NRC for comparable commercial shipments. DOE also has authority to certify packages for transport and has in place a certification program for Type B and fissile material packages which incorporates NRC package requirements, but in many cases, DOE transports radioactive material in packages certified by the NRC. Furthermore, there are particular statutory requirements which may apply to DOE shipments of radioactive material depending on the specific facts and circumstances.



**Top:** A used nuclear fuel transportation cask is tested in a potential accident scenario. The U.S. Nuclear Regulatory Commission sets the design standards for transportation casks to resist impact, puncture, fire, water immersion, and other potential accident conditions.

**Bottom:** The cask after the test was completed.

*Photo credit: Sandia National Laboratories.*

Shipments of UNF and HLW to a Federal storage facility or repository under the Nuclear Waste Policy Act of 1982, as amended (NWPA), would be undertaken pursuant to DOE's authority in accordance with this general regulatory framework, with a few modifications, as described below.

<sup>3</sup> The  $A_1$  and  $A_2$  values for different radionuclides can be found in 10 CFR Part 71, Appendix A, Table A-1, and in 49 CFR 173.435.



A Type B cask for transporting radioactive material on a railcar. *Photo credit: Orano.*

## Commercial UNF Shipments to a Federal Facility Under the Nuclear Waste Policy Act

DOE is planning for future transport of UNF accepted under the provisions of the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (Standard Contract) (10 CFR Part 961) from commercial nuclear power plants for storage and disposal, in accordance with the NWP. Packages (sometimes referred to as casks) of commercial UNF certified for transportation today weigh between 94 and 210 tons. The limit for legal weight truck loads in

the U.S. is 40 tons. Therefore, the primary mode for large-scale UNF transport is expected to be rail, with use of heavy-haul truck and barge to connect to rail where rail is not available at an origin site.

It is anticipated that various Federal agencies will have regulatory authority over these shipments.

Assuming DOE uses commercial carriers for shipments conducted under the NWP, regulatory authority over the commercial carriers conducting these shipments is expected to be as follows. In general, DOT would regulate the areas summarized above, including hazard communication, package and conveyance radiological controls, and routing. With respect to shipments of UNF and HLW to a Federal deep geologic repository under Subtitle A of the NWP or to a Federal monitored retrievable storage facility (sometimes referred to today as a Federal staging facility)

under Subtitle C of the NWP, once DOE takes title or possession of the material, DOE rather than NRC would be responsible for exercising the AEA authority. However, the NWP explicitly requires DOE to use NRC-certified packages and to follow NRC's rules on advance notification of shipments to jurisdictions through which the shipments will be transported. In general, DOE anticipates that these shipments would be subject to the same requirements and standards as comparable commercial shipments of UNF and HLW, subject to any additional provisions with respect to physical protection and security that DOE might deem appropriate.<sup>4</sup> DOE staff plan to continue working with relevant Federal agencies to coordinate operational plans for future shipments. Further details are provided below as a general overview of the regulatory framework for such shipments, as well as other relevant standards.

<sup>4</sup> For further discussion of UNF transportation to a facility under the NWP and respective roles and responsibilities of DOT, NRC, and DOE, see letter from Chairman Richard A. Meserve, Nuclear Regulatory Commission, to Senator Richard J. Durbin (May 10, 2002). Available at <https://www.nrc.gov/docs/ML0210/ML021060662.pdf>.

## Commercial Vehicle Safety Alliance (CVSA) Level VI Inspections

The CVSA Level VI is an inspection for select radiological shipments, which includes inspection procedures, enhancements to the North American Standard Level I Inspection, radiological requirements, and the North American Standard Out-of-Service Criteria for transuranic waste and highway route controlled quantities (HRCQ)<sup>5</sup> of radioactive material.

All vehicles and carriers transporting HRCQ of radioactive material are regulated by DOT and required to pass the North American Standard Level VI Inspection.

Vehicle, drivers, and cargo must be defect free by the Level VI Inspection standard before they may leave their point of origin. While en route, the Level VI out-of-service criteria is applied.

A special nuclear symbol decal was developed for vehicles meeting the Level VI Inspection criteria. The decal is affixed at the point of origin of the shipment and removed at the point of destination. It is valid for only one trip.

## Overview of Federal Regulatory Framework for UNF Transportation<sup>6</sup>

### U.S. Department of Transportation (DOT)

DOT regulates through its operating administrations commercial transportation in the U.S., including most shipments of UNF for DOE by commercial carriers.

### Federal Railroad Administration (FRA)

FRA develops, implements, and enforces rail safety regulations, including safety inspections of track, signals, operations, motive power and equipment, and requirements for rail transport of hazardous materials, including UNF transportation by DOE using commercial rail carriers.

FRA also developed a non-regulatory Safety Coordination and Compliance Oversight Plan (SCCOP) for rail transport of UNF that was updated in 2023.<sup>7</sup> The SCCOP covers operational integrity, emergency response, route infrastructure integrity, highway-rail grade crossing safety, and security.

### Pipeline and Hazardous Materials Safety Administration (PHMSA)

PHMSA develops and enforces regulations for transport of hazardous materials in commerce, including UNF shipments (49 CFR Parts 171-180, Hazardous Materials Regulations). Examples include requirements for proper packaging and placarding of hazardous materials shipments. In addition, PHMSA requires rail carriers to evaluate safety and security risks for routes used to transport certain hazardous materials, including UNF, and use the routes that pose the least overall safety and security risk. The regulation is enforced by the FRA.

### Federal Motor Carrier Safety Administration (FMCSA)

FMCSA develops and enforces motor carrier safety regulations to contribute to ensuring safety in commercial motor carrier operations, such as the commercial trucking industry. Commercial heavy-haul truck transport of UNF will need to meet FMCSA regulations which include requirements for safety inspections in accordance with Commercial Vehicle Safety Alliance (CVSA) Level VI.

<sup>5</sup> “Highway route controlled quantity” of radioactive material is defined in 49 CFR 173.403.

<sup>6</sup> Summary information on various pertinent agencies is provided here for convenience. This information is not intended to be all-inclusive. Consulting the agencies’ websites, regulations, and other sources directly is recommended for the most current, precise, and complete information.

<sup>7</sup> Federal Railroad Administration, 2023. Safety Coordination and Compliance Oversight Plan for Rail Transportation of High-Level Radioactive Waste and Spent-Nuclear Fuel. Available at <https://railroads.dot.gov/elibrary/safety-coordination-and-compliance-oversight-plan-rail-transportation-high-level>



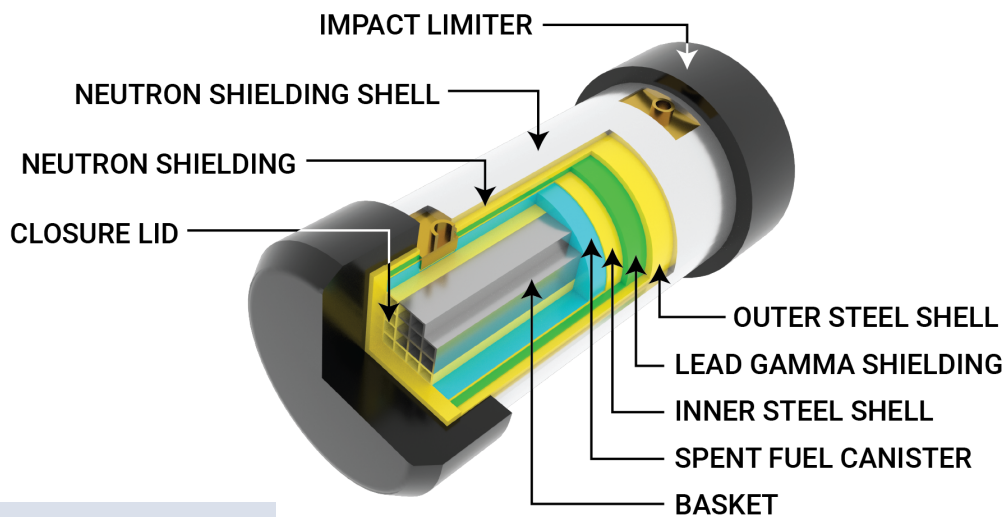
The U.S. Department of Energy's concept for a potential transport train for commercial used nuclear fuel.

## Surface Transportation Board (STB)

STB is responsible for the economic regulation of various modes of surface transportation, primarily freight rail. For example, STB regulates railroad rate and service issues and has jurisdiction over the construction of new rail lines to be used for common carriage. If DOE plans to build a new rail line to reach an origin or destination facility, DOE would need a certificate of public convenience and necessity from STB to construct and operate a new rail line for common carriage.

## U.S. Nuclear Regulatory Commission (NRC)

NRC establishes requirements for the transport of radioactive material of licensees authorized by NRC license to receive, possess, use, or transfer licensed material. It also establishes design standards for UNF transportation packages (10 CFR Part 71) and physical protection requirements for UNF transport (10 CFR Part 73), including advance shipment notifications to Tribal and State governments.



Cutaway diagram of a type BF cask for transporting used nuclear fuel.

## U.S. Department of Homeland Security (DHS)

### U.S. Coast Guard (USCG)

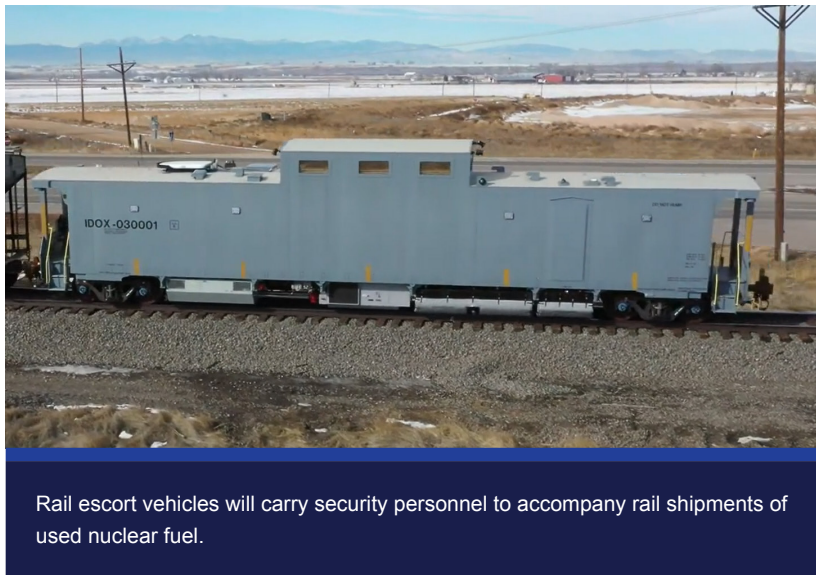
USCG enforces maritime law and security at ports and waterways. Barge transport of UNF would need to meet USCG regulations and requirements, which may include inspections and port security procedures. In addition, loading of UNF onto trucks or railcars at a water-bordering facility may require compliance with maritime transportation security requirements.

### Transportation Security Administration (TSA)

TSA focuses on protecting the Nation's transportation systems, including freight rail, to ensure freedom of movement for people and commerce. It also regulates freight rail transportation security in coordination with other agencies, such as the NRC and DOE with respect to rail shipments that are licensed or regulated by NRC or DOE under the AEA.

## U.S. Department of Energy (DOE)

DOE establishes requirements, responsibilities, and standard practices for its shipments through its directives, such as Order 460.2B, *Departmental Materials Transportation Management*, and Order 460.1D, *Hazardous Materials Packaging and Transportation Safety*, as well as through the Contractor Requirements Documents associated with the relevant Orders.



Through its directives, DOE requires that its shipments of radioactive material must be conducted in a manner that achieves an equivalent level of safety and security to that required by DOT and NRC for comparable commercial shipments.

### Requirements in NWPA Subtitle H - Transportation

With respect to UNF and HLW shipments by or on behalf of DOE to a Federal deep geologic repository under NWPA Subtitle A or to a Federal monitored retrievable storage facility (sometimes referred to today as a Federal staging facility) under NWPA Subtitle C, DOE rather than NRC is responsible for exercising the AEA authority to regulate the shipments, with a couple of exceptions, which are specified in NWPA Subtitle H (Section 180): (a) DOE is required to use packages certified for transport by the NRC, and (b) DOE is to provide advance notification in accordance with NRC regulations

to jurisdictions through which the shipments will be transported. In addition, Section 180(c) of Subtitle H directs DOE to provide technical assistance and funds to Tribes and States for training public safety officials in jurisdictions through which DOE will transport such shipments.

### Price-Anderson Act Coverage for DOE Shipments of UNF and HLW

The Price-Anderson Act (PAA) established a system of financial protection for persons who may be liable for and persons who may be injured by a nuclear incident. With respect to activities conducted for DOE, PAA requires DOE to include an indemnification in each contract that involves the risk of "public liability," meaning any legal liability resulting from a "nuclear incident" or "precautionary evacuation" as those terms are defined in the AEA. This would apply to transport of UNF and HLW for DOE.<sup>8</sup>

<sup>8</sup> In sum, DOE indemnifies persons who are found legally liable and thereby guarantees that funds will be available to pay the claims from persons who suffer nuclear damage. In common terms, it serves as an insurance policy to cover damage in the unlikely event of a nuclear incident involving DOE.



Atlas railcars will carry used nuclear fuel across the country. In 2024, the Association of American Railroads certified the Atlas railcar under Standard S-2043 to carry used nuclear fuel and other radioactive materials.

## Non-Regulatory National Industry Requirements and Standards

### Association of American Railroads (AAR)

The standard-setting organization for North American freight railroads, AAR establishes railcar design, operating, and safety standards. AAR requirements and standards relevant to UNF transport include:

**S-2043 (“Performance Specification for Trains Used to Carry High-Level Radioactive Material”)**—railcar design standard for railcars used to transport UNF and HLW, which DOE is required to meet per settlement agreements with certain rail carriers.

**OT-55 (“Recommended Railroad Operating Practices for Transportation of Hazardous Materials”)**—operating practices for railcars carrying UNF, including restricting maximum speeds to 50 mph, use of FRA track class 2 or higher, use of railcars equipped with roller bearings, and methods and responses for defect detection.

## Tribal, State, and Local Regulations

Many Tribes, States, and local governments have requirements in place that are relevant for UNF shipments. Some examples and key points are noted below:

- State, local, and/or county governments have specific requirements for oversized and overweight highway shipments, such as permitting requirements for heavy-haul trucks transported on public roads.
- Some States have requirements to escort and inspect shipments. Fees may be charged by a State for transport of hazardous materials to cover escorts, inspections, and other transport-related costs.
- Tribal Nations may exercise similar requirements to those above.
- Tribes and States may designate preferred routes for highway route controlled quantities of radioactive materials, consistent with requirements established by FMCSA.
- FRA’s State Rail Safety Participation Program allows for FRA-trained and certified State employees to conduct rail safety inspections. Currently, 31 States participate. Tribal Nations are not eligible at this time. Tribes may attend rail inspections in coordination with a qualified inspector(s) by prior agreement with the inspector(s) and the rail property owner for each time an inspection is performed.



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