



Backgrounder

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Transportation of Spent Fuel and Radioactive Materials

Roles of NRC and DOT

The transportation of radioactive materials is regulated jointly by the Nuclear Regulatory Commission (NRC) and the Department of Transportation (DOT). The responsibilities of the two agencies are generally divided as follows:

- DOT- Regulates shippers and carriers of hazardous materials, including radioactive material. It is responsible for such items as vehicle safety, routing, shipping papers, and emergency response information and shipper/carrier training requirements.
- NRC-Regulates users of radioactive material in 17 states (33 states regulate material within their borders) and approves the design, fabrication, use and maintenance of shipping containers for more hazardous radioactive material shipments. It also regulates the physical protection of commercial spent fuel in transit against sabotage or other malicious acts.

Transport of Radioactive Materials

The NRC requires radioactive materials to be shipped in accordance with the hazardous materials transportation safety regulations of DOT. Millions of “packages” of radioactive material are shipped throughout the United States annually by rail, air, sea, and over roads. They contain small quantities of radioactive material that are typically used in industry and medicine.

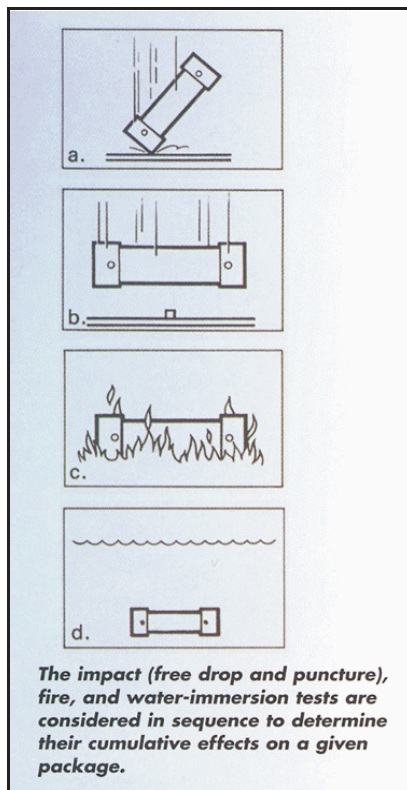
These packages are intended to provide a safe and economical means of transporting relatively small quantities of radioactive material. It is assumed that these packages could be damaged in an accident and that a portion of the contents could be released. The DOT regulations, therefore, prescribe limits on the maximum amounts of radioactivity that can be transported in these packages, such that doses from any accidents involving these packages will have no substantial health risks. Examples could include transport of smoke detectors, watch dials,

radiopharmaceuticals, and slightly contaminated equipment such as syringes used to administer radiopharmaceuticals.

Spent Nuclear Fuel Shipping Container Safety Standards

Spent nuclear fuel is solid, highly radioactive uranium that has been used to power a nuclear reactor and is no longer useful for producing energy. When it is removed from the reactor, it must be shipped in containers or casks that shield and contain the radioactivity and dissipate the heat.

Safety standards for spent fuel casks are set forth in NRC regulations (10 CFR Part 71). Casks must be designed to survive a sequence of tests including a 30-foot drop onto an unyielding surface followed by a fully engulfing fire of 1475 degrees Fahrenheit for 30 minutes. This is a very severe test sequence that equates to the cask hitting a concrete upright along a highway at a high speed, or being involved in a very severe and long-lasting fire, and encompasses more than 99% of vehicle accidents.



The standards established in NRC regulations require that spent nuclear fuel shipping containers, or casks, prevent the loss or dispersion of radioactive contents, provide shielding and heat dissipation, and prevent nuclear criticality (a self-sustaining nuclear chain reaction) under both normal and accident conditions of transportation.

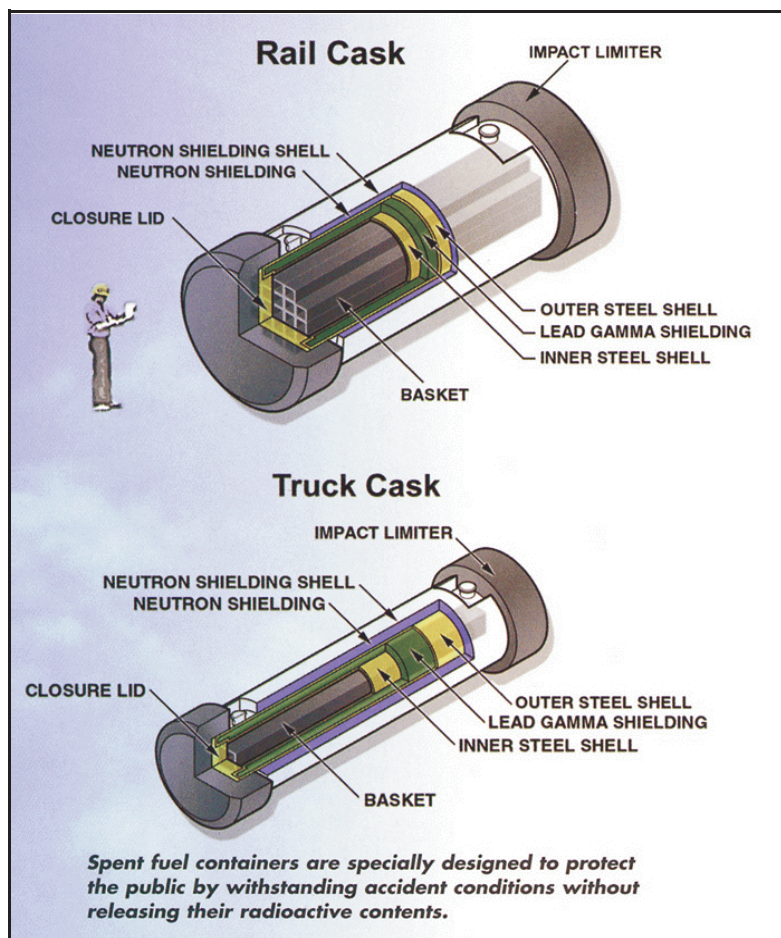
The normal conditions of transportation which must be considered are specified in the regulations in terms of hot and cold environments, pressure differential, vibration, water spray, impact, puncture, and compression tests. The accident conditions that must be considered are specified in terms of impact, puncture, fire, and water immersion test conditions.

NRC reviews each cask design and verifies that the design meets prescribed accident conditions. An approval certificate for the design must be issued by the NRC before a cask can be used to transport spent fuel.

Adequacy of Safety Standards

NRC conducts activities in three broad areas to ensure that radioactive materials are transported safely. They are:

- 1) Review and certification of transport package designs for large quantities of fissile and



radioactive material contents to ensure that the material will be transported in a safe container;

2) Inspection of fabricators of packages to provide additional assurance that packages conform to NRC-approved designs and have been fabricated in accordance with required quality assurance programs; and

3) Inspection of some spent fuel shipments.

The NRC's established system of regulatory controls protects every U.S. shipment of spent nuclear fuel from commercial reactors, no matter how small or large or frequent. For more than 25 years, this system of oversight has resulted in an outstanding record of safety and security. After the September 11, 2001 terrorist attacks, this robust system was

expanded even more.

The regulatory bases for spent fuel shipment safety include those of the International Atomic Energy Agency transportation safety standards and Department of Transportation regulations.

The NRC periodically reevaluates its transportation regulations to assess the need for new regulations, policies or technical improvements that support protection of the public and the environment.

The elements that work together to make spent fuel shipments safe include:

- Quality Assurance programs for cask design, use, and maintenance;
- Shipper and carrier training (DOT regulations);
- Emergency response coordination, training, and communication (DOT/Federal Emergency Management Agency);
- Independent review and certification of cask designs prior to use (NRC);
- Transportation inspection/enforcement programs (NRC/DOT); and

- Physical tests and modeling analyses of cask and components under test and hypothetical accident conditions showing compliance with federal safety regulations.

These elements have resulted in the safe completion of thousands of domestic and foreign spent fuel shipments. Although there will always be a slight chance that an accident will cause a release of nuclear material, NRC has found that the likelihood of such an event and the associated risk to the public are small. Even so, NRC will continue to be vigilant about public safety as an essential part of its mission.

NRC Review of Spent Nuclear Fuel Transport Safety

The shipment of spent nuclear fuel in NRC-certified packages has an excellent safety record. However, NRC recognized that the characteristics of the spent fuel and its container systems have changed over the years and that many more shipments are possible should a high-level waste repository be built to store wastes from commercial nuclear power plants.

In February 2000, NRC used improved technology to analyze the ability of containers to withstand an accident. The study found the risks from accidents in shipping spent nuclear fuel to be very small (see report NUREG/CR-6672)– smaller than originally estimated in 1977. In addition, the NRC initiated a research program that considered the public’s concern about transportation of spent nuclear fuel, including the robustness of transportation containers, the need for full-scale physical testing of the containers, and confirmation of valid computer models used in NUREG/CR-6672. This study is referred to as the “Package Performance Study.” Numerous public meetings were held to obtain a better understanding of the public’s concerns about transportation of spent nuclear fuel.

In February 2003, the NRC published for public comment, the “Package Performance Study Test Protocols Report (NUREG-1768) which included preliminary plans for examining the response of full-scale rail and truck containers to extreme accident conditions, including subjecting casks to high-speed impact and fire tests. [More information on the study can be found on our web at <http://www.nrc.gov/waste/spent-fuel-transp.html> under the topic of “Regulatory Initiatives.”] After careful consideration of comments, the Commission approved testing of a full-scale certified transportation rail cask. There will be no fire or immersion testing.

Transportation Security

The NRC requires that licensees and carriers involved in spent fuel shipments:

- Follow only approved routes;
- Provide armed escorts for heavily populated areas;
- Use immobilization devices;
- Provide monitoring and redundant communications;

- Coordinate with law enforcement agencies before shipments; and
- Notify in advance the NRC and States through which the shipments will pass.

Since the terrorist attacks on September 11, 2001, the NRC has issued safeguards advisories and orders to enhance the security of spent nuclear fuel transportation and shipments of large quantities of radioactive material. Enhancements include more pre-planning and coordination with affected States, additional advance notification of shipments, enhanced control and monitoring, trustworthiness checks for individuals who have access to the shipment or information about the shipment, and stronger information security measures for shipment routes and schedules. In addition, NRC issued Orders requiring enhanced security measures for spent fuel shipments from reactors.

Both the NRC and the Department of Energy continue joint operation of a national database and information support system to track movement of domestic and foreign nuclear materials under safeguards control.

Accident Response Assistance

If an accident occurs, state and local governments are primarily responsible for overseeing the response of the carrier, shipper and others and for taking any actions deemed necessary to protect the public health and safety.

The NRC activates its incident response program for any event involving NRC-licensed material that could threaten public health and safety, or the environment. During an event, the NRC activates its Headquarters Operations Center and one of its four Regional Incident Response Centers (Region I-King of Prussia, Pa.; Region II-Atlanta, Ga.; Region III-Lisle, Ill.; and Region IV-Arlington, Tex.).

NRC's highest priority is to provide expert consultation, support, and assistance to state and local public safety officials responding to the event. Once the NRC incident response program is put in motion, teams of specialists are assembled at the Operations Center and Incident Response Center to obtain and evaluate event information and to assess the potential impact of the event on public health and safety and the environment.

Scientists and engineers analyze the event and evaluate possible recovery strategies. Meanwhile, other experts evaluate the effectiveness of protective actions, such as sheltering and evacuation, to minimize the impact on public health and safety and the environment. Communications with the news media, State, and other Federal agencies, the Congress, and the White House are coordinated through the Operations Center. [More information is available on our web site at: <http://www.nrc.gov/what-we-do/emerg-preparedness/respond-to-emergency.html>.]

Additional information on the safety of spent fuel transportation can be found in NUREG/BR-0292 which is available on our web site at:

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0292> .

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