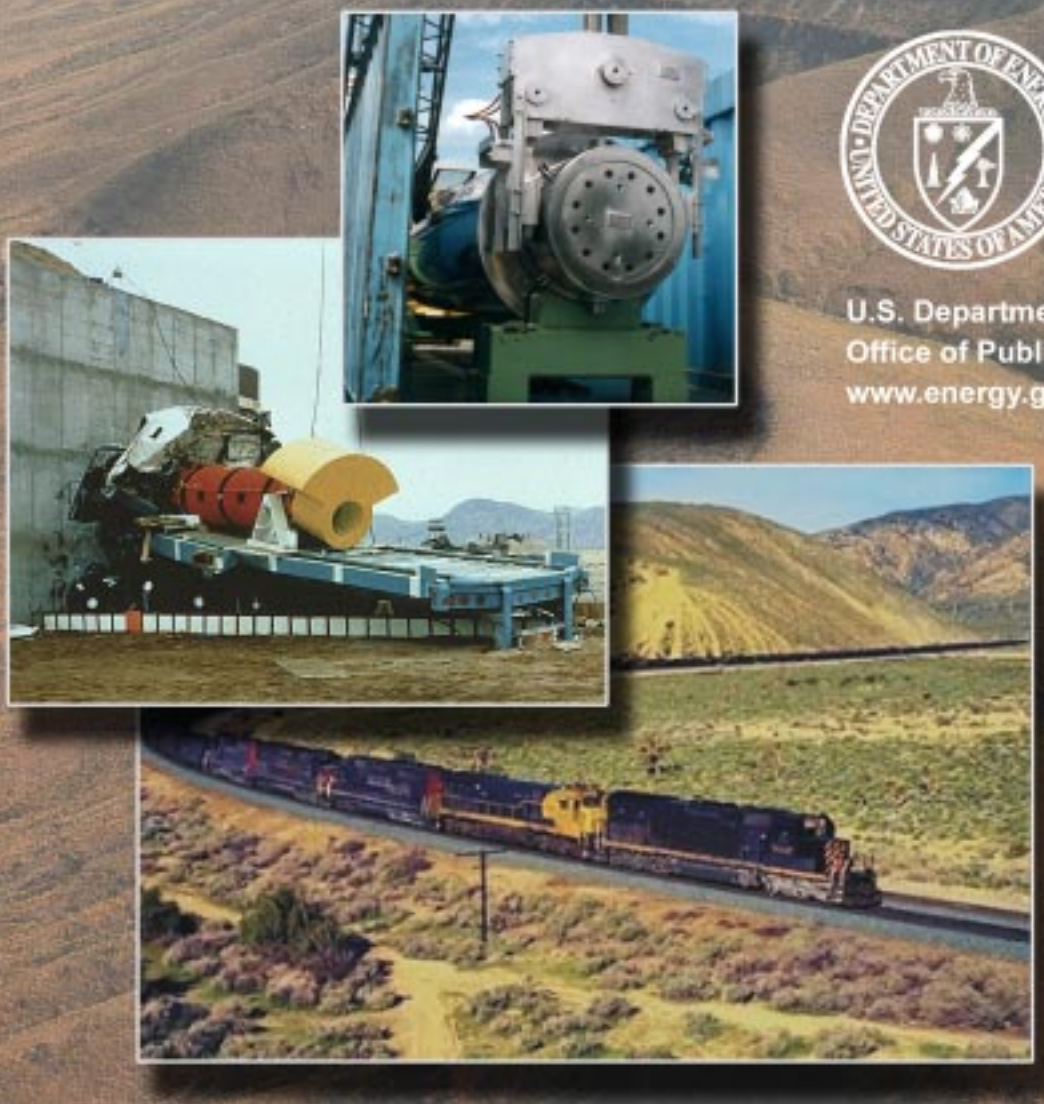
Spent Nuclear Fuel Transportation



U.S. Department of Energy
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John Eversole, Chief of the Chicago Fire Department stated:

"The International Association of Fire Chiefs have taken the position that, yes, you can safely move spent nuclear fuel and looking at the protective measures that have been taken, it seems to us that a superior job has been done in preparing to move this product."

- Our national experience (to date):
  2,700 shipments; 1.6 million miles; 30 years;
  No harmful release of radiation
- Any shipping is subject to strict Nuclear Regulatory Commission and U.S. Department of Transportation guidelines and regulations
- Shipments are forecast to begin in 2010
- Estimated number of average annual shipments: 175
- Shipping containers are the most robust in the transportation industry

Transportation of Radioactive Materials and Yucca Mountain

Introduction

The established record of transportation of spent nuclear fuel overwhelmingly indicates that it is safe. Since the 1960s, over 1.6 million miles have been traveled by more than 2,700 spent nuclear fuel shipments without any harmful release of radioactive material. If Yucca Mountain is approved and a repository is built, transportation of spent nuclear fuel and high-level radioactive waste from the 131 temporary storage sites located in 39 states would begin in **2010**—the scheduled opening date for Yucca Mountain. No spent fuel can be moved to Yucca Mountain until the Nuclear Regulatory Commission (NRC) licenses the repository for receipt of spent fuel.

Should a repository be licensed at Yucca Mountain, the Department of Energy (DOE) projects that it would conduct approximately 4,300 shipments over a 24-year period. That's an average of about 175 shipments of spent nuclear fuel per year, a relatively small amount compared with the approximately 300 million annual shipments of hazardous materials[1]—explosives, chemicals, flammable liquids, corrosive materials, and other types of radioactive materials—that are currently transported around the country every day.

The shipment of nuclear waste is highly regulated and subject to the utmost scrutiny. We follow the strict Department of Transportation (DOT) and NRC transportation rules, including the use of NRC-certified transportation casks, advance route approvals and notification, and shipment escorts. The Department also tracks its shipments by satellite on a 24-hour basis. DOE follows these precautions carefully now and will follow or exceed any others that may be required in the future, whether by the Congress or by DOT or NRC.

Preliminary route selection and detailed planning will begin at least five years before the first shipment takes place. As is current practice, the federal government will work with States and Tribes before shipments of spent nuclear fuel begin. For example, for highway shipments, each State's Governor has the ability to provide the DOT its preferred routes for use. This and similar interaction will ensure that all routes meet the regulatory requirements set for safe and secure transport of spent nuclear fuel.

Finally, the Department is committed to ensuring safe practices in the transportation of nuclear materials. DOE has already trained emergency response teams in 34 States, under a variety of programs and in cooperation with other government agencies. Using funds and expertise provided by the Department, local fire and police will continue to be trained in advance to respond appropriately to challenges unique to these shipments.

1 Hazardous Materials Shipments. Washington, DC: U.S. Department of Transportation, The Office of Hazardous Materials Safety Research and Special Programs Administration, October 1998.

The Nation's Nuclear Transportation Record is Impressive

- Our record speaks for itself. Transportation of nuclear waste is safe. Over the last 30 years, there have been over 2,700 shipments of spent nuclear fuel traveling over 1.6 million miles. There has never been a release of radioactive material harmful to the public or the environment—not one.

  - The Waste Isolation Pilot Plant, or WIPP, is the nation's first facility licensed to safely and permanently dispose of radioactive waste associated with the production of nuclear weapons. In the last 3 years WIPP has received nearly 700 shipments and logged 1.5 million safe transportation miles.

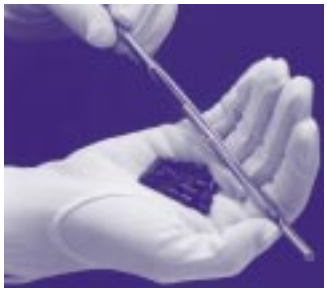
- Our safety record is comparable to that in Europe, where spent nuclear fuel has been transported extensively. Over the last 25 years, more than 70,000 metric tons of spent nuclear fuel (an amount roughly equal to what the Nuclear Waste Policy Act authorizes for Yucca Mountain) has been shipped. France and Britain together average 650 shipments per year, considerably more than 175 average annual shipments contemplated for the Yucca Mountain Project. While some of the shipments in Europe travel a shorter distance than some of the shipments to Yucca Mountain would travel, it's worth noting that these shipments travel across countries that are much more densely populated than the United States.

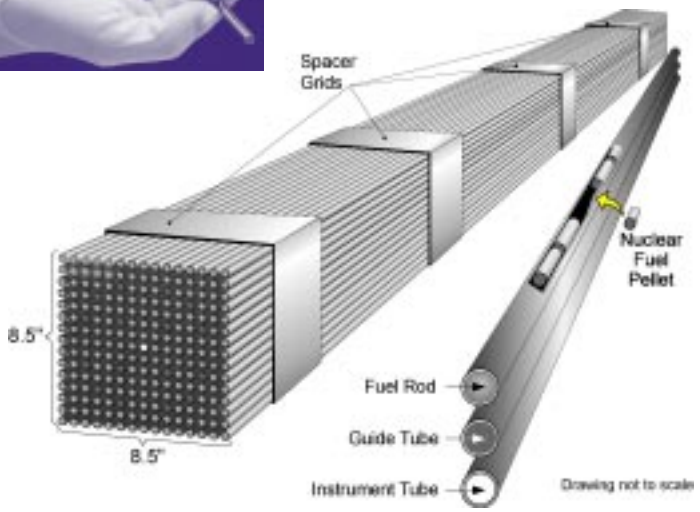
- Transportation of waste is a collaborative effort. The Department plans to continue to coordinate planning concerning shipments and specific routes with states and tribes. DOE nuclear material shipments undergo more scrutiny by state, tribal and local transportation safety specialists than any other hazardous materials shipments. That cooperation and coordination would continue.

What is Spent Nuclear Fuel and How is it Transported?

What is spent nuclear fuel?

- "Spent nuclear fuel" is a collection of solid ceramic pellets. Each pellet is approximately the size of a pencil eraser, and is secured inside an assembly of strong, multi-layer metal tubes. These pellets, tubes, and assemblies are specifically manufactured to contain radioactive materials both during use in a reactor and during long-term storage. **Spent nuclear fuel is not a liquid or a gas, and will not pour or evaporate.**
- Spent nuclear fuel does not burn. In fact, it is not flammable; **it cannot burn, even if it is engulfed in fire.** Nuclear fuel generates heat when it is subject to certain conditions in a nuclear reactor; the heat from the fuel is used to create steam, which passes through a turbine and turns a





Typical nuclear fuel assembly design

generator. Nuclear fuel is considered "spent" when it no longer gives off enough heat to effectively generate electricity. Once it is used in a reactor, spent nuclear fuel further cools in temporary cooling pools until it is safe to transport.

- Spent nuclear fuel cannot explode. Spent nuclear fuel is not explosive, and is not a "bomb" of any sort—nuclear or otherwise. Spent fuel pellets, assemblies, and transport casks for spent nuclear fuel are designed to remain safe and contain spent fuel under all credible scenarios. Conversely, nuclear weapons are specifically designed to cause damage by widespread dispersion of energy and radioactivity.

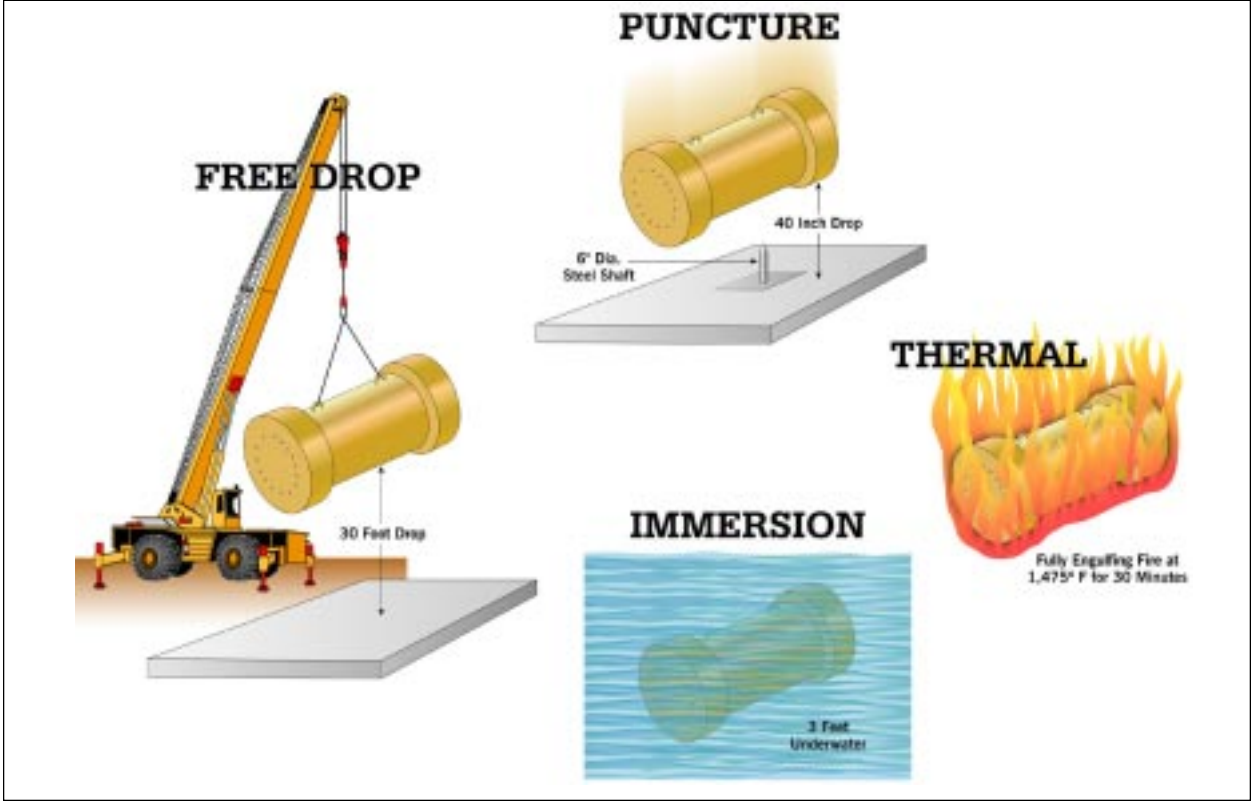
How is spent nuclear fuel transported?

- Spent nuclear fuel is transported in strong, thick-walled casks. The DOE will use extremely durable and massive transportation casks whose designs are certified by the NRC. The containers use multiple layers of lead and other materials to protect the spent fuel and confine radiation. Typically, for every ton of spent fuel there are approximately four tons of protective shielding materials.

- Transport of spent nuclear fuel is highly regulated by the DOT and the NRC. The DOT regulates all hazardous waste transportation, including radioactive materials, to ensure public health and safety. The NRC regulates all commercial nuclear activities, the transportation of spent nuclear fuel, the design, manufacture, and security of transportation casks, and any development and operation of Yucca Mountain.

- DOE spent nuclear fuel shipments are always tracked and escorted. The Department's practice is to track and escort each shipment 24-hours a day.

To be certified by the Nuclear Regulatory Commission, every type of transportation cask must be able to withstand all of the tests shown below.



How strong is a transportation cask?

- All spent nuclear fuel cask designs must be certified by the NRC, and must safely contain radioactive contents under hypothetical accident conditions that simulate the conditions of severe accidents. These conditions must be evaluated in sequence, on the same cask design:

  - a 30-foot free fall onto an unyielding surface, landing on the cask's weakest point, which would be equivalent to a crash at 120 miles per hour into a concrete bridge abutment;
  - a puncture test, during which the container must fall 40 inches onto a steel rod six inches in diameter;
  - a 30-minute exposure to fire at 1,475 degrees Fahrenheit that engulfs the entire container; and
  - submergence of the same container under three feet of water.

To achieve certification, a cask must prevent harmful release of radioactive material even when subjected to each of these tests.

How is cask safety verified?

The NRC and the DOE both maintain state-of-the-art capabilities to evaluate cask strength. The NRC evaluates cask designs as part of the certification process, and the Department's labs—the so-called "national labs"—have been called upon in the past to conduct a variety of cask tests.

- The NRC regularly updates its cask safety evaluations. The NRC reviews real-life transportation accidents to verify that cask designs will continue to perform safely and securely during transport. For example:

  - As a result of the Howard Street Tunnel accident in Baltimore, Maryland (which did not involve radioactive materials), studies were done by the NRC to determine the potential effects of such an accident if it involved a spent fuel shipping container. As a result of these studies an NRC staffer concluded that the spent fuel would not have been damaged in a similar accident scenario. ***(Nuclear Fuel***, 11/12/01)

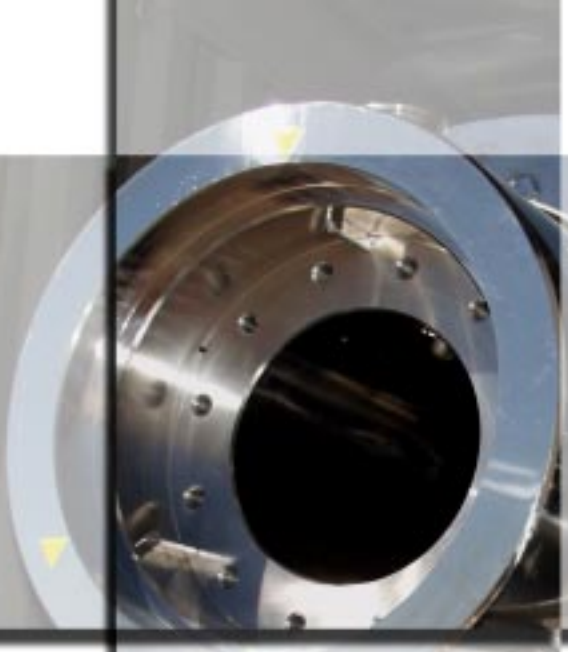
- Live-action tests. Extensive studies and tests have been conducted. Examples are:

  - Sandia Crash Tests. Sandia National Laboratories in New Mexico subjected casks to real-life accidents to see what would happen. They included:

  (1) A flatbed truck loaded with a full-scale cask was smashed into a 700-ton concrete wall at 80 miles an hour.
  (2) A cask was broad-sided by a rocket-propelled 120-ton rail locomotive traveling 80 miles per hour, and
  (3) A transportation container was dropped 2000 feet onto soil as hard as concrete, and was traveling 235 miles an hour at impact.

In all of these cases the containers survived their tests intact.

  - Operation "Smash Hit." On July 17, 1984, the Central Electricity Generating Board of Great Britain conducted a live television demonstration of spent fuel cask integrity. In front of 2,000 spectators, CEGB rammed an unmanned locomotive at 100 mph into a MAGNOX spent fuel cask. The cask survived the test with superficial damage, meeting the stringent containment standards. Although the cask was of British design, essentially the same international design standards for strength are used in both the U.K. and the U.S.



What precautions does the government currently take in transportation?

- Routing. The DOT has established a process that must be used for evaluating potential highway routes, and the NRC would approve all routes and security plans. States and tribes will work with the DOT, the DOE and the NRC to identify preferred shipping routes; all states and tribes can—and some states already have—designated their "preferred" highway routes.
- Security. Armed escorts are required through heavily populated metropolitan areas and, at the discretion of the Governor of a state, through the entire state. All shipments are accompanied by escorts 24-hours a day.
- Tracking. The Governor of each state is notified in advance of spent fuel shipments. Federal officials track these shipments around the clock through a satellite-based tracking system. In addition to continuous tracking by satellite, these shipments are required to have an escort report in to the central transportation command facility every two hours to ensure there are no problems.
- Coordination with state officials. Specific timing and routes of shipments are kept classified for security reasons. However, those with a need-to-know (such as state or tribal representatives, law enforcement and emergency response officials, and inspectors) are informed of spent fuel shipments as they are being transported. All shipments are closely coordinated with local and federal law enforcement agencies.
- Training. States and tribes have and will continue to receive federal support specifically to train in preparation for nuclear shipments. This funding is intended to train local officials along transportation routes in emergency response and inspection

procedures, and is also used for the purchase of equipment. Funding specifically for Yucca Mountain shipments is planned to begin in 2005; the Department has worked with the states and tribes to develop a process for the funds to be distributed, and plans to finalize these next year.

What is the government doing with Emergency Preparedness Assistance?

Since the 1950's, the Federal government has had its own experienced teams of emergency responders, and it currently funds an extensive array of emergency preparedness activities that are conducted at all levels of government nationwide. For example:

- Emergency responders receive assistance and training from DOE, DOT, the Federal Emergency Management Agency (FEMA) and others, and are specifically trained and prepared to respond to a wide variety of incidents and accidents. DOE will continue to provide training resources to emergency response personnel and employee organizations to prepare for any challenges unique to DOE shipments.

- The Department has directly trained over 1200 responders; in addition, DOE-trained instructors have in turn provided training to many additional emergency personnel (i.e., state, tribal and local responder organizations). Training materials have been distributed nation-wide and are being integrated into standard training for first responders.

- Since 1992, the DOE has provided about $20 million in state funding assistance. The states that have received funding assistance are:

Alabama	Arizona	California
Colorado	Georgia	Idaho
Illinois	Indiana	Iowa
Kentucky	Louisiana	Mississippi
Nebraska	Nevada	New Mexico
Ohio	Oregon	S. Carolina
Tennessee	Texas	Utah
Washington	Wyoming	

- The DOE has provided approximately $30 million in training along routes to prepare for shipments of radioactive waste to the underground Waste Isolation Pilot Plant in Carlsbad, New Mexico.

Since 1988, WIPP has trained:

21,486 State and Tribal First Responders; and
2,340 Emergency Medical Personnel

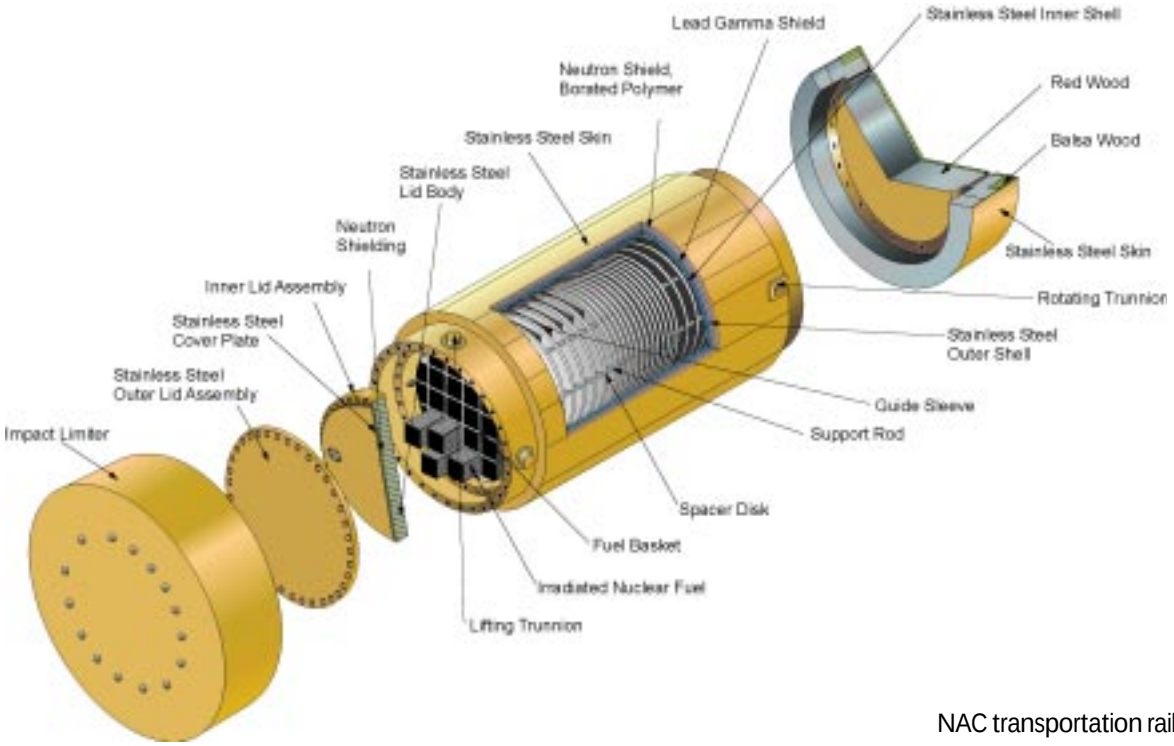
in 22 States:

Alabama	Arizona	California
Colorado	Georgia	Idaho
Illinois	Indiana	Iowa
Louisiana	Mississippi	Nebraska
Nevada	New Mexico	Ohio
Oregon	S. Carolina	Tennessee
Texas	Utah	Washington
Wyoming		

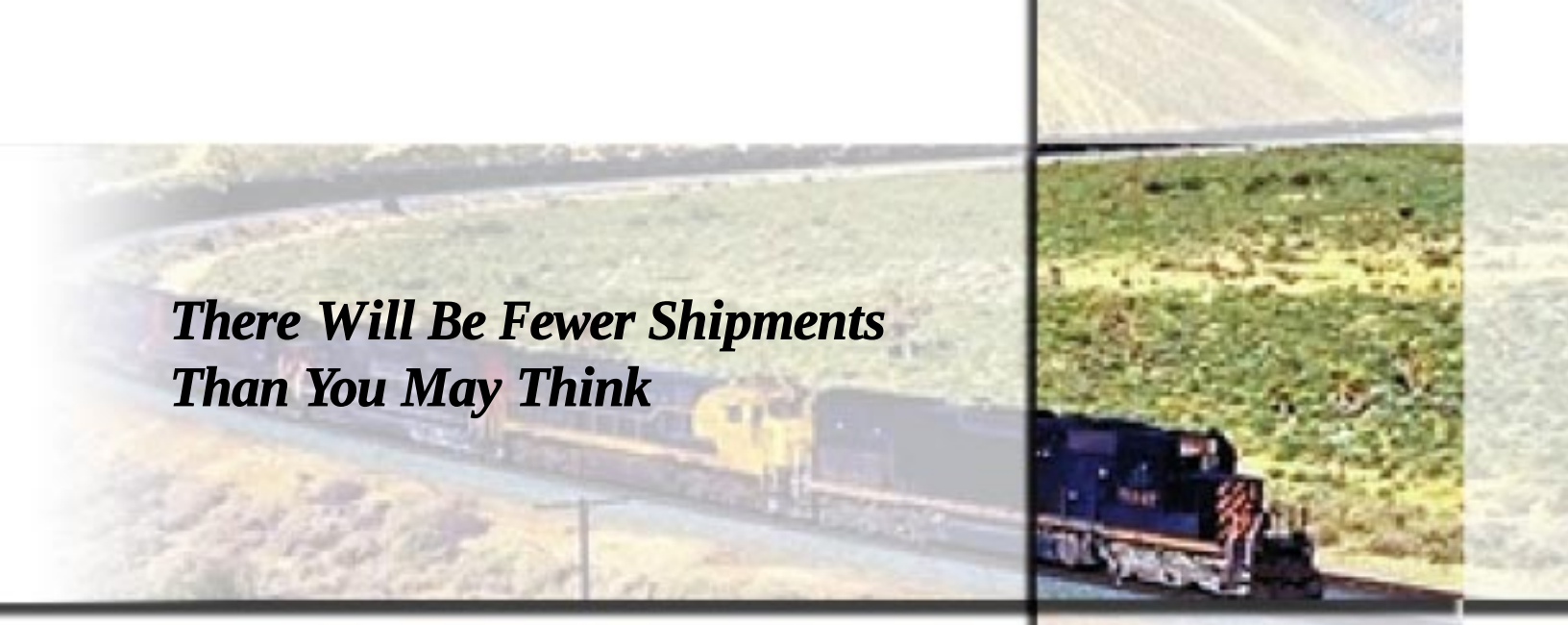
- The DOE Transportation Emergency Preparedness Program provides technical assistance and training to emergency responders. In the past 2 years, the program provided train-the-trainer and direct classroom training to responders in the following 34 states:

Alabama	Arkansas	Arizona
California	Connecticut	Delaware
Georgia	Idaho	Illinois
Indiana	Iowa	Kentucky
Louisiana	Maryland	Mississippi
Missouri	Nebraska	Nevada
New Jersey	New Mexico	New Hampshire
New York	N. Carolina	Ohio
Oregon	Pennsylvania	S. Carolina
Tennessee	Texas	Utah
Virginia	Washington	W. Virginia
Wyoming		

- DOT's Hazardous Materials Emergency Preparedness (HMEP) Grants Program has, to date, awarded $73 million in grants to all 50 states and the District of Columbia.
- FEMA's First Responder Grant Program is budgeted at $3.5 billion next year for the assistance to the nation's first responders (police, fire, and emergency management services).



NAC transportation rail cask



There Will Be Fewer Shipments Than You May Think

How many shipments are we really talking about?

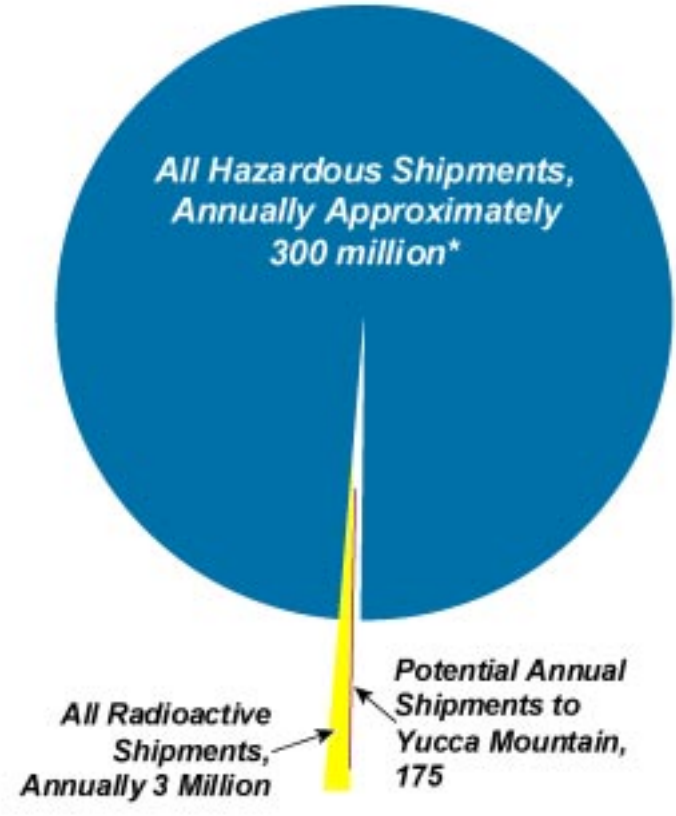
- Under the current 24 year waste emplacement plan, DOE anticipates, on average, approximately 175 rail and truck shipments a year traveling on the nation's rail lines and interstate highways to move spent nuclear fuel to Yucca Mountain. That's approximately one shipment every two days somewhere in the United States, versus the tons of waste currently stranded within 75 miles of 161 million Americans at nuclear power plants—or the 300,000 daily shipments of petroleum products.

How does 175 annual shipments compare to other shipments?

- Compared to the total shipments of hazardous material: Currently, there are approximately 300 million hazardous and radioactive shipments annually in the United States—or nearly 1.2 million shipments every working day. Many of those are potentially more dangerous than the shipments to Yucca Mountain because, unlike the spent fuel shipments that would be headed to Yucca Mountain, they involve explosive or highly flammable materials.

- Compared to all radioactive shipments: There are currently about 3 million shipments of radioactive materials each year in the United States. These shipments are made to hospitals, universities, industrial and manufacturing plants, research facilities, and radioactive waste disposal facilities. The shipments to Yucca Mountain would average approximately 175 a year, or about 0.006% of the radioactive shipments currently crossing the country every year.

A Comparison of Annual Shipments:



* Based on U.S. Department of Transportation Office of Hazardous Materials Safety Estimate. "Hazardous" shipments include materials such as explosives, flammable gases, solids and liquids, and poison gas.

What routes will the shipments take?

- Shipping routes have not yet been identified. We are not shipping until the end of this decade. While representative potential routes were evaluated in DOE's Final Environmental Impact Statement, actual transportation routes have not yet been determined.
- We expect to begin developing the actual routes about five years before shipments begin, ensuring there will be ample time to select the routes and methods of shipment that best ensure public safety.
- Shipments will be coordinated with states and tribes. The Department has coordinated with states and tribes on transportation issues for more than a decade and will continue that practice. States and tribes have the opportunity to designate preferred highway routes within their borders in accordance with DOT regulations.
- The preferred transportation mode is rail, not highway (or barge)**.** As analyzed in the Final Environmental Impact Statement, the Department's preference is to ship approximately 95% of the nuclear material to Yucca Mountain by rail. Again, however, decisions concerning transportation mode have not been made and all aspects of transportation will be thoroughly reviewed and analyzed if the site is approved for a permanent repository.

Shipments will occur whether or not Yucca Mountain is approved.

Transportation of radioactive materials will neither begin nor end with the approval of Yucca Mountain as the Nation's permanent high-level radioactive waste repository.

Spent nuclear fuel and high-level radioactive waste is currently temporarily stored at 131 sites in 39 states. This material was never intended to remain distributed at these sites permanently. Nuclear materials at the Department's environmental cleanup sites, in particular, must move to a permanent, safe repository in order for cleanup to progress toward completion. And commercial facilities, which will continue to produce spent nuclear fuel, must also continue to add storage capacity—or cease operations, putting at risk 20% of the national electricity supply.

- In fact, waste stored at the nine shut-down commercial reactor sites and one commercial storage site could be completely removed if a repository were available. Those ten sites are:

Humboldt Bay, California	Rancho Seco, California
Haddam Neck, Connecticut	Morris, Illinois
Zion, Illinois	Yankee Rowe, Massachusetts
Maine Yankee, Maine	Big Rock Point, Michigan
Trojan, Oregon	LaCrosse, Wisconsin

- We have shipped spent nuclear fuel safely for more than 30 years. Since the 1960s, we have safely shipped more than 2,700 spent nuclear fuel shipments over 1.6 million miles.

In the absence of Yucca Mountain, ad-hoc solutions and alternative fuel storage sites will be the means for dealing with spent nuclear fuel.

- Even if we merely keep our present supply of nuclear energy constant, we will soon run out of space at the current temporary

storage facilities. Off-site storage facilities will need to be built and substantial amounts of waste will have to be transported to them.

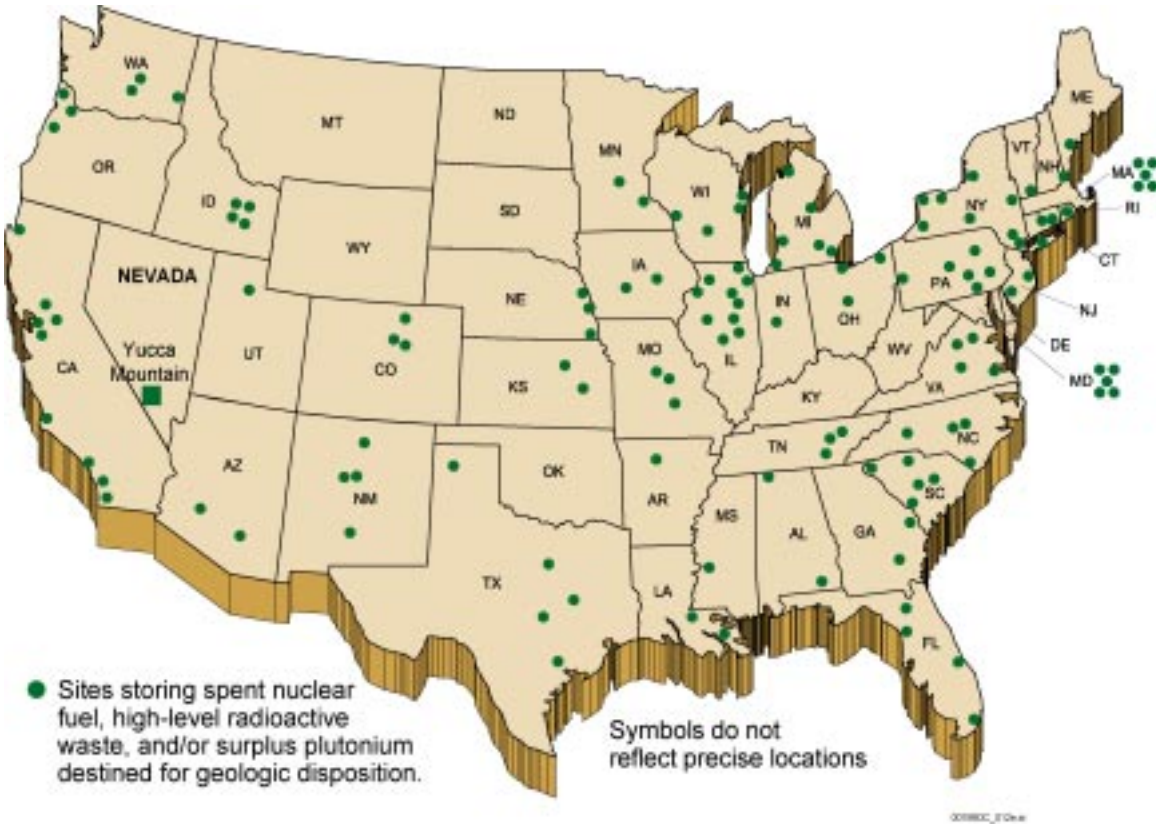
- Many of these older sites have reached or will soon reach pool storage limits. Over 40 sites are projected to need some form of dry storage by 2010—something never intended for most facilities at the time they were built. And although storage facilities will be required, in many instances the construction of additional on-site dry storage facilities will be impossible.

- Many utilities simply do not have space available for additional temporary storage facilities. Major regulatory hurdles can also pose difficulties such that other, off-site options will become attractive alternatives.

- A coalition of nuclear utilities is working toward construction of an "interim" storage facility, and is currently engaged in a licensing proceeding before the NRC; the coalition plans to ship approximately 200 casks every year for the next 20 years. Whether or not this effort ultimately succeeds, it is likely that some similar effort eventually will.

In the absence of Yucca Mountain, excess spent fuel waste will be still transported—it will just be transported on an ad-hoc basis to numerous temporary facilities instead of under a coordinated federal transportation plan to a permanent underground repository.

- The essential transportation question raised by Yucca Mountain is not whether nuclear waste will be transported or will stay put where it is. Rather, the question is whether, as a national policy, it is best for transportation to be arranged on an ad-hoc basis to potentially numerous supplemental storage sites—or for transportation to be arranged systematically and with years of careful advance planning to a permanent repository.



"The success of the cross-country nuclear shipment through our state is a direct reflection of the cooperation and coordination exhibited by both agencies."

Quote from Col. Roger D. Stottlemyre,
Superintendent, Missouri State Highway Patrol
in a letter to DOE officials, August 17, 2001

"***As stated in my earlier correspondence, I feel the Transportation Emergency Preparedness Program has established a solid foundation that can be used to prepare first responders not only in South Carolina but across the nation in response to a transportation accident involving radioactive materials… In a very short time, the [DOE] Transportation Emergency Preparedness Program has been very successful and has the support of stakeholders nationwide***.

Quote from Charles R. Sharpe,
South Carolina House of Representatives
in a letter to Secretary Abraham

Our national experience (to date):
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No harmful release of radiation

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