3 EXPERIENCE

3.1 Department of Transportation Spent Fuel Transportation Experience

3.1.1 Transportation Safety in the United States and Internationally, Mr. Rick Boyle, Department of Transportation

Mr. Boyle is head of the Radioactive Materials Team, Office of Hazardous Materials Safety, Research and Special Programs Administration (RSPA), DOT. This office works with the NRC SFPO in developing the radioactive materials packaging and transport standards. Both DOT and NRC are involved with the IAEA on international transportation issues.

Current regulatory issues that DOT is working on include security and safeguards requirements. The formation of the Office of Homeland Security highlights the attention being placed on security matters. A conference will be held in July 2003 at the IAEA to start a transport security program. DOT, as the competent authority for the United States, will participate. Currently, the Office of Homeland Security, as well as DOT's Transport Security Administration and NRC, are working on interim compulsory measures.

The mode and route selection criteria are becoming more relevant due to the potential repository at Yucca Mountain. In 1992, DOT published guidelines for selecting preferred highway routes for highway route controlled shipments of spent fuel. DOT is currently working on updating these guidelines and better defining preferred routes, alternate routes, state approvals, etc.

Another area on which DOT is focusing is public participation in the regulatory process, including public meetings. DOT is often told that once the international organizations, which include the IAEA and the Civil Aviation Administration, pass a regulation there is very little DOT can do. Therefore, the Department is looking at increased public participation to assist in this area. In addition, DOT is involved in training the operators and the shippers, the emergency responders, and the government first responders, as well as the people who will be conducting inspections and providing escorts, as necessary. DOT is also working on radiation protection issues (e.g., proper contamination limits and air and sea transport requirements).

With regard to transportation experience and safety, DOT data from the mode and route study published a few years ago noted that from 1979 to 1990, 89 percent of the spent fuel and high-level waste shipments made in the United States, excluding DOE shipments, were made by highway. However, only 27 percent of the tonnage is carried by highway; the rest is carried by rail.

Of the approximately 1600 total shipments made, 89 percent would represent just over 1400 highway shipments of 427,000 kilograms of spent nuclear fuel or high-level waste. The shipments have been made in legal weight trucks. Approximately 300 kilograms of spent fuel is the average load. The security and safeguard requirements are defined in the NRC regulations, and the route selection is currently defined by the Federal Motor Carrier Safety Administration.

Spent fuel and high-level waste shipments have logged 1.6 million miles traveled; eight accidents and no radiological release have occurred. A summary of the accidents follows.

- December 8, 1971, in Tennessee, the driver of a truck carrying nuclear waste swerved off the road in a rain storm. The truck rolled over into a ditch and the driver was killed. The cask carrying the waste was thrown off the truck, but the cask was not damaged and no material leaked.

- March 29, 1974, in a North Carolina rail yard, a train derailed and struck another train that was carrying an empty cask designed to carry spent fuel. The damage to the cask was superficial.

- February 9, 1978, in Illinois, the trailer of a truck hauling nuclear waste collapsed while the truck was crossing a railroad track. The cask was not damaged and no material leaked.

- August 13, 1978, in New Jersey, an empty spent fuel cask was being placed on a trailer when the trailer deck failed because of a broken weld. The cask was not damaged.

- December 9, 1983, on the Indiana-Illinois-Tennessee border, a waste hauling truck separated from its trailer which was carrying a spent nuclear fuel cask. The cask was not damaged and there were no leaks.

- March 24, 1987, in St. Louis, a train carrying nuclear waste collided with a car at a road crossing, the cask was not damaged and there were no leaks.

- January 9, 1988, in Nebraska, a train carrying an empty cask derailed. The cask was not damaged.

- December 14, 1995, in North Carolina, a train carrying empty casks derailed. The casks were not damaged.

About 5 or 6 years ago, the SFPO and DOT began working to put the new surface contaminated object standards into the regulations. A problem existed with transporting very large maintenance equipment used during outages at nuclear plants, as well as large components removed from nuclear plants during decommissioning or plant repairs. Large components such as steam generators (Figure 19) have been shipped to either Barnwell or Envirocare. This is usually accomplished by a short heavy haul to a multi-modal point where the equipment can then be loaded onto a train or a barge. Steam generators have been transported from Connecticut Yankee, Maine Yankee, Kewaunee, Big Rock Point, San Onofre, St. Lucie, Haddam Neck, and D.C. Cook.

Figure 19

DOT believes that it is prepared to deal with both a heavy haul on the highway, as well as a barge or rail shipment of something of this size.

Other components that have been moved in multi-modal shipments include the Waltz Mill reactor tank which was taken to the railhead by heavy haul highway and then loaded onto a rail car and taken by rail the rest of the way. DOT is looking at multi-modal transfers both to water and to rail.

Heavy haul was also used to move the San Onofre reactor pressure vessel head from San Onofre to the Envirocare facility. Heavy haul was used the entire way. The reactor pressure vessel head was moved at night with police escort from San Onofre to Utah. DOT is also prepared for heavy haul over longer distances as well.

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Transport Safety In The U.S. and Internationally

Rick Boyle
U.S. Department of Transportation
Hazardous Materials Safety

Overview

- Regulatory Overview
- Regulatory Issues
- Transportation History
- Transportation Incidents
- Programs of Interest

Regulatory Overview

- RSPA and NRC develop RAM Packaging and Transport Standards
- Modal Authorities develop operational standards and conduct CA programs
- Operators/Shippers comply with all of the above.

Regulatory Issues

- Security and safeguard requirements
- Mode and Route selection criteria
- Public Participation
- Training (operator, shipper, emergency response and governments)
- Technical issues: radiation protection; contamination limits; air and sea transport

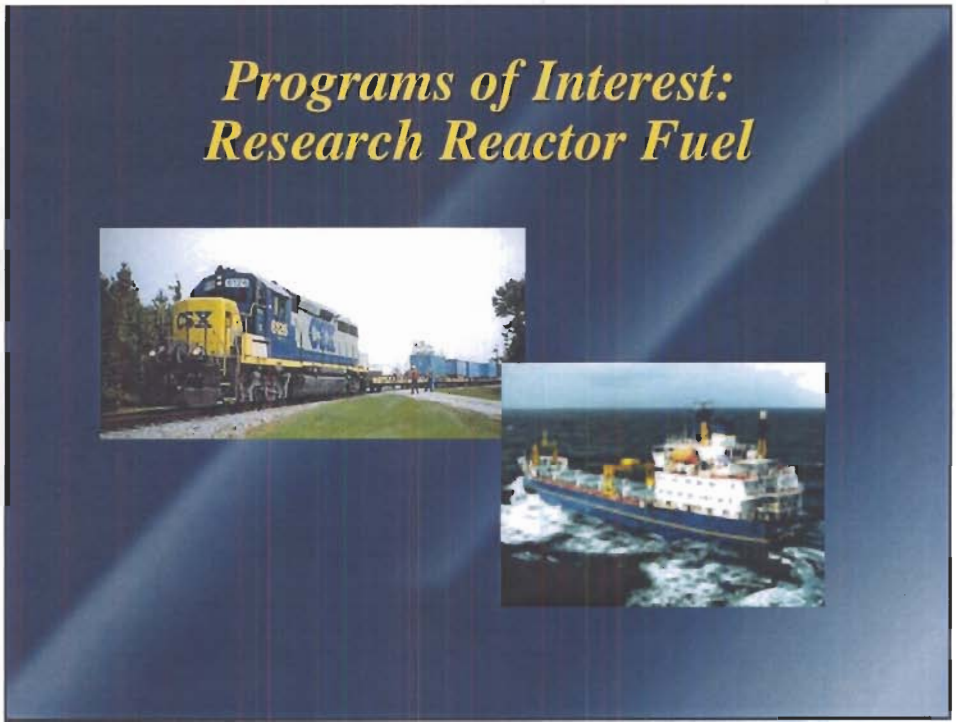
Transportation History

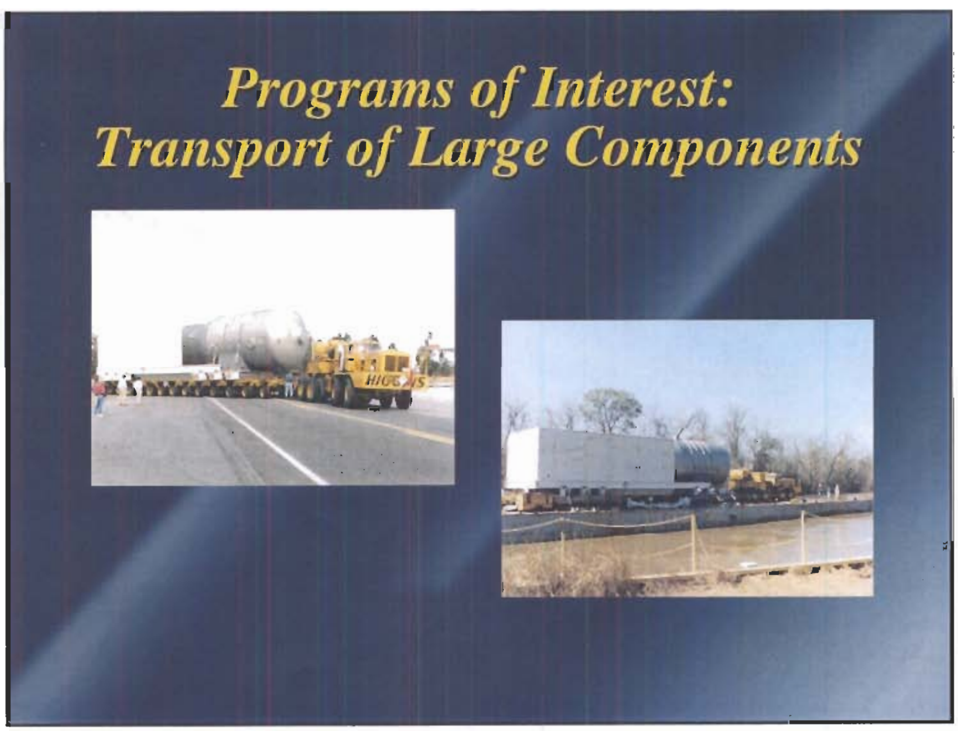
- 1979 to 1990: 89% of the shipments (27% of the tonnage) of SNF were by highway.
- Legal weight trucks (300 kg of SNF)
- Security and safeguard requirements as defined by NRC
- Route selection as defined by FMCSA

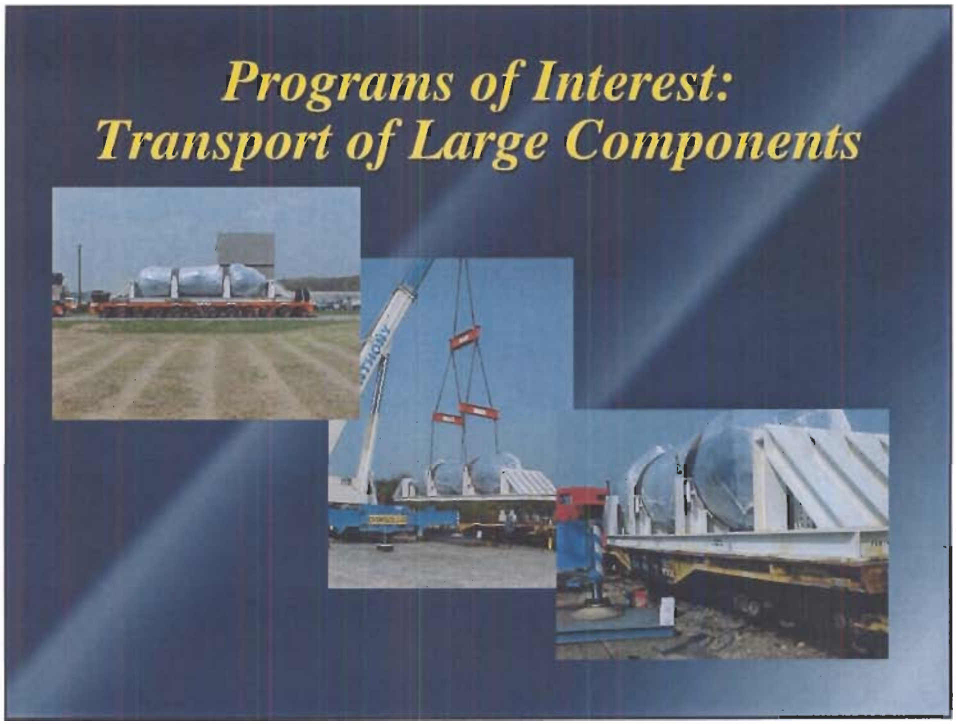
Transportation Incidents

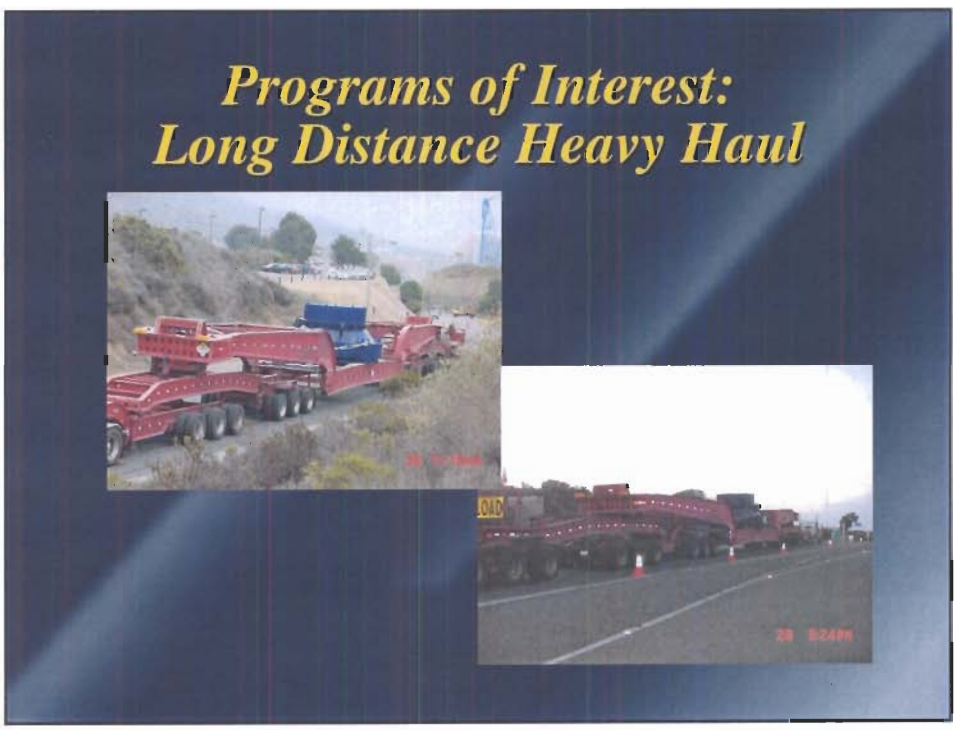
1.6 Million Miles Traveled - 8 Accidents – No releases

- 12/8/71: Truck accident in TN
- 3/29/74: Train yard derailment in NC
- 2/9/78: Truck collapse in IL
- 8/13/78: Trailer deck failure in NJ
- 12/9/83: Truck separated from trailer on IN/IL/TN border
- 3/24/87: Train collided with car at crossing in MO
- 1/9/88: Train derailment in Nebraska
- 12/14/95: Train derailment in North Carolina


Programs of Interest:
Research Reactor Fuel


Programs of Interest:
Transport of Large Components


Programs of Interest:
Transport of Large Components


Programs of Interest:
Long Distance Heavy Haul

Programs of Interest: Transport of Front End Mat'l

Contact Information

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Posted on Thu, May. 09, 2002

Past nuclear transport accidents

WASHINGTON - Since 1960, trains and trucks carrying a total of 5 million pounds of spent nuclear fuel have traveled 1.6 million miles and have had eight accidents, none of which released any radioactive material.

Starting about 2010, the Department of Energy plans to ship 154 million pounds of nuclear waste to a proposed dump in Nevada's Yucca Mountain over the following 24 years.

Opponents of the plan charge that transporting nuclear waste by truck and train endangers communities along the way. Here's what happened in past accidents:

• Dec. 8, 1971. In Tennessee, the driver of a truck carrying nuclear waste swerved off the road in a rainstorm. The truck rolled over into a ditch, killing the driver. The cask carrying the waste was thrown off the truck. The cask was not damaged, and no material leaked.

• March 29, 1974. In a North Carolina rail yard, a train derailed and struck another train that was carrying an empty cask designed to carry nuclear fuel. Damage to the cask was superficial.• Feb. 9, 1978. In Illinois, the trailer of a truck hauling nuclear waste collapsed while the truck was crossing a railroad track. The cask was not damaged. No material leaked.

• Aug. 13, 1978. In New Jersey, an empty nuclear-fuel cask was being placed on a trailer when the trailer deck failed because of a broken weld. The cask was not damaged.• Dec. 9, 1983. On the Indiana-Illinois-Tennessee border, a waste-hauling truck separated from its trailer, which was carrying a nuclear-fuel cask. The cask was not damaged. There were no leaks.

• March 24, 1987. In St. Louis, a train carrying nuclear waste collided with a car at a road crossing. The cask was not damaged. There were no leaks.

• Jan. 9, 1988. In Nebraska, a train carrying an empty cask derailed. The cask was not damaged.

• Dec. 14, 1995. In North Carolina, a train carrying empty casks derailed. The casks were not damaged.

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3.1.2 Federal Railroad Administration Experience with Spent Nuclear Fuel Shipments by Rail, Kevin Blackwell, FRA, DOT

Mr. Blackwell is in the Hazardous Materials Division, FRA, DOT.

There have been approximately 1300 spent nuclear fuel shipments transported by rail over the past 40-plus years and it is important to note that there is a distinction in the numbers between shipments and movements. While it is easy to count a shipment by highway because it is usually a single package, rail movements can sometimes encompass multiple packages with a singular movement.

Since the early 1960s, approximately five incidents or accidents have occurred involving spent nuclear fuel packages shipped by rail. However, this number depends on how accident or incident is defined. For example, a hitchhiker climbed aboard a train transporting spent fuel from TMI to INEEL to catch a ride; this event was classified as an incident. Thus, how the numbers are counted depends on how the words "accident" versus "incident" are classified.

Needless to say, only a few incidents or accidents occurred. They have all been minor in severity and none have resulted in any loss of package integrity. Concerns do exist about the increased number of shipments with regard to the rail transportation environment. To date, the history of rail transportation strongly indicates that the packages can and have been transported safely.

Pacific Gas & Electric made shipments cross-country from California to New York between 1969 and 1971. There were 15 rail movements, each of which involved one or more packages. From 1984 to 1987, 29 rail movements were made from Monticello, Minnesota, to Illinois; from 1984 to 1989, 30 movements were made from Cooper Station, Nebraska, to Illinois; and from 1986 to 1990, 23 movements were made from TMI in Pennsylvania to INEEL.

The Shoreham facility shipped slightly spent fuel that had only been used during the reactor's start-up from New York to Pennsylvania. This was an inter-modal shipment of rail-barge to Philadelphia where the fuel was transferred from barge to train and taken to the Limerick plant in Pennsylvania. This activity involved 33 movements.

Since 1989, Progress Energy (formerly Carolina Power & Light) has been making shipments of spent fuel between its operating facilities in North and South Carolina solely by rail. To date, there have been 130 moves. Again, the numbers FRA maintains do not make a distinction as to how many actual packages may be in any one move. From a safety standpoint, a train movement of spent fuel is a train movement of spent fuel.

There have been 19 movements to date of the Foreign Research Reactor Fuel, which DOE has moved to South Carolina with one exception involving a shipment from California to INEEL. All but one of the east coast shipments have been by rail from Charleston, South Carolina, to DOE's Savannah River site.

The Department of Defense (DOD) continues to make shipments of Naval spent fuel by rail. There have been 742 casks shipped in approximately 400 rail movements. One to four casks are moved per shipment. A future shipment from West Valley, New York, to INEEL is planned. This will be the first cross-country rail shipment of commercial spent fuel since the TMI shipments.

Movements of commercial spent fuel to the PFS facility in Utah are intended to be made by rail to the maximum extent. Those shipments would potentially start in 2004 or early 2005. The PFS initiative estimates about 50 train moves per year. According to the Yucca Mountain environmental Impact Statement, about 130 rail movements would be made per year to that facility.

There are universal concerns both from the standpoint of regulatory safety and the public's safety and security. Safe transport is directly related to package integrity as the first line of defense.

The FRA is a modal administration of DOT and by statute does not have direct regulatory authority for the issuance or development of hazardous material regulations. The RSPA is the organization that issues hazardous material regulations. The FRA works very closely with the RSPA on matters of regulation that will affect the rail industry from the hazardous material (HAZMAT) standpoint. The rail operational side is the responsibility of the FRA under the Federal Rail Safety Act. Its regulations are contained in 49 CFR Part 200 and describe mechanical and operational requirements, signals and train controls, track requirements, the rail environment infrastructure, etc.

Security for transportation has always been important to FRA. Since September 11th, times, it is a higher priority than in the past. Measures to address secure transport of any kind of material in the rail environment has become an issue. The FRA has been working very closely with many different entities, including the rail industry, the AAR, and different modal administrations to address security concerns and potential security threats to the rail operating environment.

The FRA as an agency has a very high confidence level in the integrity of spent fuel packaging, especially with respect to other types of packaging used to transport hazardous material. However, the FRA recognizes that risk management principles dictate that the transportation environment as a whole must be looked at in terms of the safe and secure transport of spent nuclear fuel by rail. To that end, aside from conducting its mandated mission of safety oversight of the nation's rail system, the FRA instituted a policy back in the late 1980s to address TMI and the Foreign Research Reactor Fuel shipments. This policy has evolved into the Safety Compliance Oversight Plan (SCOP).

It should be stressed that the SCOP is a policy, not a regulatory requirement. The railroad industry conducts inspections of its equipment and infrastructure. As a matter of course, the FRA conducts inspections of the operation of the nation's railroads, including track inspections to ensure regulatory compliance. The FRA developed the SCOP to provide focus to safety inspections conducted for spent nuclear fuel and high-level radioactive waste shipments because of the recognized high profile and high political concern from both the public and the rail transportation industry perspectives.

The SCOP is not meant to supplant the regulatory safety compliance requirements, nor is it meant to add extra regulatory requirements. Ninety percent of the SCOP puts the responsibility on the FRA to perform certain actions. The SCOP is meant as a third tier to help the FRA focus its resources on the equipment and the routes that may be used for spent fuel shipments.

The SCOP is a living document which is subject to periodic review. It is meant to be evaluated and updated taking in light of new regulations and new technologies that may come about and be utilized in the rail industry. It is meant to have flexibility. The current SCOP can be found at www.fra.dot.gov/safety/hazmat.htm.

DOT is addressing security concerns as they relate to transportation of all hazardous materials. Security matters affect the transportation of all hazardous materials, not just spent nuclear fuel and high-level waste; which are just one particular subcategory. However, spent nuclear fuel is a particular concern.

The FRA is working very closely with the AAR and with the rail industry to address security matters. Currently, the proposed rulemaking, HM-232, is intended to address security requirements for all transports. The comment period has closed and the FRA anticipates issuing a final rule probably within the next two to three months.

Lastly, and probably of interest to many people, the Hazardous Materials Transportation Uniform Safety Action of 1990 mandated a dedicated train study. It is anticipated that the final study will be provided to Congress and, therefore, available to the public, some time in early 2003. The Act mandated that DOT use the results of the study to determine whether or not any rulemaking is required for dedicated trains. The study will not take cost-benefit analysis into account. Only the safety of dedicated trains versus the safety of regular freight to transport spent fuel and high-level waste will be considered.

The FRA Web site contains information on rail safety statistics and accident rates (www.fra.dot.gov/safety and safetydata.fra.dot.gov/officeofsafety).

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FRA Experience with Spent Nuclear Fuel Shipments by Rail

Presentation to the Advisory Committee on Nuclear Waste Transportation Working Group Workshop

November 20, 2002

Kevin R. Blackwell

Federal Railroad Administration

1

SNF Rail Transportation

- Approx. 1300 SNF shipments have been transported by rail over the past 40+ years
- 5 accidents/incidents have occurred involving SNF packages by rail
- All were of minor severity in nature

2

SNF Rail Transportation

- None resulted in loss of package integrity or contents
- History to date of the rail transportation of SNF strongly indicates that the packages can be transported safely over the nations rail system.

3

Some Past SNF Rail Movements

Campaign			Moves
PG&E	CA to NY	1969-71	15
Monticello	MN to IL	1984-87	29
Cooper Station	NE to IL	1984-89	30
TMI	PA to ID	1986-90	23
Shoreham Plant	NY to PA	1993-94	33

4

Current SNF Rail Movements

Campaign			Moves
CP&L	NC & SC	1989-Present +	130
DOE FRRF	SC & CA	1994-Present +	19
DOD Naval Nuclear	Various to ID	1959-Present +	Approx 400

5

Future SNF Rail Movements

Campaign			Moves
West Valley	NY to ID	Potentially 2003	1
Interim Private Fuel Storage Initiative	Various to UT	Potentially 2004-2005	50/yr EST.
Yucca Mountain	Various to NV	Potentially 2010	130/yr EST.

6

SNF Rail Transportation

- Universal Concerns
  - Safe Transport
    - Package integrity, radiation levels and rail carrier operational control
  - Secure Transport
    - Measures to thwart sabotage/potential terrorist threat

7

Safe SNF Rail Transportation

- While FRA's confidence factor in the integrity of SNF packaging is "high", risk management principles dictate that the continued safe rail transportation of SNF is also a function of the integrity of the rail transportation system as a whole.

8

FRA's SCOP
(Safety Oversight Compliance Plan)

- Therefore, in addition to rail carrier inspection programs/procedures and routine FRA safety oversight inspections, FRA developed it's SCOP Policy for SNF & HLRW shipments.
- Focuses safety oversight inspections

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SCOP Summary of Contents

- SCOP contains focused safety oversight enhancements in areas of:

Planning	Inspection
Training	Miscellaneous oversight

- Addresses 21 separate tasks in 6 categories
  - Operational Integrity
  - Emergency Response
  - Route Infrastructure Integrity
  - Highway-Rail Grade Crossing Safety
  - Security
  - Miscellaneous

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FRA's SCOP (cont.)

- SCOP is a living document
- Will undergo periodic review, evaluation and updating, as necessary – is currently in process of being updated.
- Provides for flexibility in keeping pace with new rail safety developments and technologies
- Current version available at www.fra.dot.gov/safety/hazmat.htm

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Secure SNF Rail Transportation

- DOT addressing security concerns as they relate to the transportation of all hazardous materials
- FRA working closely with the AAR and rail industry on security related issues particular to the rail industry
- DOT Rulemaking: RSPA Docket HM-232 "Hazardous Materials: Security Requirements for Offerors and Transporters of Hazardous Materials", Notice of Proposed Rulemaking, FR of May 2, 2002 .

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SNF Package Transportation Companion Issue

- Dedicated Train Study
  - Congressionally mandated study comparing the safety of transporting SNF & HLRW in dedicated rail freight consists vs. regular rail freight consists
  - Study expected to be completed and provided to Congress in early 2003.

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Informational Websites

- These FRA sites may provide additional helpful information:
  - www.fra.dot.gov/safety
  - Safetydata.fra.dot.gov/OfficeofSafety

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3.1.3 TWG Questions Regarding DOT Experience

Dr. Garrick questioned who specifically is performing the dedicated train study and whether it is a technical study. Mr. Blackwell answered that the study was being performed by the Volpe Center in Cambridge, Massachusetts. Congress mandated that the study look only at the safety parameters associated with shipping spent nuclear fuel and high-level waste in a dedicated freight train versus a regular freight train.

Dr. Garrick noted that the TWG was interested in emergency response to accidents and asked about the type of implementation experience DOT had in this area. Mr. Blackwell stated that, with the exception of the Coast Guard, DOT does not have any regulatory responsibility to perform emergency response measures. However, the rail industry has an established emergency response mechanism. Every railroad has emergency response plans and emergency responders that are trained to respond to hazardous material incidents. The training is not specifically tailored to radioactive materials but covers all nine kinds of hazardous material classes that are transported, one of which is radioactive materials.

Mr. Kunita, Progress Energy, added that when his company makes spent fuel shipments it coordinates with communities along the shipping route. Coordinated tabletop exercises and field exercises are also conducted. Since the inception of the Incident Command Center, all of these organizations can respond to a radiological event. Improvements in the emergency response guides that address radioactive materials identify teams that can be dispatched, usually at the State level, to help the local community. These teams are well versed in radiological aspects.

Mr. Blackwell noted that some rail shipments of low-level radioactive waste have required responders to respond to transported radioactive material incidents; usually these shipments have contained contaminated soil or contaminated material. However, Mr. Blackwell is not aware of any being required for a shipment involving spent fuel or high-level waste.

Dr. Wymer asked whether the rail shipments discussed in this presentation were by dedicated train. Mr. Blackwell responded that most, but not all, were. There is currently no regulatory requirement to transport spent fuel or high-level waste by dedicated train. However, the Progress Energy shipments use dedicated trains. The Foreign Research Reactor Fuel shipments use dedicated trains. Many, but not all, of the Naval nuclear shipments have used dedicated trains.

Dr. Hornberger asked whether it was typical in DOT regulations that high-level radioactive waste shipments fall under all of the regulations for hazardous materials. Mr. Blackwell responded that when a regulation is developed, DOT addresses the transport of nine classes of hazardous materials. Class 7 is, "Radioactive Materials." There may be some culling out of certain hazard classes with regard to packaging, etc., depending on the type of rulemaking. However, a particular hazardous commodity is not necessarily part of the rulemaking. Mr. Boyle agreed.

Mr. Levenson asked whether the rulemaking on security was relatively new and how the responsibility for security is divided between NRC and DOT on these shipments. Mr. Boyle replied that this the division still needs to be determined. The NRC has already put forward interim compensatory measures for spent fuel and it is looking at other radioactive materials. DOT has reviewed these measures and had no comments on or support for the spent fuel case based on the need or the uniqueness of the material. For spent nuclear fuel shipments, NRC is the lead. If the scope were broadened to include all hazardous materials or all radioactive materials, it is not as clear which agency has the lead.

Mr. Levenson asked whether DOT could provide an approximate comparison between the accident rate for spent nuclear fuel and that for generic hazardous material shipments. Mr. Blackwell noted that to compare rail transport accident rates, a specific definition of "accidents" must be used. With other hazardous materials, accidents can occur because a package fails and leaks material. Derailments may involve other accident criteria that are quantified differently. Mr. Boyle added that, conservatively, the general rate equates to less than 50 accidents/incidents per year in which 3 million shipments of radioactive materials are made. No study provides the accident rate for spent fuel shipments and the accident rate for a Type B package carrying other radioactive materials.

Mr. Levenson noted that he was looking beyond radioactive material. Many other hazardous materials are shipped, and he wondered whether the accident rate for radioactive materials, no matter how it is defined, is any different than the accident rate for other hazardous material. Unless the accident rate for radioactive materials is significantly higher than the average, why would dedicated trains be used to transport spent fuel and not to transport other hazardous materials, unless there is a significant difference in the consequence and risk? Mr. Boyle responded that he did not know of any such study. He cautioned that with almost one million shipments daily of hazardous material, the criteria to define an accident and how it gets reported are very different than the criteria that apply to spent nuclear fuel. Even an incident scenario involving a truck carrying low-level waste, such as a separation, a flat tire, or equipment problem, does not register as a transportation incident for hazardous material. However, if the vehicle were carrying spent fuel, a summary of the incident would be available 30 years later. A double standard does appear to exist in reporting and data collection practices. Rail accidents could be anything from a highway grade crossing accident to trucks jumping off a track in a rail yard. The accident criteria are different and the data must be quantified to compare them to other data.

Mr. Fronczak, AAR, pointed out that in 2001, 51 percent of the rail accidents occurred at speeds greater than 10 mph, noting that 90 percent of the accidents did not happen in yards. Mr. Blackwell acknowledged that the 90 percent number was a couple of years ago. Mr. Levenson clarified that Mr. Fronczak was talking about "accidents," and Mr. Blackwell was talking about "derailments," which could be quite different. Mr. Blackwell responded that he was referring to the number of derailments that were reported a couple of years also, of which 89 percent occurred in a yard situation. Mr. Fronczak acknowledged that many of the accidents to which he was referring were grade crossing accidents without a derailment.

Mr. Boyle noted that until the accident criteria are defined, it is difficult to comment on accident rates. Mr. Levenson added that Mr. Boyle's statement was important for general information because if people go to various Web sites and retrieve data, they must be very careful on how they use the information, particularly without understanding what the data means. Mr. Blackwell stated that he had brought this point up when the data were first posted on the FRA's safety Web site and used in certain ports involving spent fuel. He suggested that the defining criteria be put on the Web site so that people would know what the numbers actually mean.

Dr. Ryan noted that car accidents can be anything from a bumper scratching a fender in a parking lot to a 200-car pile up in the fog. They are both accidents, and both involve some impact, but the results are small versus huge. Dr. Ryan asked if there is a document or reference that can be used by the public on how accidents get categorized. Mr. Boyle stated that there was. DOT has reporting requirements that list what needs to be reported to the Department; this information is considered to be DOT's accident or incident database. The reporting requirements are in a regulation. However, it should be pointed out, that what is reported to DOT is different than what is reported to NRC. Mr. Blackwell added that the FRA also has separate accident reporting criteria for the nation's railroads, found in 49 CFR Part 200, that are different from the HAZMAT criteria.

Mr. Levenson questioned if, when DOT refers to radioactive material, it is using the technical scientific definition (i.e., something radioactive) or the legal definition. Congress has declared radioactive materials originating from coal or oil or, in many cases, accelerators, as not being radioactive in the context of some regulations. Mr. Boyle stated DOT's definition of radioactive material is any material having a radioactivity level of 70 becquerels per gram or greater, regardless of its source.

3.2 Department of Energy Spent Fuel Transportation Experience

3.2.1 Waste Isolation Pilot Plant Shipping Experience, Mr. Alton Harris, DOE

Mr. Harris works for DOE's Waste Isolation Pilot Plant Office, located within the Office of Environmental Management.

Transuranic waste is radioactive waste contaminated with alpha-emitting radionuclides with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram. Congress authorized the Waste Isolation Pilot Plant (WIPP) to permanently isolate up to 6.2 million cubic feet of defense-generated transuranic waste in a deep geologic repository. The WIPP is located near Carlsbad, New Mexico. The repository is 2150 feet below the ground's surface.

The transuranic waste is stored in 55 gallon drums. The waste may include metal pipe and metal pieces of laboratory equipment, de-watered sludges, and mixtures of different kinds of things found in laboratory work associated with processing and developing nuclear weapons. The waste may also include contaminated gloves, booties, laboratory wear, and glassware.

In terms of DOE's mission for shipping to the WIPP, the Department projected between 17,000 and 20,000 shipments over the project's estimated lifetime which at this time is 2034. DOE is considering alternatives which may accelerate waste shipments to 34 shipments a week, allowing DOE to close the facility by 2013. To "close the facility," means to carry the bulk of the waste that is presently stored around the nation, referred to as legacy transuranic waste, to WIPP where it can be placed in the repository. To date, DOE has made approximately 1374 shipments.

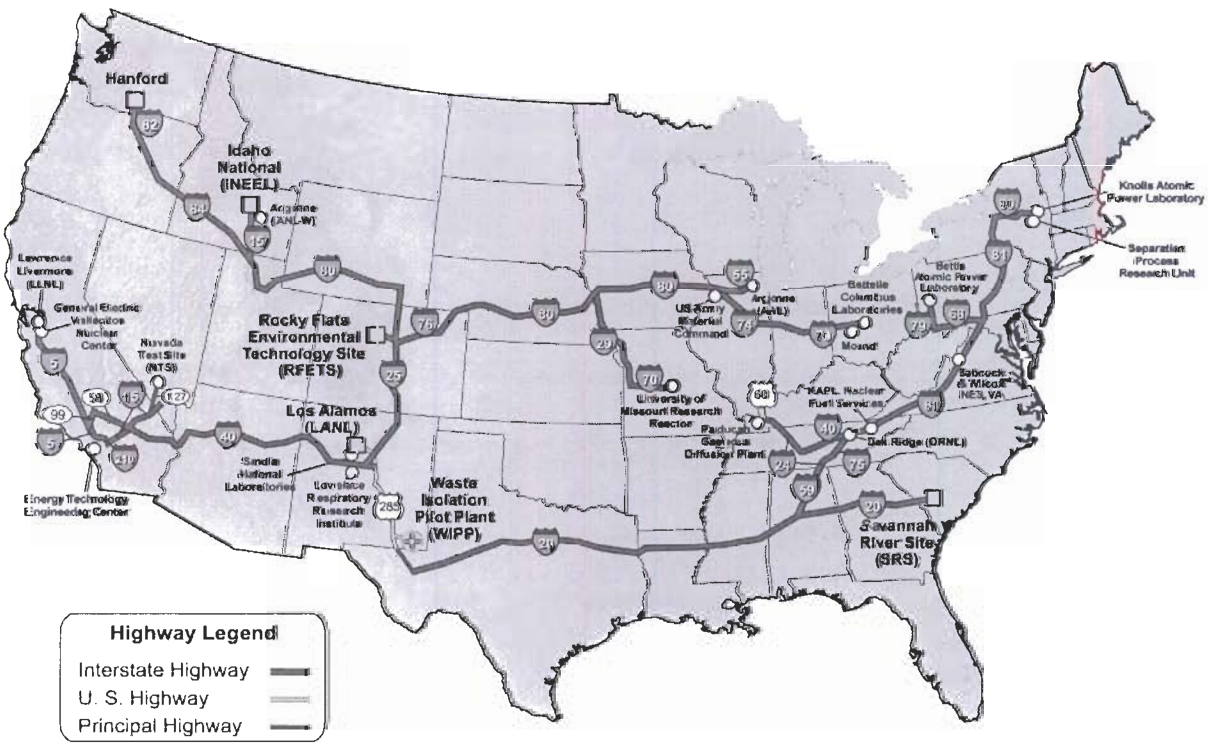


Figure 20

DOE makes shipments from sites across the United States including the Hanford site, INEEL, the Rocky Flats facility in Colorado, Las Alamos National Laboratories in New Mexico, and the Savannah River site (Figure 20). Over 36,000 drums of waste have already been moved to the WIPP.

All of these shipments have been made by truck (Figure 21), however, DOE is considering a rail option. If used, DOE expects to start rail shipments in 2005. From a routing standpoint, DOE considers its shipments as though they were highway route controlled shipments. Of the 1300 shipments that have been made, only about 400 actually have been highway route controlled shipments. DOE has entered into agreements with the Western Governors' Association and the Southern States Energy Board on the transportation protocols used for these shipments. In addition, as part of the discussions with these groups, as well as with the State of New Mexico, DOE tries to route shipments as though they were highway route controlled shipments to the maximum extent possible.


Figure 21

The packagings that DOE uses are broken down into two different classes for different wastes. There actually is a subdefinition for transuranic waste. If the radiation field exposure rate outside the packaging is less than 200 millirem per hour (mrem/h), the waste is classified as contact handled transuranic waste. The TRUPACT-II, the HalfPACT, and DOE's proposed packaging, the TRUPACT-III, are used for this waste. Currently, 67 TRUPACT-II packages comprise the bulk of DOE's transportation fleet and DOE hopes to increase that to 81. DOE is also in the process of fabricating HalfPACTs and expects to have 15 of these packages. The size for the TRUPACT-III packaging has not been defined as of yet.

Remote handled transuranic waste is waste that is too hot for a waste handler to be near. For waste of this type, the exposure rate at the surface of a waste container would be in excess of 200 mrem/h. DOE packages this waste in the RH-72B cask, which is a scaled down version of the shipping cask used for the TMI shipments. DOE currently has 4 of this particular packaging and expects the final fleet size to be 12. DOE also uses another packaging for remote handled transuranic waste, the CNS 10-160B cask. This particular packaging is single containment, the contents of each shipping container will be limited to less than 20 curies of plutonium.

All of the packagings used for the WIPP are certified by NRC. The TRUPACT-II is approximately 8 feet in diameter and 10 feet high and has a payload capacity of almost 13,000 pounds. Three packages are transported per truck which must remain under the 80,000 pounds gross vehicle weight. Fourteen 55 gallon drums will go into this packaging as a standard configuration, although there are some other configurations.

The HalfPACT is much like a thermos within a thermos. The HalfPACT is located at the back of this trailer and spans 8 feet in diameter by approximately 8 feet high. The front two packagings are the TRUPACT-II. The HalfPACT is capable of holding seven 55 gallon drums as its normal configuration. This packaging carries heavier payloads, such as sludges from INEEL.

The RH-72B cask looks like a barbell. The outer pieces are the impact limiters. The cask itself is approximately 6 feet in diameter and the overall length, with the impact limiters on, is16 feet. Its normal payload configuration is three 55 gallon drums. DOE has not started using this shielded packaging yet. DOE expects to being using the RH-72B task when the Department begins making remote handled shipments from other sites to the WIPP site in approximately 2005.

DOE will be using the CNS 10-160B cask to make some interstate shipments from Columbus, Ohio, and possibly within California, to the Hanford site before the end of the year. DOE is still making final arrangements for this to occur.

DOE has been successful in using these packagings and working with NRC to get them certified and available for use. Only two minor accidents have occurred, one in August and one in September 2002. The first was a fender bender in New Mexico less than 10 miles from the WIPP site. In September 2002, a second accident occurred in Wyoming. The driver had a medical condition and veered across the median and went off into a wooded area where the vehicle finally stopped. The three waste packages remained on the vehicle's trailer and there was no loss of life or loss of containment. The other involved an individual who was driving under the influence of alcohol and rear-ended the vehicle. There was no damage to the packaging, no loss of life, and the incident did not meet DOE's threshold for occurrence reporting and was not considered an accident.

DOE is proud of the WIPP transportation safety record to date, however, there is always room for improvement.

DOE has spent a great deal of time and effort working with NRC to improve the contents and payload capacity for the packaging used. For the TRUPACT-II, DOE had over 19 revisions to the TRUPACT, which resulted in an increase and streamlining of the capabilities of this packaging.

Excluding the TRUPACT-III, DOE could ship 74 percent of the waste to the WIPP. The remaining 26 percent of the waste is not shippable because of its size. There are large boxes around DOE complexes that would require DOE to either slice up the waste and repackage it or develop a larger package. DOE hopes to address this waste with the TRUPACT-III design once it is certified by NRC.

Waste Isolation Pilot Plant
Shipping Experience

Advisory Committee on Nuclear Waste
Transportation Working Group Workshop

November 20, 2002

Alton D. Harris, III
U.S. Department of Energy

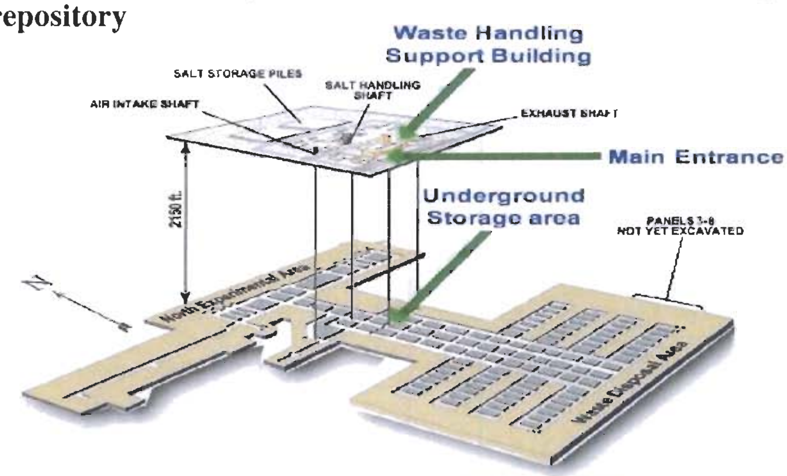
Discussion Topics

- WIPP Mission
- Packagings
- Shipping Experience

2

WIPP Mission

Permanent isolation of up to 6.2 million cubic feet (~176,000 cubic meters) of defense generated transuranic waste in a geologic repository



3

Transuranic Waste

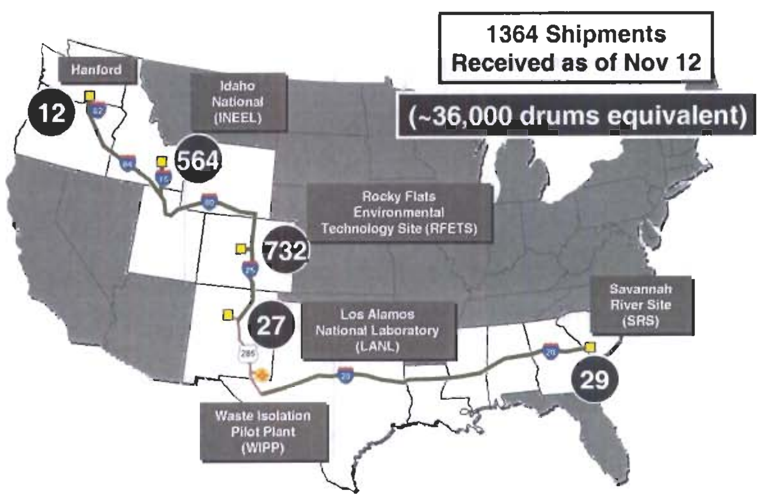
4

Mission in Terms of Shipments

- **17,000 to 20,000 shipments over estimated project life to the year 2034**
- **DOE plan to accelerate cleanup of sites calls for achieving 34 shipments per week (2003-2013) to complete the bulk of these shipments**

5

Waste Shipment Status



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Shipping Routes

7

WIPP Packagings

<u>Contact-Handled Transuranic Waste Packaging</u>

- **TRUPACT-II** — **67 -> 81 Fleet Size**
- **HalfPACT** — **0 -> 15 Fleet Size**
- **TRUPACT-III** — **TBD Fleet Size**

<u>Remote-Handled Transuranic Waste Packaging</u>

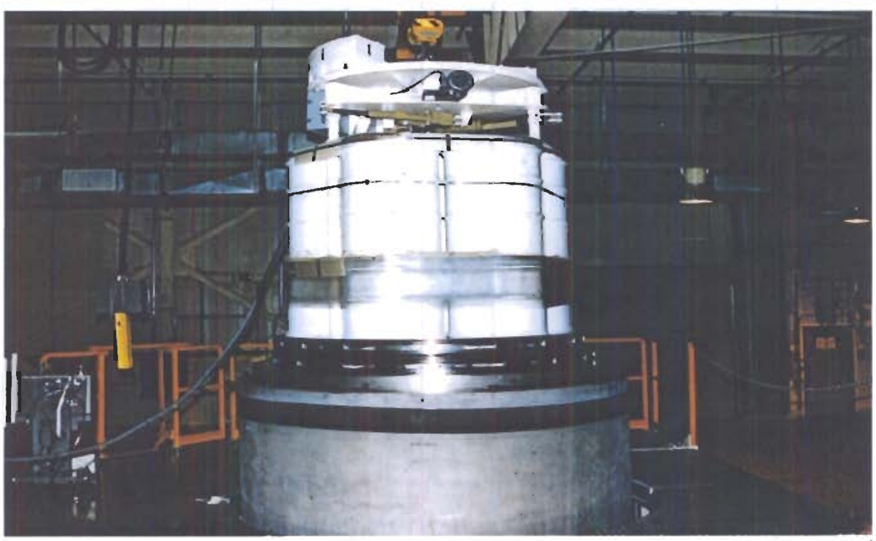
- **RH-72B Cask** — **4 -> 12 Fleet Size**
- **CNS 10-160B Cask** — **1+**

8

TRUPACT-II

9

Drums Lowered into TRUPACT-IIs



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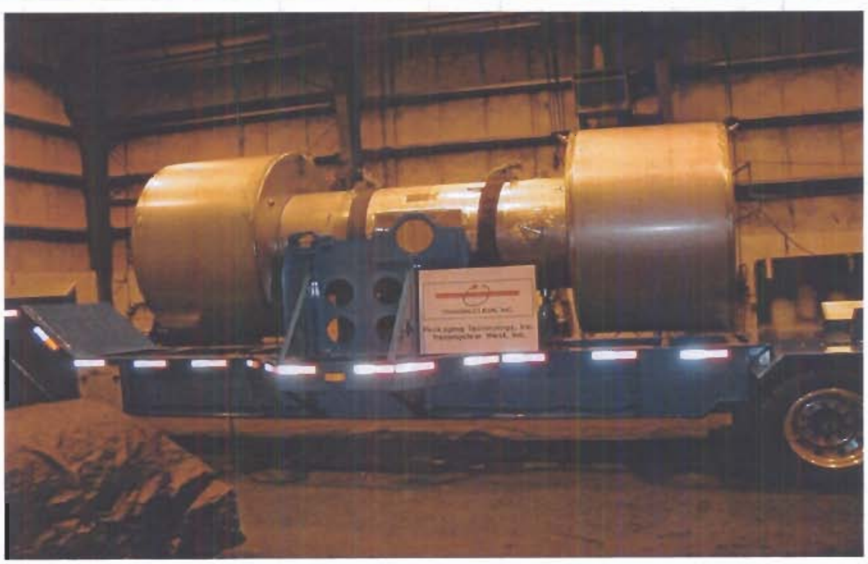
HalfPACT and TRUPACT-IIs

11

RH-72B Cask



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3.2.2 Foreign Research Reactor Spent Nuclear Fuel Acceptance Program, Maureen Clapper, Program Manager, DOE

Ms. Clapper is the Program Manager for the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program, Office of Integration and Disposition, Office of Environmental Management.

The Foreign Research Reactor Spent Nuclear Fuel Acceptance Program had its beginnings in the 1950s and 1960s under President Eisenhower. At that time, a decision was made to provide partner countries with enriched uranium for research purposes. These countries had to agree not to develop nuclear weapons in exchange for this material and to use it only in research reactors for peaceful research and development of nuclear materials. The uranium was provided to 41 countries.

The goal of the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program is to recover nuclear materials which could otherwise be used in nuclear weapons. The strategy of the program is to play a key role in the civilian nuclear fuel cycle. Since highly enriched uranium (HEU) is potentially weapons usable, the mission of the program is to get this material out of the cycle.

The program works jointly with another DOE program entitled the Reduced Enrichment for Research and Test Reactors (RERTR) program. The RERTR is involved in the technical development of low-enriched fuels that can be provided to research reactors, many of which were provided with HEU at the outset. Many of these reactors can be converted to use low enriched uranium (LEU).

Research reactors are important because they are used to produce medical isotopes, as well as for certain agricultural and industrial applications. Through the RERTR program, DOE plans to reduce the threat of nuclear weapons proliferation, while letting countries enjoy the benefits of nuclear technology; reduce and eventually eliminate HEU from worldwide commerce; and allow time for countries with spent fuel, both HEU and LEU, to resolve their own disposition pathways. The time span of the program allows reactor operators to eliminate long-term liability associated with spent fuel management and disposition.

Research reactor spent nuclear fuel containing uranium enriched in the United States will be accepted from 41 countries and managed in the United States. The original record of decision and environmental impact statement estimated that 20 metric tons would be returned. Five tons would be high-enriched uranium and 15 tons would be low-enriched uranium. This estimate includes two research reactor material types, (1) the aluminum-based MTR type fuel from material test reactors, and (2) TRIGA research reactor spent fuel. The TRIGA fuel is a zircaloy, zirconium alloy fuel, and includes some target material as well. Targets are used in the production of medical isotopes.

Based on correspondence with eligible countries and reactor facilities, DOE now anticipates about half of this material will be made available for return. Several countries have decided not to participate (in some cases, it may have a lifetime core). If they participate in this program before 2006, they would be required to shut their reactors down voluntarily.

Some reactor facilities have chosen not to participate because their fuel has slower burnup than originally expected; other countries have done what DOE really wanted and found alternatives for their own management and disposition of this material. For example, the Netherlands built COVRA which is a high-level waste and spent nuclear fuel storage facility.

DOE's Foreign Research Reactor Spent Nuclear Fuel Acceptance Program has a 10-year acceptance policy that was initiated in May of 1996 and will conclude in May of 2006. However, the fuel irradiated during this 10-year window can be accepted over a 13-year period. This provides time for reactor operators to develop their own disposal solutions. Therefore, the fuel cannot be irradiated after May of 2006, but DOE will accept it until 2009, so as long as the country comes forward and claims that it has eligible material that it wants considered for transport.

Twenty-five shipments have been completed to date as part of the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program (Figure 22). The most recent shipment was made on September 27, 2002, in which DOE received eight casks from Japan (not shown in Figure 22). To date, DOE has received 5537 spent fuel assemblies from 27 countries. Three cross-country shipments have occurred and one west coast shipment was completed. Ninety-five percent of the material under this program is test reactor fuel which will be interim stored at the Savannah River site. Therefore, most of the fuel shipments have come into the east coast.

Five percent of the fuel is TRIGA fuel. TRIGA fuel is stored at INEEL in Idaho. Therefore, DOE has had one shipment of TRIGA-type fuel come into California which was then transported by train to Idaho.

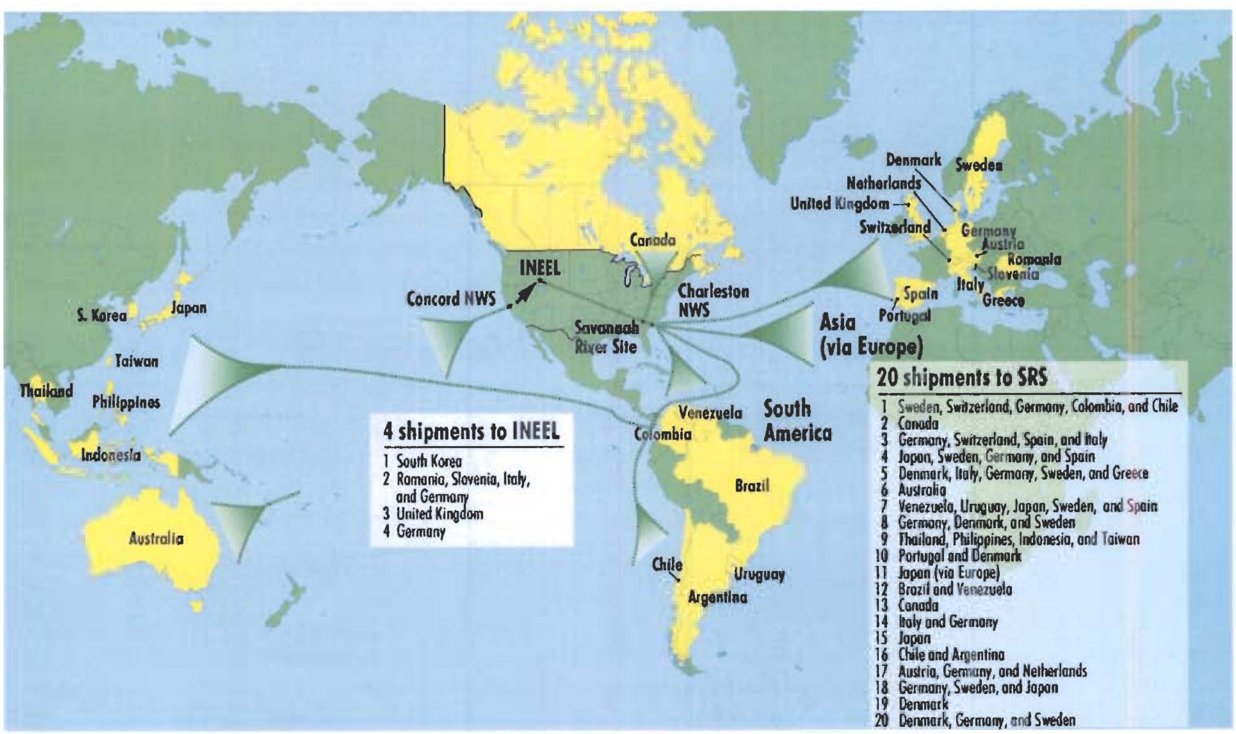

Figure 22

After September 11th, planning was under the continuous tight scrutiny of upper level DOE management. DOE did halt shipments on September 11th, and once again on October 7, 2001, the day the air campaign began over Afghanistan. DOE remains in close contact with Federal and State law enforcement agencies, the Naval installation, the Coast Guard, and NRC while shipments are underway.

Most of the shipments from Japan go through the Panama Canal, and Japan ships empty casks to England for other programs. Therefore, Japan transports the empty casks and the spent fuel casks to England and stores them there while waiting for a larger European shipment later in the year.

DOE is attempting to obtain fuel from Indonesia. DOE is also working with South Korea who is very interested in returning fuel under the program. DOE will also have a shipment from Europe in 2003 that will include fuel from Germany, Austria, and France.

Shipment planning and execution is coordinated very closely with DOT and NRC. DOE enjoys a strong and positive working relationship with staff at DOT and NRC. DOE looks to DOT and NRC for support in licensing the transportation casks. Many shipments are made in foreign casks that need to obtain a COC from the United States.

Figure 23

Once a waste shipment has been accepted, DOE must identify suitable transportation routes for the material, route approval for transportation, oversight of transportation activities, support during shipment execution, transportation planning, and stakeholder outreach needs. DOT and NRC each play critical a role in the successful implementation of several mission-critical DOE shipping campaigns.

The packages used for shipping foreign fuel are smaller than the packages used for shipping waste to the WIPP facility. Figure 23 shows a cask will be used next year to ship TRIGA fuel from Japan. On the outside of the cask are cooling fins to cool the casks. This is the Japanese 18.5T cask. The photo was taken in the Savannah River site's decontamination facility after receipt and unloading of the cask.

Cross-country shipments are highly interactive campaigns involving extensive communications among all levels of government including local and State officials. DOE receives a high level of public and media awareness and stays in very close contact with DOE public relations staff who receive numerous questions from local newspapers concerning the shipments. DOE has developed guidance to inform the public about shipments being made.

Campaign planning and execution is similar from shipment to shipment, although some approaches and participants are different. This is particularly true when the routes change. DOE can use several routes for cross-country shipments. Cross-country shipment planning is a year-long advanced planning process. During this time, DOE works with the foreign countries on timing, licensing issues, casks, collecting data on the fuel, selection and scheduling of the casks, and selecting a transportation services contractor.

A Cross-Country Transportation Working Group was formed and tasked with developing and maintaining a transportation plan for completing the cross-country shipments in a safe efficient manner. The Cross-Country Transportation Working Group includes members of local law enforcement, as well as State protection.

The route evaluation and selection process occurs for each cross-country shipment; transportation and security plans are also developed for each shipment. DOE has completed three cross-country shipments successfully. The first was in August 1999. DOE used five vehicles, with one cask per vehicle, to move 446 TRIGA rods shipped from Romania, Slovenia, Italy, and Germany. The second cross-country shipment was completed in July 2000 and involved one vehicle and one cask containing 90 TRIGA rods from the United Kingdom. The third cross-country shipment was completed in July 2001. No TRIGA fuel is scheduled to come into the United States in 2002 or in 2003. DOE is currently considering whether to accept fuel from Rikkyo University in Japan. This would involve the one cask from Japan which is shown in Figure 23.

Before transportation routes are selected DOE requests data on road conditions and planned construction to evaluate routes through every potential corridor State. DOE works with States and tribes to identify and resolve, where possible, construction, congestion, timing, escort, and training issues to ensure safety. In the future, DOE will continue to work with State and tribal officials to address planning, safety, response, and stakeholder concerns.

Until NRC's central compensatory measures, spent nuclear fuel had to be escorted only when going through populations of 100,000 and greater. DOE has not had a shipment since the new order was put in place, but however, the Department's past experience with having escorts link up with State highway patrol does cause some concern. On one occasion, the State highway patrol was not at the safe haven to meet the shipment on time. The State highway patrol on the other side of the border had to wait for another State highway patrol to meet them. This delay causes a cascading effect. DOE notifies the governors of States along the route 7 days in advance of when this material will be transported through their States. When the shipment falls behind in one State, it affects the next State. To avoid rush hour traffic, a 2-hour delay in one State can sometimes end up being a 12-hour delay in another.

Dates, times, and ship names are considered safeguards information by NRC regulations. DOE has also found that equivalent security measures do not necessarily apply in foreign countries, some of which have openness policies, so much of this information can be found on the Web sites of the regulatory equivalent bodies of NRC in foreign countries.

Current issues and challenges include identifying certification needs and getting technical information from the foreign research reactor operators to support reviews of casks early in the shipment planning process. Cooperative planning with States and tribes has been successful to date, but it is changing in this new security climate. DOE has heard from more than one director of a State homeland security office that he/she wants to be involved.

Security issues abroad may affect shipment schedules and configurations (e.g., when and where vessels can pick up the package). The Yucca Mountain debate and decision in Congress raised awareness on all spent nuclear fuel transportation. Numerous requests have been received from reactor operators for the program to extend its expiration date. At this time, there are no plans to extend the time frame for waste acceptance. DOE is starting to see some geographic challenges where scheduling is becoming more complex as fuel is de-inventoried from certain regions in the world. For example, approximately 10 fuel assemblies are still left in Peru. This presents some future geographic challenges for DOE to go back and get as much eligible fuel as possible under the program.

Spent nuclear fuel has been shipped safely in the United States by DOE and by private entities for over 40 years. DOE elements at both headquarters and in the field recognize that the Cross-Country Transportation Working Group has been, and will continue to be, successful. Every shipment is unique and reveals new opportunities for improvement. Federal agencies continue to undergo bottom-up safeguards and security reviews. DOE expects to adopt new ways to work and new interactions, particularly with the formation of the Department of Homeland Security. In addition, cooperative planning will enable DOE, States, and tribes to adapt to changing circumstances.

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Foreign Research Reactor Spent Nuclear Fuel Acceptance Program

An Update for the

Nuclear Regulatory Commissions'

Advisory Committee on Nuclear Waste

Presented by

Maureen Clapper, Program Manager

November 20, 2002

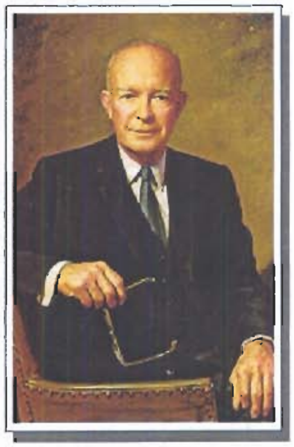
Items for Discussion

- Background of the Foreign Research Reactor (FRR) Spent Nuclear Fuel (SNF) Acceptance Program
- Status of the fuel Acceptance Program
- FRR SNF Shipment planning and execution
- Lessons Learned, Issues & Challenges

Background of the FRR SNF Acceptance Program

The FRR SNF Acceptance Program evolved from "Atoms For Peace"

- Partner countries agreed not to develop nuclear weapons in exchange for U.S. enriched uranium for research purposes.



President Dwight D. Eisenhower

U.S. Provided Enriched Uranium to 41 Countries

FRR SNF Acceptance Program

- Goal: to recover nuclear materials which could otherwise be used in weapons
- Strategy: play a key role in the civilian nuclear fuel cycle--high enriched uranium is potentially weapons-usable; get this material out of the cycle
- Implementation: U.S. accepts eligible spent fuel. Many reactors can convert directly to low enriched uranium fuel (not weapons-usable). Research reactors are used for medical, agricultural, and industrial applications.

Reason for the Policy

- Reduce the threat of nuclear weapons proliferation while enjoying the benefits of nuclear technology.
- Reduce, and eventually eliminate, high enriched uranium (HEU) from worldwide commerce.
- Allow time for the countries with spent fuel (both high and low enriched) to resolve their own disposition.
- Allows reactor operators to eliminate long term liability associated with spent fuel management and disposition.

U.S. Research Reactor Spent Nuclear Fuel Acceptance Policy

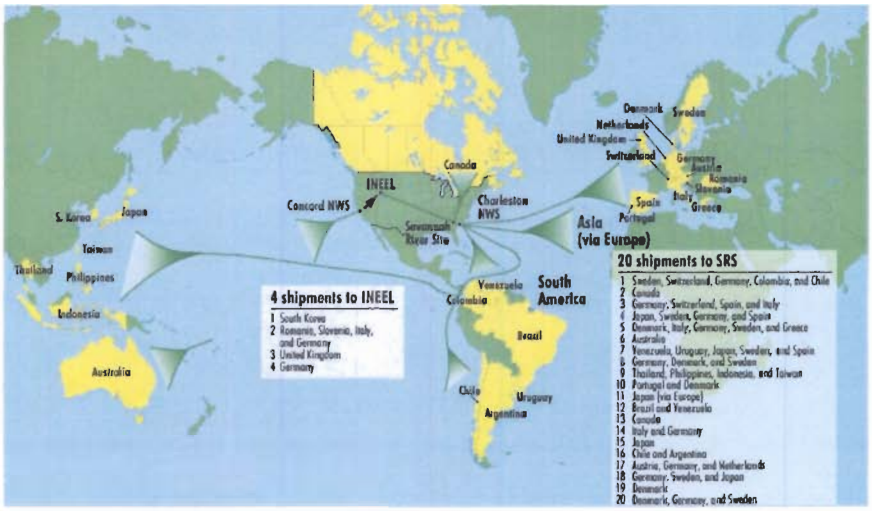
- Research reactor spent nuclear fuel containing uranium enriched in the U.S. will be accepted from 41 countries and managed in the United States.
  - Originally estimated 20 metric tons (5 tons of HEU)
  - Includes aluminum-based and TRIGA research reactor spent fuel and target material
  - Based on correspondence with the eligible countries/reactor facilities, anticipate about half of this material will be made eligible for return (not participating, slower burn-up, alternatives)
- 10-year acceptance policy (May 13, 1996 to May 13, 2006)
  - Provides time for reactor operators to develop own solutions
  - Fuel irradiated during the 10-year window will be accepted over a 13-year period

Status of the Fuel Acceptance Program

DOE Continues to Receive FRR SNF Shipments

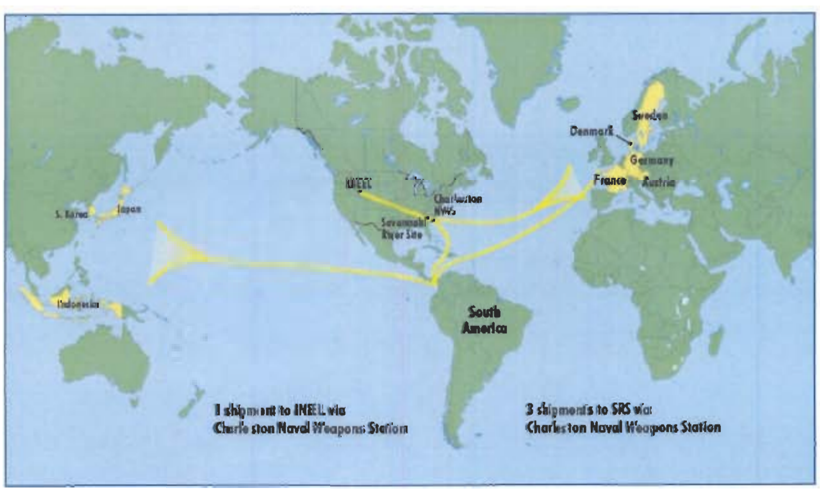
- 25 shipments completed to date (Most recent: 8 casks on 09/27/02)
- 5,537 spent fuel assemblies, from 27 countries, have been accepted to date
- 3 cross-country shipments completed to date, one west coast shipment completed to date
- After 9-11, planning was under continuous, tight scrutiny of upper level DOE management. DOE remains in close contact with Federal & State Law Enforcement Agencies, naval installations, Coast Guard, and the NRC while shipments are underway.

FRR SNF Shipments to Date



Shipments Planned

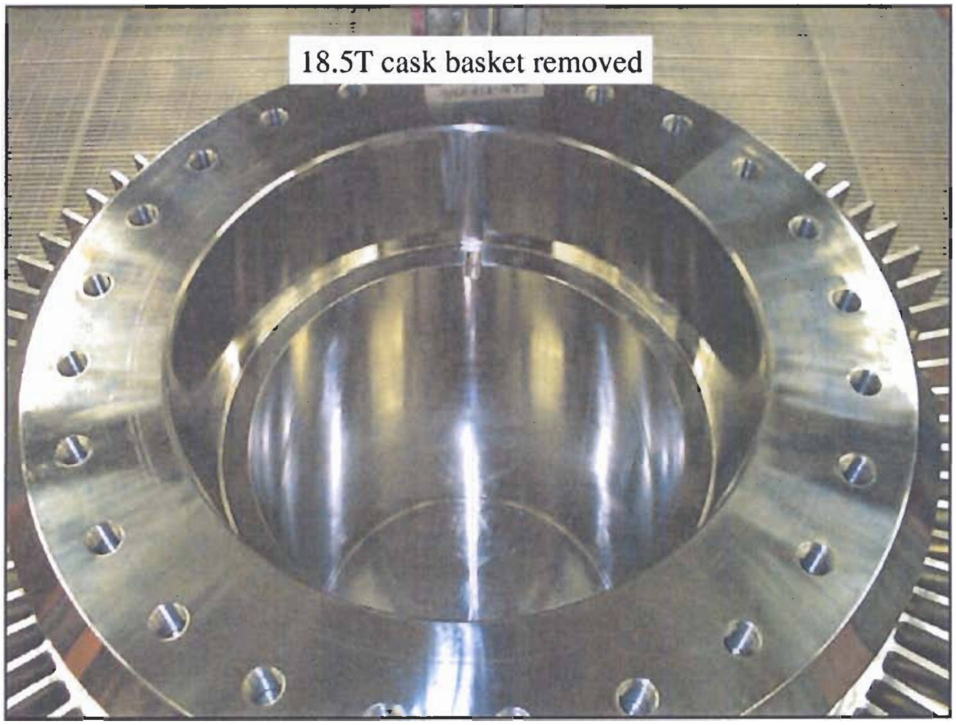
August 2002 - August 2003 (tentative)

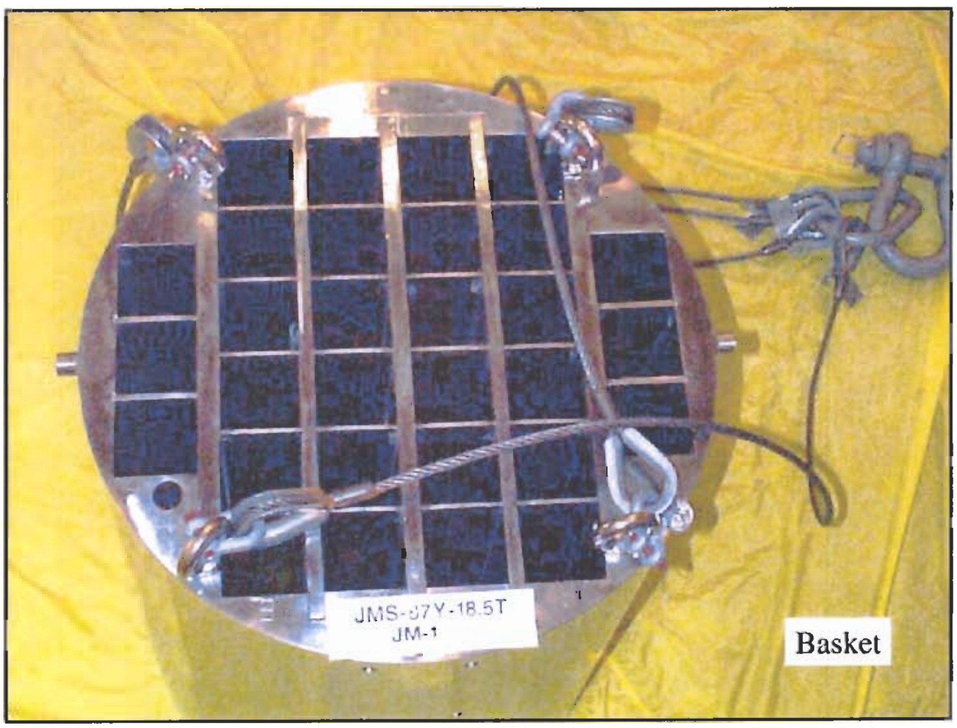


FRR SNF Shipment Planning and Execution

DOE/DOT/NRC

- FRR SNF Program enjoys strong and positive working relationships with DOT and NRC
  - Licensing of transportation casks
  - Identification of suitable transportation routes
  - Route approval
  - Oversight of transportation activities
  - Support during shipment execution
  - Transportation planning and stakeholder outreach
- DOT and NRC play a critical role in the successful implementation of mission critical DOE shipping campaigns


18.5T cask basket removed


JM-1
Basket

FRR SNF Shipment Planning

- Fuel casks arrive at naval installations and are transported to SRS or INEEL based on fuel type
- Receipt of TRIGA fuel on East Coast occurs about once a year and results in a cross-country transport to INEEL
- Route selection governed by NRC and DOT regulations require shipper to minimize radiological risk
- Minimizing time in transit minimizes radiological risk

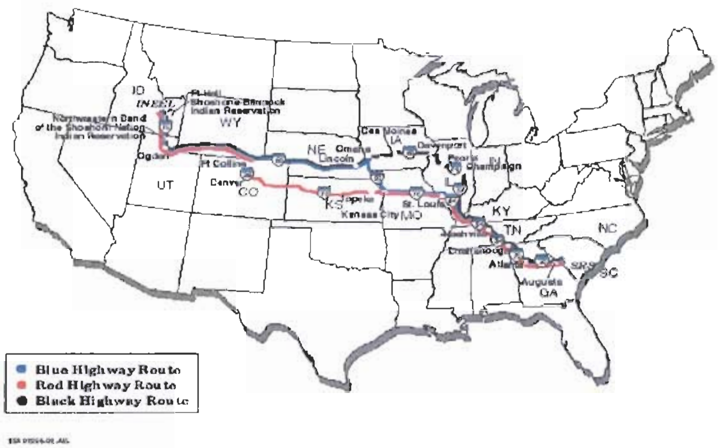
Cross-Country Shipment Key Facts (contd.)

- Highly interactive campaign involving extensive communications among all levels of government
- High level of public/media awareness
- Campaign planning and execution similar from shipment to shipment, although some approaches and participants are different

Cross-Country Shipment Planning

- Year-long advance planning process to: work with foreign countries on timing, licensing issues; collect data on the fuel; select and schedule casks; select transportation services contractor
- Cross-Country Transportation Working Group (CCTWG) formed and tasked with developing and maintaining a transportation plan for completing cross-country shipments of FRR SNF in a safe, efficient manner.
- Route evaluation and selection process occurs for each cross-country shipment
- Transportation and security plans developed for each shipment

Highway Routes Selected for Cross-Country Shipments of FRR SNF



•Three potential routes, identified in 1999, are re-evaluated for each successive shipment campaign.

Chronology of Cross-Country Shipments

- First completed in August 1999
  - 5 vehicles; 1 cask per vehicle enclosed in ISO
  - 446 TRIGA rods from Romania, Slovenia, Italy, and Germany
- Second completed in July 2000
  - 1 vehicle; 1 cask
  - 90 TRIGA rods from the U.K.
- Third completed in July 2001
  - 3 vehicles; 1 cask per vehicle
  - 126 TRIGA rods from Germany
- No TRIGA scheduled for 2002
- 2003? Considering Rikkyo, Japan

Cross-Country Planning Considerations

- DOE requests data on road conditions and planned construction and takes this into account in evaluating routes through every potential corridor state.
- DOE will work with States and Tribes to identify and resolve, where possible, construction, congestion, timing, escort and training issues to ensure safety.
- DOE will work with state/tribal officials to address planning, safety, response and stakeholder concerns.

FRR SNF Lessons Learned, Issues & Challenges

Cross-Country Shipment Lessons Learned

- Inspections, escort link-ups, avoiding rush hours are time-sensitive events if details do not go as planned (cascading effects)
- Several planning areas need to be more clear, consistent, and timely (route approvals, change in plans, information dissemination, e.g. change in designated rush hours not disseminated to DOE)
- Dates/times/ship names are considered ***Safeguards Information*** per NRC regulations; equivalent measures do not necessarily apply in foreign countries

Current Issues and Challenges

- **Identifying certification needs and getting technical information from research reactor operators to support reviews early in shipment planning process**
- **Cooperative planning with States and Tribes has been good, but is changing in the new security climate**
- **Security issues abroad may affect shipment schedules and configurations (e.g. when/where ship can pick up)**
- **Yucca Mountain debates/decision in Congress have raised awareness for all SNF transportation**
- **Numerous requests have been received from Reactor Operators to extend the expiration date of the Acceptance Policy; the United States has no plans to extend the policy at this time**
- **Geographic challenges: scheduling is becoming more complex as fuel is deinventoried**

Cross-Country: 2002 and Beyond

- **SNF has been shipped safely in the U.S. by DOE and by private entities for over 40 years**
- **DOE elements at Headquarters and the Field recognize CCTWG has been and will continue to be successful**
- **Every shipment is unique and reveals new opportunities for improvement**
- **Federal agencies continue to undergo bottom-up Safeguards & Security reviews-we expect new ways to work, new interactions**
- **Cooperative planning will enable DOE, States, and Tribes to adapt to changing circumstances**

3.2.3 United States Naval Nuclear Propulsion Program, Don Doherty, Naval Reactors, DOE

Mr. Doherty noted that with regard to the Naval spent fuel cycle, upon refueling and defueling, all spent fuel is transported by rail to the Naval Reactors Facility on the INEEL site. This site is the central location for receiving, handling, and inspecting the fuel. One hundred percent of the program's fuel is inspected when it gets there. Inspectors look for superficial damage, as well as conducing very detailed analyses including destructive examinations and detailed dimensional probing. The inspections are performed to ensure that the fuel continues to perform as it is supposed to in operation and to make the fuel better by figuring out how to get more lifetime out of it or how to get more performance per square inch of fuel area. Originally, cores operated for about 2 years back in the 1950; now they operate for 30 years. This improvement has resulted in less waste and spent fuel to be handled.

The Naval Reactors Program does not now, nor has it ever, required spent fuel to be shipped by special or dedicated trains. When there is a major scheduling need, for instance, if the first core of a new core type needs to get shipped to Idaho quickly to perform examinations to obtain confirmation of the core's performance, Naval Reactors will pay the extra cost to have a dedicated train if doing so will improve shipment times.

The shipments come from five locations. On the east coast, shipments come from the Portsmouth Naval Shipyard in Maine and from both a private shipyard and a Navy yard in the Norfolk area in Virginia. On the west coast, shipments come from the Puget Sound Naval Shipyard near Seattle, Washington. In the Pacific Ocean at Pearl Harbor, Hawaii, the spent fuel removed from ships stationed in that shipyard is transported by specially rigged ocean-going ships to Puget Sound Naval Shipyard where it is shipped by rail from there. All the fuel from both coasts goes to Idaho.

DOE has always allowed the railroads to designate the route they take because the railroad is a closed system and railroad personnel understand the system best. They know where the track is good and where there are certain problems, such as the heat problem with the rails that occurred in Washington. In the wintertime, they know where the snow and the ice may be. There may be periods of time when rail lines are blocked and it is desirable to move the fuel as quickly as possible.

DOE ships by regular rate service and does not pay for special trains. The spent fuel could be on a special train, and there are many times when it is, however, there are other times when it is on a train with general freight. Being a national security shipment, DOE tries not to draw attention to the shipments. When shipment is on a train of 40 or 60 other cars, it does not get much notice. To date, 742 casks have been shipped in the last 42 years in between 300 and 400 train shipments.

Figure 24 depicts a dedicated train. As one gets closer to INEEL in Idaho, there is not much other freight going in

Figure 24

that direction, so typically, at that stage of the shipment, the spent fuel will be on a dedicated train. There are four casks on this train although normally there are not that many. Many trains have just one cask and quite a few have two. At times, there have been as many as six. For example, Naval Reactors once had to clear out fuel that had been stacking up in shipyards and used a train with six casks.

DOE has occasionally paid for special service and dedicated trains (or special trains as they are also called). However, at the transfer on the border of Kansas and Missouri, or whenever the transfer is to Union Pacific for travel in the West, Union Pacific usually chooses to use special trains. This does not always happen, but it usually does. Union Pacific prefers to use dedicated trains to transport spent fuel. DOE has no problem with the railroad's choice so long as the Department does not have to pay extra shipping costs.

Figure 25

The containers are robust and probably no different than any other Type B container because they have to meet the same requirements (Figure 25). There are two armed, active duty Navy escorts with every shipment. They are highly trained and have participated in numerous security exercises involving train sabotage. The escorts ride in the caboose. They have a number of communication systems available to them. People who monitor national security shipments know where the train is at all times, or at least they know where the caboose is at all times, and the escorts have to make periodic reports. If the escorts fail to make a report, appropriate response mechanisms are activated.

At the top of the caboose, there is a cupola which has windows all the way around. The two escorts on duty alternate being on watch 24 hours a day. Someone watches the containers at all times, day and night. The escort car has to be positioned close enough to the containers in the train that the escorts can have visibility. If the train stops for some reason, an escort will get out and perform an inspection. The escorts also stay in communication with the train crews.

The nature of the fuel is very rugged and very different than commercial fuel. It is a solid metallic fuel that is neither flammable nor explosive. The fuel is built for combat. Most of the design details are classified. It operates in Navy ships which must continue to operate even when under fire and depth chargers are going off. No ship's crew wants to lose their propulsion power when engaged with the enemy. No fuel leakage of any kind is permitted and the primary coolant does not have fission products that could leak or vent leak from the primary system and contaminate the atmosphere of the submarine.

The Naval Reactors Program has always had a very conservative design philosophy which requires design for extreme worst case conditions. The M-140 shipping container has 14-inch thick solid stainless steel walls and is a Type B NRC-certified container. Normally, radiation levels allowed by the transportation limits are 200 mrem/h on contact or 10 mrem/h at 6 feet. Typically, the dose rate limits are about 3 mrem/h on contact and about 0.1 mrem/h at 6 feet.

Based on the fact that the fuel and the packages are both very rugged and that there have been no releases of radioactive material in a transportation incident, DOE believes the shipments are very low risk, and therefore, operates in such a way as to provide efficient operation at reasonable cost.

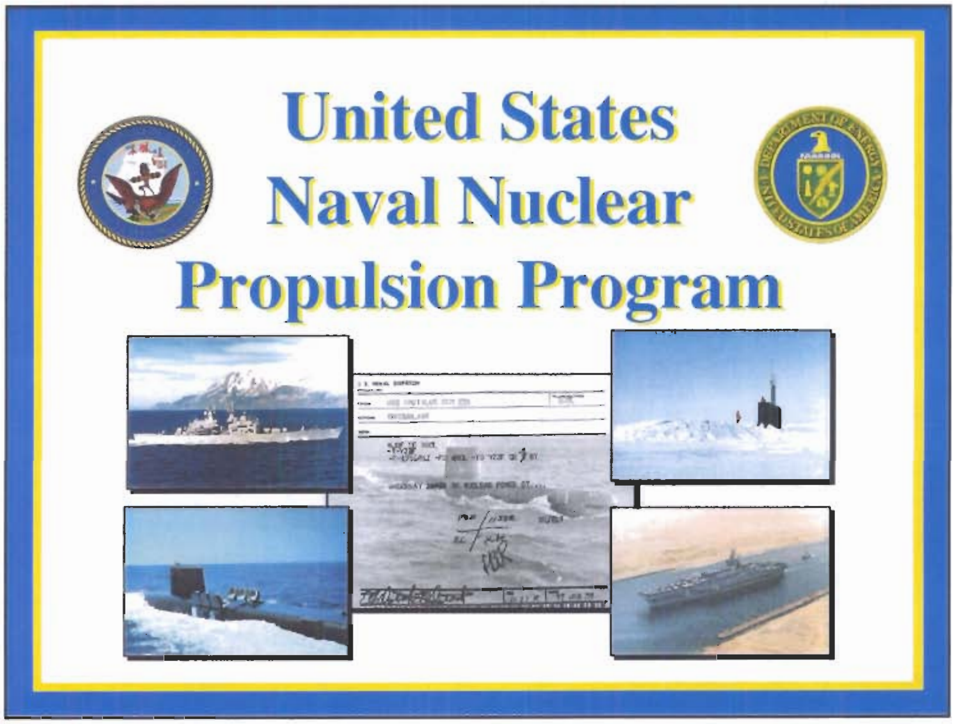
DOE performs public outreach work on emergency response in part because, unlike shipments of commercial spent fuel, national security shipments and DOE is not required to notify or interact with States and tribes. However, DOE goes out of its way to be involved and to talk to the emergency response organizations and the State organizations on the probable routes of the shipments. In addition, DOE conducts accident exercises. Since 1996, DOE has conducted exercises on both coasts and is currently planning one in Kansas which would involve local emergency responders.

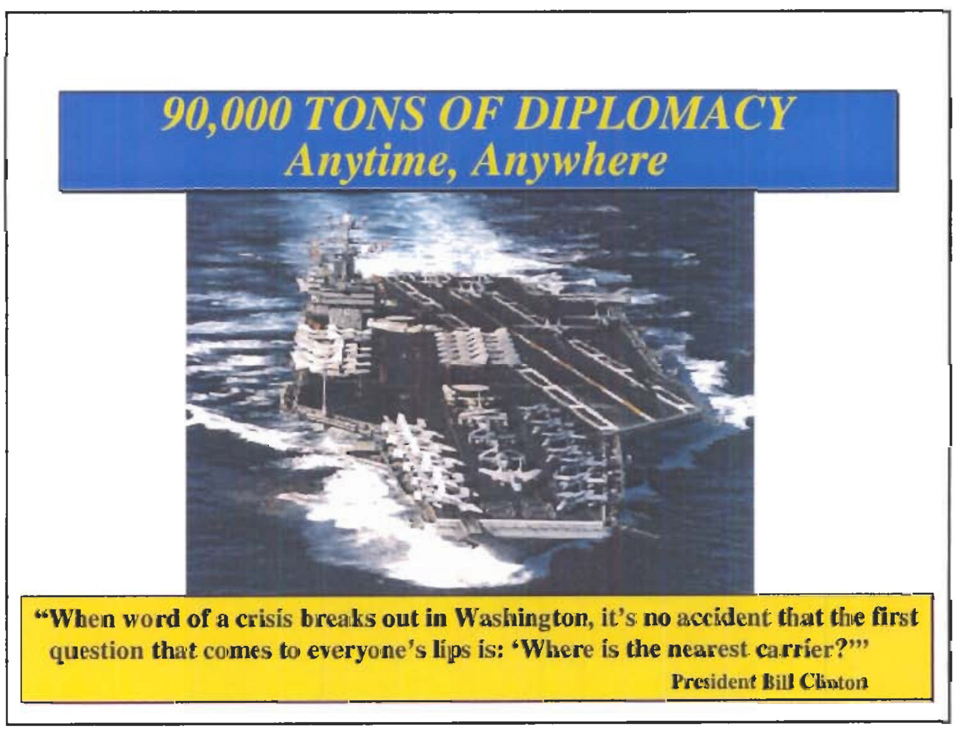
DOE is prepared for potential accidents. The DOE escorts are trained to be helpful in an accident situation. If the fuel is on a train, the escorts, along with the train conductor, are the first responders to quickly assess the situation. If there is an accident, the escorts first call it in from the escort car before one of them leaves to evaluate the situation. The other escort stays in the car to make sure that the communication system is set up. Once set up, the escorts have handheld communication devices which they can carry around with them. The escorts assist the people on the scene. They are trained in first aid and have the necessary gear in the escort car to provide first aid as needed. After assessing the immediate consequences and making sure people are safe, the escorts perform a routine survey of the rail cars to confirm that no change in any of the radiation levels has occurred. Once the State police, local fire department, and other emergency responders in the area arrive, the escorts will assist them as they take over incident command.

If something other than an accident occurs, for example, someone attempts mischief, sabotage, or theft, the escorts are trained to contact whoever is needed to provide assistance including local authorities, local police, and national security connections if appropriate.

With regard to shaped-charge weapons, explosive charge from a shaped charge occurs on the outside of a tank or bunker. This type of weapon projects a stream of very high velocity, very high temperature particles which can cut through the side of whatever they contact. If such a blast were to get into the inside turret of a military tank, it would set off ammunition. However, if shaped charge were to be detonated outside a spent fuel cask, there is nothing to blow up inside. The spent fuel is inert material and does not catch fire. Therefore, a relatively small diameter hole could be drilled through the side of a cask, even our 14-inch thick casks, and in the heat and agitation of the event, the fuel would be damaged inside and a puff of radioactive material would get out. However, no fire would occur to disperse the radioactive material. Any release would tend to be localized, although meteorological conditions might affect that. DOE believes the significance of such an event would be fairly low and it would ultimately be a local cleanup job.

In addition, a transportation package is not a very inviting terrorist target. Although it may have high psychological value, there would not be a large explosion, nor would there be very large numbers of casualties.


United States
Naval Nuclear
Propulsion Program


90,000 TONS OF DIPLOMACY
Anytime, Anywhere
"When word of a crisis breaks out in Washington, it's no accident that the first question that comes to everyone's lips is: 'Where is the nearest carrier?'"
President Bill Clinton

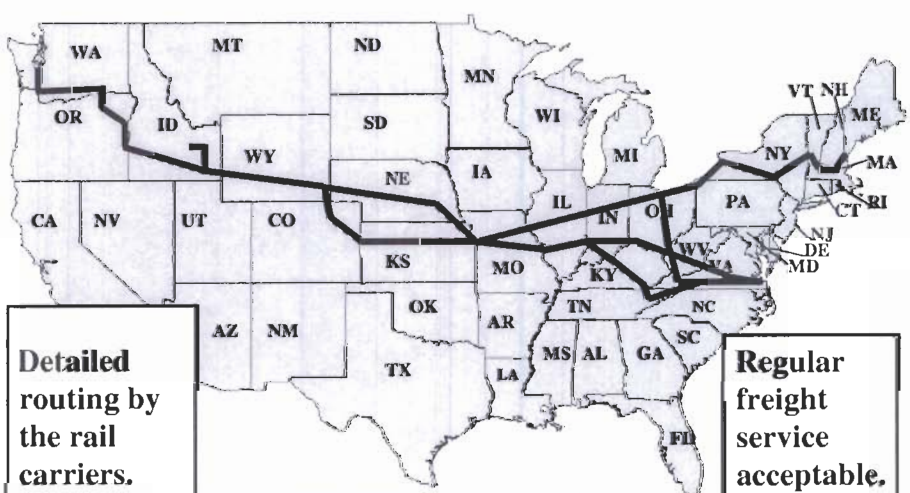
NAVAL SPENT FUEL CYCLE

Upon refueling/defueling, all naval spent fuel is transported by rail to NRF, INEEL for examination to confirm that the fuel operated satisfactorily and to gain information for:

- optimizing the performance of current fuel and reactors

- the design of new fuel designs with improved performance, such as longer lifetimes

TYPICAL NAVAL SPENT FUEL SHIPPING ROUTES



Detailed routing by the rail carriers.

Regular freight service acceptable.

742 CONTAINERS SAFELY SHIPPED
(3/8/57 - 11/20/02)

NAVAL SPENT FUEL SHIPMENTS ARE SAFE

- Nature of the fuel
  - Rugged
- Shipping containers
  - Robust
- Shipping practices
  - Escorts

Very Small Risk - Much Less Than Other Accepted Risks

NAVAL SPENT FUEL CHARACTERISTICS

- Solid metallic form - not flammable, not explosive
- Built for combat - battle shock
  - well over 50 g's
- Contains fully all long-lived radioactivity (fission products)
- Safe to operate in close proximity to sailors on warships during combat
- Not RCRA hazardous

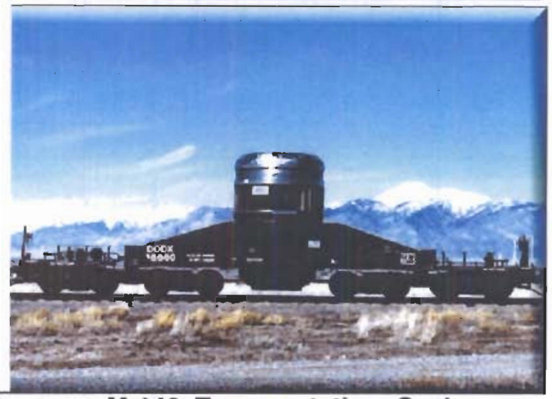
Bottom line: Well-suited for safe transport and storage for long periods.

NAVAL SPENT FUEL SHIPPING CONTAINERS

- **RADIATION LEVELS**

Dept. of Trans Limits: 200 mr/hr on contact; 10 mr/hr at 6 feet

Typical M-140 Levels: 3 mr/hr on contact; .1 mr/hr at 6 feet



M-140 Transportation Cask

- **14 INCHES SOLID STAINLESS STEEL**
- **350,000 POUNDS**
- **TYPE B NRC CERTIFIED**

TYPE B SPENT FUEL SHIPPING CONTAINERS

- Designed, manufactured, and certified to severe accident survival standards
- Equivalent of at least 60 foot drop onto reinforced concrete surface
- Other sequential accidents including fire, immersion in water and puncture
- Engineering performance standards result in very formidable, robust containers
- Will survive real world severe accident conditions
- Scale model testing and full scale crash demonstrations have confirmed that the design standards are stringent, and the techniques used to analyze the containers are effective

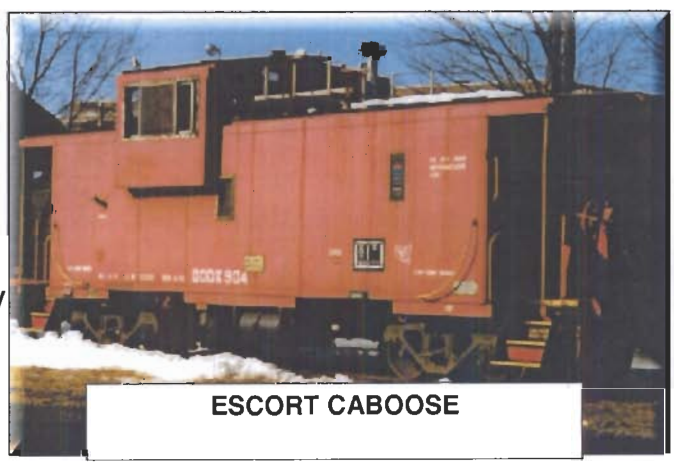
NAVAL SPENT FUEL SHIPPING PRACTICES

BASED ON:

- Rugged contents, formidable containers - low risk
- Efficient operations at reasonable cost
- Classified national security shipments
- Years of success tempered with flexibility and constant improvement

NAVAL SPENT FUEL SHIPPING PRACTICES

- Government-owned railcars, inspected and maintained
- Advance arrangements with rail carriers
- Location and status constantly monitored - satellite tracking
- State liaison, briefings, and emergency response outreach



ESCORT CABOOSE

➨ Escorted by specially-trained Navy couriers

- On-board traffic managers
- On-board first responders

EMERGENCY RESPONSE - ACCIDENT/DERAILMENT

- **Robust shipping containers provide a formidable barrier to release of radioactive material or significant radiation level increase, therefore *EMERGENCY RESPONSE PRIORITIES ARE*:**
  - **Emergency first-aid**
  - **Summon assistance**
  - **Prevent further injury/damage**
  - **Verify radiological condition**
- **Navy couriers assist Incident Commander in:**
  - **Crowd control**
  - **Communications and public information**
  - **Initial response actions, e.g., safety boundaries.**

SECURITY EMERGENCY RESPONSE (Attempted theft, sabotage, etc.)

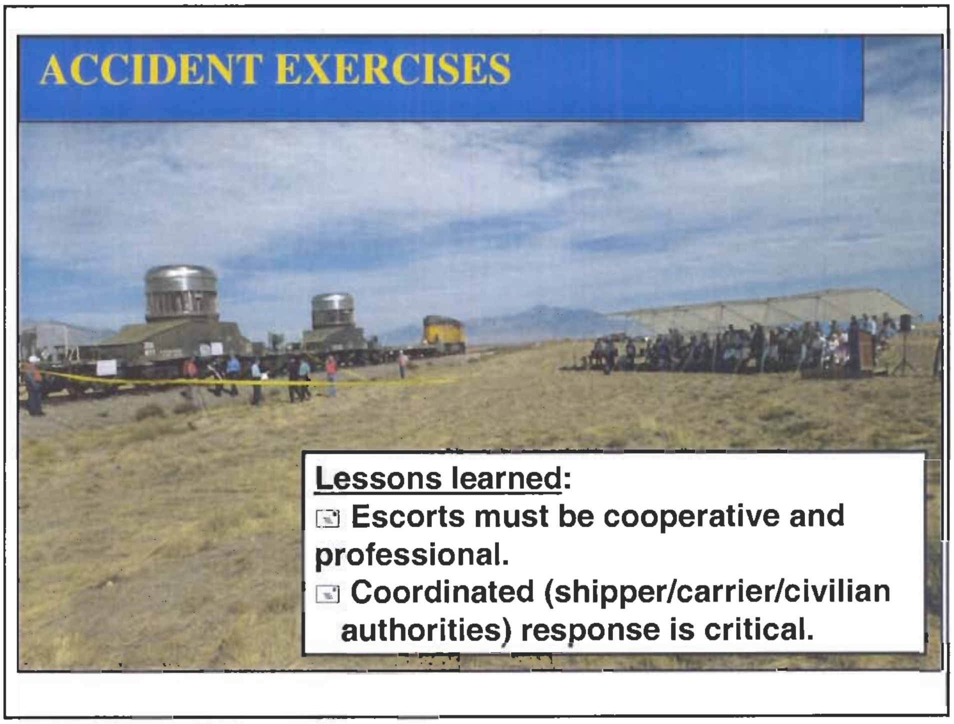
- **Do what is necessary to resolve the situation with the following objectives:**
  - Notify security contacts and request assistance
  - Ensure safety of material being shipped
  - Ensure DODX railcars not moved without proper authority
  - Attempt to minimize malicious activity
  - Ensure any attempted theft is identified and thwarted or controlled
  - Ensure the well-being of the Navy couriers is maintained
  - Promote shipment resumption as quickly as possible
- **Railroad police officials have participated in NNPP shipment security emergency exercises; ongoing liaison**

TERRORIST ATTACK

- M-140 container has walls 14 inches thick, stainless steel
- Even a shaped-charge explosive will not cause container to explode since the contents are solid metallic material
  - penetration created would be small
  - amount of radioactivity released would be small
  - absence of fire means no dispersal mechanism
- Thus, consequences of terrorist attack likely to be small

EXERCISE BACKGROUND

- SINCE 1996 EXERCISES ON THE EAST AND WEST COASTS AT SHIPYARDS AND INEEL
- OUTREACH AND EMERGENCY PLANNING FOR NAVY SPENT FUEL SHIPMENTS
- STATE, LOCAL, TRIBAL AND FEDERAL REPRESENTATIVES INTERACT WITH ESCORTS AND EACH OTHER
- OPPORTUNITY TO EXERCISE EMERGENCY RESPONSE, INCLUDING REMOTE COMMUNICATIONS


ACCIDENT EXERCISES
Lessons learned:
Escorts must be cooperative and professional.
Coordinated (shipper/carrier/civilian authorities) response is critical.

3.2.4 TWG Questions Regarding DOE Experience

Dr. Hornberger noted that DOE presented an impressive amount of information and questioned whether that experience is being used to prepare for transportation involving the Yucca Mountain Project. Mr. Harris replied that the Undersecretary of Energy has made public comments that the Yucca Mountain Project would initially model its transportation program after the WIPP program. For example, DOE is beginning to negotiate rail protocols with the western states. Before DOE can begin that process and actually select a rail carrier, the WIPP program office will be working on transportation issues with the Office of Civilian Radioactive Waste Management (OCRWM) which is responsible for the Yucca Mountain Project. Ms. Clapper added that her office also has worked very closely with OCRWM to help it respond to Congressional questions regarding transportation.

Mr. Levenson acknowledged the support of other DOE transportation programs to assist the Yucca Mountain transportation program and noted that the Foreign Fuel Program involves shipping heavily shielded materials, etc., whereas the WIPP program has shipped essentially unshielded materials to date. Both programs have had extensive experience with road transportation, although this experience has differed based on the types of material shipped. Mr. Doherty added that the Naval Reactors Program has also been working quite closely with the Yucca Mountain Project. Staff from both groups have had substantial interaction and meet three or four times a year. Much of the interaction is aimed at the Naval fuel that would be shipped to Yucca Mountain, however, there is also interaction on transportation issues.

Dr. Wymer asked how often the different DOE and DOT offices discuss transportation issues. Mr. Harris replied frequently. Mr. Harris explained that he sees Mr. Blackwell at many of the meetings he attends with the western and southern states on transportation protocols related to the WIPP shipments. In addition, there are scheduled meetings with NRC to discuss packaging issues. Mr. Blackwell added that the FRA coordinates regularly with DOE and the Marine Corps regarding foreign research and WIPP shipments. In addition, DOE and DOT participate in various other technical working group meetings and meetings with States. Mr. Blackwell noted that his supervisor often jokes with him that he works more for DOE than for DOT because of the close coordination that has occurred since 1992.

Mr. Doherty stated that Naval Reactors also participates in the gatherings of various people periodically around the country to discuss transportation issues. Naval Reactors participated very actively in the transportation protocol work that DOE was developing to try and make all parts of DOE shipments, to the extent practical, consistent in terms of practices and radioactive accident assistance procedures.

Dr. Garrick questioned what public outreach programs, activities, and drills are in place and what the response and reaction has been. Mr. Doherty stated Naval Reactors performs numerous of outreach activities, such as tours at a shipyard. He added that the Naval Reactors is fairly well regarded for doing things right and communicating clearly and honestly; when the Program says something is the truth, people can count on it. Naval Reactors tries very hard to have this level of public outreach. The same can be said of the Program's outreach to local emergency responders. This was not always true 15 years ago, but it is now.

Dr. Garrick noted that, with regard to the Yucca Mountain Project, the citizens of Nevada still appear to consider transportation the number one issue. He observed that whatever outreach DOE has done so far in this arena has not been very effective in moving the transportation issue off the table in terms of those things about which the public has great concern.
Dr. Garrick questioned whether the Naval Reactors, foreign fuel, and WIPP programs have experienced similar kinds of problems and whether or not their outreach programs were successful. If these outreach programs have been successful, Dr. Garrick asked whether the other DOE offices have offered counsel, advice, and assistance to the Yucca Mountain Project. Ms. Clapper stated that the Foreign Fuel program outreach programs have been very successful. DOE communicates with the Cross-Country Transportation Working Group which coordinates with the States that are actually performing inspections of the trucks, escorting the trucks, and serving as first responders. As a middle layer between the Cross-Country Transportation Working Group and DOE, there are regional groups, the Midwest Council of State Governments, the Northwest State Governments, and the Southern States Energy Board. These groups have meetings annually at which they regularly request that DOE, DOT, and NRC participate and give updates on the shipping programs. However, none of these groups has yet participated in public forum on Yucca Mountain.

Mr. Harris stated that DOE's outreach program for WIPP shipments uses a regional planning process and to work with regional groups like the Western Governors' Association, and the Southern States Energy Board. Not only has DOE staff and contractors been able to speak to these groups about the safety of DOE's transportation program, but, by working with these various groups and tribal organizations, DOE has also been able to speak to their constituents directly. DOE started with one shipment per week and by the summer of 2002, up to 29 shipments per week were taking place. As the number of shipments to WIPP has increased, people are more aware and more accepting of them; the media has stopped tracking and following every shipment. The only time a flux of new activity or new, refocused energy occurs is when DOE opens a new corridor. Shipments are primarily made using the Idaho to New Mexico corridor and the public in this corridor have seen DOE and are comfortable with the program. Mr. Harris stated that DOE expects a flurry of renewed public interest when new corridors are opened, and DOE considers it an opportunity for staff to do some outreach work with the public to help them achieve a comfort level with the program.

Dr. Garrick asked what the principal purpose was for performing fuel examination at the end of the shipments. Mr. Doherty responded that every fuel cell is examined in a water pit at the Naval Reactors Facility in Idaho, using TV cameras, binoculars, and mirrors. All accessible surfaces are examined for anything unexpected. It is a confirmatory examination to look for something out of the ordinary.

Dr. Garrick stated that he was interested in the examinations because one of the issues for Yucca Mountain is the ability to take credit for cladding; another issue is the assumptions that are made about the number of either casks or fuel that is flawed or damaged. Dr. Garrick questioned whether or not the Naval Reactors Program would give any insight or guidance on what might be done in the commercial fuel arena that would enhance confidence in the quality of the fuel, and therefore, impact the performance assessment. Mr. Doherty responded that the way the Navy operates the reactors on ship calls for frequent sampling of the primary coolant to look for any indication of a fission product leak. A little bit of trapped uranium in cladding is expected and there will be fission products from that, but the staff looks for an unexpected increase or rate of increase over the base level. Such an increase is not seen so the Program starts with the assumption that there is not a problem, but still does the examination for confirmation. If there is a fuel defect of any significant size, there would typically be some sort of indication at the point where the water flow leaves the module. The Zircaloy material and uranium will tend to accelerate corrosion, and there could be other deposition products. With commercial fuel, the whole phenomenon is different. The nature and the construction of the fuel assembly is different. Corrosion phenomena can occur in commercial fuel.

Dr. Garrick recalled Mr. Doherty stating that, when there is an event on a train shipment, the last thing the escorts do is check the radiation levels around the casks. He questioned whether there were permanent radiation monitors on these trains. Mr. Doherty responded not to his knowledge. Once sealed, the cask is checked to make sure it is properly sealed and is airtight. Mr. Doherty reiterated that Naval Reactors has a tremendous amount of experience with these casks.

Dr. Ryan noted that based on his experience on trucks, drivers will often be trained to verify on their routine stops that DOT requirements are still being met. He questioned if this were true for rail shipments. Mr. Doherty responded that train crews have the same responsibility, however, Mr. Blackwell added that the train crew does not have any training or responsibility to conduct radiological examinations. There is no requirement for train crews to have the knowledge or the expertise to conduct a radiological inspection. They will conduct inspections for securement, making sure the cars and the brakes are airtight. These are routine inspections, but are not in-depth radiological inspections. They are just visual inspections.

Mr. Levenson questioned whether there have ever been any cases, in the approximately 400 shipments, in which the escorts needed to responded. Tom Griffith, Naval Reactors, responded that to his knowledge since 1994, escort response has not been required.

Mr. Levenson questioned whether LEU would be returned as part of the Foreign Research Reactor Spent Fuel Acceptance Program or just HEU. Ms. Clapper responded that a total of 20 metric tons of HEU and LEU would be returned to the United States.

Mr. Levenson noted that with regard to the WIPP shipments there is potentially high hydrogen generation which means either high plutonium and questioned whether it was high enough to be a neutron source problem. Mr. Harris responded that he was not aware if this is an issue.

Mr. Kobetz questioned what the basis was for requiring the Naval packages to withstand the equivalent of a 60-foot drop onto a reinforced concrete surface. Mr. Doherty acknowledged that the requirement was a 30-foot drop onto an unyielding surface with all of the energy absorption going into the package. The reinforced concrete surface used for the Naval packages is not unyielding.

3.2.5 Stakeholder Questions Regarding DOE Experience

Mark Holt, Congressional Research Service, questioned why regular train shipments containing Naval reactor spent fuel end up sitting around in a train yard. Mr. Doherty responded that it is very difficult to keep trains moving all the time for a number of complicated reasons. However, railroads do try to expedite movement of these trains to the extent possible.

Mr. Holt asked whether the Navy was reasonably able to ensure the safety of the spent fuel shipments and therefore, there was no need for dedicated trains. Mr. Doherty responded that, in fact, there are some security reasons why a shipment would be less visible if it were not on a dedicated train. If Yucca Mountain is opened, there will be a set of conditions established for how shipments of spent fuel will go to Yucca Mountain and everyone will have to take them into consideration in planning their shipments. Mr. Blackwell added that transport by a dedicated train does not guarantee continuous motion. The train makeup does not necessarily mean it never stops; other factors come into play.

3.3 Domestic And International Licensee Experience

3.3.1 Summary of Utility Experience, Bob Kunita, Progress Energy

Bob Kunita is with Progress Energy [formerly, Carolina Power & Light (CP&L)] which has service areas in North and South Carolina.

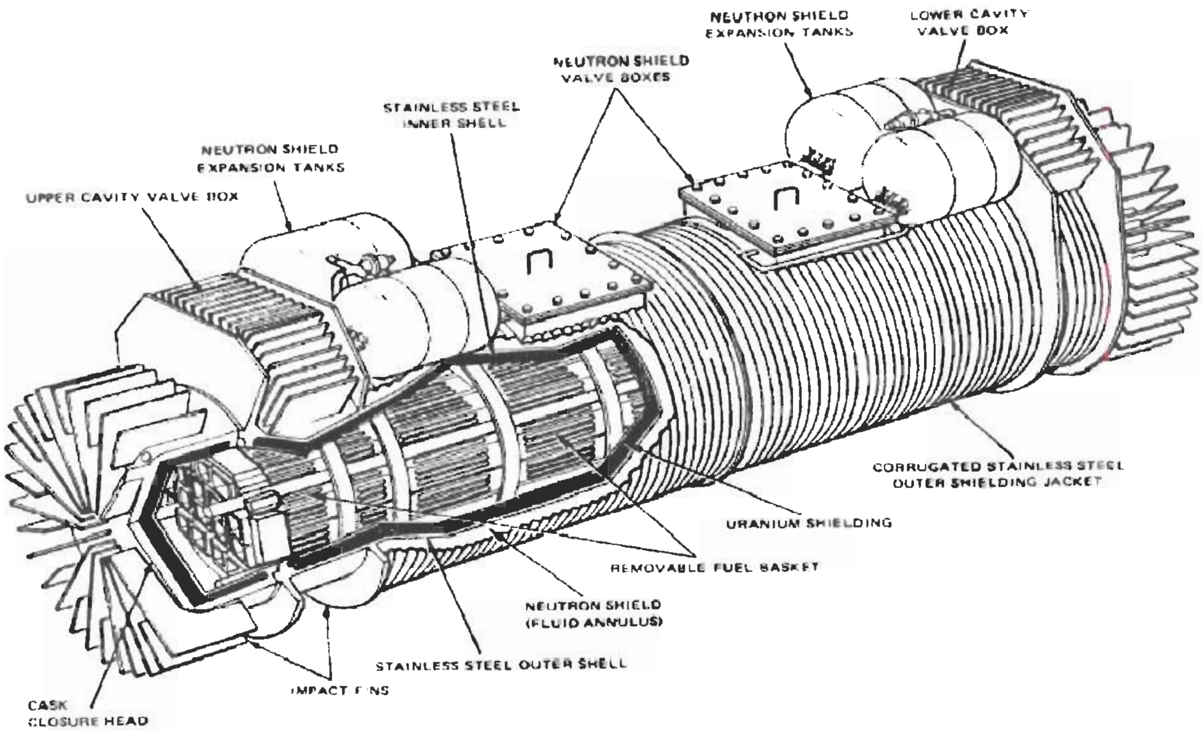
Progress Energy has five nuclear reactors. The H.B. Robinson plant in South Carolina. It is a PWR which started operation in 1971. Brunswick Units 1 and 2 are BWRs located in North Carolina which started operation in 1974 and 1977, respectively. Crystal River is a PWR plant located in Florida. It began operation in 1977. Harris is a PWR reactor located in central North Carolina.

Progress Energy is shipping spent fuel from its Brunswick units in the southeast corner of North Carolina and the H.B. Robinson plant in the upper portion of South Carolina to its Harris facility located in central North Carolina. The Brunswick and H.B. Robinson plants have had the spent fuel pools reracked to the maximum extent practical. The Harris facility started a bit later. It was initially designed for four reactors sharing one large spent fuel pool building, and that fuel building was essentially completed. Only one of the four Harris plants was finished to completion. The H.B. Robinson plant is the earliest unit, and there were spent fuel contracts in place to reprocess the spent fuel. But in 1977, when the U.S. Government changed its policy regarding reprocessing, the company suddenly ran into a storage problem.

In 1977, CP&L embarked upon a program to transfer some of the fuel to the Brunswick site which had sufficient storage in its spent fuel pool. In 1977, CP&L began shipments to the Brunswick units. Between 1977 and 1981, CP&L shipped a total of 304 assemblies in 44 shipments. Each of those was a single cask shipment.

The company then proceeded with reracking, and that helped for a time. However, in 1989, there was again a need for additional storage, and shipments resumed to the Harris facility from Brunswick in 1989 and from H.B. Robinson in 1990. At the present time, Progress Energy is still shipping from H.B. Robinson and the Brunswick units to the Harris facility. As of today, there have been 159 train shipments, consisting of 3,473 assemblies and 29,369 train miles, not including the empty return trains.

As a nuclear utility, Progress Energy does everything by very detailed procedures. Program level procedures define how the shipment program works, and specifically, how each site will handle its part of the job. Interface agreements exist among the Progress Energy sites and with the support organizations, which include procedures for annual inspections of the cask and the handling, loading, and unloading of those casks, and detailed procedures to select the field to assure that it meets the COC requirements. There are also procedures to make sure that the advanced notice required by NRC regulations is made. In addition, there are en route emergency procedures.



IF-300 Irradiated Fuel Shipping Cask

Figure 26

Progress Energy owns four IF-300 spent fuel shipping casks (Figure 26). The IF-300 uses an interchangeable basket, so the cask can be reconfigured to ship either PWR or BWR fuel. The cask is constructed of a stainless inner shell, depleted uranium for shielding, a stainless outer shell, a water annulus for neutron shielding, and a corrugated outer shell. There are two valve box covers that provide for fluid and gas entry into the inner cavity. There are expansion tanks for the neutron shielding in the annulus, and there are valve box covers to sample the fluid or change it, as need be.

The annulus is split into two compartments, an upper portion and a lower portion. This cask has integral impact limiters and does not use a balsa wood impact limiter.

Figure 27 shows one of the IF-300 casks on the rail car; the enclosure has been slid back so the cask can be seen. This cask is being prepared for entry into the Brunswick fuel handling building.

Figure 27

Each of the shipments is inspected by DOT and the FRA. Once the shipment departs, it is carried as an exclusive use shipment in a dedicated or special train.

Progress Energy has a well-defined organization in place for each and every shipment. It consists of a shipment manager and a shipment communicator who is located at the Progress Energy emergency operations facility for the duration of the shipment. The communicator is in contact with the shipment and can communicate with the warning points in each of the States through which the spent fuel is transported. The communicator also has contact with emergency management personnel in those States and communicates with the nuclear plant control rooms for notification to NRC.

There is a senior escort who has radiological expertise and a mechanical escort who has a working knowledge of the shipping cask. These individuals are separate and distinct from the security personnel. There is a plant response coordinator and teams standing by at both the shipping plant and the receiving plant. Should an event occur, the shipping plant would respond for the first half of the route; the receiving plant would respond for the remainder of the route.

Response manager has administrative responsibilities for the entire shipment. He becomes the recovery manager in the event of an accident of any type, and he has a predefined recovery organization in place. There is emergency response information on board each train, in accordance with DOT regulations. There are shipping papers which define the shipment as an exclusive use shipment. This is the information that the first responders would use, should they have to respond. The predeparture radiological surveys are also on board; the escort has a copy.

These casks have been used over a number of years and there has been a weeping or leaching problem causing cesium to sweat out of the pores of the cask. It seemed to be a function of temperature, dew point, surface furnish on the cask, and etc.

A caustic decontamination solution, trisodium phosphate or Blaze-Off, has been used to solve this problem. Currently, Progress Energy is using a mild citric acid solution to remove any contamination leaching out of the cask; this appears to have solved the problem. Working with Chem Nuclear, which had prior experience with this problem, Progress Energy has found this solution to work very well.

With regard to transportation experience, there was a road/rail crossing accident in around 1990. An empty shipment was being transported back to the shipping plant and an automobile struck the locomotive. There was cosmetic damage to the locomotive and to a rail ladder that was on the side of one of the cars. Some Progress Energy employees were on board and responded immediately to provide whatever assistance they could to the driver of the passenger vehicle. In 1995, a derailment involved an empty cask on an old, unused plant spur. The company's employees happened to back the empty train onto it while awaiting the railroad's locomotive. The car remained upright. In actuality, the car was only about a degree or two off of vertical, from the vertical line. However, technically it did constitute a derailment.

In 2002, there was an attempted boarding by unauthorized personnel on one of our loaded shipments. The necessary escorts were on board. Apparently, two young individuals who were sought by law enforcement officials, attempted to board the train. The escorts were aware of these individuals when the train approached the where the incident occurred. One of the youths was able to jump on the flat car because the train was slowing at that point. The other attempted, but failed. He was immediately challenged. The youth who got onto the flat car was immediately challenged by the escorts and other security personnel. Four law enforcement vehicles were at the train within 2 minutes. The system works.

The train cars are inspected on each and every shipment. CSX, the local railroad, also inspects the cars every 30 days at the request of Progress Energy. The FRA inspectors have been on each of the loaded shipments. There is a HAZMAT inspector to ensure that the package labeling is correct and a motive power inspector to assess the mechanical systems of the locomotive and each of the rail cars.

Progress Energy has had both NRC and FRA inspectors at the site. However, there was not agreement on when a shipment actually would begin. This distinction is important because it defines the interface between the company's onsite responsibilities and shipment responsibilities. A lack of clarity on this issue raises a number of questions. For example, when is the site emergency plan added? When are the health physics personnel, their postings, and so forth added? What about security? With regard to the company's shipment plan, when do the escort responsibilities under 10 CFR Part 73 begin? When does Progress Energy put the State warning points on notice that there is a shipment?

The NRC/DOT interface issue eventually was sent to the Government's lawyers for an answer. The lawyers responded that the shipment begins when both the locomotive is connected and the shipping papers have been provided to the carrier.

Current problems are not really safety-related. The company is running out of some of the older fuel that was being shipped, and now needs to ship spent fuel with a burnup greater than 45 GWd/MTU. The NRC and industry are working on this issue. NRC has issued guidance in Interim Staff Guidance 11, Revision 2, "Transportation and Storage of Spent Fuel Having Burnups in Excess of 45 GWd/MTU." The ability to transport spent fuel with burnups above 45 GWd/MTU is currently being handled on a case-by-case basis. Some H.B. Robinson spent fuel is now at Argonne National Labs under an NRC program examining the material properties of high burnup fuel.

NRC needs more guidance in the area of transporting high burnup fuel. For example, NRC recently issued Interim Staff Guidance 8, Revision 2, "Limited Burnup Credit in the Criticality Safety Analyses of PWR Spent Fuel in Transportation and Storage Casks." It is not clear whether this guidance can be applied to a previously approved package.

The IF-300 was an earlier generation cask. This type of cask is controlled under 10 CFR 71.13 with regard to how, as an older package, it can be modified and recertified. The IF-300 has been a very successful workhorse for Progress Energy. The company would like to continue to be able to use it, but an effort is also being undertaken to examine whether money should be spent to reanalyze this cask in terms of the new 10 CFR Part 71. These casks are only certified for 5 years, so it is very difficult to justify large capital expenditures for something that can only be assured for use for a 5-year period of time. Progress Energy would like to see a certification that is valid for a longer period of time.

3.3.2 TWG Questions Regarding Domestic Industry Experience

Dr. Ryan questioned what the unshielded neutron exposure rate would be at the surface of the cask if there were no water for the neutron shield. Mr. Kunita responded that this rate would vary depending on the contents of the fuel. Progress Energy has looked at this situation in some table top accident exercises, because even in the safety analysis, the entire water jacket is assumed to be lost. However, should this happen, the regulatory requirements would still be met.

Dr. Garrick asked whether the utilities track individual fuel assemblies. Mr. Kunita responded that the fuel assemblies are tracked by serial number. Dr. Garrick questioned if the tracking was performed all the way through to the Yucca Mountain repository. Mr. Kunita responded that the utility's obligation ends when DOE takes the fuel assembly. However, records are maintained well beyond the license life of the plant should DOE need the information in the future. Dr. Garrick stated that that would be useful because the tracking of fuel assemblies is important to the issue of heat load in the repository.

Dr. Garrick expressed interest in Mr. Kunita's experience with cask problems. Dr. Garrick questioned whether Progress Energy exchanges information with other shippers and users of other types of casks with respect to these kinds of issues. He also questioned whether other shippers experienced similar problems. Mr. Kunita stated that the weeping problem seems to be an industry problem.

Dr. Hornberger noted that it appears that Progress Energy has an excellent record of experience and safety and questioned whether that was industry-wide. Mr. Kunita stated that, while there are other types of fuel shipments, he believed Progress Energy was the only company shipping spent fuel assemblies. Other rod shipments are being made for research. In fact, Progress Energy has shipped some from the H.B. Robinson site. However, these tend to be truck shipments. Progress Energy's shipments have all been rail.

Mr. Levenson noted that, as he understood it, the shipments have all been wet-to-wet. That is, the shipments have come from a pool when they arrive at their destination. He questioned whether it would make any difference in future shipments if they were to be wet-to-dry or dry-to-dry. Mr. Kunita did not think so.

Mr. Levenson questioned whether the use of dedicated trains was influenced by Progress Energy's short shipping distance needs. Mr. Kunita responded that, Progress Energy ships spent fuel by dedicated trains as a convenience and as a scheduling matter. Shipment opportunities are defined by the reactor refueling outages. If sufficient fuel were not shipped, and the plant went down, then the replacement power costs would be astronomical. Thus, the company chooses to use dedicated trains from a business standpoint, rather than a safety standpoint.

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SUMMARY OF UTILITY EXPERIENCE

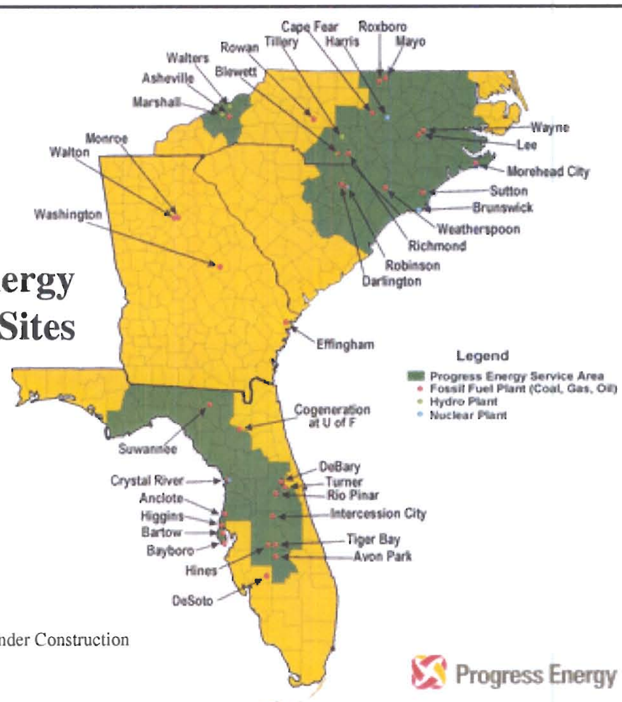
ACNW Transportation Working Group
Rockville, Md.

Bob Kunita

November 20, 2002

Progress Energy

Progress Energy Generation Sites



Includes Operating/Under Construction

2

Progress Energy

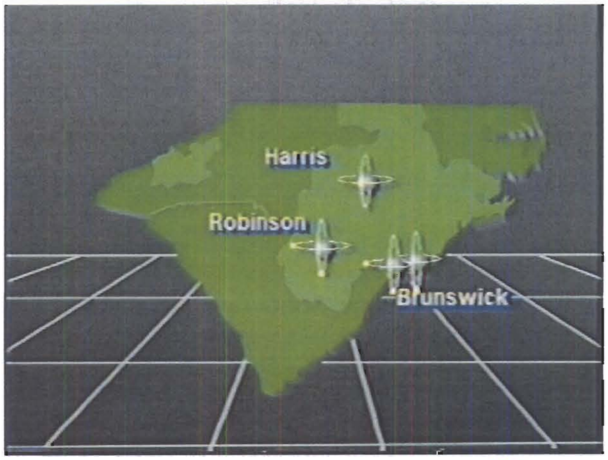
PROGRESS ENERGY REACTORS

	Commercial Operation
Robinson Unit 2 (PWR)	1971
Brunswick Unit 2 (BWR)	1974
Brunswick Unit 1 (BWR)	1977
Crystal River Unit 3 (PWR)	1977
Harris (PWR)	1987

3

Progress Energy

NC / SC NUCLEAR PLANTS



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Progress Energy

POOL CAPACITY EXPANSIONS

- Robinson Unit 2
  - 1976 rack addition
  - 1983 rerack
- Brunswick Units 1 and 2
  - 1977-78 rerack, 1984-87 phased rerack
- Harris
  - 1992, 1997 phased addition of BWR racks
  - 2001 pool C added BWR and PWR racks

5

Progress Energy

SHIPMENT HISTORY

	Years	# Trains	# Miles	# Assemblies
RNP-2 to BNP-1	1977 – 80	23	4,163	160
RNP-2 to BNP-2	1979 – 81	21	3,801	144
RNP-2 to HNP	1990 - present	32	4,224	444
BNP-1 to HNP	1989 - present	46	9,522	1,460
BNP-2 to HNP	1990 - present	37	7,659	1,265
		159	29,369	3,473

6

Progress Energy

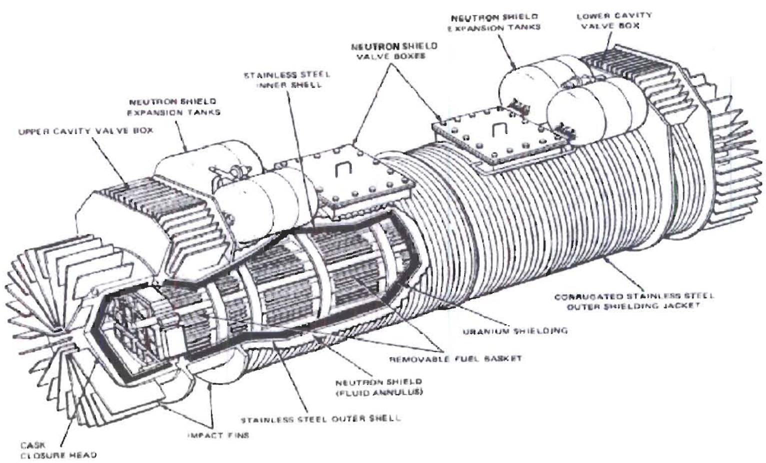
DETAILED PROCEDURES

- Program
- Interfaces Agreements
- Cask Annual Inspection
- Cask Handling / Loading / Unloading
- Fuel Selection
- Advance Notice
- Routine / Emergency (En route)

7

Progress Energy

SPENT FUEL SHIPPING CASK



IF-300 Irradiated Fuel Shipping Cask

8

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CASK ON RAILCAR

9

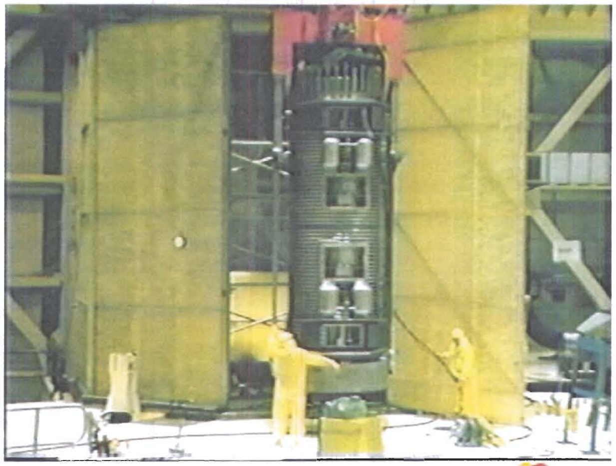
Progress Energy

CASK INTO / OUT OF POOL

10

Progress Energy

CASK DECON



11

Progress Energy

FRA (US DOT) INSPECTOR

12

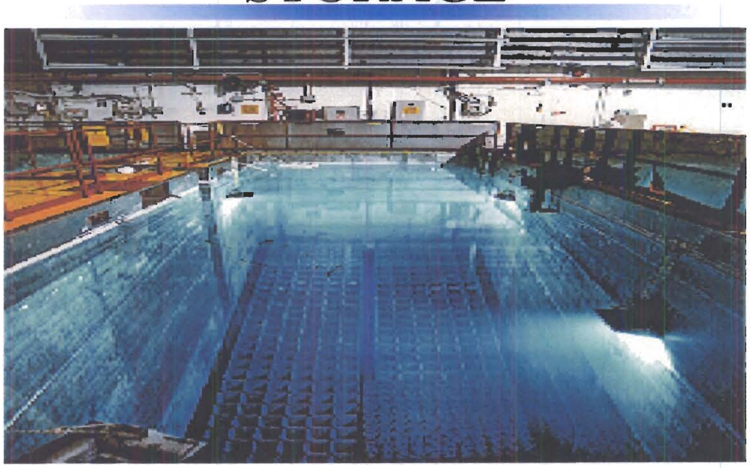
Progress Energy

RAIL SHIPMENT

13

Progress Energy

TEMPORARY POOL STORAGE



14

Progress Energy

SHIPMENT ORGANIZATION

- Shipment Manager
- Shipment Communicator
- Shipment Escorts
  - Senior Escort: radiological expertise
  - Mechanic Escort: working experience on shipping cask
- Plant Response Coordinator & Team
- Response Manager

15

Progress Energy

EMERGENCY RESPONSE INFORMATION

- Shipping Papers
  - Exclusive Use Shipment
  - Label: Radioactive Yellow III
  - Placard: Radioactive
  - Orange Panel: 2918 (loaded) or 2982 (empty)
- Pre-departure Rad Survey Results
  - Escorts have a copy

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CASK EXPERIENCE

- Cask Weeping
  - Cesium leaching from surface pores
  - Function of temperature, dew point, etc
  - Caustic decon solutions TSP, Blaze-off, etc
  - Mild critic acid solution solved problem

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CASK EXPERIENCE (Cont.)

- USQ
  - Part 71 vs Part 50 configuration
  - Head not fully secured to body; valve box covers removed
  - Potential doses far below Part 100 site boundary limits
  - NRC IN 99-15
- Seal Surface Machining / Welding
  - Machine body seal surface & head mating (1995)
  - Weld repair gouge / buff scratches (1999)

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CASK EXPERIENCE (Cont.)

- Cocked head recovery
  - Broken head cables (designed to break)
  - Bent guide pins
  - Few studs replaced
- Pool cleaniness
  - Borated pool (PWR plants)
  - BWR fuel crud
  - IN 97-51

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TRANSPORT EXPERIENCE

- Crossing accident (1990)
  - Auto struck locomotive on empty shipment
  - Cosmetic damage to railcar ladder
- Empty cask car derailment (1995)
  - Old unused plant spur; buried ties degraded
  - Car upright but off track

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Progress Energy

TRANSPORT EXPERIENCE (cont.)

- Attempted boarding (March 2002)
  - Law enforcement in pursuit of two young individuals from boot camp
  - One boarded shipment flatcar; one failed
  - Departed after escort challenged
  - Four law enforcement vehicles at train in few minutes

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TRANSPORT EXPERIENCE (cont.)

- Caboose battery
  - Charged by old friction driven generator / rectifier
  - Generator replaced by diesel generator
  - Backup battery set installed
- Train wheels (Oct-Nov, 1996)
  - Straight plate wheels replaced by curve plate wheels

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TRANSPORT EXPERIENCE (cont.)

- Rail cars inspected
  - 30 days
  - Shop inspection
- Site track inspected
  - Annual
  - UT

23

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TRANSPORT EXPERIENCE (cont.)

- FRA inspections
  - Shipments inspected by FRA (US DOT)
    - Hazmat Inspector
    - Motive Power Inspector
  - Locomotive inspection
  - Rail car air brake test
    - Leaks at compression fittings
    - Hard piped car airlines

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TRANSPORT EXPERIENCE (cont.)

- When does shipment begin?
  - Decision impacts interface of site emergency plan, HP, security, etc with shipment plan, escort duties, state warning points, etc.
  - NRC / DOT interface
  - Locomotive connects & shipping papers provided to carrier [ANSWER]

25

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CURRENT PROBLEMS

- High burnup fuel (>45 GwD/Mtu)
  - Need closure (Rx burnup vs store/ship)
  - ISG 11 Rev. 2
  - Robinson rods at ANL
- 10CFR71.13 Previously Approved Packages
  - Allow bootstrap to current regs.
- New Part 71

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Progress Energy

QUESTIONS ??

Progress Energy

3.3.3 International Experience, Ian Hunter, Vice President, Transnuclear, Inc.

Ian Hunter, Vice President of Transnuclear, Inc., stated that he had been in the nuclear industry for over 25 years, starting his career in the enrichment part of the nuclear industry, or the front end of the fuel cycle, and spent 5 years building centrifuge enrichment machines. He then started a long involvement with spent fuel and high-level waste.

Transnuclear, Inc. is part of COGEMA Logistics, a French-based organization, which has over 800 staff worldwide dedicated to the design, construction, licensing, and operation of all types of radioactive packages. COGEMA Logistics is part of the COGEMA organization. COGEMA is a nuclear fuel cycle company which is involved in mining and enrichment of uranium, as well as recycling and reprocessing of spent fuel. The company employs around 15,000 people. Transnuclear, Inc. can trace its parentage back to the AREVA Holding Company, which was formed last year and embraces both COGEMA and Framatome, the reactor company. This gives the company a total corporate size of around 50,000 people.

In 2000, there were 437 commercial nuclear units operating in 38 countries. A rough estimate is that of the approximately 250,000 tons of spent fuel that have been generated to date in commercial reactors, around one-third of it has already been reprocessed, therefore, it has already been shipped somewhere. A large proportion of the interim storage needed will be onsite storage at the reactors, but some of it will be off site, thus requiring transportation.

The COGEMA La Hague reprocessing plant in northern France employs about 5000 people. There are two reprocessing plants within the site, and they have a combined capacity of 1700 metric tons of reprocessed fuel per year. The site also houses facilities for converting the high-level waste generated from reprocessing waste from a liquid form to a vitrified form; in addition, the site also includes treatment facilities for low-level waste. Spent fuel pools at the COGEMA site act as interim storage while the fuel is awaiting reprocessing.

Nb of annual transports	1999	2000	2001	2002
French spent fuel	157	191	145	185
European spent fuel	9	12	44	61
Vitrified waste (incl. Japan)	6	11	20	22
PuO2 and MOX (incl. Japan)	150	149	187	175
Low Level Waste	643	684	757	700
Total	965	1047	1153	1143

Table 2

The latest statistics from COGEMA indicate that the company reprocessed more than 1000 tons of fuel in the last year. All of that fuel, incidentally, has been delivered in spent fuel casks. As shown in Table 2, over the last 4 years, this averages out to 1000 packages being moved per year of back-end material.

More recently, we have increased the volume of vitrified waste being shipped. This is the waste arising from reprocessing contracts being returned to the country of origin. COGEMA's current experience is roughly equivalent to what can be expected for future U.S. movements.

COGEMA owns a fleet of heavy Type B spent fuel casks (Figures 28 and 29). COGEMA also owns special heavy-haul trailers for moving shipments by truck and dedicated rail cars. In most instances, the rail cars move as normal freight with speeds of up to 60 mph.

COGEMA is involved in all types of modes of transport, not truck or rail. The company is involved in sea transports. Fuel has been shipped from as far away as Japan and Australia. The Japanese shipments were undertaken by Pacific Nuclear Transport, in which COGEMA has an interest. The other modes of transport used for these shipments were rail and truck. COGEMA also operates a marine port facility at Cherbourg to transfer spent fuel shipments from ships to rail cars. These transportation modes were used pre- dominantly in the last 20 miles between the nearest rail link and the COGEMA reprocessing facility.

Figure 28

One of the most commonly used spent fuel casks in Europe is the TN 12. COGEMA considers it the Cadillac of spent fuel casks due to its many advanced features.

The nuclear power plants of Electricite de France, EDF, were conceived with reprocessing as a direct part of the generating system. There are not large spent fuel pools at the reactor sites. This means that the challenge for the cask designer is to ship fuel with relatively low cooling periods, typically, less than 1 year.

The TN 12 was designed to meet the maximum diameter allowed for transportation on the European Rail Network and has a capacity of 12 PWR assemblies or 32 BWR assemblies. It has a forged steel construction. The TN 12 has a removable internal basket allows its use to be changed over from either PWR or BWR types. The basket can also be changed as fuel enrichments increase to keep up with operational needs. The TN 12 has an extensive heat transfer system. These casks are typically loaded with heat loads between 50 and 70 kilowatts. All of the external parts are stainless steel, and there are special features to interface with dry unloading facilities.

Figure 29

COGEMA has the capability to transfer spent fuel using dry unloading facilities. Such a facility actually exists at COGEMA La Hague. It is called T0 and it allows very fast, very efficient remote unloading of spent fuel. At some of the French PWR 1300 megawatt reactors, the same type of facility is used to load the fuel.

High-level waste casks are similar to spent fuel casks and are large 100-ton class-type casks. On the inside, there is a much simpler configuration for a basket. The baskets are of much simpler construction because the waste does not contain fissile material. The contents of the casks are stainless steel canisters with vitrified waste.

With more than 30 years of spent fuel and high-level waste transport, and millions of cask miles covered by sea, by truck, and by rail, there has never been an accident involving the release of radioactive material. COGEMA has experienced minor traffic incidents. Usually, the damage has been confined to the conveyance, and nothing of a significant nature has happened to the package. The National Radiological Protection Board in the United Kingdom has carried out regular surveys of spent fuel being shipped through the country. These surveys were aimed at evaluating the potential dose uptake to the public. The conclusions from these surveys indicated that the dose uptake to the public, resulting from the transport of spent fuel on a day-to-day basis, is insignificant.

The COGEMA group maintains equipment for accident recovery. The equipment is designed to operate in remote areas, including heavy lift equipment to recover a cask that may have fallen off of a truck or a train and rolled down an embankment. Mr. Hunter has participated in many emergency response exercises in Europe and can confirm that they are treated very seriously. They involve professionals from the emergency response organizations, fire, police, etc., who are used to dealing with emergency exercises. The responses that are tested are not just those of technical response teams who conduct simulated recovery exercises, but also of the management of the exercise itself. Tabletop exercises are performed on paper to test how well the responders communicate. However, these are not a substitute for sending people out to remote areas and practicing emergency responses in real time.

The possibility of terrorist attacks, and the likely consequences, has also been studied by COGEMA. Transnuclear, Inc. organized tests with the French military in which staff attempted to puncture a spent fuel cask using missiles and shaped charges. Obviously, the information is classified. But in general, these are extremely hard and difficult targets to penetrate. However, in the unlikely event that one is penetrated, techniques do exist to seal the cask and put it in a safe condition. Mr. Hunter has witnessed technicians practicing such techniques on dummy casks.

With regard to lessons learned, maintenance is a very important area. If a fleet of spent fuel casks are shuffled between reactor sites and reprocessing facilities covering many thousands of miles during their lifetime, it is inevitable that they are going to suffer some kind of minor damage—paint chips, knocks, scrapes, etc. The casks are very robust objects, but even a 100-ton object can be damaged when it is moved with a crane, for example, casks have been bruised and scraped. To keep the fleet in a pristine condition, it is very important to have not only good maintenance policies, but also proper facilities in which to undertake the maintenance. COGEMA has its own dedicated cask maintenance workshop at the La Hague site. There, casks can be stripped down completely to their individual component parts, repaired, and returned to almost new condition. Maintenance is something not to be forgotten by those embarking on a big fleet campaign.

On the logistics side, in the early days of fuel transports, COGEMA used to track the position of a cask by regular contact with the rail companies. In Europe, the way in which shipments are organized is perhaps different than in the United States. From a physical protection point of view, these are not Category 1 shipments. If there is any plutonium involved, such as mixed oxide fuel or plutonium itself, these shipments are performed with high security vehicles, escorts, etc. Spent fuel and high-level waste travels as normal freight. There are no escorts in Europe. COGEMA now uses satellite tracking to monitor positions of the individual casks, trucks, and trailers. Every single shipment is routinely tracked worldwide from COGEMA headquarters in Paris making it very easy to identify the position of any particular package at any moment in time. The operations center also serves as a command and control center in the event of an emergency incident.

Public acceptance is another challenge. Transport is in the public domain. We owe the public an explanation of what is about and that duty is an ongoing responsibility.

A minor technical problem can cause a disruption in transport operations. COGEMA experienced such a disruption in 1998 because of sweating from the cask. When a cask comes out of a spent fuel pool, it is decontaminated and cleaned down to very low levels of radiation. The phenomenon of sweat out or leaching is well known and has been well documented. However, in 1998, the frequency of these incidents led to a temporary cessation of COGEMA transports by the railway company, SNCF. The frequency of these incidents was in the range of 30 percent. The phenomenon of sweating from the cask can be compared to wet paint. If a cask has been painted, but has not dried, and a person or piece of equipment touches it, some of the wet paint will be transferred. Once the paint is dry, it is fixed and will not come off. Similarly, the contents of the cask were not leaking. It was simply residual moisture from the decontamination process. Unfortunately, this incident was blown out of proportion and, at the time, the casks were thought to be actually leaking.

The shipments were restarted within France within a few weeks. However, in Germany, where the political climate was such that the government was considering abandoning nuclear power completely, it took 2 years to restart transportation. This example demonstrates how a small incident can lead to significant consequences.

To address this technical problem, a meeting was held between high-level members of the French and German governments. They set up a commission comprised of members of the regulatory authorities in the two countries. Representatives from Switzerland and from the United Kingdom soon joined the Commission. The Commission undertook a comprehensive review of the problem itself and attempted to determine the root cause of these contamination incidents, including instances of contamination on rail cars, hot spots on casks, etc. The Commission also looked at the actual methods of measuring the contamination.

The Commission found differences in the techniques and the procedures used by individual countries to measure contamination. In some cases, differences in the equipment and the calibration methods used were also observed. These differences could lead to false indications. The incidents involved very, very low levels of contamination. It is not inconceivable that a consignor could c ean the cask, certify it clean, and ship it off only to have the cask measured by somebody with a different instrument who declares that there are hot spots.

The Commission also examined how to prevent contamination from taking place. The root cause of the contamination was the contaminated spent fuel pool water. An examination of the as low as reasonably achievable principles was performed. One solution identified was to actually clean up all of the spent fuel pools to eliminate dissolved fission or activation products. This would be technically feasible, however, from the point of view of dose, the collected contaminant particles would be in filters which would have to be handled, removed, and disposed. This would actually create more of a dose uptake than other possible solutions to prevent contamination.

The Commission came up with some very innovative methods to reduce contamination, such as a new technique used today in many reactors in Germany and France. One method uses a vinyl cover over a spent fuel cask that is ready to go into a pool. Underneath the vinyl cover is a stainless steel jacket which covers the finned area of the cask. Using this dual barrier system, and by introducing clean water between the cask and both the stainless steel skirt and the vinyl cover, any contact between contaminated pool water and the cask surface can be effectively prevented.

To sum up the experience in terms of quantity, 30,000 metric tons of spent fuel has been shipped by the COGEMA group worldwide over millions of miles. Safe transports are possible by careful management. The safety record can be maintained. The safety culture in the COGEMA companies is very strong, from the top down, and the corporate culture of safety, quality, and excellence adds to that success record

Public acceptance is another major issue. COGEMA ships fuel every day. The company talks to people who are concerned about rail shipments, truck shipments, or sea shipments. Event if those peopled are on the other side of the world, COGEMA listens to them and responds. COGEMA is very willing to share its experience with others.

3.3.4 TWG Questions Regarding International Experience

Dr. Ryan requested an estimate of external neutron dose rates on the surface of a cask if the neutron shielding were lost during an accident. Mr. Hunter responded that it depends on the fuel and the particular cask. The TN 12s have a solid external neutron shield of polyester resin that would be difficult to lose in an accident. In the fire accident analysis, COGEMA assumes that the neutron shielding capability is lost.

Dr. Garrick questioned how COGEMA transports the heavy cask recovery equipment to the accident site and how long this would take for some typical scenarios. Mr. Hunter replied that the heavy recovery equipment would be delivered by special trailers. This equipment could not be delivered to a remote area in a few hours; it might take a number of days. In terms of emergency response, the first crews who arrive at the scene would do radiological surveys to determine the conditions. Any direct remedial action required, would be taken by the technicians working with simple tools until the heavy equipment arrives. The recovery operation can actually take place some days after the event.

Dr. Garrick noted that the amount of experience that actually exists in the transport of spent nuclear fuel is impressive. The problem is that the data have not been very well organized. A tremendous opportunity exist to integrate and correlate a database that would greatly facilitate questions from the public on matters of transportation safety. Data could be partitioned in terms of fuel type, cask type, fuel handling, distinguishing fuel handling from transportation, distinguishing storage or interim storage from transportation, empty cask shipments, etc. Such a database would go a long way towards substituting for a large amount of analysis. Developing such a database is a great opportunity for industry. Dr. Garrick questioned whether Mr. Hunter was aware of any institution or organization that has considered putting together such a database. Mr. Hunter responded that there are databases of information available at the IAEA in Vienna in certain categories. COGEMA itself has archived all of its shipment data and would be very pleased to put them together in the form of a database, with a suitable commercial arrangement. Ms. Clapper added that she was not aware of any group that has that type of data.

Dr. Wymer asked whether any special shipping problems have arisen because of the spectrum of fuel types shipped. Mr. Hunter noted that most problems are resolved by long-range planning. Planning with utilities may start up to 5 years before they actually anticipate shipping fuel. During that 5 years, COGEMA identifies what equipment and procedures will be needed to make smooth shipment possible. If necessary, new baskets are developed to suit the fuel type, obtain licenses, etc. Most of the problems have been anticipated. At a practical level, the details across the range of PWR and BWR fuel types are extremely broad in terms of geometry, the physical nature of the fuel pins, the materials, etc.

ADVISORY COMMITTEE ON NUCLEAR WASTE TRANSPORTATION WORKING GROUP WORKSHOP NOVEMBER 19 & 20, 2002

International Experience

Ian Hunter
Vice President Transnuclear, Inc

COGEMA GROUP

TRANSNUCLEAR

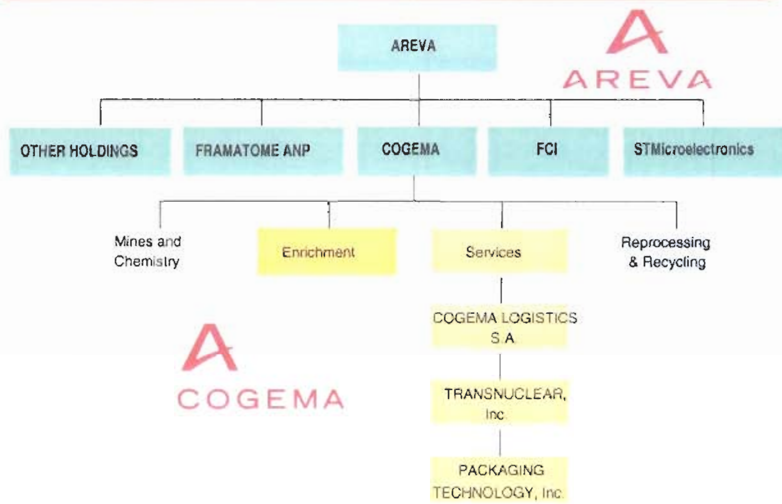
SCOPE OF PRESENTATION

- COGEMA TRANSPORT ORGANIZATION
- SCALE OF OPERATIONS
- COGEMA CASK FLEET
- TRANSPORT SAFETY RECORD
- CHALLENGES AND LESSONS LEARNED
- CONCLUSIONS

COGEMA GROUP

TRANSNUCLEAR

CORPORATE ORGANIZATION



IN 2000, THERE WERE 437 COMMERCIAL NUCLEAR UNITS OPERATING IN 38 COUNTRIES

> Units per country	Nuclear electricity generation
▪ USA 104	20%
▪ France 59*	75%
▪ Japan 53*	36%
▪ UK 33*	29%
▪ Russia 29*	14%
▪ Germany 19*	31%

* Reprocessing generates transports of spent fuel and HLW

> Cumulative worldwide total around 250,000t of spent fuel

- 70% is in some form of interim storage
- 30% has been reprocessed to date (around 75,000t)

COGEMA La Hague Reprocessing Plant

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A COGEMA SPENT FUEL POOL

COGEMA GROUP

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COGEMA TRANSPORT EXPERIENCE

- Over 1000 ‘ back-end ’ shipments per year
- 268 shipments of spent fuel and HLW in 2002

Nb of annual transports	1999	2000	2001	2002
French spent fuel	157	191	145	185
European spent fuel	9	12	44	61
Vitrified waste (incl. Japan)	6	11	20	22
PuO2 and MOX (incl. Japan)	150	149	187	175
Low Level Waste	643	684	757	700
Total	965	1047	1153	1143

COGEMA LOGISTICS LAND TRANSPORT FLEET

> 50 Heavy Transport Casks

> 10 Special Heavy Haul Trailers

30 Dedicated Railcars

MULTI MODAL TRANSPORTS





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TN 12 SPENT FUEL CASK

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TN 12 CASK FAMILY MAIN FEATURES

- A 100t cask with a capacity of;
  - 12 PWR SFA < 1 year cooling
  - 32 BWR SFA < 1 year cooling
- Forged steel construction
- Removable basket for operational flexibility
- Finned external surface with high heat load capacity
- Stainless steel cladding on all exposed surfaces
- Special features to interface with dry loading facilities

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DRY TRANSFERS OF SPENT FUEL

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HIGH LEVEL WASTE CASKS

- Vitrified residues (HLW) are transported in heavy casks
- Up to 28 HLW canisters per cask

HLW Cask Loading Operations

TN 28 V HLW CASK

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TRANSPORT INFRASTRUCTURE IN FRANCE

- Two terminals operating at Valognes and Orsan.
  - ✓ Valognes, the world biggest terminal dedicated to the transport of casks.
- Sea port facility for maritime transports at Cherbourg.
  - ✓ Dedicated crane for heavy casks

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TRANSPORTATION WORKING GROUP WORKSHOP NOVEMBER 19 & 20, 2002 14

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VALOGNES OPERATIONS

TN 52 DUAL PURPOSE
CASK USED FOR
ROUTINE TRANSPORTS

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TRANSPORT SAFETY RECORD

- In over 30 years of international spent fuel and HLW transports, casks have covered millions of miles by truck, rail and sea but there has never been an accident resulting in the release of radioactive contents.
- Traffic accidents have occurred but in most cases the damage was of a minor nature and confined to the vehicle.
- Safety from normal operations has been evaluated and public dose uptake has been shown to be insignificant.(NRPB)
- This safety record demonstrates the adequacy of the international transport regulations.
- The lack of serious accidents does not justify complacency and COGEMA takes a responsible attitude by preparing accident recovery plans.

COGEMA GROUP

TRANSPORTATION WORKING GROUP WORKSHOP NOVEMBER 19 & 20, 2002

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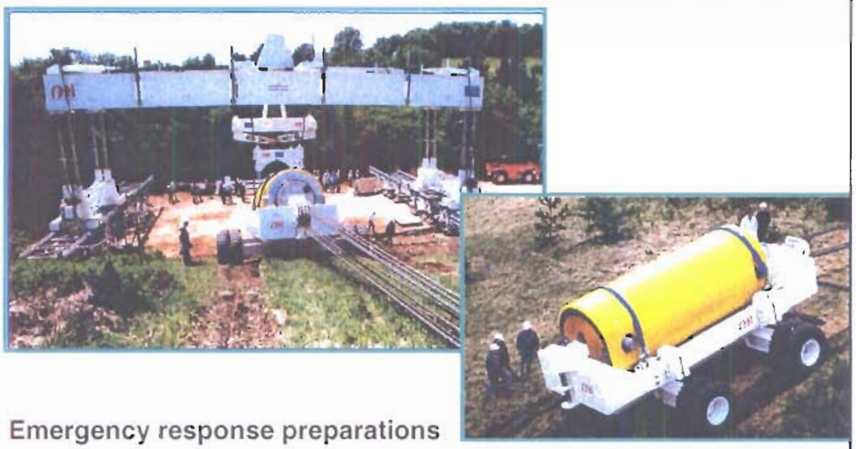
TRANSNUCLEAR

HEAVY CASK ACCIDENT RECOVERY



Emergency response preparations

Equipment designed and tested for recovering 120t casks

CHALLENGES AND LESSONS LEARNED

> Special maintenance facilities have been developed to keep the cask fleet in pristine condition.

> Logistics demands led to the development of satellite tracking systems.

> Public acceptance is an important issue.

> Even minor technical problems can disrupt transports.

>Contamination problems in 1998

CONTAMINATION EVENTS

- Regulatory limits for non-fixed contamination on transport casks;
  - 4 Bq/cm2 beta/gamma and low toxicity alpha
  - 0.4 Bq/cm2 for all other alpha emitters
  - Average measurement over 300cm2
- Occasional incidents are well documented.
- In 1998 , frequency of incidents in France led to a temporary cessation of transports.
- Risks to the public were insignificant but 4 EU states collaborated to establish causes and seek remedies.

LESSONS LEARNED FROM CONTAMINATION INCIDENTS IN 1998

- Monitoring techniques needed to be harmonized for all cask users to achieve consistent contamination checks.
- New techniques were developed to reduce in-pool contamination of cask surfaces.
- Decontamination methods were optimized for both efficiency and reducing operator dose uptake
- Close collaboration was needed with a wide range of agencies
  - Safety Authorities in different countries
  - Health and Safety experts from different utilities
  - Trucking and railway companies, unions

MONITORING CASK OPERATIONS

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TRANSNUCLEAR

WRAPPING A CASK PRIOR TO POOL IMMERSION

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TRANSNUCLEAR

CASK WASHING AFTER LOADING

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TRANSNUCLEAR

THE COGEMA EXPERIENCE

The COGEMA group has safely transported Spent Fuel from world-wide customers:

30 000 MTHM over 30 years

Transportation of Vitrified Residues Canisters (HLW):

900 tons of HLW (1800 canisters)

COGEMA GROUP

TRANSPORTATION WORKING GROUP WORKSHOP NOVEMBER 19 & 20, 2002 24

TRANSNUCLEAR

CONCLUSIONS

COGEMA GROUP EXPERIENCE

> Safe transports can be achieved by careful management of a transportation system.
> Millions of cask miles accumulated without any accident involving the release of the radioactive contents.
> This safety record is impressive but not an excuse for complacency.
> Continued vigilance ensures that high standards are applied to all parts of the transport system.
> Public acceptance is a major issue.
> COGEMA is ready to share this experience with others.

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3.3.5 Stakeholder Questions Regarding Spent Domestic and International Fuel Transportation Experience

Ms. Gue, Public Citizen, stated that while NRC holds specific responsibility for licensing high-level waste transportation casks for general use, conversations about transportation are happening right now at a time when NRC also is involved in the licensing phase of the two projects—PFS and Yucca Mountain—that would initiate unprecedented nuclear waste transportation in this country. It would be very helpful for ACNW, or NRC as a whole, to be able to consider these transportation questions within the specific context of these two projects. Yet DOE has not put forward the specifics of the transportation plan for the Yucca Mountain Project. Ms. Gue noted that there had been an assumption during the meeting of preferred rail transportation routes. But DOE has not gone on record with a decision about a mode of transport to Yucca Mountain.

Ms. Gue further observed that assumptive statements had been made about how many tunnels Yucca Mountain shipments would pass through and what other materials might be on trains going to Yucca Mountain. However, there has been no specific decisions made about shipping parameters for Yucca Mountain, much less the modes of transportation to be used. In the case of PFS, the information on transportation has been similarly minimized in the environmental impact statement. Not only does this undermine public confidence, it appears that DOE is trying to conceal this information. In addition, it makes specific analysis as to the environmental and public health impacts of transportation impossible. Ms. Gue again encouraged the TWG to recommend that DOE release some of these specifics and present them for public scrutiny and expert technical scrutiny as well.

Ms. Gue noted that the presentations focused on accident risks, on fire, and on impact consequences. Other regulatory accident parameters were not being discussed. Ms. Gue expressed her hope that the TWG would consider the nonaccident impacts of nuclear waste transportation, particularly in the context of the large-scale shipments that are planned. Such consideration would require some information about the routes that are to be used.

Ms. Gue postulated that, given that the casks licensed by NRC do not completely contain radiation, a public health impact exists from repeated close contact with these shipments as they pass by. There are demographic considerations as to who lives close to the shipment routes. It is not clear where or when these shipments might stop if they have to stop, and how often they might be stuck in rush hour or gridlock traffic. Ms. Gue admitted that consideration of the accident consequences is very important, but she also believes that consideration of the nonaccident consequences equally merits the TWG's attention.

Mr. Shaffner, Parallax, asked whether the large reliance on nuclear power in Europe makes the public at large better able to understand this issue than the people in this country. Europeans seem to be less susceptible to some of the arguments of those who are opponents of the endeavor. Mr. Hunter stated that it is very difficult to generalize about Europe, because it is a mixture of countries and cultures. In France, nuclear power is well accepted. In fact, in most French towns, the local mayor would be very happy to have a nuclear power station built in his area because it brings jobs, improves the local economy, etc. Both France and the United Kingdom have made a concerted effort at public outreach which may have helped to allay some of the public's fears. Operation Smash Hit provides a good example of the United Kingdom's public outreach efforts.

Mr. Shaffner asked whether radiation education is part of the general education curriculum in France. Mr. Hunter did not believe so.