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OCRWM Backgrounder

United States Department of Energy
Office of Civilian Radioactive Waste Management
Washington, D.C. 20585

DOE/RW-0124

January 1987

SHIPMENTS OF SPENT NUCLEAR FUEL IN SUPPORT OF NUCLEAR WASTE POLICY ACT RESEARCH AND DEVELOPMENT PROGRAMS

The Nuclear Waste Policy Act of 1982 (NWPA) assigns responsibility for development of a national system of nuclear high-level waste disposal to the U.S. Department of Energy (DOE). However, until the disposal system begins to operate (expected in 1998), the utilities are responsible for spent fuel storage. To accommodate the growing inventory of spent fuel prior to system operation, many utilities must increase their storage capacity or face the possibility of shutting down their nuclear electric plants.

To alleviate this problem, the NWPA directs DOE to establish a demonstration program, in cooperation with the private sector, for the dry storage of spent fuel at civilian nuclear power reactor sites. The purpose of these research and development (R&D) projects is to collect data to assist utilities in obtaining Nuclear Regulatory Commission (NRC) approval of various dry-storage technologies. The demonstration programs may take place at nuclear power reactors or at Federal facilities. The NWPA also tasks DOE to undertake a cooperative program with utility owners of nuclear power reactors to encourage development of the technology for spent nuclear fuel rod consolidation. Additionally, DOE will be conducting a repository-related program to characterize the spent fuel and test its behavior in various rock types.

DOE will be making a number of shipments over the next 5 years in support of these R&D programs. Approximately 50 shipments will be made from Virginia Power's Surry Power Station to DOE's Idaho National Engineering Laboratory (INEL). Initial shipping campaigns, involving 23 shipments, began in July 1985 and have been completed. It is anticipated that additional shipments (24 shipments or less) of consolidated fuel from the Surry Power Station to INEL could begin as early as the spring of 1987. Four spent fuel shipments to INEL were conducted in August 1986 from the Engine Maintenance Assembly and Disassembly (EMAD) facility at DOE's Nevada Test Site. Spent fuel shipments to INEL from the Nuclear Fuel Services facility at West Valley, New York, are also planned, pending cask certification. Shipments of spent fuel were made to the Hanford facility in Richland, Washington: in September 1985 from the Calvert Cliffs Power Station in Maryland (two shipments), and in February 1986 from General Electric's facility in Morris, Illinois (one shipment). Finally, tentative plans are being made for shipments in the next several years from yet-to-be-determined power stations to Richland, Washington, in order to conduct laboratory tests of fuel and waste-package interactions, and to INEL to test prototype fuel-rod consolidation equipment.

Over the past 30 years, more than 6,000 spent fuel assemblies have been shipped in the United States. Federal policies and procedures regulating the shipment of spent fuel were established under authority of the Hazardous Materials Transportation Act and are implemented under regulations of the Department of Transportation (DOT). In addition, DOT and the NRC, by agreement, have established roles for regulating transportation and packaging of radioactive material. DOT has developed safety standards that encompass transportation activities such as regulating radiation exposure; placarding; labeling and marking transport packages; loading, unloading, and handling transport packages; driver training; and highway routing. All DOE shipments comply with DOT requirements, therefore, spent fuel shipped under the NWPA, including these R&D shipments, will be conducted according to DOT requirements.

The NRC has developed safety standards for the design and performance of packages for shipment by NRC licensees of certain specified quantities of radioactive materials, including spent fuel. Under the governing DOT regulations, DOE also has authority to certify its own radioactive materials packages using standards that are

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equivalent to NRC requirements. Requirements for packaging and transporting radioactive materials are contained in 10 CFR 71 for the NRC and in DOE Order 1540.1 for DOE.

Consistent with the authority established under DOT regulations, both the NRC and DOE have implemented physical protection requirements to protect spent fuel shipments from acts of theft and sabotage. DOE requirements cover shipments made by DOE contractors, while similar NRC requirements apply to NRC licensees (generally involved in the operation of electric utilities).

Existing DOT, NRC, and DOE policies and procedures concerning nuclear materials shipments were established prior to enactment of the NWPA. When the disposal system is fully operational, the number of spent fuel shipments to repositories and other facilities developed under the NWPA is expected to increase significantly. This increase has prompted DOE's Office of Civilian Radioactive Waste Management (OCRWM) to begin a process of establishing procedures that will be uniquely applicable to shipments carried out under the NWPA. As an element of this process, OCRWM has announced their intent to comply with all DOT and NRC regulatory requirements that are in effect at the time of shipment to NWPA facilities [i.e., a geologic repository and if approved by Congress, a monitored retrievable storage (MRS) facility]. Pursuant to this intent, DOE and the NRC have signed a Procedural Agreement concerning certification of spent fuel and high-level waste transportation packaging under the NWP. This agreement states that DOE will use packaging that has been approved by the NRC in accordance with 10 CFR 71 (rather than DOE-certified packaging) for DOE shipments performed under the NWPA from NRC-licensed facilities to an NRC-licensed repository, MRS, or interim storage facility. In addition, OCRWM and DOE's Office of Defense Programs signed an interagency agreement on July 1, 1986, that provides that OCRWM ship defense waste to a repository in casks certified by the NRC. DOE has also determined that NRC-certified packages will be used for the R&D shipments to support NWPA programs.

The procedures that will support transportation within the waste disposal system are in the formative stage. Several factors will influence the decisions on what these procedures will be and on what schedule they can be implemented. The NRC has released for comment proposed modifications to its current physical protection requirements. Any modifications will affect OCRWM's future procedures. In addition, OCRWM is committed to a program of involving the States, Tribes, utilities, industry, and other interested parties in its program planning. Accordingly, the viewpoints of these groups will be considered in OCRWM decisions regarding appropriate procedures for NWPA shipping.

Prior to the time when new procedures for a fully operational system can be developed, DOE shipments of spent fuel in support of OCRWM R&D programs are being conducted under existing DOE procedures with some modifications. For example, all Surry-to-INEL shipments are being made exclusively in NRC-certified casks. It is the intent of OCRWM to make the transition to NRC requirements on an incremental basis for the R&D shipments as the new procedures are developed and approved.

— DOE —

OCRWM Backgrounder

United States Department of Energy
Office of Civilian Radioactive Waste Management
Washington, DC 20585

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ADDRESSING CONCERNS ABOUT WATER THROUGH REPOSITORY SITING AND DESIGN

INTRODUCTION

The U.S. Department of Energy's (DOE's) siting guidelines[1] are designed to ensure the selection of repository sites that will safely isolate high-level nuclear waste from the accessible environment. The accessible environment is the atmosphere, the land surface, surface water, oceans, and the lithosphere outside the repository-controlled area. The objective of several repository siting and design requirements, developed to meet these final guidelines, is the protection of water from all sources: surface, ground, and precipitation. U.S. Nuclear Regulatory Commission (NRC) licensing procedures[2] require protection of water resources. The NRC mandates a minimum waste emplacement depth of 300 meters (about 1,000 feet) to protect surface water and precipitation from the repository. Subsurface water or ground water occurring within the repository setting is given primary consideration for protection when siting and designing a repository.

GROUND WATER

Ground water is water that occupies spaces between rock grains or in fractures in rocks. Such openings tend to be larger and more abundant near the land surface; at depth, the openings (pore spaces) tend to be smaller and fewer due to the greater pressure of overlying material. The source of ground water is the fraction of rain and snowmelt or seepage from streams and lakes that percolates down through the soil and rock. Plants consume much of the water that enters the soil, and a small amount is held on the soil grains by capillary forces; any surplus percolates downward to the "zone of saturation" (rock in which every available space is filled with water). The top of the zone of saturation is the "water table." Candidate repository sites both above and below the water table are being evaluated.

Ground water is usually in motion, flowing under the force of gravity to lower areas. The volumetric rate of ground water flow is determined by the "hydraulic gradient" (inclination of the water table or the pressure surface) and the "permeability" (ease of conducting water). Flow rates of ground water have a wide range. For example, rock salt has an absence of, or extremely low rate of, ground water flow. On the other hand, a permeable sandstone "aquifer" (rock that contains sufficient saturated permeable material) will yield significant amounts of water to wells or springs (e.g., thousands of gallons per minute) and will not be considered for a repository.

REPOSITORY SITING AND GROUND WATER CONDITIONS

The study of ground water (geohydrology) is of primary importance in siting a repository since ground water has the potential for transporting radionuclides from the repository to the accessible environment. The "geohydrologic setting," defined as a composite description of all the major geologic and hydrologic factors that affect and control ground water movement into, through, and out of an area, requires thorough investigation before site recommendation and NRC licensing of a repository. Repository siting with respect to water is addressed in both the preclosure and postclosure siting guidelines. Surface water and ground water are preclosure considerations under technical guideline section 960.5-2-10 (hydrology). The ease and cost of siting a repository is directly influenced by the presence of water. Therefore, surface and ground water evaluations will be conducted when comparing sites under the preclosure guidelines. The presence of surface-water systems will be investigated with respect to potential flooding of the repository during construction, operation,

[1] U.S. Department of Energy, 10 CFR 960, "General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories; Final Siting Guidelines," 1984.

[2] U.S. Nuclear Regulatory Commission, 10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories; Licensing Procedures," 1983.

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and closure. Ground water aquifers between the land surface and the repository depth will be examined with respect to conditions that could require complex engineering measures beyond reasonably available technology for repository construction, operation, and closure.

Ground water is also a postclosure consideration in repository siting. The geohydrologic setting must permit compliance with requirements as specified by the NRC and the U.S. Environmental Protection Agency (EPA). The existence, therefore, of ground water (in saturated or unsaturated rock), the "porosity" (percent of void space in rock), permeability, hydraulic gradient, and ground water flow direction will be evaluated during site characterization. The first favorable condition in the postclosure siting guidelines under geohydrology is that the pre-waste emplacement ground water travel time along any path of likely radionuclide travel from the repository to the accessible environment would be more than 10,000 years. This is in compatible with the EPA release rates noted in the Environmental Standards for Disposal (40 CFR 191, Subpart B).

REPOSITORY DESIGN AND GROUND WATER CONSIDERATIONS

One of the factors addressed in repository design is ground water saturation or resaturation of the repository after closure. The isolation qualities of the "engineered barrier system" (i.e., the manmade components of a disposal system designed to prevent the release of radionuclides from the underground facility into the geohydrologic setting), including the waste packages and the repository seal system, will be designed to deter ground water from coming in contact with the waste. In the event that ground water contacts the waste package during postclosure, the waste package will be designed to deter ground water from contacting the radioactive materials within the waste package. The NRC specifies that the waste package must substantially contain the waste for 300 to 1,000 years. Additionally, the engineered barrier system and the repository seals will be designed to inhibit radionuclide transport away from the repository. In total, the combined isolation requirements of repository siting and design will, in principle, ensure that releases of radioactive materials to the accessible environment are within EPA limits for 10,000 years.

— DOE —

OCRWM Backgrounder

United States Department of Energy
Office of Civilian Radioactive Waste Management
Washington, DC 20585

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TRANSPORTATION ROUTING ISSUES RELATED TO THE SHIPMENT OF HIGH-LEVEL NUCLEAR WASTE

INTRODUCTION

In accordance with the Nuclear Waste Policy Act of 1982 (NWPA), the U.S. Department of Energy's (DOE's) Office of Civilian Radioactive Waste Management (OCRWM) is responsible for the transportation of spent nuclear fuel[1] and high-level radioactive waste[2] from various storage sites to a geologic repository or other facility. Spent nuclear fuel may be transported from commercial nuclear powerplants to a repository, or transported to a monitored retrievable storage (MRS) facility[3] for subsequent shipment to a repository. Under current planning assumptions, high-level radioactive waste from defense activities will be transported directly to a repository. OCRWM is developing plans for the transportation system that will be needed to handle radioactive shipments, scheduled to begin in the late 1990s. In providing for transportation, the NWPA requires OCRWM to contract with private industry to the fullest extent possible.

Three modes of transportation are being evaluated by OCRWM—highway, rail, and barge.[4] Routing issues related to these modes of transportation will be addressed by OCRWM in close cooperation with Congress, other Federal agencies, States, affected Indian Tribes, local governments, industry, utilities, and the public. The following discussion reviews major highway and rail routing issues identified by OCRWM and parties having an interest in the development of the NWPA transportation system. Further discussion of these issues is included in OCRWM's "Transportation Institutional Plan" (DOE/RW-0094, August 1986).

1/ Spent nuclear fuel refers to fuel that has been removed from a nuclear reactor core because it can no longer sustain an efficient chain reaction.

2/ High-level radioactive waste, generated from the reprocessing of spent nuclear fuel to extract plutonium and the remaining usable uranium, results largely from defense nuclear activities.

3/ If authorized by Congress, the MRS facility would serve as a centralized spent fuel and nuclear waste consolidation and packaging facility.

4/ The feasibility of barge transportation is currently being studied. If found to be an appropriate transport mode for NWPA shipments, specific barge routing issues will be addressed by OCRWM.

HIGHWAY ROUTING ISSUES

In 1982, the U.S. Department of Transportation (DOT) established final routing regulations, commonly known as HM-164,[5] for highway transportation of specified types and quantities of radioactive materials, which include the spent nuclear fuel and high-level radioactive waste shipped to NWPA facilities. Under DOT regulations, carriers must use preferred highway routes selected to reduce time-in-transit. Preferred routes consist of (1) an interstate highway system route, using an interstate bypass or beltway around a city where available and (2) alternative routes selected by a "State routing agency." Indian Tribal authorities, having police powers to regulate and enforce highway routing requirements, are included within the definitions of "State routing agency." Routing designations by State and Indian Tribal governments must be preceded by substantive consultation with affected jurisdictions (including local governments).

Understanding DOT Highway Routing Regulations

Based on the responsiblity placed with the State and Indian Tribal authorities in designating routes, participants at the OCRWM Transportation Institutional Plan Workshop held in Atlanta, Georgia, November 1985, noted that the States and Indian Tribes need to fully understand the requirements of DOT routing regulations and available options. Workshop participants recommended that OCRWM furnish financial support for an information program responding to the concerns expressed. DOT and OCRWM are evaluating a variety of mechanisms to disseminate such information.

5/ The Hazardous Materials Transportation Act of 1974 (HMTA) specifically grants DOT the authority to prescribe routing regulations by any mode of transportation. HM-164 is the docket number assigned to the rule making procedure.

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Reviewing Highway Route Selection Methodology

When evaluating and then designating highway routes as alternatives to the interstate highway system for transportation of highly radioactive materials, DOT regulations require State and Indian Tribal routing authorities to apply a route selection methodology suggested in DOT guidelines, or an equivalent route selection methodology, that adequately considers overall risk to the public. Some participants at the Workshop recommended a careful review of DOT guidelines and suggested supplementing the methodology with additional guidelines that address such issues as high hazard areas, the need for detailed assessments of transportation risks, and the effect of transportation on environmentally sensitive areas. Workshop participants also suggested OCRWM take a lead role in developing a route selection methodology applicable to *all* routing decisions associated with NWPA shipments.

OCRWM will participate with DOT, States, and Indian Tribes in a review of route selection methodologies for State and Indian Tribal alternative route designation. As an initial step, OCRWM will support the review of route selection methodology through financial arrangements with regional organizations. (Such activities are currently conducted through contractural arrangements with the Western Interstate Energy Board and the Southern States Energy Board.) Plans are for OCRWM to extend similar assistance to organizations of the northeastern and midwestern States and to Indian Tribes.

Assisting States and Affected Indian Tribes in Highway Route Designation

Upon request, OCRWM will provide technical assistance to States and Indian Tribes for the evaluation and designation of routes under DOT regulations. Assistance will take the form of mechanisms such as:

- providing access to a highway routing model (HIGHWAY) that is maintained by Oak Ridge National Laboratory[6]
- providing access to computer codes that estimate the risk associated with waste transport (developed specifically for OCRWM)
- providing access to computer codes developed for OCRWM to derive transportation cost estimates (also developed for OCRWM)

OCRWM will work with States and Indian Tribes, on both an individual and regional basis, to provide access to future codes involving transportation analyses, and to determine other forms of technical assistance that may be appropriate.

[6] The highway network data base used in the model was developed by Logistics Systems, Inc.; user fees may be required.

States and Indian Tribes have requested that OCRWM provide financial as well as technical assistance for route evaluation and designation activities. Grants will be provided under the NWPA to support route evaluation activities directly related to the siting of the repository within State borders or Indian Tribal lands. Financial arrangements with regional transportation organizations will support routing activities of non-host States and Indian Tribes affected by NWPA transportation.

Routing Highway Shipments to NWPA Facilities

Other issues relate to whether OCRWM will develop the routing procedures for waste shipments to NWPA facilities, and what degree of control OCRWM will exercise in determining the selection of specific highway routes.

Some comments to OCRWM have urged the development of NWPA shipping procedures that would instruct carriers to use specific highways within the DOT system of "preferred routes." OCRWM's policy is that its oversight role must be balanced with the need to allow carriers to make routing decisions during individual shipments in order to avoid adverse transportation conditions (such as local weather conditions and traffic delays). To implement this policy, OCRWM will develop NWPA route planning criteria that will conform to all DOT routing requirements. The criteria will further require the selection of routes that avoid operational delays (such as road construction and/or repair activities) and adverse weather conditions. Route planning criteria will also address such factors as:

- the preferred time of day for travel through urban areas
- the appropriate stopping places for rest, vehicle refueling, and vehicle repair

Applying Sanctions for Carrier Violations of Highway Routing Requirements

As recommended by participants at the Workshop, contracts between OCRWM and carriers providing transportation Services will specify all OCRWM and DOT procedures and regulations, formally directing the use of preferred highway routes. Transportation service contracts will include incentives for performance, and will specify sanctions for routing viplations. Such sanctions may include the suspension and termination of contracts.

Analyzing Highway Routing Factors in Future Transportation Studies

Transportation cost and risk analyses will be conducted by OCRWM for the environmental impact statement (EIS) required in the selection of a repository site. To assist in determining what routing factors should be considered in such transportation analyses, OCRWM is considering the use of regional routing workshops.

RAIL ROUTING ISSUES

The routing of rail shipments of radioactive materials differs from the routing of highway shipments.

- Federal rail routing regulations have not been promulgated, in contrast to established DOT regulations governing highway shipments of radioactive materials.
- Rail transportation offers fewer routing alternatives than does highway transportation since fewer alternative rail routes are available, and the condition of rail tracks can limit the number of acceptable routes.
- In contrast to the public highway system, rail lines are generally privately owned and maintained.

Reviewing the Need for DOT Rail Routing Regulations

When developing highway routing regulations, DOT considered whether routing rules should be established for other types of hazardous materials and other modes, including rail transportation. It was decided at that time not to proceed with development of additional routing rules. Now, OCRWM will work with DOT to review needs for Federal rail routing regulations for transportation of radioactive materials. OCRWM will also consult with the NRC, other affected DOE offices, railroad companies, and the Association of American Railroads during the review process. Mechanisms for addressing the potential need for Federal rail routing regulations may include the following:

- technical studies, to evaluate the need for rail routing regulations
- workshops specifically designed to solicit views and comments from the rail industry
- petitions to DOT for a formal rule making if, after review, OCRWM concludes that the routing of shipments of radioactive materials by rail requires regulation

Analyzing Rail Routing Factors in Future Transportation Studies

As with highway routing, the issue has been raised as to what routing assumptions and what data will be used in the rail transportation cost and risk analyses for the EIS. OCRWM will also consider the use of regional workshops on rail routing.

Developing Routing Procedures for NWPA Shipments by Rail

Some comments received by OCRWM have urged development of NWPA shipping procedures under which OCRWM would direct the use of specific rail routes for shipments to NWPA facilities. Similar to the policy for highway shipments, OCRWM's role will involve balancing an oversight role with the need to allow carriers flexibility, necessary to avoid unique or adverse local conditions (track repair or train derailments). OCRWM plans to develop NWPA route planning criteria for rail shipments that will parallel certain features of highway shipment criteria. At a minimum, OCRWM's route planning criteria for rail shipments will (1) require the selection of rail routes that limit shipping costs and transit times, (2) avoid population centers (where possible), and (3) avoid adverse seasonal weather conditions.

— DOE —

OCRWM Backgrounder

United States Department of Energy
Office of Civilian Radioactive Waste Management
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TRANSPORTATION CASKS FOR SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

INTRODUCTION

The Nuclear Waste Policy Act of 1982 (NWPA) assigns to the U.S. Department of Energy (DOE) responsibility for developing a system to safely and economically transport spent nuclear fuel[1] and high-level radioactive waste[2] from various storage sites to geologic repositories or other facilities that constitute elements of the waste management program. This transportation system will evolve from technologies and capabilities already developed.[3] Shipments of spent fuel to a monitored retrievable storage (MRS) facility could begin as early as 1996 if Congress authorizes its construction. Shipments of spent fuel to a geologic repository are scheduled to begin in 1998.

This backgrounder provides an overview of DOE's cask development program. Transportation casks are a major element in the DOE nuclear waste transportation system because they are the primary protection against any potential radiation exposure to the public and transportation workers in the event an accident occurs.

CASK CHARACTERISTICS

Many types and sizes of casks have been used with long-term safety to transport spent fuel and high-level radioactive waste. Truck casks weighing between 25 and 40 tons are used to transport from 1 to 7 spent fuel assemblies. Railroad casks weighing up to 120 tons are capable of carrying up to 36 or more assemblies. Figure 1 is a conceptual drawing of a 75-ton rail cask.

Transport casks typically have walls several inches thick that consist of shielding material sandwiched between outer and inner steel shells. The cask design provides for heat dissipation, containment, and radiation shielding.

Cask design is strictly regulated. The following section describes guidelines for their use.

THE REGULATORY FRAMEWORK

Performance standards, testing conditions, and certification requirements for transportation casks have been established by the U.S. Nuclear Regulatory Commission (NRC) and are specified in 10 CFR 71 (Packaging and Transport of Radioactive Material). Although DOE is currently authorized by the Department of Transportation (49 CFR 173.7) to certify that the casks it uses in transporting DOE-generated nuclear waste comply with equivalent NRC standards, DOE has indicated its intent to use NRC-certified casks for shipment of nuclear waste to geologic repositories or other facilities falling under the provisions of the NWPA.

NRC standards require that shipping casks prevent the loss or dispersion of their radioactive contents, provide for shielding and heat dissipation, and prevent nuclear criticality[4] under a range of accident conditions. Applicants for cask certification must demonstrate to the NRC, through analysis and/or testing, that casks can withstand the normal and accident conditions specified in 10 CFR 71.

For certification, the NRC requires that casks be evaluated or tested using the following hypothetical accident conditions: a free drop of 30 feet onto an unyielding surface (which is equivalent to a drop

[1] Spent nuclear fuel is defined as fuel that has been removed from a nuclear reactor core because it can no longer sustain an efficient chain reaction.

[2] High-level radioactive waste, generated from the reprocessing of spent nuclear fuel to extract plutonium and the remaining usable uranium, results largely from defense nuclear activities.

[3] U.S. Department of Energy, "Transporting Spent Nuclear Fuel: An Overview" (DOE/RW-0065), March 1986.

[4] Nuclear criticality refers to the point at which a nuclear chain reaction becomes self-sustaining.

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from much greater heights onto hard surfaces such as concrete or hard packed soil); a free drop of 40 inches onto a 6-inch-diameter steel bar of at least 8 inches in length; exposure to a fire of 1,475° Fahrenheit that engulfs the cask for 30 minutes; and immersion in water for 8 hours.

THE OCRWM CASK DEVELOPMENT PROGRAM

The NWPA assigns to DOE's Office of Civilian Radioactive Waste Management (OCRWM) responsibility for the design, development, and testing of casks used for the transportation of spent fuel and high-level radioactive waste. OCRWM activities related to certified cask development are described in the "Transportation Business Plan" (DOE/RW-0046, U.S. Department of Energy, Office of Civilian Radioactive Waste Management, January 1986).

OCRWM is currently determining the numbers and types of casks that will be needed to transport waste and is establishing the criteria needed to satisfy the requirements of the mandated transportation system. OCRWM's cask design objectives include minimizing the number of different casks required within the NWPA transportation system (through standardizing cask interfaces), maximizing cask payloads, and enhancing overall transportation system safety. Rail and truck casks based on new generation design concepts will be used to ship spent fuel and high-level radioactive waste. The new casks will be designed to ship spent fuel that has been removed from the reactor core for 5 to 10 years or more, and is, therefore, thermally cooler and less radioactive than fuel just removed from the reactor core. One advantage of new generation designs is that significant quantities of spent fuel and high-level radioactive waste can be shipped per cask, resulting in fewer shipments and a corresponding reduction in the potential for both radiological and nonradiological accidents.

Four types of casks are to be developed: (1) casks for moving spent fuel from reactors to either a repository or an MRS facility (if approved by Congress); (2) casks for moving spent fuel from an MRS facility to a repository; (3) casks for transporting nonstandard fuel and nonfuel components;[5] and (4) casks for transporting defense high-level waste.

[5]/ Nonstandard fuel and nonfuel components include control spiders, burnable poison rod assemblies, control rod elements, thimble plugs, fission chambers, and neutron sources.

"FROM-REACTOR CASK" DEVELOPMENT INITIATIVE

Cask design activity is focusing on the "from-reactor casks" that will constitute the major part of the cask fleet. These casks could be used for shipping either to an MRS facility or to a geologic repository. All surface modes of transportation (truck, rail, and barge) will be considered in designing the "from-reactor cask." Both overweight and legal weight truck cask designs will be evaluated. Rail casks will be designed with either a 100-ton gross weight limit (to ensure unrestricted rail travel), or with weight limits of 125 tons (for casks that could be used for both storage and transportation). Since not all reactors are accessible by rail, cask designs that facilitate intermodal transfer from trucks to railcars will be considered.

"From-Reactor Cask" Procurement Activities

In support of the "from-reactor cask" initiative of cask design, OCRWM issued an information package in February 1986 (Information Package for the "From-Reactor Cask" Program, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, Idaho, 1986) that contained material supporting the preparation of a request for proposals (RFP) for cask design and development.

To facilitate the review of OCRWM's plans for both cask procurement and the development of an RFP, OCRWM held a conference in Salt Lake City, Utah, in March 1986 with attendance open to all interested parties. Comments provided by conference participants were considered in developing the RFP that was released on July 31, 1986.

"FROM-MRS CASK" DEVELOPMENT INITIATIVE

The second cask development initiative will concentrate on the design of a "from-MRS cask." This design may embody features to accommodate MRS and repository interface requirements. The primary mode of transport for "from-MRS casks" will be by rail. Design features for rail casks could include cask weights of up to 150 tons, integration of the cask into the rail car, and potential waste capacities of 25 metric tons.

NONSTANDARD CASK DEVELOPMENT INITIATIVE

The third cask design initiative will involve the procurement of casks for transporting nonstandard spent fuel and nonfuel materials destined for a Federal repository. Development of these casks will depend on whether or not these materials can be efficiently transported by casks developed under earlier cask development initiatives.

DEFENSE WASTE CASK DEVELOPMENT INITIATIVE

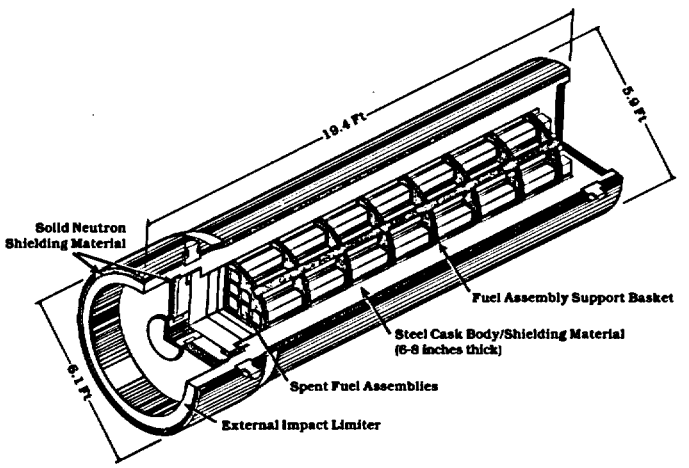
In the fourth cask design initiative, OCRWM will direct the design and development of casks for shipment of defense high-level waste (currently stored at DOE facilities) to a repository. OCRWM has begun preliminary planning and a review of strategy options for this design effort.

CASK TESTING AND CERTIFICATION

Engineering testing, design verification testing, acceptance testing, operational testing, and demonstrations will be included in the cask development program. (These tests are described in Table 1.) DOE will either perform or supervise the necessary tests and will assist its cask development contractors, when requested, by conducting engineering and design verification tests at the national laboratories. All testing results will be used to determine which of the prototype designs could be qualified under NRC certification requirements to become fleet casks.

Cask designers will be responsible for obtaining a valid certificate of compliance from the NRC for each type of cask before the cask is finally accepted by OCRWM.

Figure 1. Conceptual Drawing of a 75-Ton Rail Cask



Source: U.S. Department of Energy, "Transporting Spent Nuclear Fuel: An Overview" (DOE/RW-0065), March 1986.

Table 1. Cask Development Program Tests

Type	Responsible Organization	Test	Hardware	Schedule	Test Location
Engineering Testing	Cask Development Contractor	Materials and cask components as determined by contractor according to plan approved by DOE	Material specimens and cask components	Through final design	Any shop or lab meeting QA test requirements
Design Verification	Cask Development Contractor	Structural tests on models and thermal tests on component sections as determined by contractor according to plan approved by DOE	Scale-models and components	Upon completion of preliminary design	DOE-approved independent test facility
Acceptance Testing	Cask Development Contractor	Postfabrication inspections and nondestructive acceptance tests as specified by contractor in (Chapter 8) of Safety Analysis Report	Prototype cask	After prototype fabrication	DOE-approved independent test facility
Operational Testing	DOE/Utilities (Using Cask Development Contractor Consultants)	Facility interface and handling, transport operations, and intermodal transfer tests	Prototype cask	After prototype fabrication, prior to fleet unit procurement	Reactor, MRS facility, or repository sites
Confirmatory Demonstrations	DOE	Scenarios and test environments (to be defined)	Prototype cask	To be determined	To be determined

Source: U.S. Department of Energy, "Transportation Business Plan" (DOE/RW-0046), January 1986.