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SECY-97-161

FOR: The Commissioners

FROM: L. Joseph Callan /s/
Executive Director for Operations

SUBJECT: TRANSPORTATION OF RADIOACTIVE MATERIAL: PROGRAM STATUS
AND CURRENT AND FUTURE ISSUES

PURPOSE:

To inform the Commission of the status of the Spent Fuel Project Office s (SFPO s) program to regulate the transportation of radioactive material, and to identify current and future issues associated with the transportation of radioactive material.

SUMMARY:

SFPO s program for regulating the safe transport of radioactive material has made a significant contribution to the overall safety record achieved for radioactive material shipments. Of the millions of shipments completed, none has resulted in an identifiable injury or death through release of radioactive material. The program represents a balanced approach between package certifications, safety inspections, and enforcement, and has worked cooperatively with the Department of Transportation (DOT) to improve development and implementation of transportation safety standards.

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The transportation of radioactive materials in the United States is regulated jointly by the Nuclear Regulatory Commission and DOT. DOT regulates the shipment of radioactive material, as one of nine separate classes of hazardous materials, under the Federal Hazardous Material Transportation Law (49 USC 5101-5127). NRC regulates the possession and transportation of radioactive material under the Atomic Energy and Nuclear Waste Policy Acts. To avoid duplication in existing and future activities, the two Agencies signed a Memorandum of Understanding (MOU) in 1979, delineating their respective

responsibilities.

In general, the NRC has the responsibility for developing safety performance standards for package designs used to ship large quantities (Type B quantities) of radioactive materials and fissile material, and for certifying package designs to those standards. DOT's primary responsibilities under the MOU are to develop safety standards for packages used to ship small quantities (e.g., Type A and excepted quantities), low specific activity material, and surface contaminated objects, and to develop regulations governing the actual carriage of radioactive materials (e.g., requirements for marking and labeling packages, placarding trucks, carrier safety, and shipping papers). Inspection and enforcement activities are shared and coordinated between the Agencies.

The safety record for radioactive material shipments over the last 30 years has been exemplary. Of the millions of shipments completed in that time frame, none has resulted in an identifiable injury through release of radioactive material.

STATUS OF NRC'S TRANSPORTATION SAFETY PROGRAM

The NRC's program for assuring safety in the transportation of radioactive materials is carried out within the SFPO. SFPO's transportation safety program is comprised of seven broad elements. These are: (1) certification of spent fuel shipping packages; (2) certification of non-spent fuel shipping packages; (3) approval of quality assurance programs for package fabrication and use; (4) inspections of package fabrication and fabricators, including implementation of quality assurance programs; (5) approval of routing and physical protection arrangements for shipments of spent fuel and special nuclear material; (6) implementation of DOT and NRC requirements for radioactive shipments by licensees; and, (7) maintenance of program safety through environmental and risk assessment, rulemaking, and issuance of guidance. The full-time equivalent (FTE) resources allocated to these seven program elements in FY98 are shown in Figure 1. A breakdown of the resources needed to certify shipping packages for both spent fuel and non-spent fuel is shown in Figure 2.

Certification of Spent Fuel Shipping Packages

The SFPO approves approximately ten to fifteen applications per year involving spent fuel transportation casks. In the last few years, these approvals have been comprised of amendments to, and renewals of, Certificates of Compliance (COC) for existing spent fuel transportation cask designs. No new spent fuel cask design has been approved since September 1994. Currently, there are seven cask designs that are certified to transport spent fuel from light water reactors. These are listed in the following table. Overall, twenty casks have been fabricated, representing six of the seven certified designs. As shown in the table, most of the casks that have been built have limited capacity. Many of these casks were manufactured before 1986 under a previous revision of Part 71, and as such, new casks can no longer be fabricated.

Certified Transportation Cask Designs

Model	COC Holder	Capacity*
# Built		
NLI-1/2	NAC International	1 PWR, 2 BWR
5		
NAC-LWT	NAC International	1 PWR, 2 BWR
5		
TN-8	Transnuclear, Inc.	3 PWR
2		
TN-9	Transnuclear, Inc.	7 BWR
2		
IF-300	VECTRA	7 PWR, 18
BWR 4		
NLI-10/24	NAC International	10 PWR, 24 BWR
2		
NAC-STC	NAC International	24 PWR
0		

* Capacity is shown in number of fuel assemblies

Currently there are five applications for new spent fuel cask designs. Four of these designs

are dual-purpose (storage and transport) casks with capacities of 24 to 26 fuel assemblies (Holtec's Hi-Star 100, Sierra Nuclear's TRANSTOR, VECTRA's MP-187, and NAC's UMS) and one is a transportation-only cask with a capacity of four fuel assemblies (General Atomic's GA-4 truck cask).

Staff is investigating several significant technical issues pertinent to the certification of spent fuel casks, including: (1) the use of burnup credit in the criticality analysis; (2) the shipment of failed or severely damaged fuel; and, (3) the shipment of fuel with enrichments above 5 weight percent uranium-235. In addition, proposed legislation to amend the Nuclear Waste Policy Act, would require the NRC to certify shipping packages for a wide variety of spent fuel types and related high-level waste generated by Department of Energy (DOE) defense and Naval Reactor programs. SFPO staff believes that certifying packages for these potential contents may result in several new technical issues.

Certification of Fuel Cycle, Industrial, and Waste Shipping Packages

In addition to spent fuel packages, SFPO reviews shipping packages used for the nuclear fuel cycle, for commercial and medical sources, for research materials, and for radioactive wastes other than spent fuel. The contents of these packages cover a wide spectrum of radioactive materials including: enriched UF₆, uranium powders and pellets, fresh fuel, radiography devices, irradiator sources, irradiated hardware, various research materials,

Naval Reactor materials, plutonium, and transuranic wastes to be transported to DOE's Waste Isolation Pilot Plant. SFPO issues about 80 COC each year for new package designs and for amendments or renewals of previously-approved package designs.

Future developments and issues expected in this area include: (1) a new generation of UF₆, uranium powder and pellets, and fresh fuel packages for shipment of uranium enriched greater than five weight percent; (2) new packages for AVLIS (Atomic Vapor Laser Isotope Separation) products; (3) new packages for plutonium powder, pellets, and fresh mixed oxide fuel; (4) legacy issues concerning UF₆ packages; and, (5) additional package designs for

transporting contact-handled and remote-handled transuranic wastes to the Waste Isolation Pilot Plant.

Approval of Quality Assurance Programs

Fabrication and use of transportation packages for radioactive materials must be conducted under an NRC-approved Quality Assurance (QA) Program, in accordance with the provisions of 10 CFR 71.12(b) and 71.31(a)(3). Currently, there are 43 QA Programs approved for design, fabrication, and testing, and 119 QA Programs approved for use of transportation packagings. SFPO performs approximately 35 QA actions per year. Prior to FY1997, SFPO performed approximately 200 QA actions a year, because QA approvals were required for radiographers. In June 1997, the licensing requirements under 10 CFR Part 34 were changed to include QA activities in the radiography license; consequently, 199 QA approvals applicable to radiographers are no longer needed.

Inspections of Package Fabrication and Fabricators

SFPO performs safety inspections of fabricators and holders of COC for transportation packagings to ensure that design, fabrication, test, maintenance, and operation are conducted in accordance with the commitments made to NRC. An important part of these inspections is to verify that licensees and other parties are properly implementing their NRC-approved QA programs. The inspections extend to a broad spectrum of the industry including designers, fabricators, and vendors. Numerous team inspections are performed annually. SFPO also conducts inspections in response to allegations.

Inspections of vendors and fabricators have shown that in many instances implementation of QA programs has been generally weak. The inspections identified numerous instances where the control measures were not sufficiently implemented by the transportation package suppliers to ensure that the product meets the commitments made in the NRC-approved design. For example, these inspections disclosed that for package certification, some suppliers conducted puncture tests that did not meet requirements in 10 CFR Part 71; and that package maintenance and use leak tests were incorrectly performed. Inspection follow-

up activities have included Confirmatory Action Letters, issuance of Information Notices, and Bulletins.

Route Approvals and Physical Protection Requirements for Spent Fuel

Section 37 of 10 CFR Part 73 contains NRC's requirements for the physical protection of irradiated reactor fuel in transit. These provisions are designed to minimize the likelihood of sabotage, theft, or diversion, and facilitate the location and recovery of shipments. Basically, SFPO's review assures that the proposed spent fuel shipment route complies with DOT's routing requirements, and that the route plan identifies appropriate emergency contacts, safe havens, and urban areas requiring armed escort along the route. About five to ten routes are approved annually. Finally, SFPO maintains records on spent fuel shipments, and publishes reports summarizing shipment data. There have been about ten to fifteen spent fuel shipments per year, over the past several years.

A number of issues have been identified in this area: whether to continue to grant exemptions, or provide regulatory relief through rulemaking from the requirement [10 CFR 73.21(b)(2)(ii)] that spent fuel shipment itineraries may not be disclosed until ten days after the last in a series of shipments is completed; whether there is a need to retain the designation of spent fuel shipment itineraries as Safeguards Information; whether the requirement for the advance notification of spent fuel shipments to State Governors [10 CFR 73.37(f)] should be extended to include Indian Tribes; and finally, whether satellite tracking systems (e.g., DOE's TRANSCOM) should be approved for real-time monitoring of the status of spent fuel shipments.

Implementation of DOT Requirements

Section 71.5 of 10 CFR explicitly subjects NRC licensees to DOT transportation requirements contained in 49 CFR Parts 170 through 189. Therefore, NRC inspects licensee shipping activities for compliance with DOT requirements (e.g., marking and labeling of packages, placarding trucks, preparation of shipping papers, etc.) and takes

enforcement actions as necessary. In contrast, inspection of similar activities for DOE and Agreement State licensees, which are also subject to the same DOT requirements, are conducted either by DOT or the individual state. NRC and DOT have worked closely under the MOU to ensure nationwide consistency in the interpretation and implementation of DOT's requirements. To achieve this, SFPO and DOT meet monthly to discuss issues of mutual concern. SFPO also acts as a point of contact and coordination for providing guidance and interpretation of DOT regulations for NRC Regional Offices.

Joint activities between NRC and DOT have included vendor and shipment inspections, issuance of Information Notices and guidance, participation in industry workshops, and enforcement actions. A recent example of a joint guidance issuance is NUREG-1608/RSPA Advisory Guidance 97-005, Categorizing and Transporting Low Specific Activity Materials and Surface Contaminated Objects.

Maintaining Program Safety Basis

Another important element in SFPO's transportation program is devoted to maintaining the safety basis for the Commission's regulations for transportation safety (Part 71). This element includes rulemaking, development of guidance and standard review plans, and conducting supporting environmental impact and risk studies. Major on-going activities in this area include: (1) a limited re-evaluation of the Commission's generic environmental impact statement on transportation (NUREG-0170) to address the impact of spent fuel shipments to a repository or central interim storage facility; (2) a proposed rulemaking to achieve compatibility among NRC and DOT regulations and the 1996 edition of International Atomic Energy Agency (IAEA) transportation regulations; (3) a joint DOT/NRC initiative to revise the IAEA process for adopting transportation regulations; and (4) development of standard review plans for both spent fuel and non-spent fuel applications.

One potential concern in this area is whether current environmental impact and risk studies are adequate to support future shipments by NRC licensees and DOE. NUREG-0170, "Final Environmental Statement on the Transportation of Radioactive Material by

Air and Other

Modes," dated December 1977, provides the regulatory basis for issuance of general licenses for transportation of radioactive material in 10 CFR 71. Due to changes in industry and government spent fuel management strategies, new spent fuel shipments are anticipated that were not considered when NUREG-0170 was prepared. These anticipated shipments include the possible use of dual-purpose and multi-purpose canisters (MPCs) for spent fuel shipments, and shipments to Independent Spent Fuel Storage Installations (both on and off reactor sites), and centralized storage facilities.

Further, other studies have been completed that are directly related to spent fuel transportation, including Shipping Container Response to Severe Highway and Railway Accident Conditions (NUREG/CR-4829, Vols. 1 and 2, February 1987, often referred to as the Modal Study). The computer models used for transportation risk assessment have also been updated since NUREG-0170 was prepared. SFPO has initiated a contractor study to consider these factors and revalidate, if possible, the conclusions of NUREG-0170 with respect to the risks posed by anticipated spent fuel shipments to a central storage facility or repository. The re-evaluation may also have to be expanded to include other materials being shipped to a repository, such as DOE Naval Reactor fuel, and spent fuel and high-level wastes from DOE defense programs. SFPO is also planning to update the Modal Study for new shipping cask designs, principally to address rail mode issues (FY00), and to conduct a survey of radioactive material packages transported annually in the United States (FY98). Both of these efforts may be required in the future to do a total reassessment of NUREG-0170, and to support the general licenses for the future shipment of all radioactive material.

SFPO has also initiated plans to revise 10 CFR Part 71, in concert with DOT revising 49 CFR, to achieve compatibility with the 1996 Edition of the IAEA s Regulations for the Safe Transport of Radioactive Material. The IAEA's 1996 regulations contain, among other things, major new requirements for Type C standards for air transport, radionuclide specific exemption values, and fire protection for unenriched UF6 cylinders. DOT and NRC are

currently analyzing these provisions to see whether they should be adopted in domestic regulation. SFPO is also participating along with DOT in a major effort to revise the process used by IAEA to revise its transportation regulations. The U.S. goal is to require countries submitting proposed revisions to complete regulatory analyses, considering cost-benefit evaluations.

SAFETY RECORD FOR SHIPMENTS IN NRC-CERTIFIED SHIPPING PACKAGE

The safety record for radioactive material shipments over the last 30 years has been exemplary. Of the millions of shipments completed in that time frame, none has resulted in an identifiable injury through release of radioactive material. According to statistics compiled from incident reports made under DOT, NRC, and DOE reporting requirements from 1971 through 1995, there have been 58 accidents involving 101 Type B packages (which include spent fuel packages). Only one of the packages was reported to have failed, i.e., released contents. This case involved a radiography camera which fell from a moving truck, and was subsequently struck by an automobile. Upon further investigation, it could not be confirmed whether the radiography source had been properly secured within the camera for shipment, as required in the NRC COC. Although the circumstances indicated that it probably was not properly secured, it is nonetheless considered as a package failure. The source did not rupture and was retrieved.

During the 1971 to 1995 period, eight transportation accidents occurred involving the transport of spent fuel packages, none of which resulted in any release of radioactive material. In four of those accidents, the spent fuel casks being transported were empty and were undamaged. The other four involved loaded shipping packages:

A December 1971 accident, in which a truck left the road and threw off its spent fuel package which suffered minor damage;

A February 1978 incident, in which a truck trailer carrying a spent fuel package buckled under the weight, but the package was undamaged;

A December 1983 accident, in which a spent fuel truck tractor separated from its

axles without damaging the package; and

A March 1987 accident, in which a train carrying two packages of Three Mile Island core debris collided with an automobile causing no package damage.

Three of the accidents or incidents occurred during the 1979 to 1995 time frame for which NRC has compiled detailed data on the number and kind of spent fuel shipments. To put these accident numbers in perspective, between 1979 and 1995 there have been 1,306 separate shipments (1,335 metric tons) of commercial spent fuel, totaling a distance of approximately 840,000 miles. Of these shipments, 1,168 have been by highway, and 138 by rail. The accident rate represented by these numbers is in close agreement with historical accident rates for rail and highway transport - the accident rates used in risk studies completed by the NRC, such as the Modal Study.

COORDINATION:

The Office of the General Counsel has reviewed and has no legal objection to this paper. No resource impacts are expected as a result of the information contained in this paper.

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Attachments:

Figure 1 - Transportation Safety Program

Figure 2 - Transportation Caseload

by Fiscal Year