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TRANSPORTATION OF NUCLEAR MATERIAL

Presented By
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It is indeed a pleasure to be here and have the opportunity to discuss the transportation of radioactive materials. As any of you who have dealt with the matter know, transportation of radioactive materials is a complicated matter partly because it is regulated at the Federal level by two agencies (NRC and DOT) and partly because of the numerous and detailed requirements needed to provide adequate safety for the myriad types, forms, quantities and concentrations of materials shipped. However I will attempt to touch on the major aspects of the subject rather than getting into any great detail. I should add that it is a subject that generates considerable public concern as well as concern by State and local officials when some event occurs, be it large or small. This is because it is radioactive material which is involved more than the fact that it is transportation.

Materials Shipped

To provide some perspective concerning radioactive materials shipments, the following data may be of interest. About 500 billion packages of all types of commodities are shipped in the United States each year. Approximately 100 million (0.02%) of the total estimated shipments involve hazardous material such as flammables, explosives, poisons, corrosives and radioactive material. The most recent estimate of shipments of radioactive material originating in the US (excluding DOE shipments) indicates that there are about 2 million annual shipments of

radioactive materials which contain an average of 1.4 packages per shipments. This is a total of 2.8 million packages shipped annually which contain quantities ranging from very small to quite large. We can readily see that such shipments are an everyday occurrence and not at all unusual.

These 2.8 million packages are from a variety of sources. The sources include medical (62.2%), industrial (7.6%), nuclear power plants (4.1%) waste (6.5%), and other sources such as (19.5%) research and development and academic. Based on the activity shipped the percentages are medical - 34.3%, industrial - 63.1%, nuclear power plants - 0.7%, waste - 1.5% and other sources - 0.4%. The medical uses of radioactive material primarily involve administering radiopharmaceuticals for various diagnostic and therapeutic procedures and the use of large radiation sources for treatment of cancer. The radiopharmaceuticals are often shipped to hospitals from the supplier by means of air transportation. They consist mainly of short-lived materials and hospitals need to be supplied weekly. Industrial uses of radioactive materials include the well-logging industry, the radiography industry and various gauging sources for measuring and controlling thickness, density and fluid level. Industrial sources are primarily shipped by air and surface transport. Waste shipments of radioactive material are made from medical and academic users, industrial firms and nuclear power plants; they are usually shipped by surface transport to commercial low-level waste disposal sites.

Regulatory Authorities

The packaging and transporting of radioactive materials is regulated by the NRC, the DOT, the Postal Service, and the individual States.

Under the Transportation of Explosives Act and the Hazardous Materials Transportation Act of 1974, the DOT is authorized to regulate the transportation of hazardous materials in commerce. The regulations include requirements on safety in packaging, shipping, carriage, stowage, storage, and handling of all radioactive materials.

Under the Energy Reorganization Act of 1974 and the Atomic Energy Act of 1954, the NRC is responsible for promoting the common defense and security, protecting the health and safety of the public, and minimizing danger to life and property from the civilian use of nuclear materials. The broad authority accorded the NRC under this legislation covers all persons who possess or handle byproduct, source or special nuclear materials, and that would include shippers and carriers. Nonetheless, the NRC has exempted common and contract carriers from its licensing requirements, in view of the regulatory authority exercised over those persons by the Department of Transportation.

The Atomic Energy Act of 1954 preempts from State authority the regulation of byproduct, source and special nuclear material and assigns that regulatory authority to NRC. The same Act authorizes NRC to enter into Agreements with States whereby a State will assume regulatory responsibility for byproduct, source and less than critical quantities of special nuclear material. Thus far, 27 States have entered into such

Agreements with NRC. The Hazardous Materials Transportation Act permits State regulation of the transportation of radioactive materials, when the State's requirements are at least as stringent as those of the DOT and the DOT has determined that the State's regulations are consistent with the Federal scheme of regulations.

The Postal Service regulates shipment of radioactive materials by mail. Where intrastate transport of the material is not covered by the NRC, DOT or the Postal Service, it comes under the authority of the States.

In some cases, local municipalities and bridge, tunnel, and turnpike authorities place restrictions on transporting radioactive material shipments at specified periods of the day and over certain roadways and sections of the route. Safety in transportation does not depend on special routing although special routings are required at some bridges and tunnels to prevent possible interference with the flow of traffic should an accident occur. Recently DOT has published a highway routing rule which requires carriers to operate on routes that minimize radiological risk. This rule also designates the interstate highway system as the preferred route for specified large quantity shipments of radioactive material, such as spent fuel. States are authorized to designate alternate routes which provide equivalent safety but may not absolutely prohibit shipments.

NRC-DOT Interrelationship

The regulatory jurisdictions of NRC and DOT overlap with respect to safety in the transportation of byproduct, source and special nuclear

material. To avoid duplication, the two agencies have entered into a Memorandum of Understanding, by which DOT regulates packaging, the labeling of packages, and the conditions of carriage, while NRC reviews and approves package designs for fissionable material and for the larger quantities of radioactive material and regulates private carriage by its licensees. In effect, this means that DOT is primarily concerned with vehicles and the process of transport, and NRC is primarily concerned with approving certain types of packages.

Certain contractors of the Department of Energy (DOE), typically those who operate the national laboratories, are exempt from NRC licensing requirements. Under authority granted by DOT, the DOE regulates Type B container safety for these contractors utilizing the same standards as used by the NRC.

Small quantities of radioactive material, certain concentrations, small quantities of radioactive materials in manufactured goods and low specific activity materials may be shipped in strong industrial packages and are exempt from specification marking and labeling because of their limited potential hazard.

The next level of radioactive materials, that is, quantities exceeding the exempt quantities (Type A), but still small enough not to cause significant exposure potential if released under accidental conditions, must be shipped in specified packaging as required by DOT. Such packaging must prevent dispersal and retain shielding efficiency and

effectiveness of other safety features under specified normal conditions of transport.

Quantities exceeding the above Type A limits must be shipped in Type B packaging. Type B packaging must be designed to withstand not only normal transport conditions but also to maintain integrity in severe accidents. This is determined by testing or analyzing the package design against package damage tests which are representative of the forces encountered in severe accidents. Spent fuel from nuclear reactors, of course, must be shipped in Type B packages. Such packages must be certified by NRC or under limited conditions described earlier, by DOE.

NRC's Role

The objective of NRC in regulating the transportation of nuclear materials fall in two distinct but related areas: safety and safeguards. The safety area, in turn, involves two objectives. The first is to protect plant employees, transport workers and the general public from external radiation under normal conditions. The second safety objective is to ensure -- under normal and accident conditions -- that the packaging for radioactive materials is designed and constructed to prevent loss of radioactive material from the package or an increase in radiation levels from the package. The safeguards objectives in transportation are to deter the theft or diversion of special nuclear materials and sabotage.

To achieve the above-stated safety objective, there are four basic safety requirements -- (1) adequate containment of radioactive material, (2) adequate control (shielding) of the radiation emitted by the material, (3) safe dissipation of heat generated in the process of absorbing the radiation, and (4) prevention of nuclear criticality, i.e., the accumulation of enough fissile material in one location to result in a nuclear chain reaction.

Experience

In the time period from 1971 to 1982 a total of 906 radioactive material events have been reported. These 906 reported events comprise less than 1% of the total of hazardous material incidents reported during this time frame.

The 906 events are broken into three categories of incidents: transportation accidents, handling accidents and other reported incidents not involving accident conditions. Transportation accidents which totaled 123, are defined broadly and range from minor incidents to major collisions. Handling accidents (167 reported) are associated with storage, loading and unloading operations. Packages may be damaged because of improper handling in these operations. A total of 616 other reported incidents did not involve accident situations.

The 123 transportation accidents that occurred between 1971 to 1982 involved a total of 1581 packages. There were 19 transportation accidents that resulted in 79 packaging failures. None of the packaging

failures involved Type B packaging. For accidents where there were some releases, the packages were Type A or industrial-type packages containing limited quantities of radioactive material. Two examples of these types of accidents should characterize these package failures. In September 1977, an accident involving a truck shipment of uranium concentrate occurred near Springfield, Colorado. Several tons of yellowcake were spilled on the ground from their industrial-type packages. The effects of this accident on the public health and safety were very small. A rear-end collision occurred between a passenger car and a luggage trailer carrying 84 packages, 76 of which contained radiopharmaceuticals near Brookhaven, Mississippi in December 3, 1983, 30 of the 76 radiopharmaceutical packages, (Type A) were damaged but only 2 of the 30 packages had their contents dispersed. Full cleanup occurred within 24 hours and there were no injuries or personnel contamination. As I mentioned previously, such packages are not designed to withstand accidents. Thus, the radioactive material transportation accidents that have occurred reflect how transport regulations are designed to work.

The information I have given previously on the number of accidents includes spent fuel shipments. The number of spent fuel shipments is presently small compared to the estimated 2.8 million packages shipped annually. There were 124 shipments of spent fuel in 1984. Recently, many spent fuel shipments have been inspected by both NRC and the States, with only minor violations noted.

So far as we know, there has never been a radiation injury due to transportation accidents involving radioactive material. Also there has never been leakage of radioactive material from a Type B package involved in an accident.

Emergency Response Policy

On March 29, 1984 NRC published a general policy statement on NRC Response to Accidents Occurring During the Transportation of Radioactive Materials. The purpose of the policy statement is to state the extent of the NRC's participation and involvement in responding to transportation accidents or incidents. The statement recognizes that States have the primary responsibility for emergency response to transportation accidents. NRC's role is principally advisory in nature. The NRC will ensure that the State is informed of an accident and offer assistance in the form of information, advice and evaluations. The NRC will also ensure that the shipper, if an NRC licensee, provides complete and accurate information to emergency response personnel. Finally the NRC will act as lead agency for investigating all accidents, incidents, and instances of actual or suspected leakage involving packages of radioactive material regulated by NRC.

Shipment Notification

On July 6, 1982 the NRC amended its regulations to implement Section 301(a) of P.L. 96-295 which required the NRC to promulgate regulations for timely notification to the Governor of any State prior to transport

of nuclear waste, including spent nuclear fuel, to, thru or across the boundaries of such States. These notification requirements apply to spent reactor fuel and to high activity nuclear waste.

The notification must be made in writing to the Governor or the Governor's designee prior to the seven day period during which the shipment departure is estimated to occur. The notification includes information on shipper, carrier and receiver of the waste, a description of the nuclear waste shipment, point of origin, seven day period during which estimated departure occurs, destination, seven day period during which estimated arrival is to occur and a contact for information concerning the shipment. For spent fuel shipments, a listing of the routes to be used within the State must also be supplied. The route information is considered "protected" and must be handled as such. A list of Governors' designees receiving notification on nuclear waste and or spent fuel is published in the Federal Register annually.

While discussing the notification to Governors requirement for spent fuel, I mentioned that route information was considered protected. NRC distinguishes between safety regulations of shipments and safeguards regulation of spent fuel shipments. NRC insures the safety of spent fuel shipments mainly through stringent packaging requirements for Type B packages. Spent fuel is shipped only in massive, durable casks designed to withstand severe accidents without release of the radioactive contents. Although the design of the shipping cask makes difficult the release of a significant amount of radioactive material even as a result of sabotage, the NRC decided that until the possible consequences of sabotage could be evaluated more fully, protective

measures in addition to reliance upon cask design are prudent. The objective of the safeguards regulations is to provide protection against dispersal of radioactive material caused by malevolent acts and to prevent theft of these materials. To date no safeguards incidents involving the shipment of spent fuel have occurred.

NRC licensees planning to ship spent fuel are required to submit proposed routes for such shipments to the NRC staff for approval prior to the first use of a given route. Once approved, the same route may be utilized for additional shipments in a proposed series of shipments without further approval of the route provided that the NRC is notified in advance of each shipment. NRC routinely publishes the routes that have been approved.

In 1984, NRC issued proposed amendments to the safeguard rules based on new data. The important features of the proposed rule are for shipments of spent fuel cooled less than 150 days the current requirements apply. For shipments of spent fuel cooled 150 days or more, a new set of moderated requirements apply which includes elimination of route surveys and advance coordination with local law enforcement agencies. The final rule is expected to be published in early 1986.

State Activities in Transportation

The States have a high interest in the transportation of radioactive material and are playing an increasingly important role in this area. The 27 Agreement States have adopted regulations for intrastate

transportation of radioactive material. These regulations require shippers to conform to the packaging, labelling and marking requirements of DOT. Many States have also formally adopted DOT regulations and apply the requirements to both intrastate and interstate transportation under arrangements with DOT whereby States exercise surveillance programs.

The States continue to have concerns that the packaging and transportation of low-level radioactive waste are carried out in strict compliance with the regulations. NRC has cooperative programs with the States in this regard. On January 8, 1982 a subagreement to a memorandum of understanding (MOU) became effective between NRC and the State of Washington relating to the use of third party inspection data in transportation enforcement cases. On May 17, 1982 a similar agreement became effective between NRC and the State of South Carolina. Both Washington and South Carolina regulate a low-level radioactive waste burial site and both States maintain on-site State inspectors who check incoming waste shipments for compliance with regulations.

As a result of these agreements, the NRC uses the information gathered by the State inspectors in enforcement cases against NRC licensees. While efforts are made to avoid duplication and excessive action against a shipper for the same violation these agreements do not preclude dual actions, where appropriate.

With the passage of the Low-Level Radioactive Waste Policy Act of 1980 and development of interstate compacts to provide for low-level waste

disposal capacity of compact regions, States have also viewed the proper transportation of waste shipments originating from each State to be a responsibility of the generator State. In 1982, when Florida adopted the Southeast compact, the State committed Florida inspectors to inspect each shipment of low-level radioactive waste from Florida for compliance with the transportation regulations. In response to the States' desire for increased surveillance of waste shipments NRC has offered an MOU which would permit a State to inspect waste packaging on the premise of certain NRC licensees. On June 11, 1984 Illinois became the first State to sign this type of MOU for inspection of waste packaging. We are anticipating more interest by other States and have received inquiries from Hawaii, Pennsylvania, Virginia and Texas.

Conclusion

In spite of the concern expressed by some segments of the public and by some State and local agencies, we feel that the transportation of nuclear materials is a safe operation and well under control. Although we believe the present standards are adequate, they are being reevaluated to determine if, in view of increases in number of shipments, changes are necessary to maintain the level of safety and to identify areas where possible improvements can be made. In making this analysis, NRC will consider the costs and the benefits of any change in the regulations, as well as the need to keep radiation exposures as low as is reasonably achievable.