Historical Safety Performance Of Spent Fuel Transportation

Nuclear Waste Technical Review Board

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Definitions: Accidents and Incidents

Transportation Accident: Any accident that involves the vehicle transporting the radioactive material.

Handling Accident: Damage to a shipping container during loading, or unloading operations; e.g., a forklift puncturing the package at an air freight terminal.

Reported Incident: Transportation incidents where there is an actual or suspected release or surface contamination of radioactive materials that exceeds the regulatory requirements for either the package or the transport vehicle.

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RMIR Incident Reporting Requirements*

- A person dies
- A person is injured and requires hospitalization
- Estimated carrier or other property damage exceeds $50K
- Fire, breakage, spillage, or suspected contamination occurs involving radioactive materials
- A situation exists that the carrier believes should be reported.

* Based on the reporting requirements for the DOT Hazardous Material Incident Report (HMIR) database

RADIOACTIVE MATERIAL PACKAGING TYPES

- Strong Tight Industrial - similar to Type A package and transported in exclusive vehicles.
- Type A - Contents limited to A1 or A2 magnitudes and not designed to resist transport accident environment. Type A packages resist the normal conditions of transport, water spray, drop test, 4 ft. drop test, compression test and penetration test.
- Type B - Accident resistant package. Type B packages resist the 30 ft. drop test, puncture test, 30 minute fire test and water immersion test.

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U.S. Spent Fuel Shipments*

Year	Number of Spent Fuel Shipments (From NRC*) By Road	Number of Spent Fuel Shipments (From NRC*) By Rail	Spent Fuel Shipment Total
1979	16	11	27
1980	130	5	135
1981	81	2	83
1982	124	0	124
1983	117	0	117
1984	245	3	248
1985	135	18	153
1986	105	15	120
1987	107	15	122
1988	25	7	32
1989	16	6	22
1990	5	8	13
1991	9	10	19
1992	21	6	27
1993	16	12	28
1994	7	10	17
1995	9	10	19
Sub Total	1168	138	1306

* NUREG -0725, Public Information Circular for Shipments of Irradiated Reactor Fuel, Rev. 11, July 1996, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission.

U.S. Hazmat Incident Experience

- From 1979 through 1996, approximately 178,000 Hazmat incidents have been reported to U.S. DOT.
- The transport modal percentages for these incidents are air (3 %), highway (85 %), rail (11%), and marine (< 1%).
- The radioactive material incidents occupy on the order of 1 percent or less of all reported hazmat incidents.

U.S Radioactive Material Transportation Accident/Incident Experience *

Transportation Accidents	388
Handling Accidents	284
Reported Incidents	1156
Total reported incidents	1828

* Information source: Radioactive Material Incident Report Data Base (RMIR) which is based on the U.S. DOT Hazardous Material Incident Report Data Base (HMIR). Records date to 1971. Preliminary Incident Count Through Calendar 1996.

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U.S. Spent Fuel Transportation Accidents

ACCIDENT ID NUMBER	ACCIDENT DATE	CASK TYPE	TRANSPORT MODE	RADIOACTIVE MATERIAL RELEASED
1120173	12/8/71	HNPF	Highway	No
4040129	3/29/74	M-130	Rail	No (Empty Cask)
PNO7827	2/9/78	NAC-1	Highway	No
NRC-0020	8/13/78	GE-1600	Highway	No (Empty cask)
PNO III 83127	12/9/83	Spent Fuel Cask	Highway	No
PNO TMI 8702	3/24/87	NUPAC 125	Rail	No
PNO IV 8803	1/9/88	Spent Fuel Cask	Rail	No (Empty Cask)
EN-29722	12/14/95	Rail Car	Rail	No (Empty Cask)

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POST-ACCIDENT TEST - REGULATORY LEAK RATE EXAMPLE (FOR DEFENSE HLW CASK- A Type B package)

Post accident regulatory leak rate = A2 per week

For DHLW cask, vitrified HLW waste, A2 = 0.340 Ci
DHLW cask Inventory = 275600 Ci

Regulatory post accident leak rate = 0.340/ 275600
= 1.23 x 10-6 per week

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Concluding Remarks

- Eight spent fuel transportation accidents have been documented for the period from 1971 through the present time.
- Four of the eight spent fuel accidents involved empty casks.
- Radioactive material incident reports occupy a small fraction of the total of all incidents reported to DOT and NRC.
- Type B casks have not released their contents due to experiencing the transportation accident environment.
- The regulatory post-accident leak rate requirements provide an indication of the design reserve capability in Type B casks.

ACCESS TO RMIR DATA THROUGH THE TRANSNET SYSTEM

- TRANSNET System Administrator: Contact, Fran Kanipe, Sandia National Laboratories-New Mexico, 505-844-1121

- RMIR Information: Contact, Jim McClure, Sandia National Laboratories-New Mexico, 505-845-8753

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