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Overview of U.S. Department of Energy Environmental-Statement-Related Risk Studies

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Nuclear Waste Technical Review Board
Meeting of the Panel on the Waste Management System
Spent Fuel Transportation
Arlington, Virginia
November 19-20, 1997



Overview

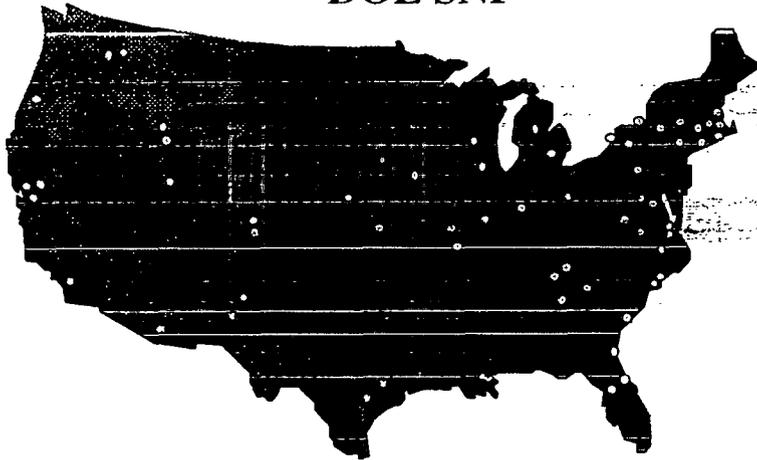
- Introduction – DOE's transportation risk assessment history
- The risk assessment process
- Review of commonly used analytical methods
- Examples of results
- Conclusions

DOE Has Over 20 Years of Experience Conducting Transportation Risk Assessments

- DOE routinely conducts transportation risk assessments under the National Environmental Policy Act (NEPA)
 - Environmental Assessments (EAs)
 - Environmental Impact Statements (EISs)
- NEPA evaluates impacts of Federal Actions and alternatives
- DOE NEPA activities have focused on spent nuclear fuel and radioactive waste transportation
- Transportation risks have been weighed against other contributors to risk, such as facility risks

DOE Faces National Issues Involving Spent Nuclear Fuel Transportation

DOE SNF

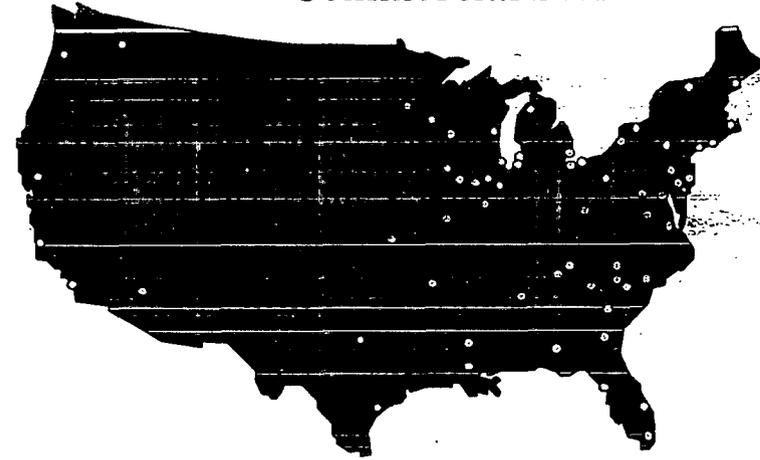


- Estimated 2,700 metric tons
- Litigations triggered DOE decisions

DOE decisions:

- INEL Programmatic SNF Environmental Impact Statement (Final 1995)
- Foreign Research Reactor SNF EIS (Final 1996)

Commercial SNF



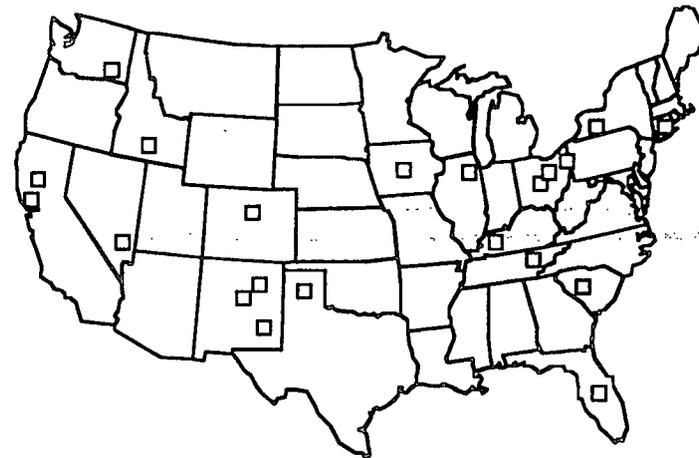
- Estimated 85,000 metric tons
- Nuclear Waste Policy Act mandates that DOE take custody by 1998

DOE decisions:

- Monitored Retrievable Storage EIS (TBD)
- Repository EIS (ongoing)

DOE's Waste Management Operations Also Involve Significant Transportation Components

Several types of waste are stored and will continue to be generated at many DOE facilities

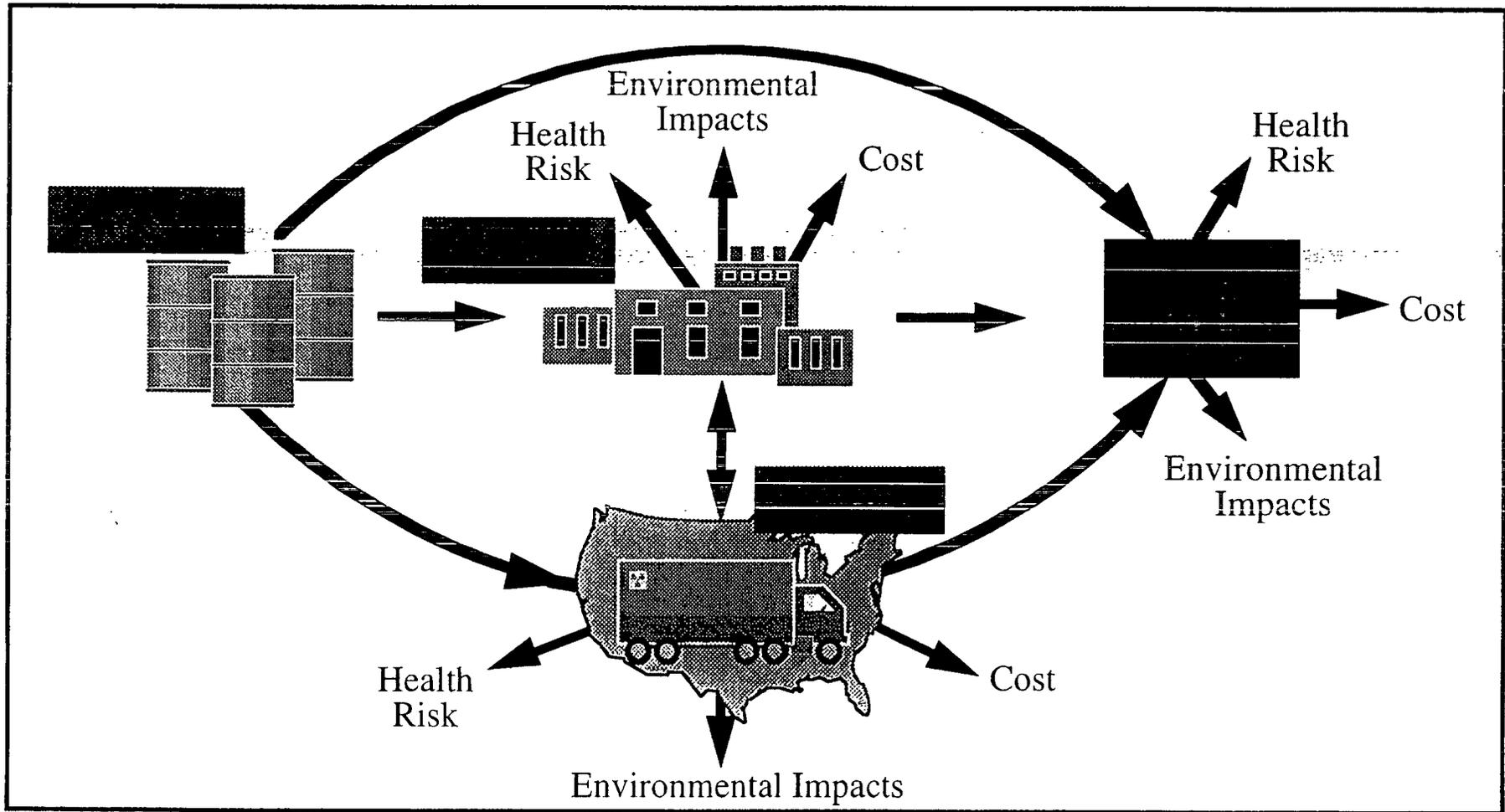


Currently Stored and Projected Waste Volumes (20 years)*

Low-level waste	= 1,500,000 m ³	High-level waste	= 400,000 m ³
Low-level mixed waste	= 230,000 m ³	Hazardous waste	= 69,000 m ³
Transuranic waste	= 110,000 m ³		

*Excludes wastes generated from environmental restoration activities

Transportation Is One of Several Areas Evaluated in NEPA Decision-Making



DOE's Transportation Assessment Guidance: The NEPA "Green Book"

- Analyze all transportation links
- Do not rely on statements that all regulations or requirements would be met
- Analyze both routine transport and accidents
- Use defensible estimation methods – “such as the most current version of RADTRAN”

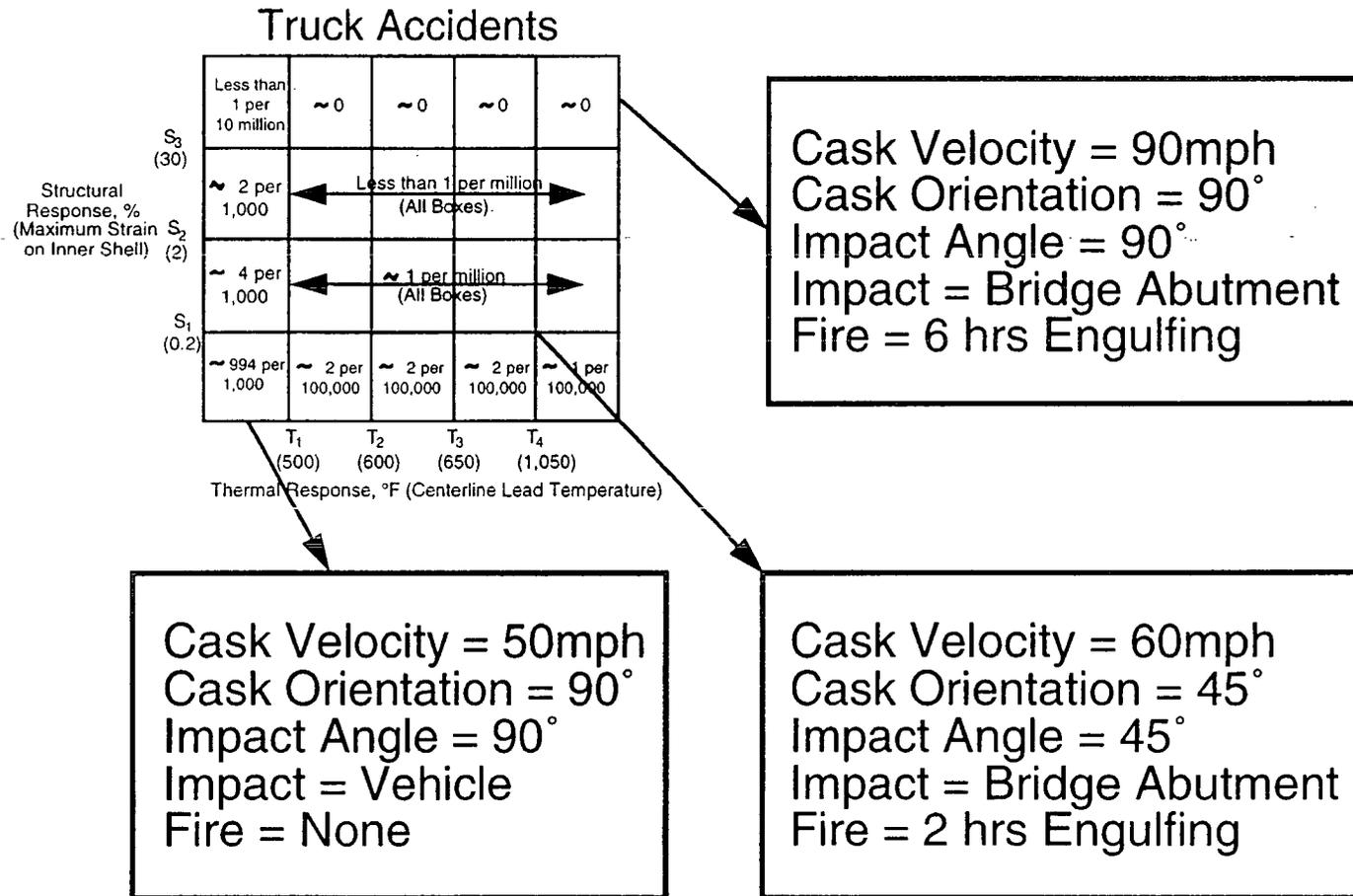
Transportation Assessments Focus on *RISK*

- Risk = frequency x consequence
- Emphasis is on human health impacts
- Evaluated for both *routine* and *accident* conditions
- Routine conditions
 - exposure to exhaust
 - exposure to ionizing radiation
 - frequency = 1
- Accident conditions
 - may or may not involve release of material
 - risk includes physical trauma from accidents
 - frequency is statistical
- Risk depends on transport mode, material, package, and route characteristics

Methods for Assessing Transportation Risks Have Evolved Over Time

- Current approach has roots in NUREG-0170 “Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes,” U.S. NRC 1977
- Approach has been continually improved with updated models and available data
 - NRC Modal Study (NUREG/CR-4829)
 - improved statistics and parameters
 - legal precedents
- Approach has evolved in response to stakeholder concerns
 - increasing route-specificity
 - scenario-specific analysis
- Emerging issues include environmental justice and cumulative impacts

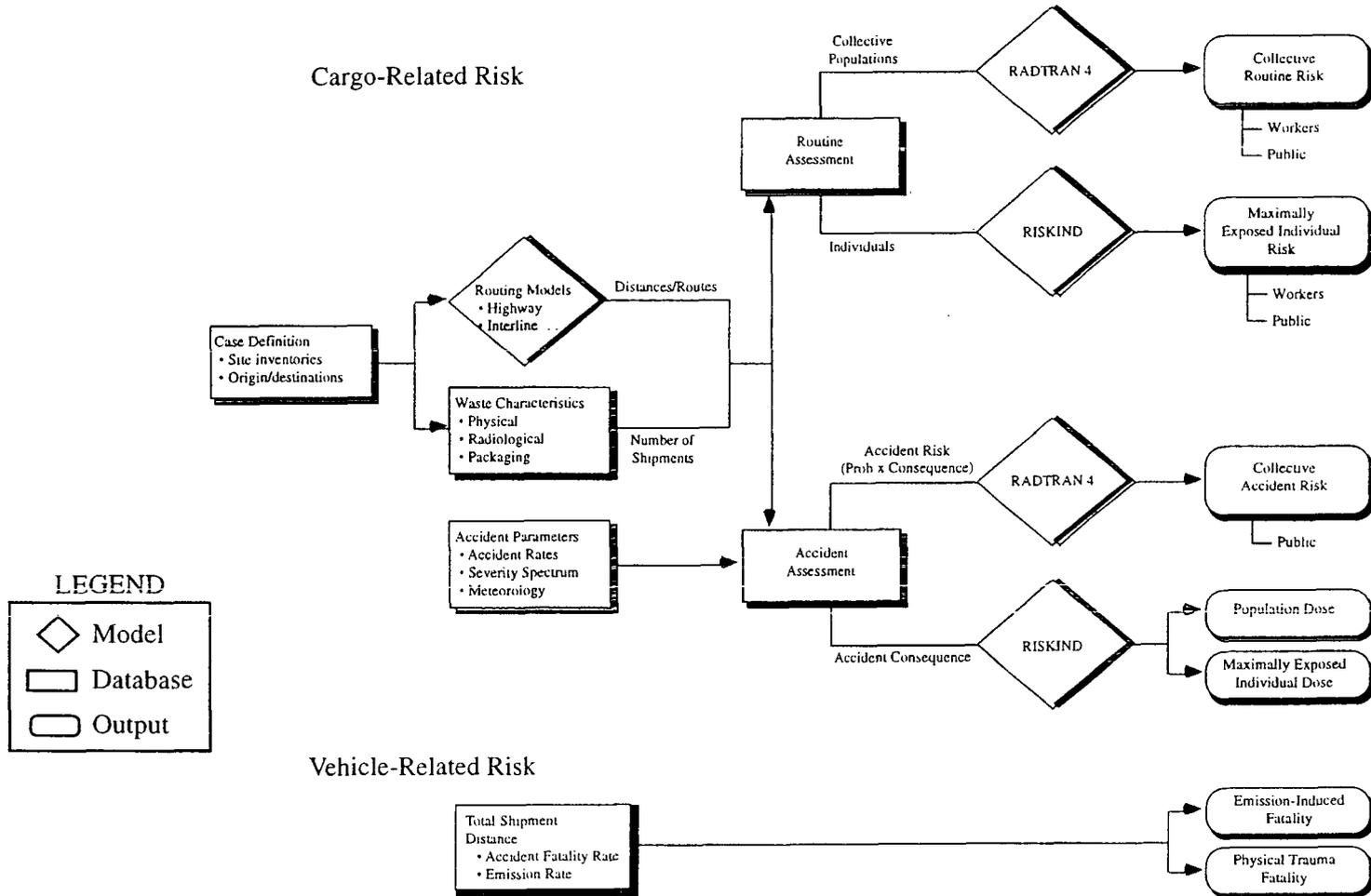
The NRC Modal Study Is Used for Accident Risk Calculations



Four Models Are Commonly Used in DOE Transportation Risk Assessments

- **RADTRAN** – primary model for estimating risks during routine and accident conditions
- **RISKIND** – model for estimating scenario-specific consequences
– often used to complement RADTRAN calculations
- **HIGHWAY** – highway routing model
- **INTERLINE** – rail routing model

Basic Transportation Risk Assessment Approach



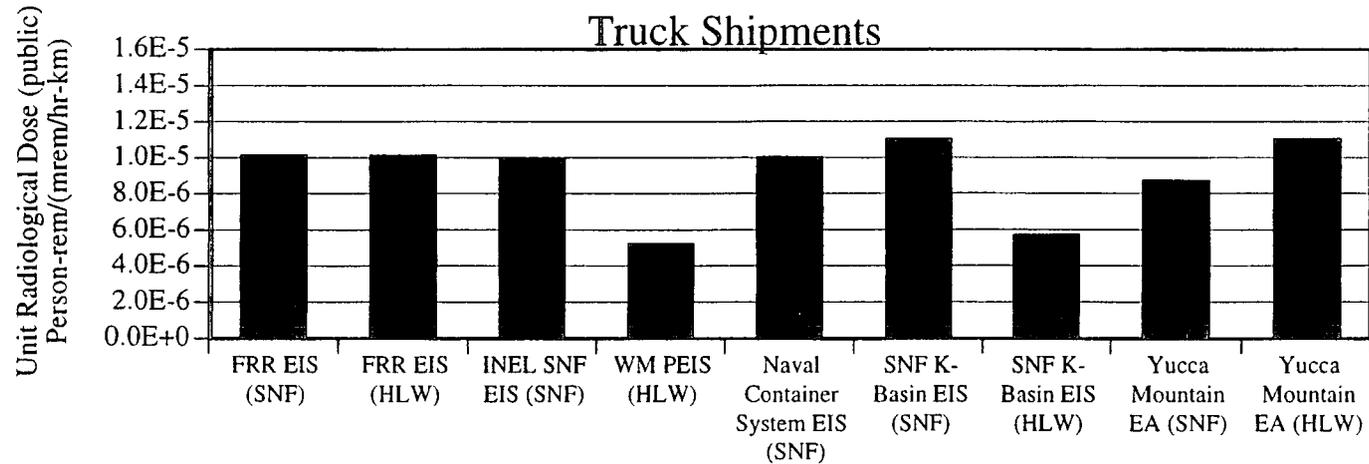
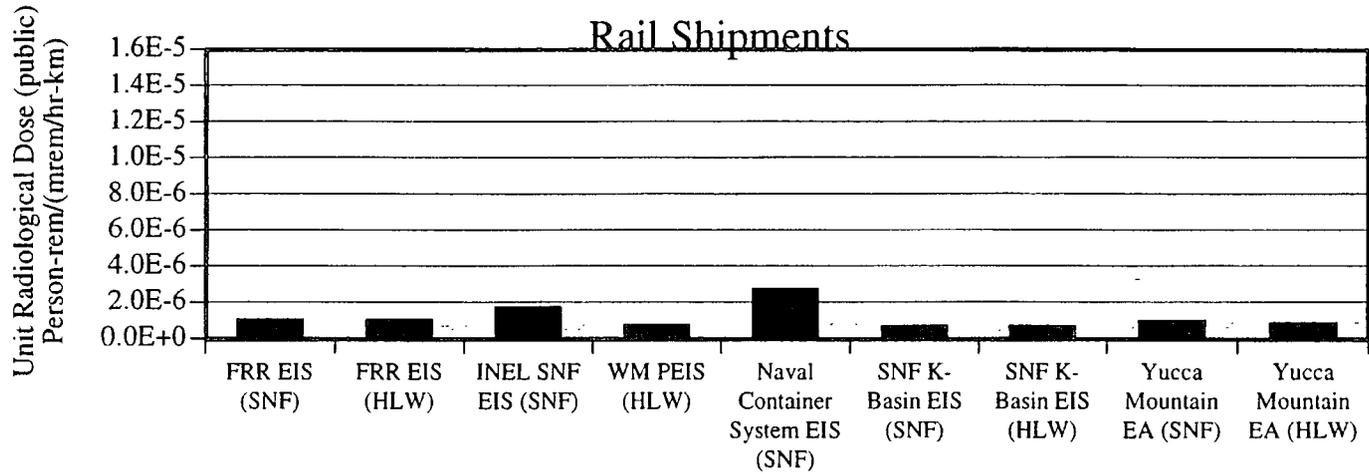
Summary of Recent DOE NEPA Transportation Risk Assessments

Document Number	NEPA Document	Predominant Cargo	Transportation Mode	Routing Model	Collective Risk Model	Routine MEI Model	Accident Consequence Model
DOE/EIS-0113	Draft EIS Disposal of Hanford Defense High-Level, TRU and Tank Wastes	HLW, TRUW	Truck, Rail	Not Specific	RADTRAN II	Not Specific	Not Specific
DOE/EIS-0200	Waste Management Programmatic EIS for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste	LLW, LLMW, HLW, TRUW	Truck, Rail	HIGHWAY, INTERLINE	RADTRAN IV	RISKIND	RISKIND
DOE/EIS-0203-F	DOE Programmatic SNF Management and INEL ER and Waste Management Final EIS	SNF	Truck, Rail	HIGHWAY, INTERLINE	RADTRAN IV	RISKIND	RISKIND
DOE/EIS-0218F	Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel	SNF	Truck, Rail	HIGHWAY, INTERLINE	RADTRAN IV	RISKIND	RISKIND
DOE/EIS-0226-D	Draft EIS for Completion of the West Valley Demonstration Project and Closure or Long-Term Management of Facilities at the Western New York Nuclear Service Center	LLW, TRUW, Contaminated Soils, LSA materials	Truck, Rail	HIGHWAY, INTERLINE	RADTRAN IV	RISKIND	RISKIND
DOE/EIS-0240	Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement	Uranium Compounds	Truck	INTERSTAT	RADTRAN IV	Not Specific	Not Specific
DOE/EIS-0245F	Final EIS for Management of Spent Nuclear Fuel from K Basins at the Hanford Site, Richland, Washington	SNF, HLW	Truck, Rail	HIGHWAY, INTERLINE	RADTRAN IV	RISKIND	GENII

Summary of Recent DOE NEPA Transportation Risk Assessments

Document Number	NEPA Document	Predominant Cargo	Transportation Mode	Routing Model	Collective Risk Model	Routine MEI Model	Accident Consequence Model
DOE/EIS-0249	Medical Isotopes Production Project: Molybdenum-99 and Related Isotopes Environmental Impact Statement	Medical Isotopes	Air, Truck	HIGHWAY	RADTRAN IV	Not Specific (aircraft passenger only)	GENII
DOE/EIS-0251	Department of the Navy Final Environmental Impact Statement for a Container System for the Management of Naval SNF	SNF	Rail	INTERLINE	RADTRAN IV	Mathematical Formulas	RISKIND
DOE/EIS-0269PD	Draft Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride	Uranium Compounds	Truck, Rail	HIGHWAY, INTERLINE	RADTRAN IV	RISKIND	RISKIND
DOE/EIS-0275	Final Environmental Impact Statement S1C Prototype Reactor Plant Disposal	Reactor Components	Truck, Rail	HIGHWAY, INTERLINE	RADTRAN IV	Mathematical Formulas	RISKIND
DOE/EIS-0026-S-2	Waste Isolation Pilot Plant Disposal Phase Draft Supplemental EIS	TRUW	Truck, Rail	HIGHWAY	RADTRAN IV	Not Identified	RISKIND
DOE/EA-0441	Environmental Assessment for Transportation, Receipt, and Storage of Ft. St. Vrain SNF at the Irradiated Fuel Storage Facility at the Idaho Chemical Processing Plant	SNF	Truck	Not Specific	RADTRAN IV	Not Specific	Not Specific
DOE/EA-0912	Environmental Assessment of Urgent Relief Acceptance of Foreign Research Reactor SNF	SNF	Truck, Rail	HIGHWAY	RADTRAN IV	Not Specific	Not Specific
DOE/RW-0073	Environmental Assessment Yucca Mountain Site, Nevada Research and Development Area, Nevada	SNF	Truck, Rail	HIGHWAY, INTERLINE	RADTRAN II	Cited References (Sandquist et al. 1985)	Cited References (Sandquist et al. 1985)

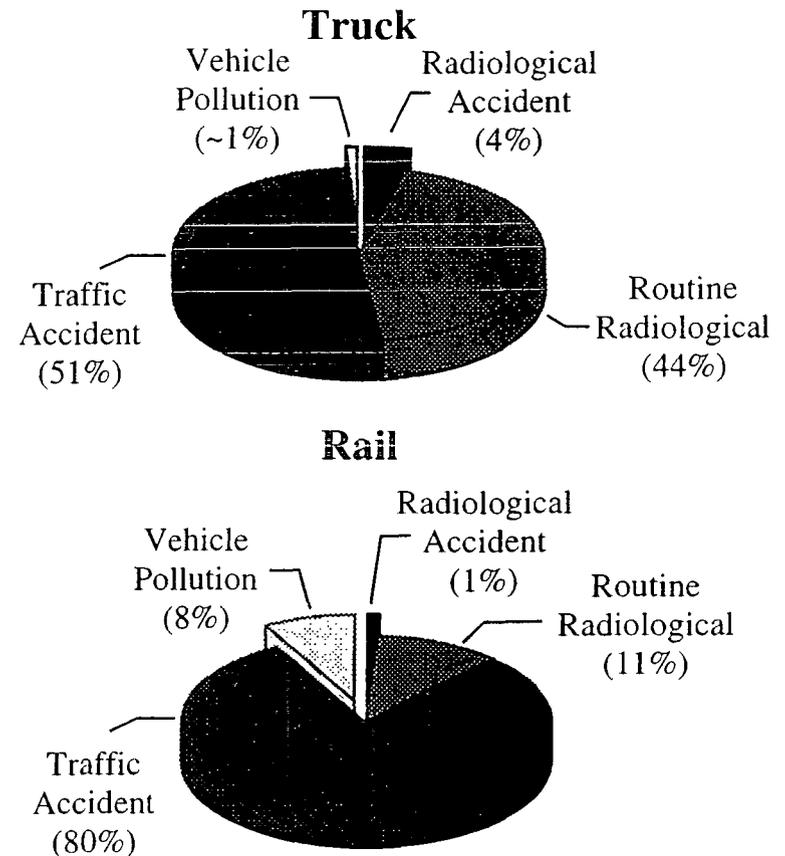
Comparison of Risk Results for Transportation of HLW and SNF



Overall Transportation Risk Is Attributed to Both Radiological and Nonradiological Causes

- Total transportation risk is proportional to shipment mileage
- Traffic accidents (physical trauma) dominate the nonradiological risk
- Radiological risk is dominated by routine exposure
- Radiological accident risk tends to be low due to the low frequency of accidents involving releases

Typical Transportation Risk (fatality) Profile for SNF Shipments



Conclusions

- The transportation risk assessment process has become increasingly comprehensive
- A consistent approach has been applied in recent DOE transportation risk assessments
- Emerging issues, including environmental justice and cumulative impacts, are being addressed
- Trend is toward increasing transparency
 - in response to stakeholder concerns
 - improves communication, not necessarily the estimates of risk
 - potential GIS applications