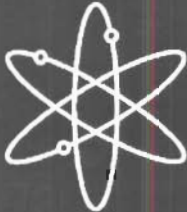




Proceedings of the Advisory Committee on Nuclear Waste Transportation Working Group Meeting



November 19-20, 2002
April 22, 2003



U.S. Nuclear Regulatory Commission
Advisory Committee on Nuclear Waste
Washington, DC 20555-0001



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ABSTRACT

This report contains the information presented at the Advisory Committee on Nuclear Waste Transportation Working Group (TWG) Meeting held at the U.S. Nuclear Regulatory Commission (NRC) headquarters in Rockville, Maryland, on November 19–20, 2002. Summaries of participant discussions and the presentation material provided during the meeting are included. In addition, Appendix D to this report contains information presented at the TWG Follow-On Meeting conducted on April 22, 2003.

The objective of these two meetings was to examine the technical aspects of spent fuel transportation package design, analysis, and testing to determine whether sufficient evidence exists or additional evidence needs to be obtained to substantiate that spent fuel can be transported safely. In addition, spent fuel and high-level waste transportation experience was reviewed to determine whether the transportation packages used have performed as designed. Various national laboratories, cask vendors, industry groups, and NRC staff who have been directly involved in the transportation of spent fuel and high-level waste over the past 30 years made presentations at the meetings. Past and future transportation safety studies were also discussed at the meetings. Special emphasis was placed on the transportation package because, if no significant package failure occurs, there can be no significant radiation consequences.

Summaries of the presentations made were edited from the meeting transcripts. Where practical, the participants were given an opportunity to review and edit their individual contributions. Meeting transcripts are available on the NRC Web site (www.nrc.gov) and should be reviewed for actual statements made during the meetings.

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EXECUTIVE SUMMARY

Background

The transportation of spent nuclear fuel and high-level radioactive waste is of significant public concern. The Advisory Committee on Nuclear Waste (ACNW or Committee) committed, in its 2002-2003 Action Plan, to convene a working group meeting on transportation to examine past and ongoing risk studies on transportation safety.

The working group is an extension of previous ACNW involvement in the transportation issues undertaken during the review of the Draft Environmental Impact Statement for the proposed high-level waste repository at Yucca Mountain, Nevada. In addition, the Committee has been involved in the review of the U.S. Nuclear Regulatory Commission (NRC) Spent Fuel Transportation Package Performance Study (PPS) and the proposed changes to NRC's transportation rule Title 10, Part 71, of the *Code of Federal Regulations* (10 CFR Part 71).

The Committee decided that the establishment of a working group focusing solely on the transportation of spent nuclear fuel and high-level radioactive waste would be the most efficient and encompassing method to identify the various risks associated with shipping spent nuclear fuel for which the NRC is responsible.

Objective of the Transportation Working Group

The objective of the Transportation Working Group (TWG) was to examine spent nuclear fuel transportation cask design, analysis, and testing methods with an emphasis on transportation safety and, in particular, rail transportation. A history of domestic and international transportation testing, analysis, and experience served as the framework of the discussions.

Specifically, the TWG assessed information in the following two areas to determine whether sufficient evidence exists, or needs to be obtained, to substantiate the safe shipment of spent nuclear fuel.

- (1) research and development, analyses performed, and analysis capability, including tests
- (2) transportation safety experience in the United States and worldwide

Areas of Interest to the TWG

- Risk studies that have been performed regarding the transportation of spent nuclear fuel that may not be included in the NRC's transportation risk studies (e.g., studies by national laboratories and the international community).
- Physical tests of spent fuel transportation packages that have been performed over the past 30 years. These include a series of transportation cask tests involving a train crash, a truck crash, and a fire test performed by Sandia National Laboratories (Sandia) in the mid-1970s. In addition, some European nations have also performed full-scale transportation cask accident tests. Currently, several vendors that design and fabricate transportation packages have performed scaled physical testing to demonstrate that their packages meet NRC regulatory requirements.

- Analytical models that exist to assess the response of transportation packages to hypothetical accident conditions.
- Problems and accidents that have been encountered during shipments of spent nuclear fuel and high-level radioactive waste transportation packages over the past 30 years by the U.S. Department of Transportation (DOT), the U.S. Department of Energy (DOE), and private industry.

TWG Meetings

Two meetings of the TWG were convened. The first was held on November 19-20, 2003, which reviewed the available test data and analysis methods for package performance to determine if additional tests or enhanced analytical methods are necessary to ensure the safety of transportation packages. In addition, actual experiences in transporting spent nuclear fuel and high-level radioactive waste was reviewed by the TWG.¹ The meeting included presentations by experts in spent nuclear fuel transportation package **design, testing, and analysis**, as well as individuals with experience in shipping spent nuclear fuel and high-level radioactive waste.²

A second TWG meeting was held on April 22, 2003. During this meeting, representatives from the State of Nevada presented numerous concerns that they have with the transportation of spent nuclear fuel and high-level waste to the proposed geologic repository at Yucca Mountain, Nevada. In addition, the National Research Council presented an overview of a broad range study it will be performing to investigate risks associated with the transportation of spent fuel. The proceedings from the April 22, 2003, meeting are documented in Appendix D to this report.

Conclusions of the TWG

The ACNW issued a report to the Chairman of the NRC on the transportation of spent fuel, dated January 7, 2003. In this report, the ACNW concluded the following:

- The full-scale test of a shipping package now being proposed by NRC staff should be a public demonstration performed under credible accident conditions. An example of such a test would be crashing a transportation vehicle and package into a target (e.g., a concrete wall, a steel bridge, or another vehicle).
- The enhanced analytical capabilities that have been developed as part of the nuclear weapons program should be used. Application of these computational tools to transportation package performance analysis would augment confirmatory testing and increase confidence in safety.

¹The security of transportation and its protection from terrorism is a separate issue and was not addressed during the meeting.

²Sandia National Laboratories, Lawrence Livermore National Laboratory, Holtec International, NAC International, Transnuclear, Inc., the Association of American Railroads, and NRC's Spent Fuel Project Office participated in the discussions of package design, testing, and analysis. DOT, DOE, Progress Energy, and COGEMA participated in the discussions of transportation experience.

- A centralized database for past and future spent fuel and high-level radioactive waste shipments should be developed. This database should include all data regarding the number and types of shipments, as well as the consequences associated with any accidents or incidents.

Information gathered during the TWG Meeting held on April 22, 2003, did not cause the TWG to change its position with regard to these conclusions.

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BACKGROUND

The Advisory Committee on Nuclear Waste (ACNW) Transportation Working Group (TWG) met on November 19–20, 2003, at 11545 Rockville Pike, Rockville, Maryland. The purpose of the meeting was to assess technical information on the analysis and testing of, and experience with, the transportation of spent nuclear fuel and high-level radioactive waste. The entire meeting was open to public attendance.

The TWG received no written comments prior to the meeting or requests for time to make oral statements from members of the public or other stakeholders. However, stakeholders were given the opportunity to ask questions and make statements during several portions of the meeting. Dr. Michael Ryan, a member of the TWG, received a waiver from the ACNW Chairman to participate in discussions with Sandia National Laboratories. Mr. Timothy Kobetz was the cognizant ACNW staff engineer and Designated Federal Official for this meeting.

The meeting was convened at 8:30 a.m. and recessed at 5:10 p.m. on November 19, 2002. The meeting was reconvened at 12:30 p.m. and was adjourned at 5:35 p.m. on November 20, 2002. The attendance list is located in Appendix A, and written comments received from stakeholders subsequent to the meeting are included in Appendix B. Appendix C contains correspondence between the ACNW and the NRC Staff regarding the November 19–20, 2002, meeting and Appendix D contains the proceedings from the April 22, 2003, TWG Follow-On Meeting.

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PARTICIPANTS

Transportation Working Group

George Hornberger, ACNW Chairman
Raymond Wymer, ACNW Vice-Chairman
Milton Levenson, Working Group Chairman
B. John Garrick
Michael Ryan

ACNW STAFF

Sher Bahadur
Neil Coleman
Michele Kelton
Timothy Kobetz
John Larkins
Howard Larson
Michael Lee
Richard Major
Richard Savio

INVITED EXPERTS

E. William Brach	Spent Fuel Project Office (NRC)
Doug Ammerman	Sandia National Laboratory
Larry Fischer	Lawrence Livermore National Laboratories
Kris Singh	Holtec International
Peter Shih	Transnuclear
Michael Yaksh	NAC International
Chris Bajwa	Spent Fuel Project Office (NRC)
Robert Fronczak,	Association of American Railroads
Rick Boyle	Department of Transportation
Kevin Blackwell	Department of Transportation
Alton Harris	Department of Energy
Maureen Clapper	Department of Energy
Don Doherty	Department of Energy
Robert Kunita	Progress Energy
Steven Edwards	Progress Energy
Ian Hunter	Transnuclear/Cogema

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ABBREVIATIONS

AAR	Association of American Railroads
ACNW	Advisory Committee on Nuclear Waste
BNSF	Burlington Northern Santa Fe
ASME	American Society of Mechanical Engineers
BWR	Boiling-Water Reactor
CEGB	Central Electricity Generating Board
CFR	Code of Federal Regulations
CNWRA	Center for Nuclear Waste Regulatory Analyses
COC	Certificate of Compliance
CP&L	Carolina Power & Light
DHLW	Defense High-Level Waste
DOD	U. S. Department of Defense
DOE	U. S. Department of Energy
DOT	U. S. Department of Transportation
DU	depleted uranium
FDS	Fire Dynamics Simulator
FEIS	Final Environmental Impact Statement
FFT	Fast Fourier Transform
FHA	Federal Highway Administration
FRA	Federal Railroad Administration
GWd/MTU	gigaWatt day per metric ton uranium
HAZMAT	hazardous materials
HEU	highly enriched uranium
IAEA	International Atomic Energy Agency
ICC	Interstate Commerce Commission
INEEL	Idaho National Engineering and Environmental Laboratory
LEU	low-enriched uranium
LLNL	Lawrence Livermore National Laboratory

MPC	multi-purpose canister
mrem/h	millirem per hour
NAC	NAC International
NAS	National Academy of Sciences
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
NTSB	National Transportation Safety Board
NWPA	Nuclear Waste Policy Act of 1982
OCRWM	Office of Civilian Radioactive Waste Management
PFS	Private Fuel Storage
PPS	Package Performance Study
PWR	Pressurized-Water Reactor
QA	quality assurance
RERTR	Reduced Enrichment for Research and Test Reactors Program
RSPA	Research and Special Programs Administration (DOT)
Sandia	Sandia National Laboratories
SCOP	Safety Compliance Oversight Plan
SFPO	Spent Fuel Project Office
TMI	Three Mile Island
TWG	Transportation Working Group
WGA	Western Governors Association
WIPP	Waste Isolation Pilot Plant

1 INTRODUCTION

The transportation of spent nuclear fuel is of significant public concern. The Advisory Committee on Nuclear Waste (ACNW) was directed by the U.S. Nuclear Regulatory Commission (NRC) to develop an action plan to frame the issue, including identification and development of a final product.

The ACNW has expanded its involvement in the transportation issues undertaken during the review of the Yucca Mountain Draft Environmental Impact Statement. In preparing the 2002 ACNW Action Plan, the Committee identified the need to review the Spent Fuel Transportation Package Performance Study as it applies to transportation and potential changes to NRC's transportation rule, Part 71, "Packaging and Transportation of Radioactive Material," of Title 10 of the *Code of Federal Regulations* (10 CFR Part 71).

The Committee determined that the use of a Transportation Working Group (TWG) would be the most efficient and encompassing method to identify the various risks associated with shipping spent nuclear fuel.

The TWG, which consisted of all five ACNW Committee members, held a meeting on November 19–20, 2002, with the following objectives:

- The TWG examined the technical aspects of spent fuel transportation package design, analysis, and testing methods to determine whether sufficient evidence exists, or additional evidence needs to be obtained, to substantiate that spent fuel can be transported safely. The primary focus of this examination was on the structural integrity of the package because, if the package is not breached or significantly damaged, no significant radiation consequences are likely to occur. Presenters during this portion of the meeting included experts from various national laboratories, cask vendors, industry groups, and NRC staff who have been directly involved in an evaluation of this type over the past 30 years.
- The TWG also examined the spent fuel and high-level waste transportation safety experience in the United States and worldwide. Presenters included various Federal regulatory agencies and industry representatives who have extensive experience in the regulation and shipment of spent fuel and high-level waste. Relevant experience, which was omitted from the presentations, was the shipment of nuclear weapons around the world.

This NUREG report documents the proceedings of the meeting, provides additional stakeholder input received subsequent to the meeting, and presents the TWG's conclusions based on the information gathered during and after the meeting.

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