TRANSPORTING TMI-2 CORE DEBRIS TO INEL: PUBLIC SAFETY AND PUBLIC RESPONSE

R. C. Schmitt, H. W. Reno
W. R. Young, J. P. Hamric

March 1-5, 1987

Waste Management '87

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This is a preprint of a paper intended for publication in a journal or proceedings. Since changes may be made before publication, this preprint is made available with the understanding that it will not be cited or reproduced without permission of the author.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED
DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.
TRANSPORTING TMI-2 CORE DEBRIS TO INEL:
PUBLIC SAFETY AND PUBLIC RESPONSE

R. C. Schmitt, H. W. Reno
EG&G Idaho, Inc.

W. R. Young, J. P. Hamric
U.S. Department of Energy
Idaho National Engineering Laboratory
Idaho Falls, ID 83415

ABSTRACT
This paper describes the approach taken by the U.S. Department of Energy (DOE) to ensure that public safety is maintained during transport of core debris from the Unit-2 reactor at the Three Mile Island Nuclear Power Station near Harrisburg, PA, to the Idaho National Engineering Laboratory near Idaho Falls, ID. It provides up-to-date information about public response to the transport action and discusses DOE's position on several institutional issues. The authors advise that planners of future transport operations be prepared for a multitude of comments from all levels of federal, state, and local governments, special interest groups, and private citizens. They also advise planners to keep meticulous records concerning all informational transactions.

INTRODUCTION
Since the 1979 accident which damaged the Unit-2 reactor of the Three Mile Island Nuclear Power Station (TMI) near Harrisburg, PA, the U.S. Department of Energy (DOE), U.S. Nuclear Regulatory Commission (NRC), and General Public Utilities Nuclear Corporation (GPU Nuclear - owner/operator of TMI) have cooperated closely in planning cleanup operations within Unit-2, as well as the packaging, transport, research, and disposal of radioactive materials obtained during cleanup. In 1984, plans for removing and packaging the damaged core of Unit-2 began in earnest, culminating in July 1986 with the first shipment of seven canisters containing core debris to the Idaho National Engineering Laboratory (INEL) near Idaho Falls, ID. The canisters were transported in one of two newly designed, tested, and licensed rail casks (Fig. 1). Packaging and transporting radioactive core debris from TMI to INEL was complex, involving close cooperation and communication between several governmental organizations, a public utility, a governmental contractor, many private subcontractors, three federal research laboratories, two railroad companies, and numerous public and private organizations and citizens.

This paper describes the approach taken by DOE to ensure that public safety is maintained during transport of the core debris and provides current information on public response to one of the most thoroughly planned and executed transport operations in the history of the commercial nuclear industry. To ensure public safety, DOE utilized extra efforts in designing, fabricating, and testing two new, double containment rail casks and readying those casks for transport. Additionally, DOE followed extensive prenotification procedures to prepare the public for transportation of the core debris. However, within the United States, the public has been, and still is, apprehensive about transportation of nuclear materials, especially transcontinental transport of spent fuel and radioactive wastes. Correspondingly, the public is becoming increasingly involved in such transportation activities. DOE and its contractors have been involved in an extensive exchange of information with the public regarding all aspects of the core debris transportation program. As a result, perhaps TMI, for all its notoriety, will serve the purpose of easing public apprehension about transportation of radioactive materials. Information in this paper will be valuable, both within and without the United States, for use in planning for transportation of spent nuclear fuel or other hazardous materials and anticipating public and governmental questions.

PUBLIC CONCERNS
Notifying State and Local Governments - DOE and its contractor EG&G Idaho, Inc. fully recognized that transporting TMI core debris would be a sensitive public issue. Therefore, procedures were written outlining the methodology whereby DOE would notify involved states of the planned action to transport the debris by rail through their respective jurisdictions. Those procedures outlined the rationale used in selecting the rail route between TMI and INEL, explained the communication network used to monitor canisters in transit, and described emergency communications used in case of an unplanned occurrence along the route. First-time notification was required at least 45 days before initiating the transportation campaign.

As mentioned above, DOE representatives notified officials - in most instances the governor's designee - in each state along the rail route between TMI and INEL. That was done well in advance of beginning transport of core debris from TMI. A traffic manager and public relations professional of EG&G Idaho were assigned to the program full-time, months in advance

a. Work supported by the U.S. Department of Energy Assistant Secretary for Nuclear Energy, Office of LWR Safety and Technology, under DOE Contract No. DE-AC07-76ID01570
of the first shipment. DOE made many public announce-
ments, hosted a news media day at TMI, met with public
and state officials, displayed a rail cask at TMI and
in the Idaho Falls area, and publicly displayed scale
and/or detailed models of casks and special hardware.
DOE also met with some states to accommodate special
inspections of the train while en route, cooperated in
special audits by federal agencies responding to
congressional requests, prepared and distributed
videos and documentation, and conducted a special
public seminar requested by a municipality along the
rail route. Still, some concerned persons claimed
secrecy about or inadequate notification of DOE's
planned action. In reality, those complaints seem to
reflect a reaction by public officials to concerns of
constituents, as well as communication difficulties
among federal, state, and local governments. Fur-
thermore, the propensity of the news media to
publicize sensational aspects of federal actions has
not enhanced balanced dissemination of information to
the public.

Route Safety - In consultation with various rail-
roads, DOE evaluated the quickest and safest rail
routes between TMI and INEL, contracted independent
rail routing analyses by third parties, and then
reached agreements with Conrail and Union Pacific
railroads for transporting the containerized core
debirs in NuPac 125-B Rail Casks. Announcement of the
rail route between TMI and INEL initiated a flood of
public inquiry. Inquiries were received from mayors,
fire chiefs, the police, town meeting participants,
state officials, congressmen, and senators, among
others. The citizenry in several communities along
the rail route voiced their desires that the TMI core
debirs be transported via alternate routes around
their domains. Seemingly, there is public perception
that rail routes can be changed here and there easily
and conveniently to avoid this or that population
center. The public does not seem to comprehend the
fact that decisions to "avoid my town" are largely
impractical. Alternate routes around cities or munic-
ipalities comprise lesser quality trackage, the use of
which would increase transport time and quantita-
tively or qualitatively add to the risk of trans-
porting the core debirs. Also, it seems that elected
officials and the public lack an understanding that
the federal government cannot and will not dictate to
rail companies the diversion of nuclear and/or
hazardous materials from high quality, mainline trackage
onto secondary trackage primarily to avoid a
population center. Regulations promulgated by the
U.S. Department of Transportation specifically direct
railroad companies to transport such materials on high
quality, mainline trackage. Hence, in the best
interests of all parties involved, requests for
rerouting of the TMI core debirs were not approved.

The two rail companies (Conrail and Union Pacific)
were selected partly because of their demonstrated
safety records with hazardous wastes, partly because
their combined route is one of the shortest distances
between TMI and INEL, and partly because the combined route is composed of top quality trackage. That trackage (a) is certified by the U.S. Department of Transportation for use in transporting hazardous wastes, (b) has the highest inspection standards, (c) has the highest level of automatic tracking systems, and (d) is inspected and certified independently by the Federal Railroad Administration at the request of DOE. However, it should be realized that the rail route and railroad companies selected are one combination of several routes and companies with equivalent certifications and reputations connecting those two geographical points.

Conrail agreed to provide rail service for transporting casks from TMI to East St. Louis, IL. At that point, Union Pacific assumes responsibility for transporting casks to the Scoville siding at INEL (Fig. 2). Conrail restricts the speed of the train to 35 miles per hour between TMI and East St. Louis, as a matter of corporate policy for hazardous shipments. Union Pacific has a higher speed restriction of 55 miles per hour in the open terrain portions of the route between East St. Louis and INEL. It is worth noting that the railcars procured by DOE for transporting the casks are heavy duty 8-axle cars, each capable of transporting loads 60% heavier than the 100-ton weight of a maximally loaded cask and conveying that load at speeds faster than those presently being used by the railroads.

Transportation Operations - For the first three trains transporting TMI core debris (two of which conveyed double cask shipments), DOE contracted with the railroads to move the debris via expedited service or exclusive-use trains, even though more expensive and contrary to DOE's stated policy of transporting unclassified nuclear materials by routine train service. For the single cask shipment, the flatcar carrying the cask was situated between two gondola cars. For the double cask shipments, the two casks were alternately sandwiched between three gondola cars. Both trains were limited fore and aft by a diesel locomotive and caboose, respectively. Surveillance personnel from the railroads and health physicists/observers from EG&G Idaho accompanied the casks en route. Presently, DOE and the railroad companies are negotiating the need for continuing expedited service, with all parties keenly aware of expressed desires of the states and public to maintain expedited or exclusive-use train service.

Monitoring/Communications - After the train with casks exits TMI, the engineer is required to telephone his control center once every four hours until arrival at INEL. The control center for Conrail is located in Philadelphia, while that for Union Pacific is located in Omaha. Each time the engineer telephones, he informs the dispatcher of his exact location and information about any unusual occurrence. In turn, the control center relays the same information on the same schedule by telephone to the Warning Communication Center of DOE and the Traffic Manager of EG&G Idaho, both at INEL. While the train is in motion, the control center monitors by computer the speed and location of the train, as well as the presence of nearby trains using the same track system. Scanners located at predetermined distances along the tracks automatically sense the multicolor bar codes on each railcar of the train and relay information on location, speed, time, date, and so forth to the control center. The control center thus knows the location of the train at any particular point in time. Besides talking with the control center, the engineer for the first three shipments regularly communicated by radiotelephone with surveillance personnel in the

Fig. 2. Rail route for transporting the TMI-2 core debris from Middletown, PA to the Scoville Siding of INEL, west of Idaho Falls, ID.
emergency response organizations there are, the public office has Radiological Assistance Program (RAP) teams emergency response plans which divide the United States into eight regionally located offices. Each office has Radiological Assistance Program (RAP) teams trained in responding to and recovering from any radiological emergency. In all, there are 26 such teams strategically located around the country, each of which is capable of mobilizing within two hours and reaching the site of the emergency within six to eight hours. Once on the scene, the RAP team, assisted by a specially trained team from the railroad company, assumes responsibility for controlling, confining, and cleaning up radioactive material. At INEL, DOE has identified a special TMI transportation response team which can reach any point along the rail route within three hours and assist the RAP team, if the situation so warrants. Regardless of how many and what types of emergency response organizations there are, the public still seems to be apprehensive and local governments concerned about responsibilities in case of a radiological emergency.

Technological Considerations of the Rail Cask - Besides emergency preparedness, public concern increasingly has focused on the safety of transport packages for spent nuclear fuel, as evidenced by penetrating questions about the TMI transport package. DOE has responded to those questions with information describing (a) how the NuPac 125-B rail cask was designed, fabricated, and tested per regulatory requirements; (b) how those requirements encompass all conditions expected in the most severe rail accidents; (c) how the possibility of a breach of cask integrity during a rail accident is extremely remote; and (d) how more than 35 years of transportation experience with Type B packaging in general has not resulted in either loss of containment of any cask or death attributable to radiological consequences. In some cases, the public has claimed that certification of the NuPac 125-B rail cask was the swiftest and most incomplete licensing since the days of the old Atomic Energy Commission. Whereas the licensing process for the NuPac 125-B rail cask may have been "swift," it nonetheless was as detailed as that given any new cask.

The NuPac 125-B rail cask is a spent nuclear fuel cask certified for use by the Transportation Certification Branch of NRC. The cask was certified by NRC only after a thorough review of the Safety Analysis Report for the cask, data from drop tests using a one-quarter scale cask model, data from drop tests of full-sized fuel and knockout canisters, and resolution of many design- and test-related questions from NRC. Before the application was submitted to NRC for review and approval, it was subjected to one of the most intensive reviews in the history of transporting radioactive materials. Reviewers included personnel from DOE National Laboratories, EG&G Idaho, GPU Nuclear, and several subcontractors. The scrutiny and analysis expended on the application by NRC were as thorough as given any application for any rail, or truck, spent fuel cask. The "rapidity" with which NRC accomplished the review and certified the NuPac 125-B rail cask was made possible by (a) DOE contracting with a highly qualified cask vendor (Nuclear Packaging, Inc.), (b) DOE willing to expend extra effort and money to resolve issues, (c) DOE electing to implement suggestions in 10 CFR 71, Subpart F, regarding drop tests of the cask and combining data therefrom with analytical data in the Safety Analysis Report; and (d) extensive reviews of the application already discussed. From the first meeting with NRC on cask certification (August 1984), until issuance of the Certificate of Compliance by NRC (April 1986), about 20 months passed and countless man-years of effort were expended in preparing, evaluating, and analyzing the application.

The approach used in designing the NuPac 125-B rail cask assumes the following: (a) worst-case loadings of core debris in each of the seven canisters (i.e., maximum quantity of radioactive material per canister and maximum concentration of radioactive isotopes available in the core at the time each canister is filled); (b) the cask and its contents are designed for transport to withstand the maximum hypothetical fire outlined in 10 CFR 71.73 (c)(3); (c) the worst-case accident for mechanical and thermal shock to the transport package [to evaluate resistance of the cask to mechanical deformation during an accident and provide data on the ability of the transport package to withstand the maximum hypothetical fire outlined in 10 CFR 71.73 (c)(3)]; (d) extensive reviews of the application by NRC were as thorough as given any application for any rail, or truck, spent fuel cask. The "rapidity" with which NRC accomplished the review and certified the NuPac 125-B rail cask was made possible by (a) DOE contracting with a highly qualified cask vendor (Nuclear Packaging, Inc.), (b) DOE willing to expend extra effort and money to resolve issues, (c) DOE electing to implement suggestions in 10 CFR 71, Subpart F, regarding drop testing a model of the cask and combining data therefrom with analytical data in the Safety Analysis Report; and (d) extensive reviews of the application already discussed. From the first meeting with NRC on cask certification (August 1984), until issuance of the Certificate of Compliance by NRC (April 1986), about 20 months passed and countless man-years of effort were expended in preparing, evaluating, and analyzing the application.

The approach used in designing the NuPac 125-B rail cask assumes the following: (a) worst-case loadings of core debris in each of the seven canisters (i.e., maximum quantity of radioactive material per canister and maximum concentration of radioactive isotopes available in the core at the time each canister is filled); (b) the cask and its contents are designed for transport to withstand the maximum hypothetical fire outlined in 10 CFR 71.73 (c)(3); (c) the worst-case accident for mechanical and thermal shock to the transport package [to evaluate resistance of the cask to mechanical deformation during an accident and provide data on the ability of the transport package to withstand the maximum hypothetical fire outlined in 10 CFR 71.73 (c)(3)]; (d) extensive reviews of the application by NRC were as thorough as given any application for any rail, or truck, spent fuel cask. The "rapidity" with which NRC accomplished the review and certified the NuPac 125-B rail cask was made possible by (a) DOE contracting with a highly qualified cask vendor (Nuclear Packaging, Inc.), (b) DOE willing to expend extra effort and money to resolve issues, (c) DOE electing to implement suggestions in 10 CFR 71, Subpart F, regarding drop testing a model of the cask and combining data therefrom with analytical data in the Safety Analysis Report; and (d) extensive reviews of the application already discussed. From the first meeting with NRC on cask certification (August 1984), until issuance of the Certificate of Compliance by NRC (April 1986), about 20 months passed and countless man-years of effort were expended in preparing, evaluating, and analyzing the application.

The NuPac 125-B rail cask is a spent nuclear fuel cask certified for use by the Transportation Certification Branch of NRC. The cask was certified by NRC only after a thorough review of the Safety Analysis Report for the cask, data from drop tests using a one-quarter scale cask model, data from drop tests of full-sized fuel and knockout canisters, and resolution of many design- and test-related questions from NRC. Before the application was submitted to NRC for review and approval, it was subjected to one of the most intensive reviews in the history of transporting radioactive materials. Reviewers included personnel from DOE National Laboratories, EG&G Idaho, GPU Nuclear, and several subcontractors. The scrutiny and analysis expended on the application by NRC were as thorough as given any application for any rail, or truck, spent fuel cask. The "rapidity" with which NRC accomplished the review and certified the NuPac 125-B rail cask was made possible by (a) DOE contracting with a highly qualified cask vendor (Nuclear Packaging, Inc.), (b) DOE willing to expend extra effort and money to resolve issues, (c) DOE electing to implement suggestions in 10 CFR 71, Subpart F, regarding drop testing a model of the cask and combining data therefrom with analytical data in the Safety Analysis Report; and (d) extensive reviews of the application already discussed. From the first meeting with NRC on cask certification (August 1984), until issuance of the Certificate of Compliance by NRC (April 1986), about 20 months passed and countless man-years of effort were expended in preparing, evaluating, and analyzing the application.

The NuPac 125-B rail cask is a spent nuclear fuel cask certified for use by the Transportation Certification Branch of NRC. The cask was certified by NRC only after a thorough review of the Safety Analysis Report for the cask, data from drop tests using a one-quarter scale cask model, data from drop tests of full-sized fuel and knockout canisters, and resolution of many design- and test-related questions from NRC. Before the application was submitted to NRC for review and approval, it was subjected to one of the most intensive reviews in the history of transporting radioactive materials. Reviewers included personnel from DOE National Laboratories, EG&G Idaho, GPU Nuclear, and several subcontractors. The scrutiny and analysis expended on the application by NRC were as thorough as given any application for any rail, or truck, spent fuel cask. The "rapidity" with which NRC accomplished the review and certified the NuPac 125-B rail cask was made possible by (a) DOE contracting with a highly qualified cask vendor (Nuclear Packaging, Inc.), (b) DOE willing to expend extra effort and money to resolve issues, (c) DOE electing to implement suggestions in 10 CFR 71, Subpart F, regarding drop testing a model of the cask and combining data therefrom with analytical data in the Safety Analysis Report; and (d) extensive reviews of the application already discussed. From the first meeting with NRC on cask certification (August 1984), until issuance of the Certificate of Compliance by NRC (April 1986), about 20 months passed and countless man-years of effort were expended in preparing, evaluating, and analyzing the application.
Compliance with NEPA - Questions were directed to DOE concerning compliance with provisions of the National Environmental Policy Act (NEPA) of 1969 (PL 90-190) and also the necessity/log of transporting TMI core debris to INEL for storage, research, and ultimate disposition at a federal repository. DOE is required (by PL 90-190) to consider the environmental impacts of its actions, including transporting TMI-2 core debris to INEL. DOE reviews such actions in accordance with regulations for implementing the procedural provisions of PL 90-190 published by the Council on Environmental Quality in the Federal Register [Vol. 43 (No. 230): 55978-56007] and DOE guidelines for compliance with PL 90-190 published in the Federal Register [Vol. 45 (No. 62):20694-20701], as amended. DOE concluded that transporting core debris from TMI falls within a categorical exclusion in DOE guidelines, which stipulates "Actions that are substantially the same as other actions for which the environmental effects have already been assessed in a NEPA document and determined by DOE to be clearly insignificant and where such assessment is currently valid." In reaching that conclusion, DOE considered (a) previous environmental analyses of irradiated fuel routinely transported by DOE via various transportation modes and (b) analysis of environmental effects and risks of transporting spent nuclear fuel by various modes discussed in the "Final Environmental Statement on the Transportation of Radioactive Materials by Air and Other Modes" (NUREG-0170) written and issued by NRC. NUREG-0170 also was used by the U.S. Department of Transportation and upheld by the courts to support a uniform national routing regulation for transporting radioactive materials (Highway Routing of Radioactive Materials, Docket No. HW-164). The U.S. Department of Transportation concurred with NRC that transportation of radioactive materials is a low-risk activity, by any level of comparison.

The "Final Programmatic Environmental Impact Statement on TMI-2" (NUREG-0603) by NRC indicated that TMI was unsuited environmentally for long-term storage and/or disposition of wastes (including the core) generated during the cleanup of Unit-2. The same document concluded that those wastes not acceptable for disposal at a commercial disposal facility should be sent to a federal installation for storage and research until repackaged or transformed into a waste form acceptable for either a commercial facility or federal repository, depending upon whether the waste form is low-level or high-level waste. Because DOE was, and is, the only agency of the federal government with installations suitable for handling, researching, and storing such radioactive and/or hazardous materials, it became the designee alluded to in NUREG-0603. Because INEL is one installation of DOE actively engaged in management and research of nuclear waste, as well as the only installation specifically dedicated to reactor behavior/safety research, it logically was targeted to receive the radioactive materials from TMI not suitable for disposal at a commercial disposal facility. Thus, DOE entered into contractual agreement with GPU Nuclear to receive, transport, research, store and/or dispose of certain, specified wastes from TMI. NRC, as regulator of the utility, was included de facto as a third party, although remaining free of any contractual obligations. The core debris canisters from TMI were designed for storage in a pool for as long as 30 years. After the federal repository is built and becomes operational, the core debris from Unit-2 will be transformed into a waste form acceptable to the repository.

At INEL, DOE has experimented with and studied the effects of loss-of-coolant accidents on numerous test reactors in order to understand reactor behavior during severe accidents. The incident at TMI was a severe accident; therefore, it was logical to assign INEL the responsibility of studying the core debris from Unit-2 and comparing it with smaller but similarly damaged cores at the laboratory. Results from the research will be used at INEL to refine safety computer codes and by national and international regulatory authorities in operating commercial nuclear reactors.

CONCLUSION

Despite all the the safety features designed and built into each transport package, multiple inspections of both the packages and package during severe accidents. The incident at TMI was a severe accident; therefore, it was logical to assign INEL the responsibility of studying the core debris from Unit-2 and comparing it with smaller but similarly damaged cores at the laboratory. Results from the research will be used at INEL to refine safety computer codes and by national and international regulatory authorities in operating commercial nuclear reactors.
increases public apprehension. Consequently, before initiating a transportation campaign such as developed for the TMI core debris, a comprehensive educational effort involving state and local officials, news media, and public at large is mandatory.

Meticulous records of all informational transactions should be kept, and preparations must be in place for managing the large volume of official, public, and private inquiries that will follow announcement and commencement of a planned transportation campaign involving nuclear materials. After the exchange of information begins, there is a tendency by some more informed elements of the public to probe, via questioning, for indefensible or "soft spots" in the plans and regulatory compliance of the transport activity. Such probing has been ineffective in disrupting the transportation of core debris from TMI. The authors believe that the amount of information exchanged concerning transportation of the TMI core debris was as large as or larger than any exchanged previously on the subject of transport packaging (of radioactive materials). We also believe that some progress has been achieved to increase public confidence on transporting nuclear materials by rail.