Transporting Spent and Damaged Fuel in the United States: Recent Experience and Lessons Learned Related to the Evolving Transportation Policy of the U.S. Department of Energy*

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INTRODUCTION

In 1987, Fischer *et al.* noted that the number of shipments of commercial spent nuclear fuel will increase dramatically in the United States, because such material will be moved from power reactors (most of which are in the East) to a federal repository for high–level radioactive waste (presently being considered in the West). The U.S. Department of Energy, through its Office of Civilian Radioactive Waste Management, is preparing for that large–scale transport effort by developing new cask systems and modifying existing transport policy. Understandably, public attention is focused on issues related to transport of radioactive materials. This paper summarizes experience gained from recent transport actions of the Department of Energy, relates lessons learned therefrom to an evolving policy in the Department, and discusses some aspects of public involvement in such transport activities.

COMPLETED, CONTINUING, AND FUTURE TRANSPORT ACTIONS

TMI–2 Transport Campaign—The TMI–2 Campaign involves transporting damaged fuel from the Unit 2 Reactor of Three Mile Island Nuclear Power Station near Harrisburg (PA) to the Idaho National Engineering Laboratory of the Department of Energy near Idaho Falls (ID) for storage and research (Reno 1986, and Schmitt and Reno 1986). The damaged fuel is transported in casks by railroad across 10 states. The campaign began in July 1986. To date, 19 shipments (40 cask loads) have been completed, equating to about 75% of the TMI–2 core. [Several trains transported one or two casks each; present policy is three casks per train.]

VP Fuel Transfer Campaign—The VP Campaign involved moving 60 spent fuel assemblies from the Surry Nuclear Power Station of Virginia Power Company and 17 from the Engine Maintenance Assembly and Disassembly facility of the Nevada Test Site of the Department of Energy via public highways to the Idaho National Engineering Laboratory (Gertz *et al.* 1986). The latter assemblies originated from the Turkey Point Nuclear Power Station of Florida Power & Light Company. The shipments were part of a cooperative agreement between the Department of Energy, Virginia Power Company, and Electric Power Research Institute to test metal storage casks and demonstrate dry rod consolidation of spent fuel assemblies. The transport campaign was accomplished in 1986.

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BCD Fuel Transfer Campaign—The BCD Campaign involved moving two fuel assemblies and parts of a third from Battelle Columbus Division near Columbus (OH) to the Idaho National Engineering Laboratory for storage. The fuel was transported via public highways. The campaign was completed in 1987.

NFS Fuel Transfer Campaign—The Nuclear Fuel Service Campaign is part of the NFS Spent Fuel Shipping/Storage Cask Demonstration Project of the Office of Civilian Radioactive Waste Management. The project will demonstrate the use of two dual–purpose, spent fuel casks. The Transnuclear TN–BRP cask is designed to transport (and eventually store) 85 boiling water reactor assemblies of the Big Rock Point Nuclear Power Station of Consumers Power Company, from the West Valley Demonstration Project of the Department of Energy near Buffalo (NY) to the Idaho National Engineering Laboratory. The Transnuclear TN–REG cask is designed to transport (and eventually store) 40 pressurized water reactor assemblies of the Robert E. Ginna Nuclear Power Station of Rochester Gas & Electric Corporation, between the same federal facilities. The casks presently are being reviewed for certification by the U.S. Nuclear Regulatory Commission. The NFS Campaign involves moving each cask, half–full of spent fuel assemblies, via railroad from New York to Idaho. Each cask will make two round trips between facilities. Once all fuel reaches Idaho, each cask will be filled to capacity and tested in a storage demonstration. Data collected during storage may be used by the Nuclear Regulatory Commission in certification of such casks for transport/storage.

WIPP Transport Campaign—Although the Waste Isolation Pilot Plant Campaign involves transport of contact–handled, transuranic–contaminated wastes, it is addressed herein because the campaign has been influenced by the aforementioned transport actions and will influence future transport of spent fuel. The WIPP Campaign involves moving wastes from various installations of the Department of Energy to a federal disposal facility near Carlsbad (NM). The Department estimates that 15,000 shipments will be needed to relocate that waste, using a fleet of specially designed, truck–mounted packages. TRUPACT–II, designed to accommodate either fourteen 55–gallon drums or several rectangular boxes per load, awaits certification by the Nuclear Regulatory Commission [Quinn and Ferguson (in press)]. Initiation of the campaign is expected in late CY–1989.

EVOLUTION OF TRANSPORT ACTIONS

Although a simplification, the following text provides a framework for discussing certain strategies used by the Department of Energy in resolving issues related to transport of high–level radioactive wastes (including spent nuclear fuel). Principal issues have included or presently include (a) communications with state and local officials; (b) interactions with state and federal legislators, and the public; (c) design, safety, and certification of cask systems; (d) emergency preparedness and response by local, state, and federal governments; (e) compliance with the National Environmental Policy Act of 1969; (f) selection of routes and scheduling; (g) safety of operations during transit; (h) types of carrier service (dedicated versus routine freight); (i) indemnification in case of accident; and (j) legality and authority for conducting transport actions. These issues are too numerous and exhaustive to detail in one paper, although some have been explored in other contributions [e.g., Schmitt *et al.* 1987 and Smith (in press)]. This paper focuses on five issues, namely (a) through (c), (e), and (h).

Issue (a)—The Department of Energy, in preparing for the TMI–2 Campaign, recognized that transport of damaged fuel from Pennsylvania would attract considerable attention. Therefore, an extensive effort was conducted to communicate with each state (and the public) regarding the rail route from Three Mile Island to Idaho. Details of that effort are included in Smith (in press). In essence, the Department provided written notification of its intent to each involved state, followed by a telephone call to the appropriate state official. The Department also conducted press conferences pertaining to the campaign, met publicly with state officials, participated in public meetings, provided whatever technical information was requested by whomever, accommodated inspections of the transport system by individual states, and displayed the cask publicly. That approach, however, did not allay all concerns.

In one case, the Governor of the State of Nebraska stopped the first train from Three Mile Island within the State of Kansas. He claimed that Nebraska was notified improperly as to when the train would enter his

state. Upon clarification, the presumed "improper notification" was shown to result from ineffective communication within the state government. Nonetheless, adverse publicity arising from that situation cast a negative light on efforts by the Department of Energy.

Despite that and other minor inconveniences, working with the states in effecting transport of damaged fuel from Three Mile Island has been positive and, in large part, the reason why the TMI–2 Campaign has been successful. Informed public officials were instrumental in educating their constituents and allaying public apprehension concerning the campaign.

Before the TMI–2 Campaign, the policy used by the Department of Energy in communicating with the states (and public and governmental officials) about transport of radioactive material was regarded generically as "courtesy communications." That is, a telephone call was placed to the Governor (or his/her designee) of each state, informing him/her of the planned action and that a shipment was in progress. Presently, based in part on experience from the TMI–2 Campaign, seven–days written prenotification is provided to the Governor or his/her designee before initiation of a shipment. Prenotification includes schedular information pertaining to when the train enters, traverses, and exits the state. If the actual schedule varies by more than six hours from that included in the prenotification, the state is notified of the variance by telephone.

For the BCD Campaign, the Department of Energy used the strategy developed for the TMI–2 Campaign. Correspondingly, the experience gained from those two campaigns will be used for the NFS Campaign. In addition, the Department plans to notify states adjoining those through which shipments will pass as to the planned actions, and also brief congressional and legislative delegations of each state.

Issue (b)—The TMI–2 Campaign resulted in possibly the largest exchange of information ever witnessed between the Department of Energy and public. In the beginning, planners of the campaign did not anticipate the large number of requests for information that would be received related to issues (a) through (h). Nor did those individuals have the resources to formulate the always written responses in a timely manner. Requests were received from congressmen, investigative entities of congress, state and local officials, local emergency planning and action organizations, special interest groups, organized critics, and private citizens. The requests numbered in the thousands.

In order to avoid a similar deluge, the Department of Energy is requiring that a detailed Transportation Plan be prepared for each transport campaign. For the NFS Campaign, that plan reflects lessons learned from the TMI–2 Campaign. It provides details regarding the authority for conducting the action, the rationale for selecting the transportation route, procedures for notifying each state, the strategy for briefing legislative organizations of each state, public relations, transport packages, compliance with the National Environmental Policy Act, emergency preparedness and definitions of local and state responsibilities, and the campaign *per se*. In other words, the Transportation Plan is a comprehensive document intended to demonstrate to organizations and individuals that the transport action is planned in ways to cause the least impact on all parties. However, one aspect of public relations being realized from experience with recent transport campaigns is that critics never can be satisfied—they, at best, only can be mollified.

Issue (c)—In planning the TMI–2 Campaign, existing cask systems were reviewed, but none met requirements of 10 CFR 71 for transport of damaged fuel. Consequently, the Department of Energy decided to procure new rail casks. Three casks were designed and fabricated, and are being used to transport damaged fuel from Pennsylvania to Idaho. The three NuPac 125–B Rail Casks are certified by the Nuclear Regulatory Commission as providing double containment of containerized fuel debris.

Although the casks are certified Type B packages, critics vigorously questioned the design and certification process, attempting to disrupt and/or curtail the TMI–2 Campaign. Perhaps the most objectionable criticism focused on the expeditious design, fabrication, and certification of the cask system. Translation of that criticism to a safety issue was simple: "When heretofore it took five or more years to certify and build a cask, anything that can be done in a shorter time must be flawed; hence, the package must be unsafe." The criticism, however, failed to recognize the massive effort put forth by the Department of Energy and its contractors to design a safe system. In fact, the Department was so confident with the design of the

NuPac 125–B Rail Cask that it authorized fabrication in parallel with certification, a time savings not realized in production of other Type B casks.

Another time savings was realized by subjecting a 1/4–scale model of the NuPac 125–B cask system to a series of drop tests, as outlined in 10 CFR 71 (Subpart H). Although those tests confirmed analytical predictions of behavior during postulated worst–case accidents, critics conjectured that actual confirmation required testing a full–scale model of the cask. For TRUPACT–II, the Department of Energy has authorized testing a full–scale model in full view of the public. [Presumably, tests using scale models will be part of the cask program being developed by the Office of Civilian Radioactive Waste Management.]

The Department of Energy also has been criticized for not having a review/certification process for its cask systems that is equivalent to the process used by the Nuclear Regulatory Commission. However, the Department does have such a system now. First, the Certification Office (DP–4.1) of the Department reviews applications for cask certification according to rules and regulations of the Nuclear Regulatory Commission. Then, where appropriate, the applications are forwarded to the Commission for review and issuance of Certificates of Compliance. Whereas the NuPac 125–B, TRUPACT–II, and other systems still in development are reviewed for licensing by the Commission from applications submitted directly by cask vendors, one can anticipate that the certification processes and strategies of both the Department and Commission will become indistinguishable.

Issue (e)—The National Environmental Policy Act has proven to be a powerful tool used by detractors of certain proposed projects or transport actions. A detractor simply has to ask why an Environmental Impact Statement has not been prepared for said project or action, and, automatically, the burden of explaining compliance with the act falls upon the proposer—and rightfully so. However, explanations take time and money; and preparation of an Environmental Impact Statement takes even more time and money. The net result is delay—which favors the detractor to the detriment of the proposer.

In the case of the TMI–2 Campaign, the Department of Energy was questioned repeatedly (from both inside and outside the federal government) regarding compliance with the National Environmental Policy Act. The Department anticipated such questioning and responded simply and appropriately, as follows: Environmental documentation prepared before and after the accident at Three Mile Island clearly addressed transport actions analogous to that between Pennsylvania and Idaho. Moreover, the study by Fischer *et al.* (1987) updated information contained in documentation prepared before the accident. Additional details concerning compliance are given in Reno (1986), Schmitt and Reno (1986), and Schmitt *et al.* (1987).

But, within the Department of Energy, the TMI–2 Campaign instigated considerable review and reevaluation of policy governing compliance with the Environmental Policy Act. Present policy requires that an environmental assessment be written for each transport action. Logical future activities include revision of NUREG–0170 (1977) by the Nuclear Regulatory Commission and preparation of generic environmental documentation for transport of spent nuclear fuel. After acceptance/approval of those documents, each transport action would be addressed in an environmental assessment that tiers upon the generic document. That approach is consistent with 40 CFR 1502.20, wherein the Council on Environmental Quality recommended tiering one environmental document upon another, where appropriate.

Issue (h)—Transport of spent nuclear fuel over public highways is well defined in existing policy of the Department of Energy. [That policy guided actions of the VP and BCD Campaigns.] However, transport of spent fuel by railroad is another matter—policy and actions sometimes do not coincide. For the TMI–2 Campaign, for example, the railroad companies (i.e., Consolidated Rail Corporation and Union Pacific Railroad) initially opted to transport the damaged fuel by means of dedicated trains. That service was accepted by the Department, since doing otherwise (i.e., transporting the damage fuel as routine rail freight) might disrupt the defueling schedule of the utility. After the first three shipments, the utility agreed to absorb the incremental costs of "exclusive–use train service" over routine freight, since such service was perceived as accelerating the defueling schedule. The Department agreed, but noted that, TMI–2 notwithstanding, spent fuel should be transported as routine rail freight, unless the use of dedicated trains facilitates compliance with constraints imposed by the Nuclear Regulatory Commission.

Certain experience supports the use of dedicated trains in transporting spent (or damaged) fuel. For instance, the public perceives the use of dedicated train service as providing an extra measure of safety over routine service, although cask systems are designed and built such that equivalent safety is realized during both types of service. Also, prenotification procedures and train schedules in and between states are easier to maintain with dedicated trains [hence, avoiding misunderstandings such as occurred with the State of Nebraska]. Finally, from a programmatic perspective, dedicated trains result in simpler logistical arrangements (i.e., escorts, communications, guards, etc.) and, generally, more expeditious service between points A and B.

Although precedents are ingrained in the use of dedicated trains, that service is more costly (by about a factor of two) and the incremental costs ultimately will be borne by the user/rate–payer. Nonetheless, the logistics of routine service are so complicated and potentially time consuming that they may ultimately result in costs exceeding those of dedicated train service.

The type of train service for future shipments of spent fuel is being debated. Present plans for the NFS Campaign include dedicated train service, which will provide an excellent comparison with the "exclusive–use train service" of the TMI–2 Campaign. The policy used for shipments to the federal repository will be derived from experience discussed herein.

PERSPECTIVES

Several perspectives are evident from information discussed in this paper. First and foremost is the approach taken by the Department of Energy to enhance communications and interactions with state and local officials, and the public at large regarding present and planned transport actions. The kinds of information being discussed with and disseminated to the public are unprecedented in the history of the Department. Moreover, public involvement in development of cask systems speaks positively of commitments by the Department to openly converse about planned transport actions. Second, the Department is enhancing its efforts to demonstrate to the public that packages developed and being developed for transport of spent fuel and high–level radioactive waste are safe. That is reflected in the willingness of the Department to encourage public observance of the testing of TRUPACT–II. Third, the Department is implementing changes in several policies, particularly those related to requiring a detailed Transportation Plan and environmental assessment for each transport campaign. Those changes should alleviate public apprehension concerning transport actions. And last, criticisms related to design/certification regulations and procedures of the Department being less stringent than those of the Nuclear Regulatory Commission have resulted in changes that make the regulations and procedures of those two organizations indistinguishable.

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