SPENT FUEL TRANSPORTATION TRENDS –A PERSPECTIVE BASED ON THE FOREIGN RESEARCH REACTOR EXPERIENCE

John Patterson
Foreign Research Reactor Liaison
NAC International
227 Gateway Drive
Aiken, SC 29803
nacaiken@aol.com

ABSTRACT

The paper will provide a comparison of foreign research reactor spent fuel transportation today verses the assumptions used by the Department of Energy in the Environmental Impact Statement, and the initial experience during the Urgent Relief program. In addition, it will suggest trends that are evident from the foreign spent fuel returns program. Cask technology, certification issues, logistics, shipment strategy, cost issues, and public acceptance are among the topical areas that will be examined.

INTRODUCTION

The Department of Energy has been receiving shipments of foreign research reactor spent fuel of US origin for decades. Prior to 1990, the shipments generally attracted little attention and were conducted using standard commercial practice. These methods conformed to US Federal Regulation and to International Atomic Energy Agency recommendations that prescribe reasonable secrecy be applied to the shipments consistent with safeguards principles. The overall effect was that while commercial ports were used for receipt of shipments and motor carrier transport was used between ports and DOE facilities, there was little public notice or involvement in the process. Shipments from the Taiwan Research Reactor proved to be a notable exception. Originally planned for entry through a west coast port, the initiative drew such political opposition in Washington, Oregon and California that DOE ultimately decided to ship through the Panama Canal and receive in Savannah, site of most of the European reactor receipts. This proved to be a harbinger of the debate that would accompany shipments in the 1990s.

US policy allowing for the return of the foreign reactor fuel expired in the late 1980s. At the same time, the US was supporting replacement of highly enriched research reactor fuel with more proliferation resistant low enriched fuel, and discouraging reprocessing of the fuel. For many countries, this left little alternative except for the fuel to accumulate in storage facilities. These factors prompted a concerted effort, largely by European reactor operators, to encourage reinstatement of the US returns policy. The hiatus that had occurred in shipments dictated that resumption of the policy be subjected to NEPA requirements. An initial attempt to validate the policy through an Environmental Assessment met with considerable opposition from states and public interest groups, leading to a DOE commitment to subject the matter to a full Environmental Impact Statement (EIS).

The scope of the EIS was quite broad, covering East and West Coast ports, commercial and military port facilities, various approaches to compensation for the cost of the program, and rail and motor carrier routes for domestic transport. The ensuing hearings subjected the program to a level of scrutiny heretofore in absence. In order to ameliorate public concerns relative to nuclear safety and transportation risks, DOE committed to a number of "extra-regulatory" precautions as a means of gaining public and political acceptance. These were first applied to a limited return of "Urgent Relief" fuel from reactors facing shutdown or fuel reprocessing to resulting from diminishing fuel storage capacity. Following release of the EIS and the Record of Decision and resolution of resulting legal challenges, the guidelines were applied to the spent fuel returns program in general. Tracing the application of the shipment protocols through the "Urgent Relief" and "Foreign Research Reactor" spent fuel shipments provides a context to judge how future more extensive spent fuel shipment programs may be conducted.

DISCUSSION

A number of Federal Regulations come into play in the statutory framework covering spent fuel shipments. Title 10, Part 71 of the Federal Regulations dictates the statutory requirements for spent fuel packages. Title 10, Part 73 provides notification and safeguards requirements. These are complemented by the Department of Transportation regulations applying to motor carrier and rail transport, and to the hazards placarding applied to the shipment. The transportation protocols applied by DOE for the foreign research reactor shipments have supplemented the statutory requirements in most instances. In addition, state and local law enforcement have used their discretion or reacted to political pressure in adding additional measures of oversight to the shipments. Each of these areas will be examined from perspectives of impact, consistency, and permanence.

Cask Technology

Throughout the Pre-EIS period, shipments of foreign research reactor spent nuclear fuel were made in a variety of casks, many whose designs dated back to the 1960s and 1970s. This practice of "grandfathering" older casks is authorized by 10CFR71.13, "Previously Approved Packages". The EIS assumed this practice would continue. As a result, it projected that a large number of potential casks would be available with which to conduct the shipments. A total of 14 different cask types were considered potentially usable for the spent fuel transport. Of these, less than half have seen service performing transportation for the FRR program due to issues relative to certification for international use. Two factors accounted for this change. First, the Nuclear Regulatory Commission was focusing additional attention to spent fuel storage and transportation, driven in part by the trend in the commercial nuclear industry from pool storage to dry cask storage. The 1985 IAEA guidelines became embodied in Part 71 and became the standard for cask evaluation. Second, DOE solicited proposals for research reactor spent fuel transportation that dictated compliance with the 1985 requirements rather than accepting "grandfathering" permitted by the regulation. Consequently the number and variety of casks useable by the program was significantly reduced. On the other hand, DOE

benefited by this change since it could assert that only casks meeting "the latest standards" would be used in the program. Since the adequacy of cask technology was a frequent subject of debate in public meetings, political discussions and legal challenges, DOE's adoption of "most current standards" provided a sound footing for its technology and safety arguments. In contrast to the FRR program, DOE continues to use an older "grandfathered" cask for a large fraction of its domestic research reactor shipments without any apparent resistance.

A more recent set of IAEA recommended guidelines are now being considered for adoption in Federal Regulations. If adopted, casks not meeting the 1985 standards will no longer be validated, further depleting the inventory of cask types available for transport. Other aspects of cask technology that are not embodied in either the IAEA guidance or Federal Regulation, such as full scale testing and the adequacy of prescribed drop tests to envelope all conceivable accident conditions, provided ample room for contention. However, the high level of support in the scientific community for the adequacy of the calculational methods, and the rather limited radionuclide inventory represented by the research reactor payloads was sufficient to resolve this debate. There is ample evidence it will resume when addressing the rail cask shipments of large inventories of commercial spent fuel.

Public And Stakeholder Involvement

The release of the EIS and resumption of fuel returns from foreign research reactors spawned significant public attention to the program and triggered several law suits by affected States and local jurisdictions. As a result of this attention, early shipments were marked by heavy press coverage, environmental protests, and, on occasion, legal interruption. The initial shipments were conducted in what might best be described as a "circus" atmosphere with a fleet of law enforcement vehicles tracking the train shipment and helicopter surveillance during the transit. This level of attention was counter to safeguards objectives relative to securing the safety of the fuel shipments. By 1998, much of this attention had subsided relative to train shipments from Charleston to SRS. However, the first fuel receipt into Concord, California once again triggered active public involvement and legal action. The precision with which the shipment was completed, however, led to favorable press coverage for DOE and NAC, and appears to have had a lasting effect on the preparation and execution of the cross-country shipment from SRS to INEEL. The cross-country shipment was marked by positive interaction and cooperation among the affected States and with DOE and NAC. The shipment was conducted without the excesses in law enforcement and press coverage that had characterized the earlier shipments from Charleston and Concord. Newspaper reports following the shipment were very limited and were absent the hyperbole that accompanied the pre-shipment reporting.

Routing

Domestic routing of spent fuel shipments requires NRC approval. Route selection considerations include transit time, distance and population density, the objective being

to minimize transit time while limiting population exposure. Interstate highways are to be used when available, although states can apply for alternate preferred routes when justified by unique conditions.

While all of the casks authorized for FRR shipments were compatible with motor carrier transport, and the pre-EIS shipments all traveled by that mode, public input to DOE during the EIS process suggested a preference for rail transport. The reason for this preference has never been entirely clear although it may be "out of sight, out of mind" philosophy, however DOE elected to specify rail routing out of respect for the EIS input. The routing options available for rail travel are far more limited than that for highway routing, at least for the initial shipments from Sunny Point, North Carolina and Charleston, South Carolina to the Savannah River Site near Aiken, South Carolina. Consequently, selection of East Coast rail routes involved little contention.

This changed dramatically with the shipment from Concord, California to the Idaho National Engineering and Environmental Laboratory near Idaho Falls. The longer travel distances afforded an opportunity to debate whether certain communities, tribal nations, and in some cases certain states, would be enveloped by the route. Points of argument included safety record of rail segments, population centers affected by the rail route, proximity of the route to nearby hazards (refineries, airports, etc.) and to municipal water supplies, and emergency response distances and times. This broadening of route selection criteria served to extend debate but did little to resolve a consensus selection. In part, this was due to similarities in characteristics of major rail routes but more likely it was because each of points served as a basis to argue against a particular selection, not in favor of an alternative.

The selection of a highway route between the Savannah River Site and the Idaho National Engineering and Environmental Laboratory followed a course similar to that of the longer rail routes. With several alternatives that differed only marginally when using the NRC criteria, affected jurisdictions could argue subjective criteria justified shifting the route from their locale to one of the other alternatives. One governor successfully argued that the condition of the interstate in his state was so degraded that its use would be unsafe. This contrasts with that in South Carolina where the specified route has been used frequently enough that it no longer attracts attention or debate. This experience suggests that lengthy debate should be expected before the initiation of any concerted national program of spent fuel transportation, but with time and experience, shipments with a regular frequency may proceed without contest.

Cask Certification

A spent fuel transportation cask and its contents are certified as a system. Changing the contents in the most minor of characteristics can dictate an amendment to the Certificate of Compliance, one requiring approval of the NRC. Cask vendors will often try to envelop a variety of contents in the cask safety analysis report as a means of avoiding this situation but there are limits to the practicality of this approach. Specifying too broad

contents in an amendment can lead to unworkable conservatism, or require so many parametric analyses to be time and cost prohibitive.

Cask certification for the FRR program proved to be a learning experience for the cask vendors, DOE, and NRC. It became painfully obvious early in the program that there was no such thing as "standard" research reactor fuel. Differing number of plates, enrichments, burnups, uranium loading, and cooling time were among the variations found in the research reactor fuel inventory. In addition, plates often were removed, destructively examined, or otherwise modified in a manner that invalidated an existing certification. Furthermore, it was not uncommon to discover some of these aberrations late in the shipment planning cycle, necessitating an expedited amendment preparation by the cask vendor and review by NRC. At DOE's request, both the cask vendors and NRC responded admirably to these challenges, so that shipments could be completed on schedule. However, efforts continue to get reactor operators to better identify the characteristics of their fuel, and to identify any "orphans" that may have been created in their research programs. A recent initiative by three of the cask vendors, NAC International, Transnucleaire, and Nuclear Cargo and Services, has as its objective the accelerated identification of all research reactor fuel parameters. Advancing the availability of data is necessary since a year or more may be required for approval of a complex amendment and validation by all of the countries of passage.

In our judgement, this will be a far less serious difficulty for the commercial power reactor inventory. While there are some differences in fuel from reactor to reactor and differences among fuel manufacturers, they are modest in scope and presumably are addressed in the design and certification process.

Transportation Protocols

DOE dictated several extra-regulatory requirements for domestic transportation, which have received broad acceptance among the involved state and local personnel. One is the use of satellite tracking of the shipment. A DOE system called TRANSCOM provides a real-time ability to track the shipments as well as affording communication capability between the vehicle and DOE's control center. It also feeds this information to state and local centers that are authorized as having "need to know" when the shipment is in their jurisdiction. This information has proven very useful in coordinating escorts, alerting emergency preparedness personnel, and possibly most critical, alerting governors and other state personnel having a political stake in the shipment. While nothing in federal regulation dictates this feature, states have been known to stop domestic DOE shipments, which have not provided TRANSCOM tracking. The broad acceptance of the tracking provision argues strongly that this will be a feature of any DOE organized commercial spent fuel transportation program.

A second provision implemented on FRR motor carrier shipments is the use of enhanced Commercial Vehicle Safety Alliance (CVSA) inspections. The CVSA is an industry body created to assure uniform standards of inspection are applied to vehicles involved in hazardous material shipments. The rationale behind an enhanced set of standards was

that if a vehicle was inspected to a rigorous enough criteria in advance of a shipment, that it could proceed to its destination without the periodic inspections that would be applied to more routine hazardous shipments. Allowing the shipment to proceed without interruption was judged to be consistent with minimizing safeguards, exposure and safety risks. The enhanced inspections have been well received, but not in the manner originally envisioned by CVSA. Not only are the shipments subjected to the inspection at their origin, but also several states have chosen to conduct them during any passage through the state. With the current frequency of shipments, it is unlikely that any change in this will occur. However, since the overwhelming percentage of the commercial spent fuel shipments will occur by rail, it should have little effect on the commercial program. Rail shipment inspections are performed by Department of Transportation personnel and these should be expected to persist.

Safeguards

The unprecedented public attention afforded the FRR program has often conflicted with traditional safeguards. As noted earlier in the paper, the pre-EIS shipments were conducted with only the statutory notifications, and with virtually no public involvement. Under the FRR program, states, tribal nations, and regional planning groups have participated in route selection, have been advised of the approximate timing of shipments (the precise timing has remained safeguarded information), and have been afforded precise tracking information during the conduct of the shipments. On the surface this would appear to be compromising to safeguards objectives. In reality, however, public interest groups and representatives of the press having cause to follow the shipments are sufficiently well organized that secrecy has proved impractical. It has not been uncommon to have the ship's position publicized on the Internet and its arrival broadcast on local television. It is not feasible to preclude public knowledge of a train or truck shipment that it is intent on publicizing. Certainly the early commercial spent fuel shipments will face every bit as much scrutiny as the FRR shipments. Whether, in time, they will cease to attract public attention, as has been the case with the FRR shipments through South Carolina, is pure conjecture.

CONCLUSION

Spent fuel shipments from foreign research reactors have been received at DOE sites in the US for decades. For much of this period, the shipments evoked little public notice, and were conducted using the characteristics dictated by Federal Regulations. The attention focused on the program as a result of the NEPA process has brought about dramatic changes in the level of public involvement and visibility. The FRR program is now the most significant sponsor of spent fuel shipments in the US. Lessons learned during their conduct can be pave the way for the commercial shipment of spent fuel, with varying degrees of applicability. The FRR experience has demonstrated that a sustained performance of shipments without incident can lead to diminished public interest, whether due to acceptance or complacency.