Initial Process and Expected Outcomes for Preliminary Identification of Routes to Yucca Mountain, Nevada - 8487

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ABSTRACT

The Department of Energy's (DOE's) Office of Civilian Radioactive Waste Management (OCRWM) is responsible for developing and implementing a safe, secure and efficient transportation system to ship spent nuclear fuel (SNF) and high-level radioactive waste (HLW) from commercial and DOE sites to the proposed Yucca Mountain repository. The Office of Logistics Management (OLM) within OCRWM has begun to work with stakeholders to identify preliminary national suites of highway and rail routes that could be used for future shipments OLM is striving to develop a planning-basis set of routes that will support long-lead time logistical analyses (i.e., five or more years before shipment). The results will represent a starting point for discussions between DOE and corridor jurisdictions, and for shipping arrangements between DOE and carriers. This fulfills a recommendation of the National Academy of Sciences report on SNF and HLW transportation that "DOE should identify and make public its suite of preferred highway and rail routes for transporting spent fuel and high level waste to a federal repository as soon as practicable to support State, Tribal and local planning, especially for emergency responder preparedness."

OLM encourages and supports participation of program stakeholders in a process to identify suites of national routes. The principal objective is to identify preliminary suites of national routes that reflect responsible consideration of the interests of a broad cross-section of stakeholders. This will facilitate transportation planning activities to help meet program goals, including providing an advanced planning framework for State and Tribal authorities; supporting a pilot program for providing funding under Section 180(c) of the Nuclear Waste Policy Act; allowing sufficient time for security and operational reviews in advance of shipments to Yucca Mountain; and supporting utility planning and readiness for transportation operations. Concepts for routing and routing criteria have been considered by several state regional groups supported by cooperative agreements with OLM. OCRWM is also working with other Federal agencies, transportation service providers and others involved in the transportation industry to ensure the criteria are consistent with operating practices and regulations. These coordination efforts will ensure the experience, knowledge, and expertise of those involved are considered in the process to identify the preliminary national suites of routes. This paper describes the current process and timeline for preliminary identification and analyses of routes.

INTRODUCTION AND BACKGROUND

The Nuclear Waste Policy Act (NWPA) established the Office of Civilian Radioactive Waste Management (OCRWM) within the Department of Energy (DOE) to construct and operate a geologic repository for the disposal of spent nuclear fuel (SNF) and high-level radioactive waste (HLW). Following the 2002 recommendation of Yucca Mountain, Nevada, as the site for the nation's first repository for SNF and HLW, OCRWM began to accelerate development of the transportation system needed to move these wastes from 76 sites in 38 States to the repository. The Office of Logistics Management (OLM) was established within OCRWM to design and implement the transportation system, and OLM is working collaboratively with stakeholders to conduct studies, gather information, develop policies, and make decisions that will ensure the transportation system for SNF and HLW is safe, secure and efficient.

OCRWM's *Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions*[1] commits to collaboratively working with States through State Regional Groups (SRGs), and with Tribal governments, to identify transportation routes. Identifying preliminary suites of routes will ultimately allow DOE and the States, Tribes and local officials to focus their planning and to allocate resources along a more defined set of routes.

NATIONAL ROUTE PLANNING NEED

OCRWM is planning to begin shipments to the Yucca Mountain repository no earlier than January 2017, and shipments will continue for at least 25 years. The national rail and highway networks are complex and dynamic systems, and both are expected to undergo significant changes and development over that time period. Therefore the routes identified now may not be the actual ones utilized at the time of shipment. Nonetheless, OCRWM believes it is prudent to begin the route identification process now to provide operational flexibility, allow time to optimize shipment logistics, and provide a basis for planning.

Many reasons support the early identification of routes:

- The experience of other radioactive materials shipping campaigns has shown routing can be a controversial issue. As a consequence, routing has become a "keystone" issue in the Department's transportation planning to determine which corridors, jurisdictions, and people the shipments may affect. The process of identifying routes for OCRWM shipments, as well as the specific routes that are identified, can be expected to generate intense public and governmental interest. It is therefore critically important to implement a process that allows sufficient time to identify suites of routes and applies sound principles and objective, transparent criteria that promote safety, security and merit public confidence.
- Section 180(c) of the Nuclear Waste Policy Act (NWPA) requires DOE to provide funds and technical assistance to States and Tribes through whose jurisdictions DOE plans to transport SNF and HLW. The purpose of the funds and technical assistance is to train local public safety officials on procedures for safe, routine

transportation and emergency response related to shipments of SNF and HLW. Preliminary identification of routes will support DOE's plans for a pilot project to test its grant procedures for providing funding to eligible States and Tribes.

- In 2006, the National Academy of Sciences issued its report on the safety of transporting SNF and HLW to the Yucca Mountain repository. The report, entitled *Going the Distance: The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*[2], strongly endorsed the DOE approach of involving State and Tribal governments in providing input to its decisions on routing and specifically recommended that "DOE should identify and make public its suite of preferred highway and rail routes for transporting spent fuel and high level waste to a federal repository as soon as practicable to support State, Tribal and local planning, especially for emergency responder preparedness."
- Operational and logistical analyses and long-term planning require input on routing to optimize system performance, i.e., maximizing shipment efficiency while decreasing costs, distances and time in transit. (Distances and time in transit are directly related to accident and dose rates, as well as costs.)
- In April 2004, OCRWM selected rail as the preferred mode for shipping SNF and HLW[3] to the repository, both nationally and in the State of Nevada. Thus, shipments will primarily involve rail, and many different railroad companies will be involved. OCRWM has not yet determined what contractual or other arrangements with rail carriers or others it will employ; however, in addition to expected shipment volumes, a preliminary understanding of likely routes will provide a meaningful starting point for discussions and negotiations.

NATIONAL ROUTE PLANNING OBJECTIVE AND PROCESS

OCRWM encourages and supports participation of program stakeholders in its process to identify suites of national routes. The principal objective is to identify preliminary suites of national routes that reflect responsible consideration of the interests of a broad cross-section of stakeholders. This will facilitate transportation planning activities to help meet program goals. To achieve this broad stakeholder involvement, OCRWM will continue to ensure that the experience, knowledge, and expertise of the transportation and nuclear industries, regulatory agencies, State, Tribal and local governments, and others who have an essential interest are considered. OCRWM also plans to continue to involve the Transportation External Coordination Working Group (TEC) membership, which consists of a broad base of stakeholders, in providing input to the decisionmaking process.

TEC ROUTING TOPIC GROUP

As an example of DOE's initiative to incorporate stakeholder input on routing, in October 2006, it recommended that the TEC Working Group form a Routing Topic Group (RTG) to provide detailed focus on routing. The topic group meets twice yearly, and holds monthly conference calls, exchanging views and interacting in the overall effort to find a reasonable approach to identify suites of routes. DOE intends that the topic group will provide cooperative, detailed input into route analysis, evaluation, and identification. The group's

work will feed into, and benefit from, other efforts undertaken by stakeholders and other entities to provide cooperative development of a routing approach and process.

The key activities initially planned for the RTG included:
1. Developing a consensus definition of the “suite of routes” concept;
2. Developing fundamental principles for routing;
3. Comparing approaches for identifying routes (e.g., use of “routing criteria”); and
4. Identifying a planning-basis suite of routes sufficient to support logistical planning and implementation of NWPA Section 180(c) pilot program.

In the interest of cooperative planning, DOE has stated its willingness to consider any reasonable approach for carrying out these activities. Preliminary analysis performed by the RTG will provide input on logistics, infrastructure, security and other studies that may need to be performed. The work of the RTG will also provide broadly accepted suites of routes and methods for identifying routes.

Routing Topic Group Standard Problem

Recently, at the encouragement of DOE, the RTG agreed to consider addressing a “Standard Problem” as a way to gain experience with the issues that surround identifying routes and allow comparison of alternative approaches in a cooperative environment.

The Standard Problem is an effort to collect detailed input from individual stakeholder's or groups' route analyses, evaluation, and identification exercises to ultimately develop a routing approach and process that is reasonable and benefits from the consideration of stakeholders’ views. The Standard Problem is intended to gain insights into differences in approaches that may be followed, values and the relative importance of those values that would govern route selection, and analytical methods that may be employed.

All members of the RTG are invited to participate by submitting their analysis for routing shipments from 12 regionally diffuse origin sites in four U.S. regions to the proposed railhead at Caliente, Nevada. The sites were identified only with consideration of the diversity of their geographic locations and include sites where reactors are shut down and sites that are not served by a railroad. These sites include in the Northeast: Indian Point, Maine Yankee and Salem/Hope Creek, in the South: South Texas, Browns Ferry and St. Lucie in the Midwest: Callaway, Zion and Prairie Island, and in the West: Palo Verde, Humboldt Bay and Hanford/Columbia.

The initial draft of the Standard Problem work plan, along with a list of resources and supplemental information, was provided to all the stakeholders in the RTG on January 4th, 2008 and will be followed up with an intensive work effort at the TEC meeting in February 2008, after comments have been received and a final draft of the work plan issued.

Each group may use any approach and tool(s) they choose so long as it is reasonable, clearly described, has alternatives where available, and can be replicated, and each will submit a written report on their approach, to include a map and a brief summary, that will

be presented and discussed at a future TEC meeting. The next step will be for the RTG to use the result of the Standard Problem to develop a RTG perspective and RTG recommendations and insights regarding a path forward to identify national suites of rail and highway routes for OCRWM shipments.

BENCHMARKING

Shipments will build upon a well-established history of safe domestic SNF shipments. In carrying out its mission, OCRWM will build on DOE's own experience of over 40 years in successfully planning and executing shipments of hazardous materials, including prior experience shipping SNF and radioactive waste. OCRWM has benchmarked the more recent shipment experiences of the Foreign Research Reactor Spent Fuel Program, Waste Isolation Pilot Project, and Navy Nuclear Propulsion Program. These benchmarking efforts, which examined previous and ongoing shipping campaigns to take advantage of lessons learned, will provide useful background information in the national routing effort.
Information is also being obtained from operators of the commercial reactors.

DOE recently collected information and documented the experiences of AREVA regarding shipping SNF in France. Plans are being developed to also collect benchmark information from domestic private industry regarding its experience in shipping radioactive materials and nuclear fuel.

Information is also being obtained from the operators of commercial reactor and DOE sites, where the shipments will originate. This includes data about local infrastructure and other needs to ensure that the interests of the operators of shipping sites and their communities are properly considered during transportation planning and route identification.

ROUTING LEGISLATION AND REGULATIONS

SNF and HLW are only one category of hazardous materials, and hazardous materials are shipped safely and securely by all modes on many different routes every day. Nonetheless, the characteristics of individual routes may differ sufficiently to cause some routes to be preferred to others for particular types of hazardous materials shipments. To help identify the routes that it will use, OCRWM is developing a potential set of routing principles that could be used to identify a national suite of routes for discussion among DOE and its stakeholders.

U.S. Department of Transportation (DOT), U.S. Nuclear Regulatory Commission (NRC) and U.S. Department of Homeland Security (DHS) regulations and guidance will comprise the starting point for routing criteria discussions.

DOT regulations and guidance specify highway routing requirements (i.e., criteria) for Highway Route Controlled Quantity (HRCQ) shipments of radioactive materials. The DOT regulations require a commercial motor carrier transporting HRCQ to use "preferred routes" which are defined in the regulations as the interstate highway system, interstate

bypasses and beltways, and preferred routes designated by State routing agencies. States, in order to designate alternative routes, must follow a prescribed process and demonstrate that use of the alternates would minimize radiological risk to the public. States must also document there has been consultation with affected jurisdictions and demonstrate that alternative routes enhance overall public safety.

On August 3, 2007, Congress passed, and the President signed, the "Implementing the 9/11 Commission Recommendations Act" (Public Law No: 110-53). In brief, the legislation requires that commercial rail carriers annually provide written analysis of the safety and security of routes used, and at least every three years conduct a review of the routes for safety and security concerns. The reviews are meant to identify practicable alternatives and provide comparative safety and security assessments which consider mitigation, remediation, potential economic effects and the utilization of carrier interchange agreements.

At the time this paper was being prepared, DOT was finalizing its rules governing rail routing of shipments of more than 5,000 lbs in a single carload of certain kinds of explosives; bulk quantities of toxic by inhalation materials; and highway-route controlled quantities of certain radioactive materials. The rules are described in Docket HM-232-E – Hazardous Materials: Enhancing Rail Transportation Safety and Security for Hazardous Materials Shipments. DOT expects to issue the rules early in 2008.

In large measure, HM-232E embodies operating practices endorsed by the Association of American Railroads and already implemented by the rail industry. The proposed rules would require commercial rail carriers of the affected hazardous materials to include in security plans an evaluation, according to specified security criteria, of the rail transportation routes over which the specified materials are transported and of the most practicable alternative shipping routes. Commercial rail carriers would be required to "utilize these analyses to transport these materials over the safest and most secure commercially practicable routes." Prior to these proposed rules, shippers and rail carriers could determine routes for rail shipments based on factors they considered important to service and operational requirements.

PLANNING PRINCIPLES FOR ROUTING

Many planning principles, including safety and security as well as operational and industrial practices need to be considered in planning the operations, including routing, of the transportation system. In the process of identifying suites of routes that it will use, OCRWM has begun to identify principles that can be broadly applied. DOE orders, policies, and practices; and industry standards will further delineate these principles. The results of the benchmarking studies and the Standard Problem exercise described above will also inform the routing process as will additional stakeholder inputs. Concurrent with the coordination of other program stakeholders on criteria development and identification of routes, OCRWM will work with rail and truck carriers and others involved in the transportation industry to ensure the criteria used in routing development are consistent with operational and safety practices. The purpose of the coordination efforts will be to

help ensure that the experience, knowledge, and expertise of the transportation industry, other Federal agencies, affected sites and communities, and current shippers are all considered in the process to identify preliminary national suites of routes. Additional routing criteria being suggested include: the desire to minimize emergency response time; the ability to retrieve casks in the event of an accident; avoiding difficult to evacuate population centers; minimizing transit during inclement weather; avoiding hazardous situations; and imposing day-of-week and time-of-day restrictions.

DOE Manual M 460.2-1, the *U.S. Department of Energy Radioactive Material Transportation Practices Manual* (Manual)[4], establishes a set of standard transportation practices for DOE and DOE contractors to use in planning and executing shipments of radioactive materials. For rail routing of SNF, the Manual states that the following factors will be considered: (1) distance traveled; (2) the number of interchanges between railroads along the route; (3) the use of higher-class track; and (4) operational input from carriers.

A preliminary list of routing principles has been developed for discussion among DOE and its stakeholders. The principles fall into two categories: safety and security planning principles, and operations and commercial principles.

Safety and Security Planning Principles

Safety and security are always the key concerns. Principles regarding safety and security can be grouped into four categories: operations safety, public safety, radiological safety, and regulatory compliance.

Operations Safety: Rail carriers have the best knowledge regarding the relative safety of train operations over alternative routes.

U.S. railroads have sophisticated systems for managing the flow of commodities on the rail lines they own and operate. These systems have the capability to provide managers real-time information regarding: a) the kinds of materials moving over each section of track; b) the safety status of the track and other fixed infrastructure; and c) the potential for rail-traffic interactions with respect to OCRWM shipments. All three of these factors will be important to safe rail transportation of nuclear waste.

The kinds of materials moving over a section of track can be important because of the potential for interactions with OCRWM shipments in the event of accidents. In planning for shipments to Yucca Mountain, OCRWM would likely request that railroad managers select the routes in a way that would limit the length of time and the distance that OCRWM shipments would share routes with other shipments of certain hazardous materials.

Among other factors, the railroads and Federal Railroad Administration (FRA) regulations limit train speeds according to the class of the track being used. Track class encompasses track type, conditions, and geometry. Train speeds are also limited by environmental factors, train consist, and commodity. For example, Key Trains, the designation as per AAR

Circular OT-55[5] required for trains transporting spent nuclear fuel and high-level radioactive waste, are limited to a maximum speed of 50 m.p.h.

Over any section of track the maximum allowable speed of trains may change due to dynamic factors such as the class of track and environmental changes. For example, track condition changes as a consequence of use and weather conditions. Railroad companies and the FRA monitor the condition of track to ensure that trains operate safely and to determine when and where to conduct track inspections and maintenance, as described in the FRA Safety Compliance Oversight Plan[6].

Public Safety: State, Tribal, and local governments have the best knowledge regarding unique public safety vulnerabilities along routes through their jurisdictions.

States and Tribes have primary responsibility for ensuring the safety of their residents and for responding to any accident which might occur. They know best how and where to deploy their public safety and emergency response resources. They will also know which routes will provide their response resources the greatest capabilities to recover from unusual conditions and incidents that might occur. The NWPA Section 180(c) funding and technical assistance provided by DOE for training local public safety officials in safe routine transportation and emergency response procedures will enhance State and Tribal preparedness along routes that are identified for shipments to Yucca Mountain.

Radiological Safety: Routes that reduce overall time in transit are preferred.

In its report *Identification of Factors for Selecting Modes and Routes for Shipping High-Level Radioactive Waste and Spent Nuclear Fuel*[7], the DOT concluded that there are six primary mode and route factors that are the most important to public safety. In selecting modes and routes for shipping SNF and HLW, shippers should consider general population exposed, occupational population exposed, shipment duration, accident rate, trip length, and amount of material. The report illustrates how each of these factors affects a measure of radiological risk but noted that shipment duration most strongly affects the safety of radioactive material transportation because it has a direct relationship with incident-free radiological exposure. Shipment duration incorporates major considerations of route length, vehicle speeds, and the number and duration of both delays and stops en route.

Regulatory Compliance: Safety for highway shipments is ensured by adherence to regulatory requirements of the U.S. Department of Transportation for routing Highway Route Controlled Quantities (HRCQ) of radioactive materials.

Rules in 49 CFR 397.101 regulate motor carriers that transport highway route controlled quantities of radioactive materials, which include spent nuclear fuel and high-level radioactive waste. Commercial motor carriers must follow these rules when selecting the routes used, including pick-up routes used to access the nearest preferred route, preferred routes that reduce time in transit, and delivery routes. OCRWM shipments of commercial spent nuclear fuel or high-level radioactive waste by truck will follow these requirements.

In addition, proposed rules that are expected to be finalized in 2008 (see HM-232E) will likely address requirements for railroads regarding routing of shipments of HRCQ radioactive materials.

Operations and Commercial Principles

In addition to matters of safety and security, OCRWM has identified and is discussing with stakeholders some additional concerns for shipment operations. These are security and operational flexibility, operational efficiency, operational utility, and commercial practicability.

Security and Operational Flexibility: More than one unique and practical route from each site to Yucca Mountain should be available for shipments.

Transportation security will be enhanced if persons who do not have a need to know are unable to predict the routes that will be used by specific shipments. Also, weather or other unforeseeable events could make a specific route unsafe, impassable, or undesirable for use. Such conditions can arise quickly and require rerouting of shipments. For such cases, alternative routes will be used. In some cases, only one practicable mode or route may be available, but DOE would only proceed with shipments that it believes can be made safely and securely.

Operational Efficiency: Direct routes that reduce time in transit and (for rail shipments) minimize the number of interchanges of shipments between different carriers should be preferred.

Shipments are expected to employ and involve substantial DOE, Federal, State, Tribal, local, and transportation carrier resources. It will be important and necessary to make efficient use of these resources. Time in transit will possibly be the most important factor that will affect requirements in several resource areas including carrier operations, transportation security, shipment tracking, and vehicle and cask fleet utilization. Time in transit will be affected by the number of rail carrier interchanges, distance traveled, type and amount of other traffic using the route, route conditions, and environmental conditions. Some of these factors will be dynamic and could change over time.

Practicability: More than one commercially practicable route from each site to Yucca Mountain should be available so that in the event of an emergency or route disruption shipments can be rerouted.

Occasionally, events and conditions (e.g., inclement weather, construction or maintenance, accidents, security, and public events) along a route may render it temporarily unusable for shipments to Yucca Mountain. The process to implement temporary adjustments will be described in planning documents. Considerations for these conditions are also detailed in the Manual (DOE M 460.2-1).

The special requirements for shipping SNF and HLW can impact the usual business practices and operations of transportation carriers. These operations involve routine, often time-sensitive, continuous movements of commodities for all sectors of the U.S. economy. OCRWM will work with the railroads in an effort to ensure Yucca Mountain shipments do not disrupt other rail traffic. In order to decrease the potential for OCRWM shipments to significantly impact other carrier operations, the routes that are used will likely be those determined able to accommodate the special needs of the shipments while also allowing routine, safe flow of other rail traffic and operations. OCRWM expects to coordinate extensively with the carriers on these issues.

CONCLUSIONS

The path toward developing a safe, secure, and efficient transportation system for shipments of SNF and HLW to Yucca Mountain will require the participation of many interested parties. Real cooperative planning is sometimes challenging, and requires a commitment from all involved parties to act in good faith and to employ their best efforts in developing mutually beneficial solutions. Identifying routes to the proposed repository at Yucca Mountain, and engaging in planning and preparedness activities with affected jurisdictions and other stakeholders, will take time. OCRWM is committed to a cooperative approach that will ultimately enhance safety, security, efficiency and public confidence.

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