Transportation of High-Level Radioactive Waste and Spent Nuclear Fuel: Proposed Rail Inspection Program to Promote Reciprocity - 9397

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ABSTRACT

With the Department of Energy's (DOE) recent submittal of the license application, the siting of Yucca Mountain. as a national spent nuclear fuel (SNF) repository moves one step closer to reality. Under the "mostly rail" transportation scenario preferred by DOE for movement of spent fuel to the site, State and Federal regulators are focusing on the review of current practices for rail safety inspections and the development of new policies and procedures necessary to show compliance with new and existing rail safety regulations, while improving public confidence in movement of these materials. For more than a decade the Commercial Vehicle Safety Alliance (CVSA) has worked with DOE and the U.S. Department of Transportation (DOT) on the development and implementation of inspection standards and out-of-service criteria for highway shipments of SNF. In addition to providing uniform inspection standards and training for inspection staff, CVSA also developed a system for communicating inspection results to other states along a transportation corridor, decreasing the number or level of detail for inspections at State borders and setting up the opportunity for inspection reciprocity.

While the CVSA program has been successful for regulation of highway movements of spent fuel, there is currently no analogous inspection program or standard for rail safety. Rail safety regulations are enforced by the Federal Railroad Administration (FRA) and State rail safety programs, through the FRA's State Participation Program. States now participate in six safety disciplines including track, motor power & equipment (MP&E), signal, grade crossings, hazardous materials, and operating practices. State level inspectors are training and certified by the FRA and have the authority to enforce FRA regulations in their own jurisdictions. Members of DOE's Transportation External Coordination Working Group's (TEC/WG) Rail Topic Group have compiled existing regulations and developed inspection formats that are comparable to information the CVSA program uses for inspection of spent nuclear fuel shipments by highway. The intended result is the development of standard inspection formats and processes that allow for availability and acceptance of inspection results and create the opportunity for reciprocity along transportation corridors. An operating site at Yucca Mountain could receive approximately 130 rail shipments annually. The large number of shipments will require and expansion of existing rail safety inspection programs and streamlining of inspection policies to ensure a safe and efficient process that best meets the needs of all stakeholders.

INTRODUCTION

In June 2008, the Department of Energy (DOE) submitted a license application to the Nuclear Regulatory Commission (NRC) for authorization to construct a repository for spent nuclear fuel and high-level radioactive waste at Yucca Mountain, Nevada. This site is 90 miles northwest of Las Vegas. Currently, the waste is stored at 121 temporary facilities in 39 States. In 2002, the President and Congress designated Yucca Mountain as the site for the repository. The NRC is the licensing and regulatory agency that will make the final decision on whether the DOE will proceed with the construction and operation of the repository. It may take 3-4 years to review the application and make a determination.

Assuming the license is approved and the facility is constructed, the repository could receive as many as 175 spent nuclear fuel shipments per year for a period of 24 years. In 2004, DOE announced that rail was the preferred mode of transportation for movement of SNF from reactor sites to the repository. This decision is driving rail infrastructure improvements at reactor sites and will require construction of a major rail corridor across Nevada, to the repository site. While rail is the "preferred" mode, infrastructure limitations will dictate that some fraction of shipments received at the repository will be by heavy haul truck. Current estimates suggest the repository could receive as many as 130 rail shipments and 45 truck shipments annually.

As part of the Nuclear Waste Policy Act of 1982, DOE is required to work with stakeholders, including the transportation industry, States, Tribes and other federal agencies on issues related to transportation planning, safety and emergency preparedness. One of the avenues for stakeholder interaction is the State Regional Groups (SRG). Another forum that includes both government and industry is DOE's TEG/WG. Both groups give participating organizations the opportunity to weigh in on issues such as routing, advance notification, emergency response funding, training, inspections and escorts and help to ensure that all stakeholders contribute to the success of the transportation and storage endeavors.

SAFETY INSPECTIONS FOR SNF SHIPMENTS

Of particular interest to stakeholders is safety of SNF shipments to the repository. While the NRC has some authority in the regulation of transportation, their responsibilities are limited to the certification of packages, advanced notification and security standards for shipments. DOT is the governing body responsible for the safety standards for transportation via rail and highway. The two organizations that enforce DOT safety regulations are the FRA and the Federal Motor Carrier Administration (FMCA). In most cases, federal transportation regulations are adopted by States and enforced by the State program responsible for motor carrier safety, such as the State Department of Transportation, State Police or Highway Patrol. The Rail Safety Act of 1970 gave State rail safety inspectors the authority to enforce FRA regulations within their own states. State rail safety programs are often located with State transportation departments or public utility Commissions. Railroad safety inspectors from these programs are certified and qualified to enforce FRA regulations through the FRA's Rail Safety State Participation Program.

FRA State Participation Program

The State Participation Program provides state personnel with the training and experience necessary to conduct railroad safety inspections. States currently participate in six safety disciplines. These disciplines include track inspection, motor power & equipment (MP&E) inspection, signal/grade crossing inspections, hazardous materials inspections, and inspection of operating practices. There are currently 160 safety inspectors from 30 states participating in the program. FRA inspectors often coordinate and work with State rail safety inspectors to fulfill the safety and inspection requirements that all stakeholders demand. Training state inspectors is one of the FRA's major customer service initiatives. The training and certification program helps states develop rail safety programs and enables qualified state inspectors to maintain technical proficiency.

Commercial Vehicle Safety Alliance (CVSA)

CVSA is an international not-for-profit organization comprised of local, state, provincial, territorial and federal motor carrier safety officials and industry representatives from the United States, Canada, and Mexico. Their mission is to promote commercial motor vehicle safety and security by providing leadership to enforcement, industry and policy makers. Through a cooperative agreement with DOE, CVSA has spent the last decade developing the "north American inspection standard" for highway shipments of transuranic waste and highway route controlled quantities of radioactive materials.

The standard has been adopted by the USDOT and all shipments of these materials are now required to have a CVSA Level VI inspection on the vehicle and packaging, prior to departure. In addition to development of a strict inspection and out-of-service criteria, one of the objectives of the standard was to create an avenue for reciprocity between inspection and enforcement organizations along transportation corridors. That is, they hoped that the availability of documentation showing compliance with the standard at the point of origin would eliminate the need for additional inspections at state borders or other jurisdictional crossings along the route. A hallmark of the CVSA inspection program is the production of standard inspection reports, in an electronic format, that are easily transferred or communicated to inspection and enforcement organizations downstream, along a transportation corridor.

TEC/WG RAIL TOPIC GROUP – INSPECTIONS SUBGROUP

The objective of the Inspections Subgroup of the TEC/WG Rail Topic Group was to review the CVSA Level VI standards for highway and identify existing safety standards that would correlate to and provide the same level of safety for rail movements. During the review process it was noted that by the nature of rail transport, the inspection standards would be more complex and the inspection process could be more time consuming. However, by regulation, many components within the rail safety standards only require inspection on an annual basis. For rail applications, the non-governmental industry group, the American Association of Railroads (AAR), functions in much the same way the non-governmental CVSA group, indentifying inspection standards and criteria. Neither the FRA nor the AAR has designed a concise inspection standard that relates directly to CVSA's Level VI standard.

The FRA has developed what is referred to as the Safety Compliance Over site Plan or SCOP. In some respects the SCOP is more far reaching that a CVSA Level VI inspection because it addresses track, bridges and other infrastructure, along with equipment. Table I includes those items that would be addressed under the existing SCOP and the proposed frequencies.

Table I. Summary of the SCOP Inspections

- FRA will arrange for a track geometry car to operate over designated routes.
- FRA will conduct visual inspections of bridges along the designated routes and review railroads' bridge inspection programs to ascertain structural integrity.
- FRA will review the rail carrier's rail flaw detection vehicle data to ensure that a rail flaw detection vehicle has been operated over the designated route, and necessary rail repairs are made prior to shipments.
- The SCOP requires that every train involved in the transportation of Spent Nuclear Fuel (SNF) and High-Level Radioactive Waste (HLRW) be equipped with a 2-way End-of-Train (EOT) braking device, regardless of train length.
- Prior to each shipment, and during each crew change point along the route, FRA will endeavor to inspect trains to ascertain that EOTs are operational.
- Along a designated route, FRA will inspect all automated warning devices, at highway-rail grade crossings along the route, to ascertain that they are operational.
- FRA will assist DOE and the offeror or agent in the development of Emergency Response training and safety briefings. FRA also will liaison with the rail industry to verify that requisite training and briefings have been performed.
- Prior to the first shipment, and at least annually for subsequent shipments, FRA will review emergency response plans for designated routes and recommend modifications, if necessary.
- Prior to the first shipment, and at least annually for subsequent shipments, FRA will conduct the necessary reviews to ensure that train crews are properly certified, trained, and experienced in operating over the designated routes.
- FRA will place Operating Practices personnel in the rail carriers dispatching centers for the first shipment on designated routes, and will review dispatching procedures periodically for subsequent shipments.
- Prior to the first shipment, and for subsequent shipments as appropriate, FRA will focus on Operation Lifesaver training in communities along designated routes

SCOP is a very good first step in the inspection process for rail transportation. It is a living document and will undergo revisions with new technologies, investigations, technical analyses, and regulations. However, it falls short in comparison to a CVSA type inspection because the inspection frequencies do not guarantee inspections will be required for every shipment and there is no apparent means for documentation or transmittal of information.

For shipments to a national repository, safety inspections will be conducted prior to transport and along the selected routes. At their discretion, states may choose to inspect shipments. Rail transportation inspection procedures are different than highway because rail is on private property, whereas inspections of trucks are performed on the public highway system. The inspection points must be worked out well in advance of the shipment. For truck shipments, ports of entry are generally acceptable. For rail shipments, the shipper and carrier should strive to arrange crew changes and routine inspections, at a point that will accommodate the needs of state inspectors. To meet the intent of state policies or laws, the inspection points for rail and truck shipments must be reasonably close to the state's border. In 2005, DOE announced its policy decision to use dedicated train service, meaning – no other freight will be included in the train. Benefits of this service include system efficiency and operational control. Another benefit is that safety inspectors will not have to inspect an entire freight train at each inspection point; the inspection will concentrate on the cask cars and locomotive.

The Inspections Subgroup of the TEC/WG developed a system of coordinated safety inspections for use by FRA and FRA-certified state inspectors. The purpose of this proposed inspection program is to identify inspection standards and provide uniform criteria. The intended result is the development of standard inspection formats and processes – similar to what CVSA has done for truck shipments – that allow for availability and acceptance of inspection results and create the opportunity for reciprocity along transportation corridors.

A fundamental part of the inspection procedures created by the TEC/WG Inspections Subgroup is an inspection form for the inspectors to complete (Figure I).

Figure I. Spent Fuel Freight Point of Origin Inspections List

SPENT FUEL FREIGHT POINT OF ORIGIN INSPECTIONS LIST

General

Location of inspection:_____
Date:_____
_
Shipment type: _____
Shipment route: _____
Shipper:
_____
Shipper reference number: _____
Carrier: _____
Locomotive number: _____
Rail car number:_____

Cask model number:_____
Cask serial number: _____
FRA personnel performing inspection:_____
NRC personnel performing inspection: _____
State personnel performing inspection_____
Security seals on cask: _____
Bracing present: _____
Communication system: _____
Cell
#:_____

Motive Power and Equipment Inspection

Items to be checked immediately prior to use. Please see reference guide for specific items under each general category.

49 CFR	Item Category	(please note if not applicable)	
215.103	Wheel Defects	☐ No defect found	☐ Defect found:
215.105	Axle Defects	☐ No defect found	☐ Defect found:
215.115	Roller Bearing Defects	☐ No defect found	☐ Defect found:
215.117	Roller Bearing Adapter Defects	☐ No defect found	☐ Defect found:
215.119	Freight Car Truck Defects	☐ No defect found	☐ Defect found:
215.121	Car Body Defects	☐ No defect found	☐ Defect found:
215.123	Coupler Defects	☐ No defect found	☐ Defect found:
215.127	Draft Gear Defects	☐ No defect found	☐ Defect found:
215.301	Stenciling Defects	☐ No defect found	☐ Defect found:
224.103	Characteristics of Reflective Sheeting Defects	☐ No defect found	☐ Defect found:
224.105	Sheeting Dimension Defects	☐ No defect found	☐ Defect found:
232.105	General Requirements for Locomotive Brake Defects	☐ No defect found	☐ Defect found:
232.205	Air Brake Rigging Defects	☐ No defect found	☐ Defect found:
232.303	Air Brake Piping and Related Defects	☐ No defect found	☐ Defect found:
232.409	End-of-Train Device Defects	☐ No defect found	☐ Defect found:

Comments or defect specifics:

The form, signed by a duly certified inspector, would acknowledge that the rail equipment, including the locomotive, complies with FRA regulations. The subgroup also developed Reference Sheets for the MP&E inspectors to refer to for a quick guide to the pertinent regulations. The inspectors may use the Reference Sheets as

a checklist while they perform their inspection. Safety inspections of the rail cars and locomotives to be used in transporting the material will reduce the risk of mechanical failure and ensure the operational readiness of the rail cars and locomotives for each shipment; it will also ensure that corrective action is taken as necessary.

The Hazardous Material (HM) inspectors would also check the shipment for FRA compliance. The Inspections Subgroup created a Hazardous Materials Inspection Form for these inspectors to complete (Figure II).

Figure II. Hazardous Materials Inspection Form

Hazmat Inspection

Shipping Paper (49 CFR 172.101, 172.200, 172.402, 172.403, 172.436-440, 173.403, 397.101)

Shipping name:		
ID number:		
Total quantity and unit of measurement:		
Radionuclides that represent 95% of total radioactive material:		
Physical and Chemical form:		
Activity (must be noted in SI units):	TBq	Ci
Highway route controlled quantity (if applicable):		
Exclusive use shipment (if applicable):		
Label type – category of label:		
SCO I or II or LSA, if appropriate:		
Transport Index – assigned to each package if labeled as a Radioactive Yellow II or III:	Yes	No
Fissile excepted- if appropriate:	Yes	No
"Warning- Fissile material controlled shipment …" if applicable:	Yes	No
Package identification – Entry of NRC or DOT certificate identification marking:	Yes	No
Instruction for exclusive use – if applicable:	Yes	No
Certification signature:	Yes	No
Shipping paper match label:	Yes	No
Rail route plan available:	Yes	No
Emergency Response Information available:	Yes	No
Emergency Response Telephone number available:	Yes	No
Hazardous substance notation (RQ) present, if applicable:	Yes	No
CSI label present (if applicable):	Yes	No

Labeling (49 CFR 172.403, 172.436-440, 173.433-435)

Label type		
Labels legibly marked w/ contents, (radionuclides) activity, and transport index:	Yes	No
Label on two sides:	Yes	No
CSI label when applicable:	Yes	No

Markings (49 CFR 172.301, 172.310)

Gross weight – for packages of over 110 pounds	Yes	No
Type B packages shall have "Type B" shall be marked on the outside of the vehicle:	Yes	No
Type B, B(U), B(M) must be marked with the radiation symbol:	Yes	No
Package identification markings – outside of package shall be marked with identification markings indicating package certificate number:	Yes	No
Proper shipping name and UN number:	Yes	No
Name and address of consignee/consignor:	Yes	No
Security seal on package for Type B packages – reference 10CFR 71.43(b):	Yes	No
"RQ" for shipments that meet the definition of a hazardous substance:	Yes	No

Cask Placarding (49 CFR 172.504, 172.505, 172.527, 172.556)

When placards on required must be on all 4 sides:	Yes	No
UN I.D. number (not allowed for domestic shipments of Class 7 materials):	Yes	No

It is important to standardize the hazardous materials inspection procedure so there is reciprocity throughout the country. The standardization includes the inspection procedure and radiological equipment for FRA and state personnel. Training is the key to standardization and reciprocity. A sample of uniform training for the hazardous material inspectors would include identifying shipping paper information, package selection, package markings, package placarding and activity level limits. In addition to the Hazardous Materials Inspection Form, a Radiological Survey Data Form is being developed to record survey meter readings. This Form, if adopted, will provide standardization among inspections.

CONCLUSION

State authority to conduct inspections and escort shipments enhances transportation safety and reinforces public confidence in the safety of radioactive materials transportation. The CVSA Level VI inspection program is widely

endorsed by the states and is now included as part of federal requirements for highway shipments of SNF. Through the Rail TEC Topic Group, states are working with the FRA to develop a system for downstream compliance confidence similar to CVSA. This CVSA-type inspection system would provide confidence and information to downstream states. For example, the inspection forms could be transferred via TRANSCOM or other tracking systems, giving access to secure interested parties. The inspection plan may also assist in keeping the shipment traveling without stopping for redundant inspections. The federal inspectors will coordinate and work with state safety inspectors to fulfill the safety requirements that all stakeholders demand. With all agencies working together, the unblemished goal of safely transporting radioactive waste will continue.