Department of Energy Spent Fuel Shipping Campaigns: Comparisons of Transportation Plans and Lessons Learned

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ABSTRACT

Over the last 30 years, the U.S. Department of Energy (DOE) has successfully and safely transported shipments of spent nuclear fuel over America's highways and railroads. During that time, an exemplary safety record has been established with no identifiable fatalities, injuries, or environmental damage caused by the radioactive nature of the shipments. This paper evaluates some rail and truck shipping campaigns, planning processes, and selected transportation plans to identify lessons learned in terms of planning and programmatic activities. The intent of this evaluation is to document best practices from current processes and previous plans for DOE programs preparing or considering future plans. DOE's National Transportation Program (NTP) reviewed 13 plans, beginning with core debris shipments from Three Mile Island to current, ongoing fuel campaigns. This paper describes lessons learned in the areas of: emergency planning, planning information, security, shipment prenotification, emergency notification/response, terrorism/sabotage risk, and recovery and cleanup, as well as routing, security, carrier/driver requirements, transportation operational contingencies, tracking, inspections and safe parking.

INTRODUCTION

Over the last 30 years, the U.S. Department of Energy (DOE) has successfully and safely transported thousands of shipments of spent nuclear fuel (SNF) over America's highways and railroads. During that time, an exemplary safety record has been established with no identifiable fatalities, injuries, or environmental damage caused by the radioactive nature of the shipments.

DOE-owned SNF will be transported to three sites for consolidation: the Savannah River Site (SRS), the Idaho National Engineering and Environmental Laboratory (INEEL), and the Hanford Reservation, and then to a geologic repository when one becomes operational. Specially designed containers called "casks" are used to transport SNF. Before a cask can be used, its design must be licensed by the Nuclear Regulatory Commission (NRC) or certified by the U.S. Department of Transportation (DOT) to ensure that it will protect the fuel even in the event of an accident. Prior to shipment of SNF, comprehensive operational, preparedness, and communications planning takes place.

Purpose and Scope

This paper benchmarks the recently approved *Radioactive Material Transportation Practices Manual (2002)*,1 also know as the "protocols," against recent transportation plans and guides for rail and highway shipping campaigns in terms of specific planning and programmatic activities for the shipping of radioactive waste. The protocols are the most current descriptions the Department has for describing the transportation planning process and specific operational planning issues. Although the actual transportation plans and planning guidance examined in this document were developed before the protocols were issued, this comparison has been made to compare DOE's past and current practices, develop lessons learned and

potential findings that future planners may find useful in conducting their own shipping campaigns. Twelve overall planning processes and transportation plans were reviewed and compared against the recent protocols.

The documents reviewed consisted of actual transportation plans, a paper documenting a shipping campaign, a summary on a shipping campaign, and planning guides. Specifically, these included:

Transportation plans:

U.S. Department of Energy Foreign Research Reactor Nuclear Spent Fuel Shipments Transportation Plan for Rail or Motor Transport, Charleston, SC to Savannah River Site (1998),2
U.S. Department of Energy Foreign Research Reactor Spent Nuclear Fuel Shipments Transportation Plan for Motor Carrier Transport, Savannah River Site to Idaho National Engineering and Environmental Laboratory (2001),3
Transportation Plan for the West Valley Spent Nuclear Fuel Shipment Project (2001),4
*U.S. Department of Energy Brookhaven National Laboratory High Flux Beam Reactor (HFBR) Spent Fuel Transportation Plan (1997),*5
U.S. Department of Energy Cesium Transportation Plan (1994),6
Commercial Light Water Reactor Project Office Transportation Implementation Plan (1999),7

A summary entitled:
Historical Summary of the Three Mile Island Unit 2 Core Debris Transportation Campaign (1993),8

A paper entitled:
Transportation Planning and Execution: Commercial Spent Nuclear Fuel, documenting the Shoreham fuel transfer campaign (1997).9

Planning guides:
Western Governors' Association WIPP Transportation Safety Program Implementation Guide (2002),10
Program Manager's Guide to Transportation Planning (1998),11
Planning Guide for Shipments of Radioactive Waste through the Midwestern States (2002),12
TEC/WG Transportation WIPP-PIG Rail Comparison (1999).13

This report was developed from a review of the above literature with the objective of identifying findings and lessons learned in the areas of transportation planning, emergency planning, projected shipment planning information, shipment prenotification, emergency notification, routing, security including terrorism/sabotage risk, carrier/driver requirements, transportation operational contingencies, tracking, inspections, safe parking, emergency response, and recovery. These topical areas are derived from the 14 "protocols" developed in the *Radioactive Material Transportation Practices Manual*.

Table 1 summarizes the characteristics of the campaigns in this report. As seen in Table 1, in addition to representing both rail and highway transportation modes, the selected campaigns also represent long and short campaigns and campaigns that were conducted at different times.

Table I. Shipping Campaigns Summary

Title of Plan	*Shipper*	*Origin*	*Destination*	*Type of Fuel Shipped*	*Transport Mode*	*Duration*	*No. of Shipments**
U.S. DOE Foreign Research Reactor Nuclear Spent Fuel Shipment Transportation Plan for Rail or Motor Carrier Transport Charleston, SC to SRS	DOE; foreign reactor operators	Overseas via Naval Weapons Station, Charleston, SC	SRS, SC	material test reactor (MTR)-type research reactor SNF	Rail and Motor	1996-2006	TBD; 24 as of 9/02
Historical Summary of the Three Mile Island Unit 2 Core Debris Transportation Campaign	GPU Nuclear	Three Mile Island, Harrisburg, PA	INEEL, Scoville, ID	core debris	Rail	1986-1990	22
Transportation Plan for the West Valley Spent Nuclear Fuel Shipment	DOE	West Valley, NY	INEEL, Scoville, ID	85 boiling water reactor (BWR)-assemblies; 40 pressurized water reactor assemblies	Rail	2003	1
U.S. DOE Brookhaven National Laboratory High Flux Beam Reactor (HFBR) Spent Fuel Transportation Plan	DOE	Brookhaven National Laboratory, Upton, NY	SRS, SC	840 spent fuel elements	Motor	1997	4
U.S. DOE Cesium Transportation Plan	DOE	IOtech Facility, Northglenn, CO	Hanford Site, WA	309 cesium capsules	Motor	1994-1995	22
U.S. DOE Commercial Light Water Reactor Project Office Transportation Implementation Plan	DOE	Watts Bar Nuclear Plant, TN	ANL-West, ID	4 lead test Assemblies	Motor	1999	4
U.S. DOE Foreign Research Reactor Spent Nuclear Fuel Shipments Transportation Plan for Motor Carrier Transport, SRS to INEEL	DOE	SRS, SC	INEEL, Idaho Falls, ID	X MTHM of TRIGA foreign research reactor spent fuel	Motor	1999-present	3
Transportation Planning and Execution: Commercial Spent Nuclear Fuel - Shoreham Fuel Transfer Project	Long Island Power Authority	Shoreham Nuclear Station, Long Island, NY	Limerick Nuclear Station, Limerick Township, PA	560 irradiated BWR fuel assemblies	Barge and Rail	1994	33

*Shipments are the number of actual shipments (contemporaneous movements of material), not the number of casks.

SRS = Savannah River Site; INEEL = Idaho National Engineering and Environmental Laboratory; ANL-W = Argonne National Laboratory-West; MTHM = metric tons of heavy metal; TRIGA = Training, Research, Isotope, General Atomic reactors

SUMMARY OF THE BENCHMARKING DOCUMENT

Benchmarking can be used to improve any activity performed by an organization, including transportation planning. For this benchmarking effort, the best practices identified were those outlined in the recent *Radioactive Material Transportation Practices Manual (2002)*. The Manual was developed to establish a set of standard transportation practices (also known as "protocols") for DOE programs to use in planning and executing offsite shipments of radioactive materials or waste. The identified practices are for use by all DOE programs, including those of the National Nuclear Security Administration (NNSA) and the Office of Civilian Radioactive Waste Management (RW). These practices establish a standardized process and framework for interacting with State, Tribal and local authorities and transportation contractors and carriers regarding DOE radioactive material shipments. DOE programs are responsible for compliance with all applicable transportation regulations and agreements with State, Tribal, and local authorities. The regulations provide a comprehensive basis for safely shipping radioactive materials.

SUMMARY OF THE BENCHMARKED DOCUMENTS

Introduction

The planning guides and transportation plans that were benchmarked consisted of both DOE and commercial documents. The first documents reviewed consisted of planning documents designed to help with the development of transportation plans. The other documents reviewed included a paper that outlined the planning steps for a commercial shipment, a document that described the lessons learned from a commercial shipment and several actual transportation plans. The documents also represented a wide range of shipments including SNF, cesium capsules, and core debris.

This section briefly describes the scope and purpose of the documents benchmarked against the protocols, and examines potential trends in the development of transportation planning. The documents analyzed were developed between 1993 and 2002. Some of the documents are still in use, while others are no longer used (i.e., the campaigns have been concluded).

Planning Guides

The *Program Manager's Guide to Transportation Planning (1998)*: The purpose of the Program Manager's Guide was to provide information to program managers on how to develop and execute a comprehensive shipping campaign. The National Transportation Program (NTP) published the Guide to assist DOE program managers at Headquarters and site offices in fulfilling their roles and responsibilities related to the transportation of hazardous materials. This Guide addresses all aspects of shipment planning and identifies selected resources, including DOE and contractor personnel, documents, regulations, and external organizations.

The DOE study, *Transportation External Coordination Working Group, TEC/WG Transportation WIPP-PIG* [Waste Isolation Pilot Plant Planning and Implementation Guide] *Rail Comparison: A Framework for Comparing Rail Safety Issues to Safety Issues Outlined in the WIPP Transportation Safety Planning & Implementation Guide (1999)*: The TEC Transportation Safety Rail Comparison was developed to provide summary information to TEC members and participants concerning the approach used for the rail mode in addressing a variety of transportation issues, objectives, approaches and procedures arising from the shipment of DOE-owned radioactive materials. This document was the result of a series of conference calls and face-to-face meetings involving group participants representing the rail industry, the regulatory community, Federal managers, research groups, and State, Tribal, and local officials. The document specifically compared WIPP transportation operational practices (defined in the WIPP-PIG) with those for rail shipments of radioactive material.

The *Western Governors' Association WIPP Transportation Safety Program Implementation Guide (2002)*: This guide presents the overall transportation issues, objectives, approaches and procedures which were

agreed to by the Western Corridor State Governors and DOE through a Memorandum of Agreement signed in 1996 for WIPP shipments. These issues, objectives, approaches and procedures govern the conduct of the highway transport of contact-handled transuranic waste through the Western States.

The Planning Guide for Shipments of Radioactive Materials Through the Midwestern States, a publication of The Council of State Governments' Midwestern Office and the Midwestern Radioactive materials Transportation Committee (2002): This planning guide outlines the expectations of the Midwestern states for all shippers that transport spent nuclear fuel, high-level radioactive waste, or transuranic waste through the region. The objectives of this planning guide are: to state the preferences of the Midwestern States regarding the best practices for shipping radioactive materials through the region, to provide shippers with a single source of information on the Midwestern states to help in planning shipping activities, and to improve the efficiency of the transportation process for both the Midwestern States and shippers.

Related Papers

The report *Transportation Planning and Execution: Commercial Spent Nuclear Fuel (1997)*: This report was presented to the Nuclear Waste Technical Review Board in November of 1997. This paper outlines the Shoreham Fuel Transfer Project shipping campaign and the planning that took place prior to the campaign. The preshipment planning took almost a year and included information on project management team assembly; routing modes and equipment; facility requirements; emergency response/public outreach, and planning integration.

Historical Summaries

Historical Summary of the Three Mile Island Unit 2 Core Debris Transportation Campaign (1993): This summary was developed to provide an understanding of the multiple-year effort to prepare, transport, receive and store core debris from Three Mile Island (TMI) at the INEEL. The document outlined the roles and responsibilities among involved organizations, logistical issues, site preparations, and public communications strategies.

Transportation Plans for Actual Shipping Campaigns

The *U.S. Department of Energy Foreign Research Reactor Nuclear Spent Fuel Shipments Transportation Plan for Rail or Motor Transport, Charleston, SC to Savannah River Site (1998)*: This plan was developed by SRS to outline the activities and responsibilities of DOE and other organizations to follow to conclude the movement of Foreign Research Reactor (FRR) SNF from the Naval Weapons Station-Charleston to the SRS. The plan summarizes transportation activities, organizational responsibilities, emergency preparedness guidelines, and other methods for achieving safe transport.

The *FRR SNF Shipments Transportation Plan for Motor Carrier Transport SRS to INEEL (2001)*: This plan identifies the responsibilities, requirements and procedures to ensure the successful, safe and efficient transportation of TRIGA fuel rods and pins from SRS to INEEL. The Plan summarizes transportation activities, organizational responsibilities, emergency preparedness guidelines, and other methods for achieving safe transport.

The West Valley Spent Nuclear Fuel Shipment Project (2001): This plan describes the requirements and organizational responsibilities of DOE, its contractors, rail carriers, States, Tribes, and other Federal agencies involved in the shipments. It provides information about the material, packaging, and tracking of shipments, route/operations, notifications, emergency response, and security for the shipments. (Note: as of the date of this publication, the initial shipment from West Valley to INEEL had not commenced.)

The *Brookhaven National Laboratory High Flux Beam Reactor SNF Transportation Plan (1997)*: This transportation plan was developed to outline the activities, responsibilities, requirements and procedures of DOE and other organizations to be followed to conclude a movement of research reactor SNF from Brookhaven National Laboratory (BNL) to SRS.

The *Cesium Transportation Plan (1994)*: This transportation plan identified responsibilities, requirements and procedures to ensure the successful return of cesium capsules from the Intelligent Operating Technologies, Inc. (IOtech) facility in Colorado to the Hanford Site. The plan summarizes transportation activities, organization responsibilities, emergency preparedness guidelines, and other methods for achieving safe transport.

The *U.S. Commercial Light Water Reactor Project Office Transportation Implementation Plan (1999)*: This plan was developed to create a single reference document that identifies the requirements and guidance needed for shipments of four irradiated Lead Test Assemblies (LTAs) from the Watts Bar Nuclear Plant in Tennessee to Argonne National Laboratory-West (ANL-W) in Idaho.

BEST PRACTICES AND FINDINGS FOR RAIL AND HIGHWAY SHIPPING CAMPAIGNS

Transportation Planning

Best practices for transportation planning shows that offsite transportation requires significant program planning and development to successfully move SNF and other materials. With the objectives of safe, secure, timely, and cost-effective movement of radioactive materials, the level of planning and development needed is based on a number of considerations. Generally defined as the activities that take place after the need for a shipment has been identified, transportation planning includes characterization and classification of the material to be shipped, identification of applicable regulatory and programmatic requirements, selection and procurement of appropriate packagings, evaluation and selection of modes and carriers to be used, and planning for needed public information. Shipment planning decisions are based first on statutory, regulatory, and Departmental requirements. Other considerations can include the relative hazard of the material involved, the public's perception of the risks associated with the material and its shipment, key intergovernmental partners who have regulatory authority or responsibility for public safety, the number of shipments needed, and the mode and route shipments may require. The protocols also include the best practice of having the cognizant DOE office consult with State and Tribal officials, and carrier representatives when developing plans and that the plans are to describe the operational strategy and steps needed to ensure regulatory compliance.

In an examination of past transportation plans and processes, the level of program planning and development varied considerably in terms of what was required and what different planners believed a transportation plan should contain. Some of the best practices identified in the *Program Manager's Guide for Transportation Planning* (1998) include using the logistics staff to develop a plan and having a plan that is operational and contains responsibilities, schedules, maps, emergency plans, communication plans, regulatory agreements, package recovery plans and packaging information. The *Midwestern Planning Document (2002)* outlines detailed guidelines offered by the States for shipment planning, including who should develop a transportation plan, who should review it, the timing of the plan, when planning should begin, the elements of an acceptable transportation plan, and the coordination and consultation involved. In the *TEC Rail Comparison* document (1999), a best practice identified is that the shipper of record should take the lead in developing coordinated communication plans with the various carriers.

For the rail transportation plans, best practices identified include integrated planning that all parties contributed to and abided by in the Shoreham SNF Transportation Plan (1997), and good coordination and working relationship between all the involved parties for the Three Mile Island Unit 2 Core Shipping Program Plan (1993). Best practices in the West Valley Plan (2001) included responsibilities, requirements and procedures, although there was no explicit mention of stakeholder involvement in the planning.

In the case of the highway campaigns reviewed, all but one of the campaigns had a best practice of cooperation among all the parties involved for transportation planning and included the responsibilities, requirements and procedures necessary to ensure a safe, efficient and cost-effective shipment.

Findings:

Despite the differences in shipments and in requirements for planning, all planning requires substantial teamwork among all parties involved, including agency traffic managers, emergency response planners, environment safety and health professionals, and public participation staff to safely transport SNF materials and their cohorts in state, tribal or other federal agencies.

Shipments which have transportation plans that describe operational strategies and delineate steps that will be taken to ensure compliance with applicable regulatory and DOE requirements have been shown to have support from state and tribal officials who previously had significant issues with DOE transportation. Transportation plans should include all aspects of the shipment, including organizational roles and responsibilities, material to be shipped, projected shipping window, estimated number of shipments, mode of transport and carriers to be used, packagings to be used, preferred and/or alternative routes, shipment prenotifications, safe parking arrangements, tracking systems, emergency preparedness and response, recovery and cleanup, security arrangements, and public information.

Emergency Planning

In recent years, the transport of all types of hazardous materials has gained increased visibility. This is particularly true for radioactive material. An underlying concern is the adequacy of emergency preparedness along DOE shipping corridors. Transportation plans should ensure that emergency planning has been done.

Best practices in the protocols include identification of hazards and threats, hazard mitigation, development and preparation of emergency plans and procedures, and identification of personnel, training, equipment, and other resources needed for an effective response. Other best practices in the protocols include the use of the DOE Transportation Emergency Preparedness Program (TEPP) "tools" for state and tribal authorities to assist them in preparing for response to a transportation incident involving DOE shipments of radioactive material.

Best practices identified in the planning guides and plans reviewed included requirements for emergency planning, including stakeholder involvement in developing the plan, identifying who is the responsible lead for developing the plan, and what constitutes an emergency response plan.

Like the protocols, the *Program Manager's Guide (1998)* recommends that the DOE Transportation Emergency Preparedness Program (TEPP) be used to ensure that procedures and resources are in place in the event of a shipping incident. The TEC Rail Comparison (1999) states that in the case of planning for rail emergencies, best practices result in the rail carriers committing much of the needed resources themselves for developing, testing, and implementing response plans. Other best practices include having Federal, State, Tribal and local agencies having distinct responsibilities in any response effort and having them participate in a variety of ways in the planning process. In the *WIPP Transportation Safety Program Implementation Guide (2002)*, emergency planning also included best practices of medical preparedness, mutual aid agreements, emergency response plans and procedures, training and exercises, and emergency response equipment. The *Planning Guide for Shipments of Radioactive Waste through the Midwestern States* (2002) requires that shippers have an adequate emergency management plan that identifies roles and responsibilities, the proper procedures, a list of emergency contacts, description of the resources available, and plans for recovery and cleanup.

In the case of the rail plans reviewed, the *FRR Rail Transportation Plan (1998)* states that the shipper [CSX Transportation (CSXT)] has contracted out certain incident response recovery assistance activities to private companies. The Shoreham SNF plan (1997) recognized the need for emergency response planning and incorporated it in its transportation plan with contact made ahead of time with the appropriate States. The TMI shipment (1993) coordinated the emergency response planning with stakeholders and planned for it through presentations, documentation and workshops.

In the case of the highway campaigns reviewed, some campaigns gave the lead for planning to State, Tribal and local agencies, although they offered DOE training or the TEPP for assistance. In several cases, emergency management plans were included as part of the overall transportation plan.

Findings:

Advance planning for transportation emergency response will be most effective if it is undertaken as a cooperative effort among transportation managers, public information managers, and emergency preparedness (TEPP) coordinators. DOE could benefit from using a consistent approach to planning for emergency response.

DOE implements the complex-wide TEPP to address preparedness issues for nonclassified/nonweapons radioactive material shipments. TEPP provides support to DOE and other Federal, State, Tribal, and local authorities to prepare for a response to a transportation incident involving DOE shipments of radioactive material. TEPP, by integrating transportation and emergency preparedness activities, takes a coordinated approach to addressing the emergency response concerns of State, Tribal, and local officials affected by DOE shipments. TEPP also ensures responders have access to the model plans and procedures, training, and technical assistance necessary to respond safely, efficiently, and effectively to transportation incidents.

In past campaigns, emergency planning has not always involved the TEPP (obviously, before TEPP became fully operational this would not have been possible). Some campaigns conducted shipment-specific training through a variety of mechanisms. Current campaigns should use tools developed by TEPP to assist in planning. These include a Model Needs Assessment, a Model Planning Annex, Model Initial Response Procedures, and "Drills-In-A-Box." More information on TEPP is available at http://www.em.doe.gov/ otem/program.html.

As a result of best practices identified in previous shipments, pre-planning for emergency response has become interactive almost on a continual basis. Emergency planning has increasingly become smoother, since the inception of TEPP. Planning should be done with the needed materials and the first responders.

Projected Shipment Planning Information

Planning information is the general information regarding projected shipments that is shared with State and Tribal authorities to allow them to adequately plan resources for inspections, emergency response, accident prevention, and public information/outreach activities. Best practices for planning information and outreach efforts were identified in all of the campaigns reviewed. In all the campaigns, the shipper was responsible for taking the lead for the planning information.

The best practices of the protocols state that DOE programs and shippers will establish an ongoing dialogue, consistent with security considerations, with State and tribal agencies that demonstrate an ongoing interest in shipments traveling through their jurisdictions.

The *Program Manager's Guide (1998)* describes best practices for sharing information and informational products that are useful. The *WIPP Transportation Safety Program Implementation Guide* (2002) provided additional best practices on coordinating public involvement and developing public information products. Best practices from the *Midwestern Planning Guide* (2002) recommend that a shipment-specific public information program should be to respond to inquiries rather than to disseminate information on a routine basis along the proposed routes. However, it does note that as part of the transportation planning process, shippers should prepare a communication plan that defines the roles and responsibilities of the shipper, states, tribes, and other parties in providing timely, accurate information on the shipment.

In the rail campaign plans reviewed, various best practices were identified at the planning stage to share information with the public. One best practice was for the shipper to be responsible for coordinating and communicating information. Two campaigns provided a separate communications plan as part of the overall transportation plan.

In the case of the highway campaigns, best practices included information packets, identification of a point-of contact for communication and coordination, a communications and public outreach plan, and a communications and public outreach program.

Findings:

Each DOE program and shipment took a different approach to working with stakeholders with various levels of planning. The TEC Communications Group studied different campaigns and developed a best-practices paper entitled "Best Practices for DOE's Radioactive Materials Transportation Public Information Program" - available at http://twilight.saic.com/newtec/comm/BestPractices.pdf. This paper identifies several findings, including: (1) properly identifying the scope or level of interest in the campaign or shipping schedule, enlisting the assistance of State, Tribal, and regional points-of-contact at the start and throughout the campaign; (2) making use of existing resources; (3) providing accurate information written for the target audience; (4) having the program managed directly by the DOE program or public information officers themselves; (5) freely sharing information with other agencies and organizations that are helping to plan the shipments; and (6) considering a post-shipment press release.

Shipment Prenotification

Shipment prenotification is defined as near-term notification activities for pending shipments, such as that required by NRC. Shipment prenotification informs public officials that specific near-term shipments will be transported through their jurisdictions. Such prenotification should be done as required by regulations and agreements with States and Tribes. To help with these requirements, one method that DOE uses is a widely endorsed tracking and notification system known as TRANSCOM.

Best practices identified in the protocols for shipment prenotfication include an advance formal notification in accordance with applicable requirements and verbal or written notification to be provided to State and tribal designated points of contact at least 7 working days prior to actual shipment.

Best practices from past plans and guides for both rail and highway reference required prenotification regulations. The *WIPP Transportation Safety Program Implementation Guide* (2002) provided information on using TRANSCOM for shipment prenotifications.

Findings:

Because prenotification is a requirement in several regulations and agreements, the transportation plan, at a minimum, should state what prenotifications will occur and how they will be transmitted as required by such regulations and agreements. The plan should include a brief description on the coordination taken to involve key internal and external stakeholders in shipment prenotification. As noted in best practices from the TMI shipment (1993), the plan should also note how DOE intends to keep up with changes of State administrations, including elections and departures. These changes may require DOE to retransmit previous communications regarding shipment notifications.

Emergency Notification

Emergency notification is the process DOE uses to notify State and Tribal officials after DOE itself has received notification of a transportation emergency involving DOE radioactive materials shipments. It does not address the initial notifications made by the carrier or others to local emergency response organizations. Notification to DOE may come from local responders or others. Emergency notification to State and Tribal points-of-contact occur after DOE, as the shipper, receives notification of an emergency.

Best practices identified in the protocols include information on emergency notification, including criteria for identifying an emergency situation requiring notification, emergency notification including the need to notify the NRC, the type of information to be provided during notification, information on maintaining the State/Tribal 24-hour points-of-contact list, and other non-emergency events that may require notification.

The *Program Manager's Guide* (1998) provided a best practice of providing a 24-hour number and restated the requirement of DOE Order 232.1 for emergency notification. Best practices in the *Midwestern Planning Guide (2002*) include the shipper making notification to the 24-hour point of contact for the state and a description of the type of information to be provided.

In the rail plans, no best practices were identified for emergency notification. Of the highway campaigns reviewed, most of the campaigns noted the best practice of having TRANSCOM automatically logging messages allowing the TRANSCOM Control Center (TCC) operator to initiate notifications.

Findings:

All transportation plans should clearly delineate what constitutes a notification; how notification will be made; and how DOE, State and Tribal authorities, and other Federal agencies, if required, will be notified in the event of an emergency. Plans should also identify who will be notified in accordance with existing requirements, site transportation emergency plans, memorandums of agreement, or campaign-specific transportation plans. Plans should provide a contact list and the type of information to be provided during the notification process, and should identify who has the overall responsibility for making the notification. Plans should describe the coordination between the carrier, the shipper and the receiver site to ensure that necessary notifications are made. DOE transportation plans should be coordinated with carriers' notification plans. Contingencies should also be identified in the event the person responsible for notification is unable to do so (i.e., the driver because he or she has been incapacitated).

Routing

Routing is a complex issue, with special aspects related to each transportation mode. Routing issues will arise in all campaigns regardless of the mode. Routing is a very complex issue in shipping SNF because it is a concern of all stakeholders and is related to a variety of other issues. In the case of highway, DOT regulations require that carriers follow "preferred routing" requirements. In the case of rail, routing has few viable alternatives and is treated differently from highway routing from a regulatory standpoint. Regulations for route selection like those for highway truck shipments do not exist for rail transportation. Instead a shipper and rail carrier jointly plan the route considering such factors as starting and end points, the shortest distance/time, and other factors like bridge conditions relative to the weight of the load.

Best practices in the protocols for routing include the regulations to be followed for highway routing; how routes are proposed; the involvement of States, Tribes, and other stakeholders; how routes are to be documented; and the criteria for submitting routes to the NRC.

The *WIPP Transportation Safety Program Implementation Guide (2002)* described the approach taken by DOE to identify and select the safest and most acceptable routes for transporting transuranic waste including how the routes will be evaluated. The *Midwestern Planning Guide (2002)* stated that shippers will select the routes for highway and rail shipments in consultation with the states and provides information on factors for shippers to consider in selecting a route.

In the case of rail campaign plans, the best practices for selecting routes included selecting a route through a joint approach with the shipper and rail carrier or in the case of the *TMI Shipment (1993)* selecting a route that had the shortest total distance, the greatest percentage of high quality tracks, and a route with the minimum number of times the railcars would have to be switched. For the *West Valley Shipments (2001)*, route selection consisted of evaluating the recommendation of a study, presenting the recommended route to carriers for technical comment, and soliciting comments/concerns from States and Tribes.

As in the rail shipments, best practices from the highway shipments varied. The best practices included d following DOT requirements, identifying three possible routes with the final route selected and approved by NRC, and describing the actual route.

Findings:

Although DOT regulations relating to rail routing have not been promulgated, DOE criteria and models do exist and should be followed. Routing plans need to consider routes and modes with the shortest time distance that would enhance overall public safety related to the transportation of SNF. Various factors that could be considered when planning for a route include types and conditions of modal infrastructures, quantities of SNF or materials being transported, exposure and other risk factors, terrain considerations, continuity of routes and number of interchanges, available alternative routes, use of higher-class track, environmental impact factors, and operational input from carriers.

Most campaigns will experience some opposition to the route or mode selected. DOE should anticipate this and not attempt to avoid opposition by routing around "problem" areas. DOE can manage opposition by following a standardized approach for all planned route selections. Coordinated and integrated planning with representatives from State, Tribal and local governments, and carriers, should be conducted to identify the appropriate route early in the planning process. To promote safety and public acceptance, the final approved route should be approved by the carrier and if necessary, the NRC. Alternate routes should be identified.

The transportation plan should include the final routing plans and identify to whom they will be submitted for review and/or approval. The plan should clearly articulate how the routes are evaluated, ultimately picked, and the criteria used to pick them.

Security

Security of radioactive material not only involves actions taken to ensure the security of the shipment but also includes the planning for such events as terrorism and sabotage. Security of the material will be provided through compliance with NRC regulations in 10 CFR Parts 71 and 73, equivalent DOE requirements, or DOT requirements/industry practices, depending on the ownership, type, and quantity of radioactive material, and whether the transport activity falls under NRC license. Obviously, security planning must necessarily be less visible; many important aspects involve NRC safeguards information and must be disseminated on a "need to know" basis. State, Tribal and local law enforcement have important roles to play in effective security planning.

Best practices identified in the protocols include early identification of and compliance with Federal regulations and requirements, including NRC regulations, equivalent DOE requirements, and DOT requirements/industry practices. Other practices include identifying and following appropriate memoranda of understanding or memoranda of agreement, safeguarding sensitive information, and the need to use threat assessments in determining the level of security needed for a shipment. Specific practices identified for Spent Nuclear Fuel include a Liaison with State and tribal law enforcement officials provided by DOE, escorts at the discretion of State, tribal, or local jurisdictions, and the use of TRANSCOM

Best practices from the guides reviewed include a recommendation for a security plan as part of the overall transportation plan in the *Program Manager's Guide (1998),* information on communicating with the states regarding security, and stating security considerations as part of a detailed security plan in the *Midwestern Planning Guide (2002)*.

In the rail campaign plans reviewed, best practices were identified in four campaigns. The practices included reference to NRC regulations, inter-carrier agreements with the shipper taking the lead for multiple coordinated communication plans between the various carriers, and a separate "Security Plan" disseminated on a "need to know" basis. Other practices in the *TMI Shipment (1993)* included procedures involving physical protection for the shipment both while in transit and while on site being loaded and unloaded.

In the highway plans reviewed, best practices include qualified drivers with a clearance, trucks fitted with a panic or disabling switch in the case of unauthorized use, and interagency agreements, if necessary.

Findings:

To ensure the security of DOE shipments of radioactive material, transportation plans should identify the Federal security regulations and requirements applicable to the shipment and the appropriate memoranda of understanding or memoranda of agreement. The transportation plan should ensure that the security plan is coordinated among the necessary parties.

The security plan should take into consideration the assessments that have been performed by DOE and external organizations (e.g., NRC, Federal Bureau of Investigation (FBI), State law enforcement agencies) of possible security threats against shipments (sabotage or terrorist threats), as applicable. These threat assessments should be used to plan appropriate security measures for the shipment.

It should be noted that depending on the type and quantity of material being shipped, the information dealing with the security of radioactive material shipments in transit can be sensitive and may need to be protected as Safeguards Information under NRC regulations or as Unclassified Controlled Nuclear Information under DOE requirements.

Carrier/Driver Requirements

Highway and rail carriers must comply with DOT regulations and are both responsible for the training and qualification of their crews. This includes recurrent and function-specific training for personnel including drug and alcohol testing. Only motor carriers with "Satisfactory" DOT ratings are used for DOE shipments of radioactive materials. In addition, DOE maintains a Motor Carrier Evaluation Program (MCEP) to evaluate the fitness of carriers to ship truckload quantities of radioactive material.

Best practices identified in the protocols included drivers that have been evaluated for safety, financial status, security, and compliance with applicable regulations, hold a current CDL with a hazardous material endorsement; meet applicable requirements; be knowledgeable in the Commercial Vehicle Safety Alliance Enhanced (CVSA) (Level VI) North American Standard Inspection Procedures; have training that covers operation of the specific package tie-down systems, cask recovery procedures, use of radiation detection instruments, use of TRANSCOM and other communications equipment, adverse weather and safe parking procedures; and have specific training for public affairs awareness, first responder awareness, and radiation worker "B.

If the shipment is classified, best practices include a driver that is at least 21 years old, passes an annual recertification with a check ride, receives extensive driver training, complies with DOT safety regulations, passes a comprehensive annual physical examination and is subject to random drug and alcohol testing.

For rail, the protocols have best practices where carriers comply with FRA regulations and if the shipment is a NWPAA spent fuel shipments, carriers also maintain a training program.

In the planning guides reviewed, best practices included stating the FRA and DOT requirements. The *WIPP Transportation Safety Program Implementation* Guide (2002) provided information on enhancing carrier contracts and developing a management plan to ensure high-quality drivers. The *Midwestern Planning Guide (2002)* endorses the "Model Safety Elements in the WIPP Transportation Contract and Corresponding Carrier Management Plan," and the Compliance Audit Program prepared by the Western Governors' Association (WGA) WIPP Technical Advisory Group and also notes that shippers must use carriers that earn satisfactory DOT ratings.

For the actual rail plans, only the F*RR Shipment Plan (1998)* and the *West Valley Shipment (2001)* covered driver/carrier requirements.

For the highway campaign plans, *the Cesium Transportation Plan (1994)* stated that the carrier was responsible for driver training. The *Commercial Light Water Reactor (CLWR) (1999)* project discussed the fact that the shipments would be overweight and that the drivers require a clearance.

Findings:

Each plan should state how the carrier/driver will comply with applicable Federal and State requirements to ensure that high-quality carriers and drivers are utilized and meet the safety standards for transportation of radioactive materials. This should include industry rules, standards, and practices that correspond with the regulations. The plan should also include information on DOE's MCEP.

Transportation Operational Contingencies

Transportation operational contingencies are those taken in response to adverse weather, natural disasters, vehicle breakdown, travel and road/rail conditions, and unanticipated delays that could interrupt normal transportation of DOE shipments of radioactive material. This includes determinations made prior to departure and while en route.

For weather contingencies, before dispatch the shipper and the carrier must agree that travel conditions are considered to be acceptable. This includes current weather conditions, weather forecast(s), and projected road conditions at the point of origin and along the entire route. Information on weather and road conditions may be obtained from State information numbers and from other sources. Rail carriers use train control and monitoring systems to make informed decisions to avoid or minimize potential weather-related or track condition risks. Transportation restrictions may be imposed when local conditions make travel hazardous. Adverse operational conditions should be reported to DOE. In the plans reviewed, operational contingencies generally only included weather-related contingencies and usually were not coordinated with States and Tribes.

The protocols provide best practice information on operational contingencies including the need for the shipper and carrier to agree that weather conditions are acceptable before shipment, the involvement of States and Tribes, what happens when adverse weather and road conditions occur, and what happens in the event of a delay. The protocols also discuss how weather conditions are identified and what happens for Classified National Security Shipments.

The *WIPP Transportation Safety Program Implementation Guide (2002)* provides information on monitoring road and weather conditions. The *Midwestern Planning Guide (2002)* has information on contingencies relating to adverse weather and road conditions and provided information on what to do in the event of such conditions.

Of the campaign plans reviewed for both rail and highway, seven provided information on contingency plans that outlined the procedures to be followed in the event of unacceptable weather conditions and one provided a detailed contingency plan for all operational contingencies. Only one plan discussed operational contingencies for all possible cases including unplanned detours; unscheduled delays due to vehicle breakdown, weather, illness, and road blockage due to construction or non-involved accident; an accident involving nuclear material; suspicious situation or potential threat against the shipment; explicit or imminent threat against shipment; and vehicle breakdown.

Findings:

Each plan should provide a comprehensive operational contingency plan that includes how States and Tribes will be involved. This plan should include contingencies for weather and adverse road/track conditions and what provisions will be made in the event of unplanned detours, unscheduled delays, accidents, vehicle breakdown, and threats against the shipment. The plan should also identify who is responsible for authorizing use of alternate routes and which DOE authority and others need to be notified. If the carrier develops the operational contingency plan, the contingency should receive prior approval by DOE.

Tracking

Tracking is the practice DOE uses for monitoring and locating the shipments of radioactive material and for facilitating communication with the crew of the train or driver of the truck. For DOE shipments, TRANSCOM is used to provide real-time position tracking and communications. For NRC-covered SNF shipments, user designation and access will be consistent with NRC regulations to ensure that safeguards information, such as schedules and itineraries for specific shipments, is protected against unauthorized disclosure and is provided only to authorized individuals.

The protocols state that TRANSCOM will be used for all shipments for near real-time position tracking and communications.

Of the guides reviewed, both the *Program Manager's Guide (1998)* and the *Midwestern Planning Guide (2002)* recommend that TRANSCOM be used as the tool for tracking shipments.

Of the rail plans reviewed, two stated TRANSCOM as the system to be used and three stated the rail dispatch as the system to be used as the primary shipment with TRANSCOM as the backup. Of the highway plans reviewed, all stated that TRANSCOM would be used.

Findings:

Transportation plans should outline how TRANSCOM will track the shipments and coordinate with other tracking systems such as those used by the rail dispatch center or the motor carrier. The plan should also state any other methods available for tracking, such as the use of cellular and satellite phones, and what procedures should be followed in the event of a TRANSCOM failure.

Inspections

Transportation equipment and radiation safety inspections are performed prior to, during and post shipment by Federal, State, or carrier inspectors. Inspections assure compliance with applicable Federal and State requirements, Association of American Railroads (AAR) rules, and industry standards (i.e., the "Recommended National Procedures for the Enhanced Safety Inspection of Commercial Highway Vehicles Transporting Transuranic, Spent Fuel, and High-Level Radioactive Waste"). Inspections of DOE radioactive materials shipments include verification of vehicle safety and the radiological safety of containers. The plans and processes reviewed generally discussed inspections, although few outlined all the necessary inspections and who performed these inspections.

A best practice in the protocols included identification of who performs preshipment, enroute, and postshipment inspections to comply with regulatory standards.

The *WIPP Transportation Safety Program Implementation Guide (2002)* described the independent inspection program used for WIPP shipments. The *Midwestern Planning Guide (2002)* discussed point-of-origin shipments and en-route shipments.

For the rail plans reviewed, one plan discussed the coordinated safety compliance oversight plan (SCOP) that was developed to complement existing inspection arrangements, one plan discussed a policy that establishes inspection frequency criteria above and beyond what is normally required, and one plan stated where inspections will take place. The *West Valley Plan (2001*) noted that inspections would take place prior to and upon receipt of the shipment, with additional necessary inspections being performed in accordance with applicable regulations. The *TMI Shipment Plan (1993*) talked about an inspection plan that was developed to include the locations of the inspections, who was to perform the inspection, and what was to be inspected.

For the highway plans reviewed, five provided information on the need for inspections and stated that inspections will be conducted in accordance with requirements.

Findings:

Transportation plans need to outline the necessary inspections that will take place prior, during and post shipment, and how they meet applicable requirements. The plan should describe where, who and what will be inspected (tie-downs, casks, etc.). The plan should also describe related policies and plans that complement other required inspections (e.g., enhanced inspection procedure policy, Safety Compliance Oversight Plan).

Safe Parking

Safe parking includes the process used to identify parking locations and the criteria for selecting the parking areas if a predesignated location cannot be reached in the event that transportation operational contingencies occur.

The protocols provide information on the selection of safe parking areas and how they will be coordinated with the States and Tribes through which the shipments will pass. They provide key factors in selecting safe parking areas.

The *WIPP Transportation Safety Program Implementation Guide (2002)* described the criteria developed by the Technical Advisory Group for selecting safe parking for WIPP shipments. The *Midwestern Planning Guide (2002)* stated that safe parking areas be coordinated with the states and tribes and that the security plans should identify safe parking areas and avoidance criteria for selecting other safe parking locations. This guide also noted that state law enforcement personnel have the authority to direct shipments to specific parking areas.

In the rail plans reviewed, three addressed safe parking. These three campaign plans described general steps that should be taken to identify and select a safe parking area and stated that selection of predesignated parking areas should be coordinated with the affected States. One plan described who should be notified in the event of an unscheduled stop and who had the responsibility for determining such a stop.

Of the highway plans reviewed, four discussed safe parking. One of these plans described how and who will pick the location and how the vehicle should be parked, and the other plan had a policy specifically developed for "bad weather and road conditions and safe parking." This policy described what conditions warrant parking, provided guidelines on where to park, and discussed who should make the decision for an unscheduled stop. The other two plans included specific information as part of the Security Plan.

Findings:

Transportation plans should identify safe parking areas available along the selected routes and who should be notified in the event of an unscheduled stop. The parking areas should be coordinated with States and Tribes prior to developing the plan. To the extent practicable, safe-parking areas should be selected to provide adequate separation from other hazardous materials and to facilitate required security. For highway shipments, the plan should state who has the authority to direct shipments to safe parking. For rail, the carrier would decide where to locate the affected railcar(s). Within a DOE facility is the most desirable location, and another Federal facility is a secondary option; the third choice would be a protected "siding," a safe, secure position along the track controlled by the railroad. State or Tribal officials also have the option of rerouting the shipment. Any additional security required from State, Tribal or local law enforcement should be coordinated by the shipper and/or the rail carrier. Transportation plans may specify additional safe parking criteria.

Emergency Response

Emergency response is DOE's response to a transportation emergency involving DOE rail and highway shipments of radioactive materials. State, Tribal, and local governments have the primary responsibility

and authority to respond to and manage emergencies within their jurisdictions, including incident command. DOE will provide assistance in accordance with Federal statutes and regulations.

Best practices identified in the protocols for emergency response included information on the assistance DOE will provide, responsibilities of the DOE shipper such as making emergency notifications and providing necessary information, responsibilities of the carrier such as notifications and responses, and responsibilities of the cognizant DOE RCO such as providing radiological assistance.

In the guides reviewed, all discussed emergency response. The *WIPP Transportation Safety Program Implementation Guide (2002)* described steps to ensure that States have effective response plans and procedures. The *Midwestern Planning Guide (2002)* states that it is the States or Tribes responsibility for emergency response and that the shipper will provide emergency response information on shipping papers. It also states that the shipper will provide any technical assistance as required.

In the campaign plans reviewed, all discussed emergency response. Most provided comprehensive detail on the roles and responsibilities of all involved and, in one case, even included a copy of the Carrier Emergency Response Plan.

Findings:

A transportation plan or a separate emergency management plan should describe in detail how the shipper and carrier will comply with Federal statues, regulations and DOE Orders. The plan should list the responsibilities of the shipper including: making emergency notifications as identified in the emergency notification section; conducting follow-up communication; providing shipment-specific emergency information and access to DOE/contractor personnel for technical advice and detailed information; implementing transportation emergency response procedures; assisting in the coordination of DOE resources to provide additional assistance if requested; coordinating with DOE Headquarters and the cognizant DOE Regional Coordinating Office (RCO) in the affected region to designate a Federal On-Scene Coordinator/Commander; conducting activities if an emergency occurs that warrants a Federal response under an applicable Federal plan; assisting in the coordination of DOE resources to provide information to the public unless a DOE public information officer is sent; and coordinating with the cognizant DOE program office statements or news releases.

The plan should also state the responsibilities of the carrier. Some of these include notifying the 24-hour emergency response notification number; forwarding calls regarding technical advice and detailed information; giving notice to DOT if required; and responding to the requests of State, Tribal and local government authorities regarding recovery activities and coordinating activities with the DOE shipper.

The plan should state the responsibilities of the cognizant DOE RCO. Some of these responsibilities include providing radiological assistance, assisting in the coordination of other radiological assets, and any other DOE response activities deemed necessary.

The plan should also state how public information is to be handled if a classified national security shipment is involved.

Recovery and Cleanup

Recovery and cleanup occurs after emergency actions have been taken. The carriers have primary responsibility for recovery and cleanup and will coordinate with DOE, State, Tribal and local agencies regarding these activities. DOE will ensure that cleanup is performed to the required level. Regulations exist that provide financial reserves for cleanup.

Although recovery and cleanup is not the responsibility of DOE, most of the documents reviewed addressed recovery and cleanup and provided some information.

Best practices identified in the protocols include information on financial requirements, requirements ensuring that carriers have specific written procedures for providing recovery and cleanup, and other requirements, such as ANSI N14.27 ("For Truckload Quantities of Radioactive Materials - Carrier and Shipper Responsibilities and Emergency Response Procedures for Highway Transportation Accidents")

The *Program Manager's Guide (1998)* stated that it was the carrier's responsibility to provide cleanup/restoration.

Recovery and cleanup was included in most of the transportation plans reviewed for both rail and highway. Each plan acknowledged that it was the responsibility of the carrier to provide for emergency recovery and cleanup.

Findings:

Transportation plans need to address recovery and cleanup and should ensure that carriers have specific written procedures for providing recovery and cleanup in the event of an accident or incident, or that they have a contract with a remediation company as part of the MCEP. DOE should review carrier procedures. If possible, the plan should provide a copy of the procedures as an attachment.

Transportation plans should also identify a point of contact for archaeological purposes before cleanup on Tribal land begins.

SUMMARY OF ISSUES AND HOW DOE HAS IMPLEMENTED FINDINGS

In this report, past transportation plans have provided insights into how recent shipping campaigns prepared and planned for shipments of SNF and other nuclear materials and how they compare to the best practices outlined in the recent protocols. The findings from this study are intended to highlight successful plans and suggest alternatives to those that were not as complete as others. These findings include:

- Transportation plans need to provide information on shipment planning that includes regulatory review and involvement of responsible parties for shipment safety and security (state agencies, federal agencies and carriers).

- Plans should be developed by the shipping program with involvement from site traffic managers, emergency response planners, environment safety and health professionals, and public participation staff. Early periodic planning meetings that involve all participants will ensure effective coordination.

- The main objective of a transportation plan should be operational. The plan should contain DOE organizational responsibilities (Headquarters and site), responsibilities of other participants (other Federal agencies or State, Tribal or local governments), other stakeholder considerations and carrier responsibilities. The plan should also include information describing material type, estimated number and weight of shipments, mode of transport, shipment schedules (except for safeguarded materials), route maps, emergency plans and contacts, communication strategies, any regulatory agreements that will be followed over the course of the shipping campaign, package recovery plans, and packaging information. Transportation plans should also follow all requirements of DOE Orders.

- The components of a transportation plan necessary to support transportation activities are: Transportation Planning, Emergency Planning, Projected Shipment Planning Information, Shipment Prenotification, Emergency Notification, Routing, Security, Carrier/Driver Requirements, Transportation Operational Contingencies, Tracking, Inspections, Safe Parking, Emergency Response, and Recovery and Cleanup.

- Transportation planning requires flexibility in planning and decision making and long lead times for the first in a series of highly controversial shipments. Experience has shown that after demonstrating success with one shipment, much of the interest and controversy is eliminated.

CONCLUSION

Shipping DOE radioactive materials is becoming routine. This has been a common theme in a 12-year process. This success can be attributed to careful planning for shipments of radioactive waste and involvement of other parties responsible for safety and security of the shipments, primarily state, tribal and other federal agency officials which include DOT and NRC. A review of past DOE transportation plans and guides demonstrates that the level of planning and operational detail varied in terms of what was required and what was considered to be the elements of a complete transportation plan (see Table 2). This is perhaps not surprising given the variety of campaigns undertaken and the different times and circumstances under which shipping campaigns have been conducted.

It is significant to note that although the level of detail varied among the different plans, there has not been an increasing trend toward more prescriptive approaches or more elaborate requirements, even when considering the experience of commercial SNF shipments. In other words, there does not appear to be an increase in "extra-regulatory" requirements, and the different approaches DOE programs have taken are not substantially different from those undertaken by non-DOE shippers of SNF. This should offer reassurance to observers concerned about the potential for ever-increasing added procedures that may not increase overall safety. As the protocols are implemented and programmatic approaches become more standardized, this stability should be expected to continue.

One area in which change is rapidly being implemented, is for security planning. Following the September 11th terrorist attacks and heightened security awareness throughout the United States, DOE and its involved stakeholders have begun to devote more attention and resources to ensuring security for SNF shipments. While this element has been addressed from the beginning of the FRR shipments, the level of attention paid to future shipments and the increased regulatory requirements may prompt different approach to security plans and implementation actions.

Table 2: Elements of the Transportation Plans Reviewed

Protocol Area	*TMI (1993)*	*Cesium (1994)*	*Shoreham (1997)*	*BNL (1997)*	*FRR (1998)*	*CLWR (1999)*	*WV (2001)*	*FRR (2001)*
Transportation Planning	X	X	X	X	X	X	X	X
Emergency Planning	X	X	X	X	X	X		X
Projected Shipment Planning Information	X	X	X	X	X	X		X
Shipment Prenotification	X	X	X	X	X	X	X	X
Emergency Notification	X	X		X	X	X	X	X
Routing	X	X	X		X	X	X	X
Security	X			X	X	X	X	X
Carrier/Driver Requirements		X		X		X	X	X
Operational Contingencies			X	X	X			
Tracking	X	X		X	X	X	X	X
Inspections	X			X	X		X	
Safe Parking		X					X	X
Emergency Response	X	X	X	X	X	X	X	
Recovery and Cleanup	X	X		X	X	X	X	X

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