TRANSPORTATION INSTITUTIONAL ISSUES

IN VOLVING THE U.S. DEPARTMENT OF ENERGY’S CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM

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TRANSPORTATION INSTITUTIONAL ISSUES INVOLVING THE U.S. DEPARTMENT OF ENERGY’S CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM

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# Table of Contents

Table of Contents........................................................................................................................................... 1
Acronyms .......................................................................................................................................................... 3
Introduction ......................................................................................................................................................... 5
Openness and Accountability ............................................................................................................................ 7
  Public Information and Outreach .................................................................................................................. 7
  Stakeholder Involvement .............................................................................................................................. 10
Programmatic Requirements .......................................................................................................................... 13
  Database/Model ........................................................................................................................................... 13
  Federal Regulation of Transportation ......................................................................................................... 15
  Liability ......................................................................................................................................................... 16
  Oldest Fuel First .......................................................................................................................................... 17
  Shipment Scheduling .................................................................................................................................. 18
  State Regulation ........................................................................................................................................ 20
  Transportation of High-Level Waste ........................................................................................................... 23
  Transportation Safety Program Funding .................................................................................................... 24
Transportation Planning ................................................................................................................................. 26
  Operational Procedures ............................................................................................................................... 26
  Pilot Program ............................................................................................................................................. 29
  Program Evaluation .................................................................................................................................... 30
  Seasonal Scheduling .................................................................................................................................. 31
  Transportation Operational Contingencies .................................................................................................. 32
  Transportation Planning .............................................................................................................................. 34
  Transportation Planning Timeline .............................................................................................................. 36
Modes, Packages, and Routes .......................................................................................................................... 38
  Full-scale Cask Testing ............................................................................................................................... 38
  Intermodal Shipments ................................................................................................................................. 40
  Mix of Transportation Modes .................................................................................................................... 44
  Overweight Trucks .................................................................................................................................... 47
  Rail Access .................................................................................................................................................. 48
  Rail Service Analysis ................................................................................................................................. 50
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route Identification</td>
<td>52</td>
</tr>
<tr>
<td>Transportation Infrastructure Improvements</td>
<td>56</td>
</tr>
<tr>
<td>Safety and Security</td>
<td>58</td>
</tr>
<tr>
<td>Carrier/Driver Requirements</td>
<td>58</td>
</tr>
<tr>
<td>Inspection and Enforcement</td>
<td>60</td>
</tr>
<tr>
<td>Safe Parking</td>
<td>63</td>
</tr>
<tr>
<td>Security Planning</td>
<td>65</td>
</tr>
<tr>
<td>Terrorism and Sabotage</td>
<td>67</td>
</tr>
<tr>
<td>Shipment Information</td>
<td>70</td>
</tr>
<tr>
<td>Long-Term Planning Information</td>
<td>70</td>
</tr>
<tr>
<td>Prenotification</td>
<td>71</td>
</tr>
<tr>
<td>Tracking</td>
<td>72</td>
</tr>
<tr>
<td>Emergency Management</td>
<td>74</td>
</tr>
<tr>
<td>Emergency Notification</td>
<td>74</td>
</tr>
<tr>
<td>Emergency Planning and Management</td>
<td>75</td>
</tr>
<tr>
<td>Emergency Response</td>
<td>76</td>
</tr>
<tr>
<td>Emergency Response Equipment</td>
<td>77</td>
</tr>
<tr>
<td>Emergency Response Training Standards</td>
<td>78</td>
</tr>
<tr>
<td>Medical Preparedness</td>
<td>79</td>
</tr>
<tr>
<td>Section 180(c) Implementation</td>
<td>80</td>
</tr>
<tr>
<td>High-Level/Cross-Cutting Issues</td>
<td>85</td>
</tr>
<tr>
<td>Human Factors</td>
<td>85</td>
</tr>
<tr>
<td>System Safety</td>
<td>86</td>
</tr>
<tr>
<td>Top-level System Studies</td>
<td>86</td>
</tr>
<tr>
<td>Transportation After Very Long Term Storage</td>
<td>88</td>
</tr>
<tr>
<td>Transportation Implications of Storage Solutions</td>
<td>89</td>
</tr>
<tr>
<td>Transportation Management Structure</td>
<td>91</td>
</tr>
<tr>
<td>Transportation Risk Management Program</td>
<td>95</td>
</tr>
<tr>
<td>References</td>
<td>99</td>
</tr>
</tbody>
</table>
ACRONYMS

AAR – Association of American Railroads
CBFO – DOE Carlsbad Field Office
CONOPS – Transportation System Concept of Operations
CSG – The Council of State Governments
CSG Midwest – The Council of State Governments, Midwestern Office
CVSA – Commercial Vehicle Safety Alliance
DOE – Department of Energy
DOT – Department of Transportation
EIS – Environmental impact statement
EM – DOE Office of Environmental Management
EPRI – Electric Power Research Institute
FICA – Facility Interface Capability Assessment
FRA – Federal Railroad Administration
FRR – Foreign Research Reactor
GAO – Government Accountability Office
HLW – High-level radioactive waste
HRQC – Highway route controlled quantities
MHLRWC – Midwestern High-Level Radioactive Waste Committee
MPC – Multipurpose canisters
MRMTC – Midwestern Radioactive Materials Transportation Committee
MRS – Monitored retrievable storage
MTU – Metric tons of uranium
NWPA – Nuclear Waste Policy Act
NAS – National Academies of Science
NEPA – National Environmental Policy Act
NRC – Nuclear Regulatory Commission
NSTI – Near Site Transportation Infrastructure
NTP – National Transportation Program
NWTRB – Nuclear Waste Technical Review Board
OCRWM – DOE Office of Civilian Radioactive Waste Management
PHMSA – Pipeline and Hazardous Materials Safety Administration
PSR – Projected Shipment Report
RFID – radio frequency identification
RFP – Request for Proposals
SNF – Spent nuclear fuel
TAD – Transportation, aging, and disposal canister
TCG – Transportation Coordination Group
TEC/WG – Transportation External Coordination Working Group
TRAGIS – Transportation Routing Analysis Geographic Information System
TSOP – Transportation System Operations Plan
WGA – Western Governors’ Association
WIEB – Western Interstate Energy Board
WIPP – Waste Isolation Pilot Plant
WIPP PIG – WIPP Program Implementation Guide
INTRODUCTION

In 1989, The Council of State Governments’ Midwestern Office (CSG Midwest) established the Midwestern Radioactive Materials Transportation Project. Supported by a cooperative agreement with the U.S. Department of Energy’s (DOE) Office of Civilian Radioactive Waste Management (OCRWM), the agreement was intended to help CSG Midwest engage the Midwestern states in planning shipments of spent fuel and high-level waste to a proposed national repository at Yucca Mountain in Nevada. Two decades later, in 2009, the Obama Administration announced its intention to cancel the Yucca Mountain program and, instead, convene the Blue Ribbon Commission on America’s Nuclear Future to chart a new national course on long-term management of spent fuel and high-level waste.

The cancellation of the Yucca Mountain program signaled the end of the cooperative work between CSG Midwest and OCRWM. Other DOE programs continue to support the Midwestern states’ engagement in planning other shipments, notably the transuranic waste shipments that travel by truck through the region to DOE’s Waste Isolation Pilot Plant (WIPP) in New Mexico. With regard to the large-scale movement of commercial spent fuel, however, the Midwest’s work is, for now, on hold indefinitely.

This document compiles information on the transportation-related issues that the Midwestern Radioactive Materials Transportation Project has encountered in its 20 years of helping to develop the transportation system for the repository program. The purpose of the compilation is to create an accessible “snapshot” of where things stood at the end of June 2010: What issues had been worked? Which ones were resolved? What documents contain additional information? And what position, if any, did the Midwestern region take with regard to the issue? The document is targeted toward state and regional personnel in the Midwest who might be called upon to resume the work left unfinished when the Yucca Mountain project was cancelled. The document should also prove useful to anyone interested in understanding the transportation institutional issues that OCRWM and the states identified and attempted to resolve.

In creating this archive of transportation issues, the research revealed a recurring theme: OCRWM’s transportation institutional program got off to an excellent start, but over time, the program’s performance declined significantly. The publication of the Transportation Institutional Plan in 1986 ushered in a period of nearly 10 years of intense activity. Starting in the mid-1990s, the level of activity began to drop until 1998, when the transportation program was abruptly terminated as a result of the redirection of the OCRWM program to place all emphasis on Yucca Mountain site characterization. In 2003, after five years of virtual inactivity, the institutional program struggled to restart, never quite managing to hit its stride. As a result, the program’s final years were marked by few real accomplishments.

There are some obvious lessons learned emerging from this recurring theme. First, given the history of the transportation institutional program, it is clear that the federal program would benefit by returning to its roots. While much of the factual information in the Transportation Institutional Plan is out of date, the plan’s inclusive approach to stakeholder consultation and cooperation in developing the transportation system stands as a model that the states and others stakeholders would likely continue to support. A good first step in resuming the transportation program, therefore, would be to update the Transportation Institutional Plan while retaining its underlying philosophy.

Second, the history of the transportation program demonstrates the negative impact of shutting down and attempting to restart program activities. In the 1990s, the transportation program competed
unsuccessfully with the disposal element as OCRWM management responded to budget constraints by devoting all of the program’s resources to site characterization. The five-year interruption in transportation activities from 1998 to 2003 proved to be a significant impediment to program progress when the work finally resumed in earnest in 2004. The loss of momentum and the loss of institutional knowledge over that period resulted in the transportation institutional program producing few tangible accomplishments in the final five years of the program – with advancements in Section 180(c) program development being a notable exception. Any new attempt to develop and operate a national repository, therefore, must take an integrated approach to long-term management of spent fuel and high-level waste rather than fragment the program, even in the face of continuing budget shortfalls.

Once momentum is lost, it cannot be recovered; it must be built anew. It is possible, however, to preserve at least some of the institutional knowledge built up over a period of more than two decades. This archive of issues is intended to do just that: to contribute to the written record on transportation issue resolution, highlighting the Midwestern states’ role in the process. By documenting the attempts the Midwestern states and other stakeholders made over the years to resolve transportation institutional issues, the archive should make it easier for new personnel to learn about what came before. Armed with an understanding of what was done, what worked, what did not, and why, the people charged with carrying a new program forward may have a greater chance of success.
OPENESS AND ACCOUNTABILITY

PUBLIC INFORMATION AND OUTREACH

Despite acknowledging a need to inform people about the repository program and associated shipments, OCRWM’s public outreach activities often did not reflect a concerted effort to produce materials that were responsive to public concerns. Early efforts like the OCRWM Bulletin and a high school curriculum on nuclear waste management were good examples of a carefully planned program. In later years, however, OCRWM’s public information materials did not reflect the same quality of thoughtful planning but rather gave the appearance of responding to events as they unfolded (e.g., producing a brochure on transportation as Congress debated the Yucca Mountain site selection in 2002). Moreover, it was rare for the states and other stakeholders to be consulted on information products. When they were, OCRWM sought their input far into the process, often when it was too late to incorporate substantive feedback. To succeed in reaching out to the public, OCRWM needs to develop a concerted plan for explaining the risks and benefits of shipments to the public and presenting it in a way that is meaningful to various audiences. Being on the “front lines,” the states need to be engaged at the very earliest stages of this effort.

In the early days of the repository program, OCRWM recognized the value of public understanding leading to acceptance of the transportation system. Indeed, OCRWM revealed this understanding in the very first line of the 1986 Transportation Institutional Plan:

“The Department of Energy (DOE) recognizes that the success of its program to develop and implement a national system for nuclear waste management and disposal, as directed by the Nuclear Waste Policy Act of 1982 (NWPA), depends not only on safety, but on broad-based public understanding of and confidence in program activities and objectives. While each program element has its particular sensitivity, the transportation of the waste to facilities developed under the NWPA may be the most visible element nationwide” (DOE 1986c, p. i).

OCRWM had an ambitious plan for maintaining a “communication network” comprised of OCRWM and other federal agency staff, state, tribal, and local governments, regional groups, the utilities, the transportation industry, special interest groups, and the public at large (ibid., pp. 19-28). OCRWM’s stated policy was “to make program information publicly available to the fullest and most timely extent possible” (DOE 1986a, p. 1).

OCRWM lived up to this commitment in the program’s early history. Vehicles for engaging and reaching out to the public and other stakeholders included the OCRWM Bulletin (a periodic newsletter), OCRWM Backgrounders (papers on specific topics) and factsheets, and INFOLINK – an “electronic bulletin board” designed “to impart transportation news and information to the interested public” (DOE 1986c, p. 29). In 1992, OCRWM released Science, Society, and America’s Nuclear Waste, an ambitious four-part curriculum for teaching high school students about the “scientific and societal issues” related to the repository program (DOE 1995f). OCRWM updated the curriculum just once in 1995. According to the letter accompanying the 1995 edition, between 1992 and August 1995, OCRWM received requests for approximately 20,000 “Teacher Guides” and 200,000 “Student Readers,” with requests coming in from all 50 states and 48 countries (DOE 1995f, p. 5). It is unknown whether OCRWM assessed the use of the curriculum or the impacts, if any, the curriculum had on students’ understanding of the nuclear waste management program.
In addition to printed public information materials, OCRWM also communicated with stakeholders through meetings of the Transportation Coordination Group (TCG), held at least annually starting in 1986 and continuing until 1995 (DOE 1994c, p. 4-8; DOE 1997c, p. 36). The TCG was the forum OCRWM used to bring together a variety of stakeholders that were interested in the program’s transportation activities. OCRWM described these meetings as involving states, tribes, local governments, utilities, and the transportation industry, with issues covered as the need or interest arose. OCRWM varied the location of TCG meetings in order to give people in all parts of the country a chance to attend. OCRWM also reached out to program stakeholders with a “Director’s Forum,” which provided an opportunity for the public and other stakeholders to address their concerns directly to the OCRWM director. Held in May 1992, the meeting focused on the issue of early site suitability studies at Yucca Mountain (MHLRWC 1992, p. 8). Participants at the TCG meeting that same month suggested that a forum be held specifically on the subject of transportation; however, OCRWM did not follow up on this suggestion (ibid.).

The TCG served as the model for a new DOE-wide stakeholder group called the Transportation External Coordination Working Group (TEC/WG). OCRWM organized the TEC/WG along with DOE’s Office of Environmental Management (EM). The TEC/WG was so successful in its early years that, for some time, it managed to fill the void left when OCRWM disbanded the TCG in the mid-1990s due to a program redirection and subsequent lack of funding. The TEC/WG remained the national forum for DOE to use in communicating with transportation stakeholders until it, too, was disbanded in 2009, largely as a result of another OCRWM program redirection. EM replaced the TEC/WG in 2010 with a new National Transportation Stakeholders Forum.

The mid-1990s saw a general slowing down of the pace at which OCRWM communicated with the public. This change was not surprising given the department’s 1995 decision that it was not legally obligated to accept spent fuel in 1998 absent the availability of a repository or monitored retrievable storage facility (DOE 1994b; DOE 1995a). Starting in 1997, OCRWM focused most of its resources on characterizing the Yucca Mountain site, putting all work related to transportation on a back burner during this period, including its active involvement with the TEC/WG (DeCesare et al. 1997, p. 7). The OCRWM Bulletin eventually ceased production, to be replaced later by the semi-annual OCRWM Enterprise. Not long afterward, OCRWM stopped even this less-frequent outreach newsletter, perhaps intending its new website, which replaced INFOLINK in 1995, to be a substitute for more traditional outreach activities like newsletters (DOE 1995d).

In the meantime, the end of the Cold War and the rapid shift within EM toward site cleanup created the need for transportation-related factsheets and other publications. In the mid-1990s, states and other stakeholders had a strong role in helping EM’s National Transportation Program (NTP) create numerous factsheets on various aspects of radioactive waste transportation. The NTP recognized the value of enlisting the help of state officials – eventual users of the materials – in actually writing the documents. To involve states in this effort, the NTP tapped the TEC/WG Communications Topic Group as the forum for reviewing and providing feedback on draft public information materials. The NTP envisioned having generic factsheets on topics like spent fuel transportation regulations, along with “quick facts” on transportation casks and other packaging. Programs that had shipments in the works could then pull out the factsheets that pertained to their specific campaigns and package them together in NTP folders for sharing with states and other stakeholders. If campaign-specific materials were needed, the DOE program could prepare them independently or with assistance from the NTP and the Communications Topic Group. The approach was a good one, and states particularly appreciated having access to all the outreach materials on CDs so they could print and distribute them as needed.
Like other TEC/WG topic groups, the Communications Topic Group disbanded when its tasks were complete. The NTP was eventually replaced by the EM Office of Packaging and Transportation. Unfortunately, for a variety of reasons, EM has not invested in maintaining these transportation-related factsheets or replacing them with new materials for keeping the public informed. In addition, despite the best intentions of the DOE authors and the state reviewers, some of the factsheets rely on messages that may be ineffective – or, worse, counterproductive – in helping the public understand the benefits and risks of radioactive waste shipments. A paper by Lisa Janairo and Ken Niles, presented at the 2008 Waste Management Conference, identified five frequently used messages that fail to “resonate” with the public, and offered suggestions for other, more useful messages (Janairo and Niles 2008). OCRWM staff were interested in pursuing some of the recommendations in the paper and consulted with one of the authors in 2008 on how to improve four draft factsheets that were then being developed by OCRWM’s office in Nevada (DOE 2008b, 2008d, 2008h, and 2008i). The OCRWM staff indicated that additional factsheets were in the works, and expressed their interest in incorporating Janairo and Niles’s recommendations into new materials. The program was redirected, however, before this effort could make much progress.

In the same year, the regions provided input to OCRWM regarding the future direction of the TEC/WG. In the comments from the Midwest, the states favored the formation of a new Communications Topic Group similar to the one that had worked with EM in the 1990s on the NTP transportation fact sheets. OCRWM staff seemed genuinely interested in a new approach that would bring states and other stakeholders together to improve OCRWM’s public outreach strategy and materials. When funding for the OCRWM program was reduced, however, DOE dissolved the TEC/WG. It remains to be seen whether DOE’s new National Transportation Stakeholders Forum will follow through on any of the regional recommendations regarding outreach to stakeholders.

Looking to the future, to adequately inform the public, OCRWM or its replacement will need a carefully crafted public information program that reflects the input of states and other stakeholders. Such a program would include written materials (web and print); a web site that is up to date and searchable, containing complete information on transportation-related topics; public meetings (both OCRWM-driven as well as in response to community requests); and exhibits that not only provide information from OCRWM but give visitors a chance to ask questions and leave feedback. The rapid development of new technologies should open up new possibilities for communicating with the public and other stakeholders in the future. Because OCRWM anticipated state cooperation in disseminating information materials and messages, it will be important to include states in the effort to develop the information and outreach program from the very earliest stages.

There may be an opportunity for an OCRWM successor to benefit from improvements to EM’s outreach program. While the old NTP fact sheets are out of date and contain some messages that are unhelpful, they are testament to the EM personnel giving a great deal of consideration to their task of informing the public and other stakeholders. If the current EM transportation office were to pick up this early effort and work cooperatively with the states and others to improve upon it, the result could form the foundation upon which to build a new OCRWM outreach program. If a revamped EM outreach effort is successful, it would behoove an OCRWM successor not to reinvent the wheel but rather to make use of the same materials, when possible, with supplementary information prepared following the same consultative, cooperative approach.
**Stakeholder Involvement**

OCRWM needs to reexamine its approach to involving stakeholders in decision making with regard to the program to transport spent fuel and high-level waste. The original Transportation Institutional Plan of 1986 laid out a robust program for involving stakeholders. Later, in the 1990s, the Secretary of Energy Advisory Board produced an excellent report on earning public trust and confidence. OCRWM’s efforts in 2002 and beyond, however, failed to meet the high standard set by these earlier documents. If a new or resumed program is to succeed, the program would do well to return to its roots in the area of stakeholder involvement and follow the guidelines of the 1986 plan.

In 1986, OCRWM published its *Transportation Institutional Plan* for the purpose of “lay[ing] a foundation for interaction among all interested parties for the purpose of productive cooperation and resolution of issues related to establishment and operation of the NWPA transportation system” (DOE 1986, p. i). Indeed, the approach contained in the *Transportation Institutional Plan* demonstrated a solid understanding on OCRWM’s part of the many institutional issues that it would need to resolve prior to commencing shipment operations. Committing to resolve issues cooperatively, establishing cooperative agreements with key stakeholder groups, sponsoring public workshops, and providing target schedules for completing activities were all positive steps toward building a solid foundation for true cooperation and consultation in the transportation program development.

In 1993, the Secretary of Energy Advisory Board’s Task Force on Radioactive Waste Management released its final report on a two-year study of how DOE “might strengthen public trust and confidence in the civilian radioactive waste management program” (SEAB 1993, p. v). The report described the importance of public trust and confidence: “On a pragmatic level, public trust and confidence is generally essential for agencies to carry out effectively missions assigned to them. More fundamentally, however, trust and confidence makes a central contribution to sustaining the legitimacy of public organizations within the American system of governance” (ibid.). The Task Force found that there was “widespread lack of trust in DOE’s radioactive waste management activities” (ibid.). Most troubling, despite the early promise of the OCRWM institutional program, the Task Force singled out OCRWM as having “a relatively constricted view of what is required to restore trustworthiness; it has not implemented any consistent approach to doing so; and has rarely considered explicitly the consequences of its actions for public trust and confidence” (ibid., p. vi).

Among its recommendations, the Task Force advised OCRWM to “commit itself to …early and continuous involvement of State and/or local advisory groups as well as national advisory bodies” (ibid., vii). Furthermore, the involvement envisioned by the Task Force “would be characterized by frequent contact, complete candor, rapid and full response to questions, use of at least some suggestions, and assistance in increasing the technical and oversight skills of the community” (ibid.). The Task Force also recommended that OCRWM undertake “[c]onsistent and respectful efforts to reach out to state and community leaders and to the general public for the purpose of informing, consulting, and collaborating with them about the technical and operational aspects of Departmental activities” (ibid.).

To read OCRWM’s program documents and public information materials, however, one would conclude that states and other stakeholders were intimately involved in working with the program to develop the transportation system. One of the program’s last factsheets, prepared in 2008, specifically addressed “Stakeholder Interaction” and included the statement that “DOE is working with stakeholders through a collaborative planning process” (DOE 2008h, p. 1). This statement echoed earlier OCRWM documents,
such as the 2003 Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions (DOE 2003). In the plan, OCRWM stated that its mission was to “manage and dispose of SNF and HLW in a manner that protects public health, safety, and the environment; enhances national and energy security; and merits public confidence” (DOE 2003, p. 1). The program pledged to “work with interested parties in a collaborative process to build a transportation system that supports the OCRWM mission and effectively addresses the concerns of stakeholders” (ibid., p. 2). Toward that end, OCRWM committed to “conduct a thorough, open and collaborative planning process with interested parties” (ibid.). For interactions with state and tribal governments, OCRWM declared, the “[s]tate regional groups will anchor our collaborative process with the states” (ibid., p. 4).

In the Strategic Plan, OCRWM may have said the right things, but its actions told another story. In their comments on the 2009 draft of OCRWM’s “National Transportation Plan,” the state regional groups observed that “DOE appears to understand ‘consultation and cooperation’ to consist largely of a review-and-comment function involving the states…and other stakeholders. This limited view is not consistent with the states’ vision of what consultation and cooperation mean” (Niles et al. 2009, p. 1). The regions urged OCRWM to “look to the 1986 Transportation Institutional Plan as a guide for managing [the] institutional program” (ibid.).

The Western Interstate Energy Board’s (WIEB) Jim Williams examined the possible root causes of the disconnect between how OCRWM and the regions – the “anchors” of OCRWM’s “collaborative process” – defined “consultation and cooperation.” Acknowledging that OCRWM had “provided commendable statements regarding the role of consultation process in SNF system design,” Williams nevertheless found that “DOE’s commitment to federal-state consultation remains tentative” (Williams 2009a, p. 1). Williams attributed some of the states’ concern over federal-state consultation to “recent DOE initiatives to preempt state authority in this critical aspect of SNF and HLW management” – a reference to legislation OCRWM supported in 2006 and 2007 (see the section on State Regulation). Williams asked, “Why does the consultation gap – the gap between expressed intent and actual process – persist?” (ibid., p.2). In answering the question, he identified eight “challenges” that were “primarily institutional,” one “rooted in human cognition,” and two involving “technical system design and application” (ibid., p. 7).

One of the institutional challenges was a “receding sense of urgency,” with the opening date for the repository receding (at the time) far into the future. Williams urged OCRWM not to forget “a key lesson of history” – namely, the events that transpired during the nearly decade-long hiatus in DOE’s WIPP program while the department waited for “regulatory approvals and land withdrawal legislation” (ibid., p. 3). As Williams observed, “[d]uring this period, DOE authorized several rather remarkable people in its Transportation Management Division to negotiate intensively and continuously with the western states....The result was the creation of an ‘institutional infrastructure’ for such shipments, codified as the ‘WIPP Transportation Program Implementation Guide’” (ibid.).

The WIPP transportation program stands today as DOE’s most successful large-scale shipping program, and is cited often by the states in the West and elsewhere as a model for how other DOE shipping programs – including OCRWM’s – should work cooperatively with states to plan shipments (Niles et al., 1998, p. 2; WGA 2009b). The Western states include “the WIPP model and effective coordination with states and tribes” in the WIEB “Report Card” on the OCRWM transportation program, with the program most recently scoring an “F” for giving “no sign that it intends to model key elements of its OCRWM transportation planning process after the WIPP program” – this “despite receiving clear policy direction
on this issue not only from western states, but from all four regional cooperative agreement groups” (emphasis in original) (WIEB, p. 2). Anne Clark and Tammy Ottmer, writing on the “model framework” established for WIPP shipments by DOE and the Western Governors’ Association (WGA) transportation committee, concluded that “the success of the entire program has relied heavily upon the commitment of all parties to the concepts of open communication, collaboration, and cooperation” (Clark and Ottmer 2007, p. 7).

Summing up OCRWM’s progress over the years, it is reasonable to describe the program as having fallen short of not only the expectations of the states and regions – key stakeholders – but also the high standard it set for itself in 1986. This is particularly unfortunate given 1) the clear direction the program received from DOE’s Secretary of Energy Advisory Board and 2) the excellent example set by the WIPP program managed by DOE’s Carlsbad Field Office (CBFO). It is hoped that, for future activities, the new or revamped program will look to the past, heed the recommendations it received, and engage in a truly cooperative and consultative process. To do so is the only way the transportation program will meet with success.
For the purposes of planning their transportation safety programs, states will need to be able to analyze data on shipment numbers, modes, routes, route characteristics, and other transportation program parameters. Early in the development of the transportation system, OCRWM worked on a comprehensive database and model for internal use to help the program evaluate alternative scenarios. In the 2000s, attempts were made to broaden the scope and application of the model to assist states in their own evaluation of routes and the potential impacts on communities. Those efforts were shelved as a result of program redirection and termination of funding.

In the early 1980s, OCRWM used separate models to determine routes: HIGHWAY for truck shipments and INTERLINE for rail and barge shipments. Both models were developed at Oak Ridge National Laboratory, with HIGHWAY dating back to 1979 (Johnson 2003, p. 1). In 1989, OCRWM reported at a meeting of the Nuclear Waste Technical Review Board (NWTRB) on its plans to add graphics capabilities to these models so as to make it possible to “see” the routes, which would enhance OCRWM’s ability to share information with the public (NWTRB 1989, pp. 287-288). Upon questioning by the NWTRB members, the OCRWM officials at the meeting confirmed that the models, at the time, did not include data on accidents, tunnels, bridges (ages and capacities), or sensitive surroundings like lakes. The officials did express hope that they would be able to add that functionality to the models someday (NWTRB 1989, pp. 287-288). Christopher Kouts, one of the OCRWM officials presenting at the meeting, also reported that, in addition to the routing models, OCRWM had a “transportation systems data base…and a wealth of knowledge associated with the assumptions that we would operate the system under” (NWTRB 1989, p. 466).

The two routing models provided information on population statistics, which were then used to assess transportation risks with the computer program RADTRAN – “a nationally accepted standard program and code for calculating the risks of transporting radioactive materials” (Weiner et al. 2008, p. 9). DOE’s Sandia National Laboratory created and maintains RADTRAN, which OCRWM used to calculate all transportation-related risk estimates in its environmental impact statements on the Yucca Mountain repository.

In 2003, DOE’s Oak Ridge office succeeded in combining the old HIGHWAY and INTERLINE models into a single model – “Transportation Routing Analysis Geographic Information System,” or TRAGIS – which is a GIS-based system capable of calculating primary and alternate routes by truck, train, or barge and displaying the results graphically. The decision to merge the two models came about as the result of a “Baseline Requirements Assessment Session” involving DOE and other users of the HIGHWAY and INTERLINE models (Johnson 2003, p. 1). Like the original models, TRAGIS provided population statistics and generated input data for assessments of shipment risk using RADTRAN. Paul Johnson, one of the principal developers of the model, observed that there was a need “to continually review and update the routing networks” in TRAGIS as a result of infrastructure changes like “new road construction, highway renumbering, rail abandonment, and changes of rail ownership (ibid., p. 2). TRAGIS was a definite improvement over the old dual-model system, but it provided only limited information on route characteristics that might be of help to state personnel interested in evaluating and comparing the state-specific impacts of shipments along different routes.
In September 2004, at the TEC/WG meeting, Dean Jones reported on OCRWM’s Investment Planning Model, which was intended to be “the first of three modules of the Logistics Modeling effort to support planning, development and operation of a safe, secure and efficient transportation system for the RW Office of National Transportation” (TEC 2004, p. 24). Rather than serve as an assessment tool for the states and tribes affected by OCRWM’s shipments, the model was intended to be “a resource investment planning strategy to address the utility allocations and repository disposal target volumes while considering the total cost” (ibid.). The 2004 TEC/WG meeting marked the first and last time OCRWM reported to the states on its progress in developing the Investment Planning Model. OCRWM never indicated any intention of expanding the model to be the type of tool that states could use to evaluate and plan to mitigate the impact of shipments on their jurisdictions.

Recognizing a definite unmet need on the part of the states, WIEB took up the ambitious task of trying to establish the type of planning tool described above – a tool that would merge the functions of TRAGIS and RADTRAN while adding significantly more information through the application of GIS technology. In 2008, WIEB launched a pilot study to test the “web-based geospatial portal” called IRRIS (developed by GeoSystems) as a means of “assessing route conditions along potential alternate nuclear waste shipment routes and for assessing state-local emergency response capabilities and needs.” According to the pilot study proposal, the goal of such a tool would be to provide data that are “detailed, ‘featured,’ updatable, and packaged for effective use by state and local agencies for emergency response planning, assessing emergency response training and equipment needs, and evaluating routing options” (WIEB 2008, p. 1).

WIEB completed the first phase of the pilot in June 2008. In its Phase I report, WIEB identified 11 possible uses for “detailed, ‘featured’ information” on potential routes, among them route assessment, development of state and local emergency response plans, and shipment operations management (WIEB et al. 2008, pp. 2-6). In a later paper on the project, the staff proposed three full pages of questions as examples of how states and OCRWM could use a system such as the one envisioned in the WIEB IRRIS pilot. The questions included concepts ranging from evaluating “best practice choices” (like the impact of dedicated trains or an “oldest fuel first” policy on incident-free accident risk) to identifying emergency response training needs (e.g., “what is the current emergency response capability along route X in my state?”) (Williams et al. 2009, pp. 9-12). Although the WIEB project showed a great deal of promise, OCRWM’s decision to discontinue funding for the regional cooperative agreements prevented WIEB from going beyond Phase I of the pilot program.

The states are still in need of a system for analyzing shipment information to help them determine the potential impacts they will experience as a result of large-scale movement of spent fuel and high-level waste. It is unclear how much progress OCRWM made in the development of its own internal model or whether this specific model would be useful to the states in the future. The work done by WIEB holds more promise in that it was conducted fairly recently with a system that is still available. For the West to resume this project, however, would require a significant investment of funding – unlikely given the elimination of the Yucca Mountain program. Furthermore, by the time the states or the regions have both a pressing need and sufficient funding to pick up this work in the future, IRRIS may no longer be the most suitable platform given the rate of technological advances.
**Federal Regulation of Transportation**

The NWPA, as amended, carves out a small role for the Nuclear Regulatory Commission (NRC) in regulating repository shipments, but the Midwest has consistently advocated for greater NRC oversight. The NWPA stipulates that all shipments to a federal repository be made in NRC-certified packages and in accordance with NRC regulations on the advance notification of state and local governments. OCRWM is not required to comply with other NRC regulations on spent fuel and high-level waste shipments, but has indicated that the program will do so voluntarily. DOE orders commit departmental elements to following all relevant Department of Transportation (DOT) regulations, but the orders do not address NRC regulations. The Midwestern states feel it is important for OCRWM to comply with NRC regulations pertaining to other shipment activities, including route approval.

In its 1994 draft document “The Office of Civilian Radioactive Waste Management Transportation Plan: Developing the Transportation System,” OCRWM briefly described the roles of the NRC and DOT in regulating the transportation of spent fuel and high-level waste. DOT is primarily responsible for establishing standards to ensure that radioactive materials are transported safely in the United States. DOT has general highway routing regulations for shipments of radioactive materials to make routing requirements uniform throughout the nation. Additional requirements apply to routing higher-radioactivity shipments. The role of state and local governments in routing radioactive materials is described in DOT regulations. DOE Order 460.1B directs the department to follow DOT’s Hazardous Materials Regulations for transporting hazardous materials (Title 49 Code of Federal Regulations Parts 171-180).

The NRC, which licenses and regulates nuclear facilities and materials, is responsible for regulating the packaging and transportation of radioactive material for its licensees. However, because DOE is not an NRC licensee, the department is not legally bound by NRC regulations. The NWPA requires OCRWM to use NRC-certified casks for shipping and to follow the NRC’s regulations for provide advance notification of shipments. In “Developing the Transportation System,” OCRWM stated its intent to “comply with all applicable DOT, NRC, and DOE safety and security requirements and standards that exist at the time of the shipment, as well as all applicable safety requirements of state, tribal, and local governments consistent with federal requirements” (DOE 1994c, p. 3-2).

OCRWM repeated the same commitment in several later transportation planning documents. The table of resolved issues contained in OCRWM’s “pre-decisional draft” of its “National Transportation Plan” included the question, “What regulations apply to NWPA shipments?” OCRWM provided an answer: “DOE meets or exceeds DOT and NRC transportation standards that would apply to comparable commercial shipments” (DOE 2007a, p.8). In the “National Transportation Plan, Revision 0,” OCRWM emphasized the program’s “longstanding commitment to meet or exceed the DOT and NRC safety and security requirements and standards that apply to comparable commercial shipments” (DOE 2009, p. 6).

The Midwestern states have identified NRC regulation of transportation as one of the region’s “key issues” recommending that “OCRWM’s shipments of commercial spent nuclear fuel and high-level radioactive waste follow the same safeguards and security criteria (e.g. regulations, orders, and additional security measures) as NRC-regulated shipments” (MRMTC 2008a, p. 1)

With regard to DOT regulations, early on in the repository program, OCRWM said that, in compliance with DOT regulations, transportation routes would be chosen by the carrier. In the late 1990s, however,
OCRWM agreed with the regions’ recommendation that the program choose the transportation routes in consultation with stakeholders rather than leaving the decision to a private carrier. This issue is of particular interest to the states because knowing transportation routes well in advance of shipments is essential to the success of OCRWM’s program to provide financial assistance to states and tribes (see the section on Section 180(c) Implementation). States may not know the routes far enough in advance if they are determined by the carriers.

In 2008, DOT’s Pipeline and Hazardous Materials Safety Administration (PHMSA) published a rule to enhance the safety and security of hazardous materials shipments, including those of radioactive materials. The rule requires rail carriers to compile annual shipment data and use that data in selecting future shipping routes. Compliance with this new DOT rule could have a serious impact on OCRWM’s routing decisions.

**Liability**

The Price-Anderson Act covers nuclear power plant accidents. Early on, there was some concern that the Price-Anderson Act coverage would not apply to transportation accidents involving spent fuel, however according to OCRWM documents, the repository program’s transportation activities are among those covered under the Act. States and the public, therefore, will not incur the costs associated with responding to a nuclear transportation incident. Additionally, the states had sought assurance from OCRWM that they would not be burdened with the costs for recovery and cleanup from transportation accidents. OCRWM considers cleanup costs to be included in the list of costs for which states could seek reimbursement from OCRWM.

The issue of liability for incidents that could occur during the shipment of spent fuel and high-level waste to a federal repository is addressed in several OCRWM documents, principally the 1986 *Transportation Institutional Plan,* “Transportation Contingency Plan,” and the *Final Yucca Mountain Environmental Impact Statement* (EIS).

According to OCRWM’s 1986 *Transportation Institutional Plan,* “Liability coverage is currently available to reimburse the public for damages suffered in the event of either general traffic accidents or serious radiological incidents occurring during the transportation of radioactive waste” (DOE 1986c, p. A-62). Such incidents are indemnified under the Price-Anderson Act of 1957, which sought to promote the nuclear industry while protecting the public by making sure that funds would be available to pay damages incurred in the event of a nuclear incident. In 1988, the Act was expanded to cover precautionary evacuations at nuclear facilities (DOE 1995g, p. 16).

The Act established a system of federal indemnification and private insurance to ensure that funds would be available to cover the costs of a nuclear incident. Under this system, “regardless of who is found legally liable for a nuclear incident resulting from a DOE contractual activity or Nuclear Regulatory Commission-licensed activity, the indemnity will pay the claim” (DOE 2002, p. M-27). Indemnification of liability applies to “contractors, subcontractors, suppliers, shippers, transporters, emergency response workers, health professional personnel, workers, and victims” (ibid.) and the Price-Anderson Act requires DOE to include indemnification agreements in its transportation contracts. DOE nuclear waste activities, including storage, handling, transportation, treatment, and disposal of spent fuel, high-level waste, and transuranic waste are among those covered under the Price-Anderson Act.
The Price-Anderson Act indemnification covers “all reasonable additional costs incurred by a state or subdivision of a state in the course of responding to a nuclear incident or precautionary evacuation” (ibid., p. M-25). State and local governments would thus be able to recover any costs they incurred in responding to a nuclear incident, including a transportation incident. A nuclear incident is defined as “any occurrence, including an extraordinary nuclear occurrence, causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material” (ibid.). States, tribes, and local governments are included among the parties that are indemnified for any liability in the event of a nuclear incident. Events that do not involve the release of radioactive material are not covered under the Price-Anderson Act, and for these incidents, liability would be determined under state law. Motor carriers are required, under the Motor Carrier Act of 1980, to carry $5 million insurance for each vehicle that carries spent fuel or high-level waste (DOE 1986c, p. A-62). Many rail carriers carry similar levels of insurance coverage.

States have expressed the concern that they would be burdened with the costs of recovery and cleanup from incidents involving spent fuel or high-level waste shipments. According to OCRWM’s 1986 Transportation Institutional Plan, “The DOE views cleanup activities and cleanup costs associated with a transportation accident (e.g., the removal of accident debris, decontamination, and radiation monitoring) to be an element of property damage appropriately reimbursable by the DOE” (ibid., p. A-68). Thus, states should not have to bear these costs.

**Oldest Fuel First**

Various groups have advocated for OCRWM to ship the oldest fuel first to take advantage of cooler, easier-to-handle spent fuel. The Standard Disposal Contract into which OCRWM has entered with utilities, however, does not require such an approach. Furthermore, utilities may not have ready access to their oldest fuel in storage because of pool or dry storage configurations.

The state of Nevada has long recommended that OCRWM ship oldest fuel first, claiming that doing so could reduce radiological hazards to workers and the public by 65-85 percent (Halstead et al. 2008, p. 3). If a policy of oldest fuel first is not feasible, then Nevada advocates for shipping “older fuel first.”

In 2003, the Government Accountability Office (GAO) issued a report on spent fuel transport. Among the report’s findings, the GAO noted that security could be enhanced by attending to the order in which spent fuel is shipped. The GAO identified three instances in which the order of shipping could achieve the goal of enhanced security: shipping fuel from shutdown reactor sites first, shipping oldest fuel first, and shipping fuel first from “densely packed pools” (GAO 2003, pp. 19-21). Citing cobalt and cesium as examples, the GAO reported that “[r]adioactivity emitted by some components of spent fuel declines significantly over comparatively short periods of time,” such as 25-30 years (GAO 2003, p. 20). While “a deliberate or accidental release” from a shipment involving 30-year old spent fuel would still be “significant,” the GAO asserted that the “threat to public health” in such an instance would be less than if the spent fuel had aged for only 5-10 years (ibid.).

The GAO report noted that a significant obstacle OCRWM faced in implementing a policy of oldest fuel first would be the fact that spent fuel owners would select the spent fuel for shipping based solely on their operational needs. Spent fuel owners from operating plants would likely wish to remove spent
fuel from sites where pools are reaching their capacities, thereby reducing the need for dry storage (ibid., p. 21).

The National Academies’ Committee on Transportation of Radioactive Waste (NAS), in 2006, published *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*. Among the report’s findings, the NAS stated that there “are clear transportation operations and safety advantages to be gained from shipping older (i.e., radiologically and thermally cooler) spent fuel first” (NAS 2006, 19). Among the advantages, the NAS cited the ability to “optimize routing, scheduling, and emergency responder planning and training, especially during the early phases of the program” (ibid.). In *Going the Distance*, the NAS recommended that OCRWM “negotiate with commercial spent fuel owners to ship older fuel first to a federal repository or federal interim storage, except in cases (if any) where spent fuel storage risks at specific plants dictate the need for more immediate shipments of younger fuel” (ibid., p. 20). Recognizing that negotiations toward that end might fail, the NAS recommended OCRWM work with Congress to devise “legislative remedies” to the problem.

If OCRWM were to adopt a policy of shipping oldest fuel first, it must make such a decision within a timeframe that could support the implementation of Section 180(c) (see the section on Section 180(c) Implementation). Routes for shipments must be known at least four years prior to the start of shipments in order for states to be informed of their eligibility to receive 180(c) assistance.

**Shipment Scheduling**

The terms of the Standard Disposal Contract give spent fuel owners great latitude over decisions regarding where shipments will originate and when. Following the contract-specified shipping queue would result in a highly inefficient transportation system. OCRWM will need to negotiate with utilities to produce a more manageable shipping queue.

In the early days of developing an approach to implementing Section 180(c), a significant topic of discussion was the need for states to have advance information on the number of shipments that would impact them and the routes those shipments would use. This information is critical for the assessment of state needs in connection with shipment preparations. Without specific information, all potentially affected states would need to conduct training and other preparedness activities along every route that could possibly be used for shipments. Such an approach would result in scarce dollars available for training assistance being spread unnecessarily thin among the states. A related issue is OCRWM’s goal of conducting the transportation system in a manner that is not only safe, secure, and merits public confidence, but is also efficient.

The OCRWM program never came close enough to shipping spent fuel to require the development of a proposed shipping schedule. Had the program reached this point, the process would have revealed a serious impediment to creating an efficient shipping system, namely the terms of the Standard Disposal Contract that OCRWM has entered into with all utilities that own commercial spent fuel. The contracts give OCRWM the authority to establish the shipping queue, based on the information provided by “Purchasers,” or utilities, regarding the date and quantity of spent fuel removed from their reactors. In essence, each bundle of spent fuel taken out of a reactor gets a place in line based on the date it was removed.
Under the terms of the contract, the Purchaser has the responsibility to “identify all SNF and/or HLW the Purchaser wishes to deliver to DOE beginning sixty-three (63) months” before shipment (10 CFR 961.11, Article V, Part B, paragraph 1). The Purchaser has until 12 months prior to shipment, however, to “submit to DOE final delivery schedules” (10 CFR 961.11, Article V, Part C). Purchasers “have the right to exchange approved delivery commitment schedules with parties to other contracts with DOE... provided, however, that DOE shall, in advance, have the right to approve or disapprove, in its sole discretion, any such exchanges” (10 CFR 961.11, Article V, Part E). Purchasers have to provide an exchange request to OCRWM at least six months prior to delivery, with OCRWM allowed 30 days to either approve or disapprove the exchange (ibid.). By these terms, OCRWM may not know for certain where it will be picking up spent fuel for transport until five months prior to shipping. Complicating this situation further is the consolidation of the nuclear industry since the time the contract was first written. Instead of identifying for shipment the specific quantity of spent fuel at the particular site that “holds” the place in the shipping queue, a Purchaser could choose to ship an identical quantity of spent fuel located at a reactor hundreds of miles away, affecting a completely different set of states along the shipping route.

In 2003, the GAO recommended that OCRWM limit the number of shipments as a way to reduce the risk of terrorism against shipments (GAO 2003, p. 17). The GAO acknowledged, however, that OCRWM’s “ability to minimize the total number of shipments may be limited by its contracts with owners of spent fuel” (ibid., p. 18). One problem is that “in many cases, the places in the queue correspond to quantities of spent fuel that would fill less than three large rail containers,” which was OCRWM’s plan (based on rail industry recommendations) for the size of rail shipments (ibid.). The GAO calculated that, for the “12 spent fuel owners with the largest quantities of spent fuel,” all the spent fuel could be shipped in 576 shipments if OCRWM adhered strictly to the shipping queue specified in the standard contract. This number could be reduced to 479 – a 17-percent reduction – if OCRWM did not follow the queue but instead filled each cask completely (ibid.). Increasing the number of casks per train to five would result in nearly a 50-percent reduction in the number of shipments (ibid., p. 19).

In its report in 2006, the NAS also found the shipping queue to be limiting, describing “the order for accepting commercial spent fuel” as “not designed with the transportation program in mind” (ibid.). Like the GAO, the NAS observed that, because “[s]ome of the allocations are not large enough to fill even a single transportation package,...there could be a large number of partially filled packages transported to Yucca Mountain” (ibid., p. 239). The result would be to “greatly increase the number of total shipments to the repository” (ibid.). The NAS concluded that the shipping queue would provide “little opportunity for optimizing the transportation program to reduce the total number of shipments or the need for maintaining large numbers of transportation routes and for emergency responder training” (ibid., pp. 240-41). The NAS also noted the benefits of having OCRWM ship “older fuel first,” which could be precluded if the program adhered to the existing acceptance order (see the section on Oldest Fuel First). The NAS recommended that, if OCRWM were unable to negotiate successfully with Purchasers in order to maximize the efficiency of the shipping queue, “Congress should consider legislative remedies” (ibid., p. 20).

In their joint comments on Rev. 0 of OCRWM’s “National Transportation Plan,” the regional groups in the Midwest, West, and Northeast mentioned the need for OCRWM to make decisions regarding the shipping queue (Niles et al. 2009, p. 2). The West’s Jim Williams prepared a detailed treatment of “the question of queue” in a paper delivered at the Waste Management Conference earlier that year. Williams cautioned that the “SNF acceptance rankings established by the Standard Contract” would be a “barrier [to] best practice cross-country transport of the nation’s inventory of SNF” (Williams 2009b, p.
1). The paper discussed four possible “elements of best practice” for the cross-country transport of spent fuel: the shipment mode, the age of spent fuel transported, prioritization of certain origin sites, and concentrated acceptance at transportation origins (ibid., pp. 2-3). Williams noted OCRWM’s reluctance to provide detailed responses to stakeholder questions about the shipping queue, attributing the program’s reticence to the “ongoing litigation with nuclear utilities” over OCRWM’s failure to begin accepting spent fuel in 1998 (ibid., p. 3).

Looking at the acceptance priority rankings for the first 500 metric tons of spent fuel to be accepted, Williams noted several inefficiencies, particularly the fact that “500 MT can be transported in 18 dedicated train shipments, [however] the ‘Standard Contract’ campaign requires 114 overweight truck, 11 dedicated train, and 6 mixed freight shipments” (ibid., p. 5). Williams suggested that OCRWM develop a market-based system by which it would “offer money for…queue slots” so as to structure the acceptance order in a manner that emphasizes “best practice transport” (ibid., p. 9). Williams acknowledged that additional work would be needed to refine his proposal; however, the work was cut short as a result of the Yucca Mountain program being canceled.

**State Regulation**

OCRWM addressed the issue of state regulation very early in the development of the transportation system. Because of the close working relationship they had with OCRWM through the regional groups, the states had every expectation that OCRWM would respect their role overseeing shipments of spent fuel and high-level waste to a national repository. The states’ role as co-regulators of shipments along with the NRC and DOT guaranteed they would have a place at the table in planning the transportation system. OCRWM’s commitment to work with the states as partners in planning came into question in 2006 with proposed legislation to amend the NWPA. If passed, Section 7 of the Nuclear Fuel Management and Disposal Act (S. 2589) would have facilitated OCRWM’s efforts to seek preemption of state laws related to shipments of radioactive waste. The legislation was defeated, but a similar proposal surfaced the following year. OCRWM’s expressed support for the legislation seriously eroded the states’ trust in the program – trust that had taken literally decades to build.

The Transportation Institutional Plan identified “state, tribal, and local regulation of transportation” as an “added issue” that resulted from discussions with stakeholders in 1984. The discussion paper in the Transportation Institutional Plan addresses the history of transportation regulation, noting that – “to ensure the free flow of interstate commerce and, where necessary, to provide adequately for national safety” – much of the authority over shipments rests with the federal government (DOE 1986c, p. A-113). State and local governments, however, are afforded a role over some aspects of transportation, generally to ensure that local safety concerns are addressed. The discussion paper cites examples of “valid state and local regulations” based on DOT “inconsistency rulings” and court cases. Among the examples of “activities falling within the scope of legitimate State and local regulatory authority” are vehicle inspections “at loading and unloading points,” “immediate accident reporting to appropriate State or local officials to facilitate emergency response,” and “local regulation of traffic, including restrictions concerning the actual operation of motor vehicles and penalty actions for traffic violations” (ibid., pp. A-121-122).

OCRWM’s discussion paper addressed the matter of state fees and permits, observing that “the extent to which States and local governments can enforce permit and fee requirements…remains somewhat unclear” (ibid., p. A-122). OCRWM acknowledged that states traditionally have enforced “permit and
fee systems for highway transportation involving overweight trucks” – even trucks carrying radioactive waste. However, the paper goes on to state that “the validity of permit and fee systems that are directly related to the hazardous nature of cargo being shipped, but are imposed for the purpose of supporting State and local police-power responsibilities, has not been firmly established” (ibid.). A DOT inconsistency ruling – recently decided, at the time the Transportation Institutional Plan was written – had determined that a “transit fee” imposed by the state of Illinois per cask of spent fuel was not inconsistent with the Hazardous Materials Transportation Act. OCRWM indicated in its discussion paper that it would review the ruling “and its potential effect on NWPA shipping in the next iteration of the transportation plan” (ibid.).

The discussion paper concluded with OCRWM stating that it would “comply with all legally valid State, Tribal, and local transportation requirements when conducting waste shipments under the NWPA” (ibid., A-124). It remained to be determined, however, which state, tribal, and local requirements would be deemed “valid.” OCRWM pledged to continue studying “DOT advisory rulings and court decisions” to help define the role these non-federal entities would have with regard to regulating shipping activities. According to OCRWM, “All editions of the comprehensive transportation plan will continue to outline DOT and court rulings, and note progress toward a definition of regulatory authority” (ibid.). OCRWM intended to produce a “written policy statement by mid-1990” to clarify the program’s position on state, tribal, and local regulation of transportation, identifying restrictions that would apply to NWPA shipments. The target date for issuing the policy statement was timed to precede the publication of a request for proposals for service contracts, since the information would be useful for potential bidders (ibid., p. A-125).

As reported in the Transportation Institutional Plan discussion paper, participants at the 1985 institutional workshop offered three suggestions for OCRWM to work with states, tribes, local governments, and other federal agencies to “clarify the regulatory roles of various governmental agencies for such activities as emergency response, inspection, and enforcement” (ibid.). One suggestion pertained to “special transportation requirements” in states that served as host for NWPA facilities or shipping sites. A second suggestion was that “a negotiated intergovernmental approach” might be necessary to resolve issues related to the regulation of shipping activities. Finally, stakeholders suggested OCRWM evaluate “the use of interstate agreements to facilitate the development of nationally uniform transportation requirements” (ibid.). OCRWM’s cooperative agreement with the Commercial Vehicle Safety Alliance (CVSA) is the single example of the agency following through on this suggestion – in this case, to develop a standardized approach to state inspection of truck shipments of spent fuel and high-level waste (for more information, see the section on Inspection and Enforcement).

The 2007 pre-decisional draft of OCRWM’s transportation plan stated that “DOE’s policy for meeting or exceeding the regulatory standards for shipments of SNF and HLW is further detailed in DOE M 460.2-1 [DOE’s Radioactive Material Transportation Practices Manual, or DOE Manual]...and Appendix M of the FEIS [Yucca Mountain Final EIS]” (DOE 2007a, p. 6). The DOE Manual states that, “As a matter of policy...all DOE shipments will be undertaken in accordance with the requirements and standards that apply to comparable commercial shipments, except where there is a determination that national security or another critical interest requires different action” (DOE 2008f, p. 2). Appendix M of the Yucca Mountain Final EIS, published in 2002, does include a section on “Transportation Regulations” (M.2); this section, however, makes only one reference to state regulations: “DOE shipments of spent nuclear fuel and high-level radioactive waste from reactors and DOE sites around the country to a repository at Yucca Mountain would comply with applicable Federal, Native American, state, and local government regulations” (DOE 2002, Appendix M, p. 3).
OCRWM’s revised transportation plan, published in 2009, makes a similar reference to the DOE Manual and another appendix – this time, to Appendix H of the Supplemental EIS (published in 2008). The wording in Appendix H is even more vague with regard to what non-federal requirements would apply to NWPA shipments. Section H.2 – analogous to Section M.2 in the Yucca Mountain Final EIS – addresses “Transportation Regulations” (DOE 2008c, p. H-1). The opening paragraph states that “For transportation of [spent fuel and high-level radioactive waste] to Yucca Mountain, DOE would meet or exceed U.S. Department of Transportation and NRC rules” (ibid., pp. H-1 and H-2). The only mention of states is with regard to DOE’s objective of working “with states, local government officials, federally recognized American Indian tribes, utilities, the transportation industry, and other interested parties in a cooperative manner to develop the transportation system” (ibid., p. H-2).

OCRWM’s gradual movement away from early commitments to work cooperatively with the states and other affected parties to define regulatory requirements was perhaps foreshadowed by the agency’s unsuccessful attempts in 2006 and 2007 to have Congress amend the NWPA. In 2006, for example, OCRWM succeeded in getting the Nuclear Fuel Management and Disposal Act (S. 2589) introduced in the U.S. Senate. The principal goals of the legislation were related to the repository program – including “funding reform” and lifting the 70,000 metric ton statutory cap on the capacity of Yucca Mountain. Section 7 of the bill, however, would have authorized the Secretary of Transportation, upon request by the Secretary of Energy, to determine “that any requirement of a State, political subdivision of a State, or Indian tribe regarding transportation done by or on behalf of the Secretary of Energy in carrying out the NWPA is preempted, irrespective of whether the transportation otherwise is or would be subject to regulation under the Hazardous Materials Transportation Authorization Act of 1994” (S. 2589, Section 7).

The Midwestern states and their counterparts in other regions objected to the legislation, expressing their strong dissatisfaction through resolutions (e.g., CSG 2006) and letters (Campbell 2006, Napolitano 2006). The Council of State Governments’ (CSG) resolution urged the removal of Section 7 from the bill, noting that its passage would threaten “not only the partnership between CSG and DOE, but also safe, secure transportation of radioactive wastes to Yucca Mountain by exempting these shipments from existing federal regulation, limiting states’ abilities to assist in routine transport and to maintain emergency readiness capabilities at the highest level, and possibly undermining public confidence” (ibid., pp. 3-4). The Midwestern Radioactive Materials Transportation Committee even designated preemption as one of its “key issues” related to the OCRWM program, stating the region’s opinion that OCRWM “supporting the preemption of state laws will significantly harm the cooperative relationships the program has spent much of the last two decades cultivating” (MRMTC 2008a, p. 2).

In its letter, CVSA expressed concern that Section 7 would “pre-empt the Level VI inspection program that all states have uniformly participated in for the past 20 years” (Campbell 2006, p. 2). The Western governors objected that Section 7 would “effectively eliminate the states’ ability to take reasonable measures to ensure the safety and confidence of our citizens, such as carrier and shipment inspections, routing restrictions in high-risk areas..., and shipment escorts” (Napolitano 2006, p. 2). The governors pointed out that “[r]epository shipments on this sale cannot be made in a vacuum under DOE self-regulation,” but instead must “be made safely as part of our existing transportation system and regulatory framework” (ibid.).

S. 2589 was never passed, however the language of Section 7 surfaced again in 2007 in a bill that Energy Secretary Samuel Bodman sent to then Vice President Cheney and Speaker Nancy Pelosi, urging their support (Bodman 2007). Fortunately for the states, that bill did not get picked up for consideration by
the Congress. OCRWM’s two attempts to pass legislation preempting state regulation succeeded only in seriously eroding the trust and confidence that it had spent 20 years developing through regional cooperative agreements with groups like CSG Midwest and WIEB. These actions occurred just three years before the program was terminated, therefore the OCRWM staff had little time to repair the damage that had been done. It remains to be seen whether the continuing relationship between the states and other DOE shipping programs (principally EM and WIPP) will be able to strengthen the ties that OCRWM cut with its action to preempt state laws.

**Transportation of High-Level Waste**

*OCRWM put a lot of work into figuring out how it would transport spent fuel, but very little work has been done on high-level waste. There is little mention of planning specific to high-level waste in OCRWM documents after the 1986 Transportation Institutional Plan, which identified several key issues related to transporting defense high-level waste. The Yucca Mountain Final EIS mentions the number of projected shipments of high-level waste, but the assumption seems to be that high-level waste would be shipped like spent fuel. OCRWM and its transportation stakeholders have not delved into the details of whether that would work and, if not, how else to do it. These details should be included in key OCRWM transportation documents, such as the “National Transportation Plan.”*

OCRWM’s 1986 *Transportation Institutional Plan* discussed the department’s policy for shipping defense high-level waste to a repository. OCRWM defines defense high-level waste as “the highly-radioactive waste that results from reprocessing of spent nuclear fuel that contains a combination of transuranic waste and fission products in concentrations as to require permanent isolation” (DOE 1986c, p. A-12). Inventories of defense high-level waste currently exist at the Savannah River Site, Idaho National Engineering and Environmental Laboratory, and the Hanford Reservation. A fourth site – West Valley in New York – stores high-level waste generated from commercial reprocessing of spent fuel. The Yucca Mountain Final EIS estimated that there would be an inventory of 22,280 canisters of high-level waste by the time Yucca Mountain shipments began; under DOE’s proposed action, 8,315 canisters would be shipped to the national repository for disposal (DOE 2002, p. J-20).

The *Transportation Institutional Plan* identified several issues with regard to shipments of high-level waste, the first of which was the “transportation requirements for defense waste.” OCRWM stated that shipments would be carried out “in full compliance with Federal regulations and procedures established by OCRWM” (ibid., p. A-14). This statement implies that defense waste shipments will be subjected to the same requirements as shipments of commercial waste carried out under the NWPA. The “National Security Classification” of defense waste shipments was another issue raised in the *Transportation Institutional Plan*. According to the document, high-level waste shipments “will not be classified as needing special protection for national security purposes, and will comply with all applicable DOT transportation requirements” (ibid.). The plan further stated that, according to OCRWM transportation planning documents, “it is assumed that defense waste would be shipped directly from DOE facilities to a repository” (ibid.).

The *Transportation Institutional Plan* identified emergency response as another issue to be addressed. Prior to the commencement of shipments to a repository, OCRWM, other federal agencies, states, tribes, and local governments will review existing emergency response capabilities for dealing with potential transportation incidents. According to OCRWM, “current discussions between the OCRWM, the Office of Defense Programs, the FEMA, and other Federal agencies have not identified any unique
aspects of defense waste transportation that would require the development of a separate emergency-response program for defense waste shipments” (ibid.). Finally, the Transportation Institutional Plan identified liability coverage for shipments of defense waste as an issue that must be addressed prior to the commencement of shipments. Defense waste shipments to an NWPA-authorized repository would be covered by “1) carrier insurance for general traffic accidents, and 2) the government indemnity provisions of the Price-Anderson Act for serious transportation accidents involving a release of radioactive materials” (ibid.).

The pre-decisional draft of OCRWM’s “National Transportation Plan” listed the destination for defense waste as a “resolved transportation issue” because “[t]he 1982 NWPA left it up to the President to determine whether civilian and defense-related wastes should be emplaced in the same repository. On April 30, 1985, the President issued a decision that they should be, with each party paying its proportional share of the full costs” (DOE 2007a, p. 9). The draft document also stated that, according to a 1986 Memorandum of Understanding with the Office of Defense Programs, defense waste would be transported in NRC-certified casks. Later, amendments to the NWPA required that all shipments to Yucca Mountain be made using NRC-certified packages (ibid., p.8). The pre-decisional draft of the “National Transportation Plan” identified March 2009 as the target date for awarding the contract to design and certify transportation casks for shipping high-level waste (ibid., p. 51).

Transportation Safety Program Funding

Section 180(c) of the NWPA requires OCRWM to provide technical and financial assistance to states and Indian tribes for training public safety officials in jurisdictions through which the Secretary plans to transport spent fuel or high-level waste to an NWPA-authorized facility. DOE’s Office of General Counsel has interpreted Section 180(c) as applying only to “training-related activities.” The states strongly believe that OCRWM has an obligation to cover all costs related to repository shipments, including the operational activities of the state transportation safety programs. The WIPP program provides a model for funding state transportation safety programs.

One of the major unresolved issues around OCRWM’s plans to ship spent fuel and high-level waste to a repository is that, to date, OCRWM has not committed to funding the states’ operations-related activities connected with shipments. The TEC/WG Section 180(c) Topic Group worked intensively in 2004 and 2005 to develop a series of recommendations on Section 180(c) policy (see the section on Section 180(c) Implementation). Comprised of numerous parties with an interest in OCRWM’s transportation program, the Section 180(c) Topic Group was able to reach consensus on eight issues related to Section 180(c) policy. One of the three issues on which consensus could not be reached was how to provide funding for operational activities (TEC 180c TG 2005, Executive Summary, p. 2).

The states will incur significant costs in connection with OCRWM’s shipments, including inspections, tracking, escorting, and public information activities. Shipment-related activities carried out by the states directly contribute to safe, routine transportation and public acceptance of OCRWM’s shipments. If OCRWM does not fund these activities, the states will be left with the choice of paying for their transportation safety programs with tax dollars, foregoing these operational activities, or charging fees to recoup their costs. The Nuclear Waste Fund was established to “... ensure that the costs of carrying out activities relating to the disposal of... waste and spent fuel will be borne by the persons responsible for generating such waste and spent fuel” (NWPA Section 111(b)(4)). For this reason, the states feel their operations-related costs should be covered by the Nuclear Waste Fund.
Other DOE shipping programs have set the precedent of providing funding to states to cover operational activities. For example, the WIPP Land Withdrawal Act, passed in 1992, directed DOE to “provide technical assistance and funds” for training, equipment purchases and operational safety programs. Section 16 of the Act directs the Secretary of Energy to “provide in-kind, financial, technical, and other appropriate assistance to any State or Indian tribe through whose jurisdiction the Secretary plans to transport transuranic waste to or from WIPP, for the purpose of WIPP-specific transportation safety programs” (WIPP Land Withdrawal Act, Section 16).

The states have long argued that OCRWM should provide funding for transportation safety programs related to OCRWM shipments, just as the Carlsbad Field Office does for WIPP shipments. This funding could be made available to states through Section 180(c) or some other mechanism. The TEC Section 180(c) Topic Group recommended that OCRWM commit to funding the same kind of transportation safety programs that are in place for WIPP shipments (TEC 180c TG 2005, Appendix J, p.2).

Some states, including seven in the Midwest, have enacted fees on shipments of radioactive materials, including spent fuel and high-level waste (MRMTC 2010b). Fee revenue is used to fund state programs for escorts, inspections, and emergency response, among other activities. In the absence of OCRWM funding for operational activities, it is possible that states will increase these fees and more states will impose fees on shipments to cover the costs of their transportation safety programs. In a paper presented at the Waste Management conference in 2009, Lisa Janairo compared possible awards under the Section 180(c) program to the revenue the states could feasibly generate through fee programs. The analysis showed that most states would “likely derive greater benefit from Section 180(c) grants than they would from fees” (Janairo 2009, p. 1). The states that could fare better with fees would be those with the highest projected shipment numbers. According to Janairo, compared to Section 180(c) assistance, “fees offer states the advantages of relative simplicity compared to the [180(c)] grant application process, greater certainty of the revenue source, and flexibility in using the fee revenue” (ibid.)
When OCRWM director Ward Sproat testified before Congress in 2006, he identified as one of his four strategic objectives “to develop and begin implementation of a comprehensive national spent fuel transportation plan that accommodates state, local and tribal concerns and input to the greatest extent practicable” (Sproat 2006, p. 6). Three years later, the program met this objective, on paper, by publishing for comment Rev. 0 of OCRWM’s “National Transportation Plan.” The document, however, fell far short of the expectations Mr. Sproat’s pledge had created. Instead of describing how a typical shipment would take place, the document focused more on the development of the transportation system itself.

The Midwest has advocated for OCRWM to develop a detailed transportation operations plan. The Midwestern Radioactive Materials Transportation Committee’s “key OCRWM issues” for FY09 included the need for OCRWM to develop “a transportation operations plan in the very near term” (MRMTC 2008a, p. 1). The committee observed that “[a] well-crafted plan will be adaptable to changes in shipping sites, destinations, and modes…and would demonstrate OCRWM’s ability to conduct shipments in a safe and timely manner to both Yucca Mountain and temporary storage facilities” (ibid.). The Midwest and other stakeholders have consistently urged OCRWM to use as models for its transportation plan the plans of successful shipping campaigns such as WIPP and the Foreign Research Reactor (FRR) program. While OCRWM’s benchmarking study did identify aspects of these programs that were important “lessons learned” for the repository transportation system, OCRWM’s latest transportation plans do not reflect attempts to use these programs’ planning documents as a guide.

OCRWM identified the issue of transportation operational procedures in response to stakeholder feedback. In its discussion paper on this topic in 1986, OCRWM laid out a 10-year schedule that included holding a workshop “to discuss the outline of operational factors,” producing a “preliminary outline of operational factors,” and defining “general operational procedures” for a “comprehensive transportation plan” (DOE 1986c, p. A-105). The Transportation Institutional Plan also identified “procedural considerations” that would affect the transportation plan, including the “operations-management structure” for the transportation program and the program’s “strategy for rate negotiation” (ibid.).

OCRWM’s plan in 1986 was to develop a “Transportation Operations Procedures Manual” that would “serve as a management guide and control system for the OCRWM and contractor management” (ibid., p. A-107). OCRWM described the manual “as a road map to provide guidelines for uniformity in overall transportation operations, similar to other manuals that exist in the transportation industry today” (ibid.). Indeed, the Transportation Institutional Plan specifically mentioned that OCRWM would use the experience of other DOE programs as well as “the electric utilities and the transportation industry” in developing the transportation system for the repository program (ibid., p. A-105). Given the early stage of planning in 1986, the Transportation Institutional Plan contained a “preliminary outline of the contents of the [Operations Procedures] manual” that is impressive in its detail, including among the many steps Operational Scheduling, Shipment Checkout, as well as Shipment in Transit (ibid., pp. A-107-108).
In the 1990s, OCRWM produced many plans that addressed operational procedures. In June 1994, the program published “Developing the Transportation System,” which purportedly “supersede[d] the Transportation Institutional Plan… and the Transportation Business Plan” (DOE 1994c, p. i). The report was “intended to provide an overview of the OCRWM national transportation program,” focusing “on the development of an operational system” (ibid., p. 1-1). In reviewing the document, the Midwestern High-Level Radioactive Waste Committee (MHLRWC) noted that, while the draft plan did “an adequate job of describing the transportation component of the Civilian Radioactive Waste Management System…, much of the information contained in the document is presented in a manner that makes it unintelligible to the general reader” (MHLRWC 1994, p. 1). The committee observed that the critical section – Chapter 3, on “Development of the OCRWM Transportation System” – was “particularly hard to follow, even for stakeholders who are already familiar with the program” (ibid.). Key among the committee’s recommendations was the need to make the document a “complete yet reader-friendly source of information on the transportation system” with the committee suggesting that OCRWM enlist the help of the writers who had prepared the program’s many factsheets (ibid.).

OCRWM did not finalize “Developing the Transportation System,” choosing instead to produce a new OCRWM Transportation Report. The preface to the report explained that OCRWM had decided “not to combine the Transportation Business Plan, Transportation Institutional Plan, and operations plan into one document” (DOE 1995e, p. i). The rationale for the change in approach was that OCRWM had produced other documents that “reflected” the program’s plans for the transportation system (ibid.). The new Transportation Report would “report on the status of OCRWM’s transportation system,” giving “special emphasis to ‘institutional issues’” (ibid.). The intention was to update the report annually; the 1995 edition, however, was the only one OCRWM prepared.

One of the documents the Transportation Report cited was the “Transportation System Operations Plan” (TSOP), which OCRWM’s 1994 Program Plan included as a milestone for FY95 (DOE 1994a, p. 38). OCRWM’s management and operating contractor released Revision 0 of the “Transportation Subsystem Operations Plan” in February 1995, designating the document as “Volume 15 of the WAST Project Management Plan.” According to the TSOP, the purpose of the plan was to 1) provide “the concept of operations” for the OCRWM transportation program; 2) provide “a planning basis for lower level functions identified in the Transportation Subsystem design requirements documents;” and 3) describe “the Transportation Subsystem in terms of mission, organizational structure, and architecture” (DOE 1995i, p. 1).

The TSOP described the transportation planning process as involving “long range planning” (occurring “one year or more before the commencement of a campaign year”) and “operations planning” (occurring within one year of a campaign’s start) (ibid., p. 13). As envisioned in 1995, there would be “two types of key campaign planning documents.” The “Campaign Plan” would be a “comprehensive document that provides a detailed description of all the activities required to move fuel from an acceptance site” to facilities for storage or disposal (ibid.). The “Annual Campaign Plan” would compile all the schedules for all campaign plans. Each shipping site would have its own “Site-Specific Servicing Plan,” which would be finalized “at least 18 months” before OCRWM would deliver shipping casks to the site – 24 months in advance for shipments that would take place the first year of the program (ibid., p. 16).

As with “Developing the Transportation System,” the MHLRWC found the TSOP to be “difficult to read” and lacking in “relevant specifications” (MHLRWC 1995, p. 1). As an example, the committee noted that
“the reader...learns about DOE’s plans to have office equipment but not about the department’s protocols for safe parking and bad weather” (ibid.).

In 2006, after a hiatus in transportation planning activities, OCRWM published a new “Transportation System Concept of Operations” (CONOPS) (Rev. 0). The document suffered from the same problem as earlier transportation program plans – namely, being densely packed, difficult to understand, and lacking in tangible details about operational procedures. The authors of the plan described it as “the core high-level OCRWM document written to describe the Transportation System integrated design and present the vision, mission, and goals for Transportation System Operations” (DOE 2006d, p. 8). In Section 5, Technical Baseline for Transportation System Operations, OCRWM identified the “Transportation System Documents” and their relationship. The goal at the time was to have a Transportation Operations Plan feed into the Annual Shipping Plan and Site Campaign Plans.

The link between the CONOPS and the Transportation Operations Plan was somewhat tenuous, with three documents or processes interspersed along the way (ibid., p. 17). The CONOPS described the “Transportation Operations Plan” as providing “well-defined operations, safety, security, and emergency response guidelines for the Transportation System” (ibid., p. 18). Instead of being the operational procedures plan, however, the Transportation Operations Plan would provide “the framework from which detailed operational procedures [would] be developed” (ibid.). These procedures would address “several topical areas, including: campaign planning; shipment tracking, training; emergency response; safety; and security” (ibid.). Unlike the Transportation Institutional Plan and other earlier OCRWM documents, the CONOPS did not provide a schedule or target timeframe for developing the Transportation Operations Plan.

Within a year of publishing the CONOPS, OCRWM produced an outline of a new “National Transportation Plan.” As with previous efforts at creating a comprehensive plan, this one fell short. In its comments on the outline, the Midwestern committee – now the Midwestern Radioactive Materials Transportation Committee (MRMTC) – observed that the “stated purpose of this plan is to ‘tell the story of how the [transportation] system will be developed and deployed’” (MRMTC 2007, p. 1). The committee went on to note that “the system is sufficiently ‘developed’ for OCRWM to be telling the story of how waste will get from the power plants to the repository” (ibid.). In its comments, the committee asked when OCRWM would “begin to develop an operations-focused transportation plan, covering activities such as tracking, inspections, and security” (ibid.). The region also noted that, at the 2007 TEC/WG meeting in Atlanta, OCRWM had taken the action item of producing a list of “all the transportation-related documents that [the program] had prepared and what their relationship is to one another” (ibid.). OCRWM did not follow through with this action item to produce a publicly available listing.

In the summer of 2007, in time for the TEC/WG meeting, OCRWM produced the pre-decisional draft of the “National Transportation Plan.” The draft was a 54-page plan, with schedules and funding profiles, that included a list of transportation issues and their status (DOE 2007a, Table 2, Table 3, Section VI). The document was not the Transportation Operations Plan that the CONOPS had referred to, but instead outlined “the strategy and process for developing and implementing the transportation system,” including “how stakeholder collaboration [would] contribute to specific elements of the transportation system” (ibid., p. 1). The section on “Operational Planning” noted that, “[b]ecause of the early stage of system development, operational planning has been limited” (ibid., p. 17). Less than a month later, OCRWM retracted the document.
In 2009, just days before the inauguration of President Barack Obama, OCRWM published for comment a new version of the “National Transportation Plan,” labeled “Revision 0.” Half the length of the pre-decisional draft, the new plan lacked the detail provided in the earlier plan, with no schedules or cost projections. The plan also lacked information on the status of various institutional issues, covering only Section 180(c) implementation and route identification (DOE 2009, pp. 23-25). In comments on the plan, the Midwest explained that “the brevity of our comments reflects the level of detail OCRWM included in Rev. 0 of the transportation plan” (Leuer and Rasmusson 2009b, p. 1). The region committed to providing “a much more extensive set of comments in the future when OCRWM produces a truly comprehensive national transportation plan” (ibid.).

The Midwest’s joint letter with the West and the Northeast similarly observed that there were some “significant deficiencies in the plan,” noting that “[a] great deal of work remains to be done before the plan will be the ‘comprehensive national transportation plan’ committed to by former OCRWM director Edward Sproat” (Niles et al. 2009, p. 1). In closing, the regions expressed their disappointment that OCRWM had “made the decision to solicit input on the “National Transportation Plan” formally through the Federal Register but not to respond to stakeholder comments with a comment-response document or with further stakeholder discussion” (ibid., p. 2). The regions urged OCRWM to reconsider this decision, as well as to “post the comments received on the program website so that a record of the input received [would] be available to stakeholders and to future federal staff tasked with completing the transportation plan” (ibid.). OCRWM did not follow through on this suggestion.

**PILOT PROGRAM**

Some groups have recommended that OCRWM initiate shipments on a small scale with a pilot program so as to work out the bugs in the system before launching the full-scale transportation program. OCRWM acknowledged the benefits of a pilot program in its 2007 report Radioactive Waste Logistics Benchmarking and announced its plans to conduct “pilot projects” in versions of its transportation plan. OCRWM provided little in the way of detail, however, regarding the scope and schedule for its pilot testing.

In its 2006 study *Going the Distance*, the NAS alluded to the advantages of a small-scale pilot program in its finding on the acceptance order for spent fuel shipments under the NWPA. Specifically, the NAS found that there were “clear transportation operations and safety advantages to be gained from shipping older spent fuel first and for initiating the transportation program with relatively short, logistically simple movements to gain experience and build operator and public confidence” (NAS 2006, p. 19). From this finding, the NAS recommended that “DOE…initiate transport through a pilot program involving relatively short, logistically simple movements of older fuel from closed reactors….DOE should use the lessons learned from this pilot activity to initiate its full-scale transportation program from operating reactors” (ibid., p. 238). The NAS expressed the belief that a pilot program involving shipments from shut-down reactors would help DOE “gain experience and build public confidence by demonstrating an ability to transport spent fuel to Yucca Mountain in a safe, secure, and operationally effective manner” (ibid., p. 246).

In Rev. 0 of the “National Transportation Plan,” OCRWM indicated that it would conduct “pilot projects to assess the adequacy of policies, procedures, and processes that are unique to OCRWM’s transportation system” (DOE 2009, p. 19). Indeed, this suggestion was one of the recommendations in OCRWM’s own benchmarking report, published in 2007: “Extensively pilot test and refine plans, equipment and operations” (DOE 2007c, p. iii). That report compiled the lessons learned from various
DOE shipping programs, including the WIPP program. The report described the WIPP “demonstration program,” involving prototype casks, that “focused on stakeholder interactions, emergency response preparedness, and public education” (ibid., p. 24). The WIPP contributors to the report noted that “the demonstration program could have been even more effective” had it included testing of the equipment “under routine and continuous operating conditions;” “notification procedures for an in-transit emergency, and the joint information center response;” and “addressing the possible need to reverse shipments due to unexpected rejection of waste at WIPP” (ibid.). The WIPP program also recommended that OCRWM conduct “extensive operational readiness reviews with utility sites,” since the shipping sites’ ability to meet their waste characterization and packaging goals proved to be an early challenge for the WIPP program (ibid.).

According to Rev. 0 of OCRWM’s plan, the purpose of the OCRWM pilot projects would be to “support system development before larger scale investments are made and before commencement of full-scale operations” (DOE 2009, p. 19). This description is consistent with the type of pilot identified in OCRWM’s benchmarking report. The “National Transportation Plan” did not provide much in the way of detail, therefore it is unclear whether OCRWM envisioned the same kind of pilot shipping program – specifically one involving spent fuel from shut-down reactors – that the NAS had recommended in 2006. The earlier, pre-decisional draft of the transportation plan sheds some light on OCRWM’s plans for the pilot projects. OCRWM cited as one example “training in cask handling for the logistics operator, for repository personnel and for shipping sites using non-radioactive and non-contaminated cask systems” (DOE 2007a, p. 31). The plan also mentioned the long-planned pilot of the Section 180(c) program assistance. With regard to actual shipments, however, the only plans OCRWM had were to ship “empty casks using contracted carriers and selected routes,” which would involve “carriers, state, tribal and local officials in OCRWM shipment operations before loaded casks are shipped” (ibid.). It appears, therefore, that OCRWM had different plans than the NAS did for pilot testing the transportation system.

OCRWM’s 2008 Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel gave OCRWM an opportunity to address the NAS’s recommendation directly. Congress had requested the report in the House Appropriations Committee report on the Consolidated Appropriations Act of 2008. Specifically, the House Appropriations Committee requested that OCRWM “…develop a plan to take custody of spent fuel currently stored at decommissioned reactor sites to both reduce costs that are ultimately borne by the taxpayer and demonstrate that DOE can move forward in the near-term with at least some element of nuclear waste policy” (U.S. House of Representatives Appropriations Committee 2007, pp. 87-88). The resulting OCRWM report consisted largely of documenting the cost and legal constraints that would prevent the program from carrying out such a demonstration project. A short section on transportation addressed the four-year shipping schedule that would move a total of 294 shipments from the nine decommissioned sites. The report noted that the schedule was “based on an approach that focuses on efficiency in transporting the SNF to the interim storage facility and does not follow the notification and scheduling requirements contained in the Standard Contracts” (DOE 2008g, p. 13). OCRWM also provided a cost estimate for transportation equipment acquisition and operations, amounting to $320 million over two years of acquisition and four of operation (ibid., p. 14).

Program Evaluation

How OCRWM would evaluate the repository transportation program remains undecided. The Western states conduct a thorough review of the WIPP transportation safety program every two years. The states believe it would be appropriate for OCRWM to implement a comparable evaluation program for the repository shipments.
The WIPP Transportation Safety Program Implementation Guide (WIPP PIG) calls for a rigorous evaluation of the WIPP Transportation Safety Program to be carried out every two years. The evaluation measures the program’s effectiveness and identifies areas in which improvements are needed. Each component of the WIPP Transportation Safety Program is evaluated, and the overall program is evaluated according to criteria developed by the states. The evaluation relies on quantitative, qualitative, and anecdotal information. Each state along the Western WIPP transportation routes responds to a detailed survey that is about 30 pages long. Surveys are distributed to states in December every two years, and responses are collected in January. Three Western states take the lead on conducting the evaluation and compiling results. Program evaluations have been conducted since 2000, and the overall results have been that the WIPP transportation program is working well.

The biennial evaluation process allows DOE and the states to work together continuously to make improvements in the safety program and resolve open issues. The results of past evaluations have led to improvements in shipment scheduling, the TRANSCOM system for tracking shipments, and emergency response training. The most recent evaluation covered 2007 and 2008, and was finalized in 2009. That evaluation identified that carrier audits were not being conducted as required by the WIPP PIG (Niles 2009, p. 6). DOE and the states have worked together to remedy this issue. The Western states generally support the transportation safety program, and the evaluation process is an important tool for identifying and resolving issues. The process promotes the communication between DOE and the states that has been essential to the WIPP transportation program’s success. Like other elements of the WIPP transportation program, the program evaluation developed by WGA with input from DOE is an excellent model for the OCRWM program.

**Seasonal Scheduling**

The Midwest has been an advocate for OCRWM considering a seasonal schedule to take advantage of good weather conditions in the North and the South. OCRWM’s transportation program never advanced to the point of working with states on long-term schedules for shipments, therefore no work has been done on this issue.

The CSG Midwest Planning Guide for Shipments of Radioactive Materials through the Midwestern States specifically calls for DOE and other shippers to avoid winter shipments in the Midwest:

“Because of the likelihood of severe winter weather resulting in shipment delays, as a general rule, shipments of spent nuclear fuel, high-level radioactive waste, transuranic waste, and HRCQ material should not take place in the Midwest in December or January” (MRMTC 2008b, p. 23).

This provision reflects the states’ experiences with shipment rescheduling and delays requiring safe parking in connection with winter shipping campaigns. Shipments of transuranic waste in the West are often subject to weather-related delays during the winter months because DOE, the drivers, and the states have legitimate concerns about hazardous driving conditions. Shipment safety must be paramount, so diverting shipments to safe parking is the right decision when bad weather occurs. Such weather conditions are often predictable, however, in the northern reaches of the nation. As a result, it would behoove OCRWM to work with its shipping sites and the affected states to assess the feasibility of following a seasonal shipping schedule by which sites in the northern part of the country would ship during warm-weather months and sites in southern locations would ship in the winter months.
A seasonal shipping schedule could be consistent with the states’ desire to see OCRWM maximize the efficiency of its shipping queue by removing only fully loaded casks from each site that is scheduled to ship during the year, not just the amount specified in that site’s annual allocation. Seasonal shipping could also concentrate the impact on some states within a constrained time frame, thereby reducing the long-term burden placed on state government agencies charged with overseeing shipments. Possible drawbacks to seasonal shipping could include greater impacts on shipment duration due to road construction, difficulty identifying shipping dates that avoid key events and holidays in the states, and increased likelihood of encountering other types of inclement weather (e.g., tornadoes in the central U.S., ice storms in the South). As with all issues related to the shipping queue, making a seasonal schedule work would also depend on OCRWM’s ability to negotiate with purchasers over the terms of the Standard Contract. Whether the benefits of seasonal shipping would outweigh the costs can only be determined by a through feasibility assessment with input from all potentially affected parties.

Transportation Operational Contingencies

Aside from a draft plan published in 1994, OCRWM did not produce much in the way of detail for what it would do in the event of operational contingencies such as weather-related delays or rerouting due to unforeseen events like natural disasters or damage to roadways or rails. OCRWM will need to produce detailed contingency plans – outlining specific steps the program and other entities will take in response to various scenarios – to build confidence in the planning for shipping spent fuel and high-level waste.

Section 9 of the DOE Manual addresses transportation operational contingencies. As defined in the manual, operational contingencies are “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” (DOE 2008f, p. 31). The manual further explains that these contingencies can take place prior to departure or while a shipment is en route.

The DOE Manual specifies actions DOE shippers, including OCRWM, should take, first, to avoid adverse travel conditions and, second, in the event unforeseen adverse conditions materialize while a shipment is en route (ibid., p. 31-32). While the manual provides clear guidance for truck shipments, it leaves decisions regarding rail shipments to the discretion of the carrier. The exception is that, “if an accident or incident results or develops, the DOE shipper will consult with appropriate States and Tribes” (ibid., p. 35). The emphasis in the manual is on adverse weather and road conditions, which admittedly are the most common contingencies shipments might face. Actions by protestors or, in the case of train shipments, “rail fans” would be considered a security-related issue and would be addressed in security plans for shipments.

The OCRWM report “Developing the Transportation System” addressed contingency planning only in the context of planning for early shipment. At the time of the report’s publication, OCRWM’s cask programs were on schedule to “provide a transportation capability for the CRWMS by the year 2000” (DOE 1994c, p. 3-22). The report noted, however, that OCRWM had “developed contingency plans in the event an interim storage site becomes available in the near future” (ibid.). The two options considered were using existing casks (with limited capacities) or using higher-capacity casks using the latest technology. OCRWM predicted that these newly designed casks “could be built and certified quickly if reliance was placed on design approach, materials, and technologies currently used in existing casks” (ibid.).
In 1995, OCRWM published Revision 1 of its “Transportation Contingency Plan for Limited Capacity Shipment.” Like the 1994 “Developing the Transportation System,” this plan focused exclusively on the specific contingency of OCRWM being faced with ramping up the transportation system on a compressed schedule. In the “Transportation Contingency Plan,” OCRWM addressed institutional considerations that “must be addressed prior to Transportation System Element operation” (DOE 1995g, p. 14). The issues cited in the plan were a sampling of issues contained in the Transportation Institutional Plan or added at a later date, included routing, emergency preparedness, and full-scale testing of casks (ibid., pp. 14-15). The document is useful for getting a sense of what steps OCRWM would need to take in order to ship earlier than planned. Nevertheless, the states have repeatedly cautioned against the possibility of shipments occurring before all the institutional issues have been addressed to the mutual satisfaction of OCRWM and the affected states. OCRWM has demonstrated through activities like the development of the Section 180(c) policy and procedures that, when given proper direction and authority, the program can move swiftly to resolve even complicated issues. Other examples, however, such as route identification, call into question OCRWM’s ability to get things done on a tight schedule.

During its discussions of the various issues pertaining to the provision of financial assistance to states and tribes, the Section 180(c) Topic Group considered contingency planning specifically with regard to rerouting. Appendix F of the group’s recommendations to OCRWM management addressed contingency re-routing during which shipments might need to be diverted to “a less prepared or unprepared route” (TEC 180c TG 2005, Appendix H, p. 1). The discussion paper noted that, while DOT does not require hazardous materials emergency response training as a “prerequisite” for hazardous materials shipments along a particular route, this fact “must be balanced against OCRWM’s legal mandate to provide assistance along shipping routes” (ibid.). The paper described the proposal in the 1998 version of the 180(c) policy and procedures: specifically, the policy stated that “eligible states and tribes may receive an additional amount of financial assistance if asked to complete activities in shorter amounts of time” (ibid., p. 2). This situation would pertain to three different scenarios: a route is selected too close to the start of shipments to allow for Section 180(c) implementation; a route is closed while a shipment is en route; or no training (or insufficient training) has occurred along the route “as a result of fraudulent actions or non-cooperation by a state or tribe along the route” (ibid.). As noted in the paper, a weakness of this approach was that two of the scenarios would be the result of “poor planning, not unforeseen events” (ibid.).

The topic group recommended that “instances of poor planning should not be considered in contingency planning” (ibid.). Instead, the members of the group defined a contingency, “for the purposes of the 180(c) program, [as] an occurrence such as an emergency route closure that turns into a long-term route closure that affects planned or ongoing shipments” (ibid., p. 3). In the event of contingency re-routing, the topic group recommended that OCRWM should “make funds available, if necessary, and work with state, local and tribal governments as necessary to reach a mutually acceptable solution” (ibid.). The group further recommended that contingency re-routing “be considered as part of a comprehensive transportation plan, rather than limiting the discussion to Section 180(c) concerns” (ibid.).

OCRWM’s 2007 “Benchmarking” report recommended that a contingency plan should “identify who is involved and who the responsible parties are,” including “how the States and Tribes will be involved, contingencies for weather and adverse road/track conditions, and provisions that will be made in the event of an unplanned detour” (DOE 2007d, p. 15). The report further stated that any incidents that
could interfere with shipments – such as “accidents, vehicle breakdown, and threats against the shipment” – should also be considered in contingency planning (ibid.). These recommendations were based on the experiences of other DOE shipping programs. Of the “commonly cited logistics issues” identified in the report, the only one mentioned by all six “lessons-learned” sources was “operational contingency plan” (ibid., Table 2).

OCRWM’s 2009 “National Transportation Plan” was not the “comprehensive transportation plan” that the Section 180(c) Topic Group referred to in its recommendation regarding contingency re-routing. The plan did, however, shed some light on OCRWM’s plans to conduct contingency planning by stating that “contingency plans will be built into transportation campaign plans” (DOE 2009, p. 18). OCRWM identified some specific examples of transportation operational contingencies. For example, in the event of bad weather and other natural phenomena, which are “local and transitory in nature,” OCRWM would “instruct commercial highway carriers to follow directions issued by local law enforcement and other authorities regarding route conditions and travel restrictions” (ibid., pp. 18-19). If such contingencies occurred during the course of a rail shipment, OCRWM expected the shipments to proceed “under railroad operating procedures” (ibid., p. 19). Other contingencies cited in the plan were mechanical and changes in scheduling (ibid.). Appendix H of the Supplemental Environmental Impact Statement provided additional detail about OCRWM’s plans for dealing with contingencies. This section, however, like the DOE Manual, was unnecessarily restrictive in considering primarily weather and road conditions as operational contingencies (DOE 2008c).

The Midwestern Radioactive Materials Transportation Committee addressed operational contingencies in the region’s Planning Guide for Shipments of Radioactive Materials through the Midwestern States, which contains sections on bad weather and road conditions, as well as safe parking (MRMTC 2008b, p. 21-23). Because the states have first-hand experience with the conditions that are likely to arise in their states – and the appropriate response actions to take – OCRWM should work closely with the states when it develops its operational contingency plan for shipments of spent fuel and high-level waste.

**TRANSPORTATION PLANNING**

The states in the Midwest and elsewhere are strong advocates for OCRWM conducting transportation planning in a consultative fashion on a regional level, with appropriate interactions among the regions and other stakeholder groups.

OCRWM first established cooperative agreements with regional groups of states in the mid-1980s. By 1995, OCRWM had reached out to all four regions of the country, engaging states through agreements with WIEB, the Southern States Energy Board, CSG Midwest, and the CSG Eastern Regional Conference. Over the years, the states consistently maintained that a regional approach to transportation planning was the best option for managing a national transportation program. In its “Report Card” on OCRWM’s transportation program, WIEB advocated for a regional approach in the broader context of modeling the transportation program – or at least the institutional part of it – on the transportation system that DOE developed for shipments of transuranic waste to the WIPP site in Carlsbad, New Mexico. Observing that “early coordination and effective communications with state, tribal, and local governments is essential to the ultimate success of any nuclear waste transportation safety program,” the WIEB Report Card urged OCRWM to “look to the WIPP program as a model” in several areas, including “transportation planning similar to the WIPP Program Implementation Guide” (WIEB, pp. 2-3). WIEB gave the OCRWM program an “F” for its failure to model the Yucca Mountain transportation program after WIPP and for terminating funding for the regional cooperative agreement groups (ibid., p. 2).
The Midwestern states followed the West’s lead in the late 1990s when the region identified regional planning as a “key issue.” By that time, the Midwest had more experience working with the FRR Spent Fuel Acceptance Program, which began conducting cross-country shipments of FRR spent nuclear fuel from the Savannah River Site to Idaho National Laboratory in 1999. This experience prompted the Midwest to recommend that OCRWM follow the regional planning process established by both the WIPP and FRR programs (MRMTC 2008a, p. 4).¹ In 1998, in the first “letter of consensus” co-signed by the regional groups, the four regions stated their shared opinion that the regional groups were a “valuable resource” that OCRWM should tap “to do the work they are uniquely qualified to do” (Niles et al. 1998, p. 3). The signatories further stated that the states had not only a “willingness but a deep commitment to working together to achieve the shared goal of safe radioactive materials transportation” (ibid.).

In general, OCRWM has demonstrated a commitment to conducting its transportation planning activities in coordination with the states. In 2003, after a lengthy hiatus in transportation-related activities, OCRWM published its Transportation Strategic Plan in which the program committed to “conduct a thorough, open, and collaborative planning process with interested parties,” including the states (DOE 2003, p. 2). The program acknowledged the success of the WIPP, FRR, and other programs, and pledged to use “a collaborative process that incorporates the successful elements from transportation systems developed for other DOE programs” (ibid.). The Transportation Strategic Plan even went so far as to declare that the “state regional groups will anchor our collaborative process with the states” (ibid., p. 4).

The 2007 pre-decisional draft of the transportation plan maintained a commitment to work “with interested parties through a collaborative planning process seeking input for developing specific policies and procedures and key program decisions” (DOE 2007a, p. 32). Like the Transportation Strategic Plan, the draft plan stated that the regional groups would “anchor the collaborative process with the states” (ibid.).² The commitment to a “collaborative planning process” was perhaps inspired by the findings of OCRWM’s “Benchmarking” report in 2007. Based on feedback from various programs that had successfully shipped spent fuel or other radioactive waste, the report recommended that OCRWM “make cooperative shipment planning the rule, not the exception” (DOE 2007c, p. 33). The report cited an observation from DOE’s FRR program that one result of stakeholder involvement is “greatly increased confidence that any reasonably predictable contingency has been prepared for” (ibid., p. 34). The same official reportedly added that “lack of involvement, and the resulting consequences, can be extremely expensive” (ibid.).

OCRWM repeated its commitment to “work cooperatively” with stakeholders in the 2009 version of the transportation plan. In commenting on the 2009 plan, three of the regional groups co-signed a letter to OCRWM that offered the opinion that “federal-state consultation is central to SNF/HLW transportation, and how DOE plans to promote cooperation with states should be evident in all aspects of the [National Transportation Plan]” (DOE 2009, p. 1). The regions further expressed concern that OCRWM understood “consultation and cooperation’ to consist largely of a review-and-comment function involving the states, through the regional groups, and other stakeholders” – a view that was “not consistent with the states’ vision of what consultation and cooperation mean” (Niles et al. 2009, p. 1). WIEB’s Jim Williams

¹ The Midwest incorporated this key issue into its Planning Guide for Shipments of Radioactive Materials through the Midwestern States, advocating that “Coordination and consultation with the affected states should take place through the regularly scheduled meetings of the Midwestern Radioactive Materials Transportation Committee” (MRMTC 2008b, p. 7).
² The plan also indicated that OCRWM was “developing an internal institutional plan that guides its outreach efforts and outlines the issues being addressed and the resolution mechanisms” (DOE 2007a, p. 32). OCRWM never made this plan available to the public.
elaborated on these ideas in his 2009 paper on federal-state consultation, asserting that, “for states, federal-state consultation (or ‘constructive engagement’) in all aspects of SNF transport has become a first concern – the basis for an acceptable process of assessment, consideration and decision on all other issues” (Williams 2009a, p. 2).

According to Williams, the “states have said, ‘With full consultation, large-scale cross-country transport of SNF is possible; without full consultation (not precisely specified) it will be contentious and may not work’” (ibid., p. 2). Williams stopped short of recommending specific actions to take to bring OCRWM and its stakeholders to a more clear, shared understanding of what consultation and cooperation mean. He concluded, however, that the “gap between the expressed consultation intent and actual consultation process is probably attributable to a combination of institutional and technical factors” (ibid., p. 7). These factors must be addressed in order to successfully resolve this issue. Being a “first concern,” it is imperative that any successor to OCRWM address this issue very early in the process of developing its transportation system.

Transportation Planning Timeline

In the early years of the Yucca Mountain program, OCRWM consistently produced planning timelines in its transportation-related documents. These very broad timelines included target schedules for achieving milestones ranging from cask procurement to issue resolution. In recent years, however, OCRWM moved away from publishing detailed schedules for rolling out the transportation system, with the most recent transportation plan (January 2009) being published without any kind of schedule. The states in the Midwest and elsewhere would benefit from the publication of detailed planning timelines that cover all the steps in the transportation-planning process. Such information would help the states prepare for their role in helping to plan, oversee, and monitor OCRWM’s shipments. DOE’s TEC/WG developed a timeline with an acceptable level of detail in 2006 specifically for rail shipments. OCRWM neither adopted nor endorsed the timeline before transportation-related work ended in 2009.

In the 1986 Transportation Business Plan, OCRWM published a schedule for the transportation program that showed the program’s goals for transportation systems acquisition, institutional programs, and “support to repository and MRS” (the last item relating to OCRWM’s compliance with the National Environmental Policy Act (NEPA)) (DOE 1986b, p. 6). The Transportation Business Plan also laid out timelines for Phases I and II of the Transportation Systems Acquisition activity. Later that same year, OCRWM published the Transportation Institutional Plan, which included a “Preliminary schedule for transportation policy decisions and activities” (DOE 1986c, p. A-4). As the Yucca Mountain program evolved, similar timelines appeared in later OCRWM documents such as the 1994 draft “Developing the Transportation System.” Dates shifted, activities were added and dropped as the need arose, but none of the later timelines that appeared in other OCRWM documents rivaled the relatively high quality of the timelines in the Transportation Institutional Plan or the Transportation Business Plan until the late 2000s.

Recognizing that the affected states and tribes would benefit from schedules that showed all the planning steps in greater detail, in 2005 the TEC/WG Rail Topic Group organized a Planning Timeline subgroup to develop a timeline that could be suitable for planning OCRWM shipments. As stated in the introduction to the document, the subgroup developed the timeline “to assist the TEC/WG members, DOE managers, and others understand the many steps – and the relationship between the steps – that can contribute to the successful movement of spent fuel and high-level radioactive waste to a national
repository” (TEC Rail TG 2006a, p. 1). The level of detail in the timeline was intended to help all parties – states and tribes, carriers, OCRWM, and other federal agencies – “understand how and when they will be involved in shipment planning” (ibid.). In closing, the subgroup noted that the timeline provided an “excellent starting ground for identifying what interactions must take place, between what parties, and when” (ibid.).

Two things distinguished the TEC/WG “Rail Planning Timeline” from earlier OCRWM attempts. First, the timeline was developed with input from many groups – states, tribes, federal agency staff, and DOE staff and contractors with shipment-planning experience. Not only did this mark a contrast to OCRWM’s timelines, which had been developed without any external input, but it also resulted in the timeline showing the steps all parties could be expected to take, not just OCRWM. Second, the OCRWM timelines covered the major milestones needed to reach the point of shipping, such as awarding contracts and completing operational testing (DOE 1994c, p. 3-9). In contrast, the “Rail Planning Timeline” addressed very specific steps in the planning process, starting as early as five years prior to the start of shipments.³ As the planning horizon approached the start of shipments, the level of detail increased significantly. For example, the timeline showed steps to be taken during the shipment, less than 12 hours beforehand, and at least 24 hours before the start of shipments, among other time periods. The “Rail Planning Timeline” underwent extensive review by the TEC/WG as a whole and was published in final form in August 2006. This document represented the most detailed publicly available timeline for planning shipments associated with the OCRWM transportation program.

In 2007, OCRWM’s pre-decisional draft of the “National Transportation Plan” included a “Preliminary Milestone Schedule” for the National Transportation Project. Like earlier OCRWM schedules, this one covered major operational and procurement milestones such as the awarding of contracts for the transportation, aging, and disposal (TAD) system and obtaining certificates of compliance for TADs and other new cask designs (DOE 2007a, p. 51). OCRWM retracted this pre-decisional draft of the transportation plan due to legal considerations. When the next version was released in January 2009, it did not contain any schedules for completing work on the transportation system.

³ The timeline included a group of steps whose timeframe could not be agreed to by all members of the subgroup. These activities were grouped together under the heading “Prior to the First Shipment” (indeterminate timeframe)” (TEC Rail TG 2006a, p. 11).
MODES, PACKAGES, AND ROUTES

FROM THE BEGINNING OF THE YUCCA MOUNTAIN PROGRAM, OCRWM WRESTLED WITH THE QUESTION OF WHETHER TO CONDUCT FULL-SCALE TESTING OF THE TRANSPORTATION CASKS IT WOULD USE TO SHIP SPENT FUEL AND HIGH-LEVEL WASTE TO A REPOSITORY. THE 1987 AMENDMENTS TO THE NWPA, REQUIRING OCRWM TO USE ONLY NRC-CERTIFIED CASKS, DID NOT REDUCE CALLS FROM STAKEHOLDERS FOR OCRWM TO CONDUCT FULL-SCALE TESTING. DESPITE COMMITTING TO MAKING A POLICY DECISION ON THE SUBJECT, OCRWM CHOSE INSTEAD TO DEFER TO THE NRC, WHICH INITIATED A PACKAGE PERFORMANCE STUDY IN 1999. BEING SUPPORTED BY OCRWM, THE PACKAGE PERFORMANCE STUDY HAS STALLED DUE TO THE CANCELLATION OF THE YUCCA MOUNTAIN PROJECT. THIS ISSUE, THEREFORE, REMAINS UNRESOLVED.

Throughout the history of the Yucca Mountain program, OCRWM consistently emphasized in its public outreach materials the “robust” nature of the casks that would be used to transport spent fuel and high-level waste to the repository (Janairo and Niles 2008, p. 6). The Yucca Mountain information center in Las Vegas featured a video loop showing the crash tests performed at Sandia National Laboratory in the 1970s, in which casks were subjected to numerous assaults involving trains and trucks. OCRWM’s purpose in showing these films was clear: the image of a shipping cask emerging nearly unscathed after crashing into a concrete wall is a powerful visual display of the seemingly indestructible nature of the cask. The demonstration is all the more powerful when the video reveals the extreme damage experienced by the truck and train involved in the crash tests (DOE 1978).

As a program, OCRWM understood the contribution full-scale cask demonstration tests could make in terms of building public confidence in the transportation system. Despite this understanding, the program was unable to bring itself to commit to full-scale testing of the shipping casks it would use to transport waste to the repository. In 2008, near the end of the program, OCRWM was working on a fact sheet entitled “Transportation Casks: Protecting the public by securing the contents.” The fact sheet describes the design of the casks — noting that “casks can weigh up to 125 tons with walls up to 15 inches thick” (DOE 2008i, p. 1). The section “Certified and tested” alludes to the fact that full-scale testing is not a requirement for NRC certification: “To receive certification from NRC, manufacturers must demonstrate, through computer analyses and/or physical testing, that a cask design can survive severe accident conditions without releasing its contents” (ibid., p. 2). This language, however — especially preceded by a subheading “Certified and tested,” and followed by a list of four “tests” that are required as part of the certification process — could easily lead a lay reader to think that casks would, indeed, undergo physical “testing” (ibid., pp. 2-3).

“Cask design and testing” was one of OCRWM’s original nine institutional issues in OCRWM’s Transportation Institutional Plan. The “design” aspect addressed the benefits of OCRWM developing new shipping casks that would have higher capacities than existing casks, thereby reducing the number of shipments. OCRWM did succeed in developing new designs for high-capacity truck casks and multipurpose canisters (MPCs) in the 1990s, with the idea of MPCs being resurrected in 2005 with OCRWM’s interest in TAD canisters (Kouts 2007, p. 2). Partly because of the work OCRWM sponsored, private vendors now have the capability to meet the program’s demand for shipping casks to move spent fuel and high-level waste. This aspect of the issue is, therefore, closed.

Testing, however, remains an open issue. In the Transportation Institutional Plan, OCRWM reported that “interested parties” had suggested the program develop “testing programs [ranging] from those
that would test casks using both analytic techniques and model testing as necessary to meet NRC requirements, to programs that would result in the destructive testing of full-scale casks under conditions that result in cask failure” (DOE 1986c, p. A-75). To respond to this feedback from stakeholders, OCRWM was at the time developing “a cask-testing plan” that would “establish... OCRWM’s testing policy and the role of participants (including the OCRWM and other DOE program offices, oversight organizations, testing organizations, the utilities, carriers, and public representatives)” (ibid, p. A-75). Although OCRWM’s plans for testing at the time were limited to “engineering tests of cask materials and component parts” and “design verification of ¼ scale models for rail casks, ½ scale models for truck casks,” the Transportation Institutional Plan did indicate OCRWM’s intention to “address the potential use of confirmatory, demonstration testing under conditions that exceed Federal test requirements” (ibid., pp. A-75 and A-77).

Among the many stakeholder groups that have called for OCRWM to use only casks that had undergone full-scale testing are regional cooperative agreement groups, the state of Nevada, and the NAS. The Midwestern High-Level Radioactive Waste Committee passed a resolution in 1993 that expressed the committee’s support for “the development and implementation of a federal program to conduct full-scale testing of the design and integrity of spent-fuel shipping cask prototypes that includes sequential tests (drop, fire, puncture, and immersion), reflects the input of major stakeholders, and serves as an integral component of the process for certifying spent-fuel shipping casks” (MHLRWC 1993, p. 2). Two years later, at its annual conference in 1995, the Midwestern Legislative Conference passed a similar resolution urging OCRWM to conduct full-scale testing and resolving that the program should be developed “in consultation with major program stakeholders” such as the Midwestern committee (MLC 1995, p. 2). The Midwestern Legislative Conference reiterated this position in 2003 (MLC 2003).

WGA maintains a resolution that calls for DOE to “commit to conducting full-scale testing of casks to be used to transport SNF/HLW” (WGA 2008b, p. 3). The WIEB “Report Card” on the OCRWM transportation program gave OCRWM the grade of “F” for failing to meet the Western governors’ request (WIEB, p. 3). In 2006, the NAS Committee on Transportation of Radioactive Waste gave its strong endorsement to “the use of full-scale testing to determine how packages will perform under both regulatory and credible extraregulatory conditions” (NAS 2006, p. 14). The NAS recommended that “full-scale package testing should continue to be used as part of integrated analytical, computer simulation, scale-model, and testing programs to validate package performance” (ibid). The committee stated that testing “to destruction” should not be required (ibid, p. 15).

In 1999, the NRC got involved in the issue when it initiated a “Package Performance Study.” While emphasizing that shipments of spent fuel in the U.S. were safe using “current regulations and programs,” the commission undertook the Package Performance Study with the goal of testing “the robustness and capability of spent fuel packages to withstand accident conditions significantly beyond the regulatory limits” (NRC 2003b, p. 13). As described in the draft testing protocol issued in 2003, the study would involve “tests of full-scale rail and full-scale truck casks including a high-speed impact with an unyielding surface followed by an extreme fire test” (NRC 2003a, p. iii). The NRC had contracted with Sandia National Laboratories for the impact and fire tests, as well as for some of the analytical work. The commission staff felt the proposed tests would help the NRC meet the objective of “enhancing public confidence in the inherent safety of spent nuclear fuel cask design, validating the capability of the cask models and analysis codes to accurately capture cask and fuel response to extreme mechanical and thermal environments, and providing data to refine dose risk estimates” (ibid).
The states in the Midwest, as well as other stakeholders, were involved in discussions regarding the scope and objectives of the Package Performance Study. In a 2002 letter to the NRC staff in anticipation of regional workshops, the CSG Midwest staff noted that the committee had “repeatedly urged [OCRWM] to conduct full-scale testing” and had hoped “to be involved in developing the test protocols if OCRWM were to commit to full-scale testing (Sattler 2002, p. 1). The letter further observed that the NRC was, “in essence, doing what the Midwestern committee had asked OCRWM to do,” and went on to endorse the idea of an NRC-managed test: “Having the regulator conduct the test is...a better approach than having OCRWM do so” (ibid).

Stakeholders had an opportunity to participate in three public workshops in 2003 with the NRC staff to review the draft protocol and further refine the NRC’s plans. The Midwestern states were well represented at the Chicago-area workshop. Starting in the spring of 2004, the NRC staff began corresponding with the commissioners regarding the recommendations for testing. Over the course of the next year, the plan changed several times. In May 2004, the commission approved the staff’s request to conduct a full-scale test of a rail cask and directed the staff to seek funding from OCRWM to help pay for the test. The commission further instructed the staff to continue its interactions with OCRWM to determine whether and, if so, when it would be possible to perform testing on a certified truck cask (Vietti-Cook 2004a, p. 2). In July 2004, the NRC staff sought the commission’s approval of the testing plan, as well as approval to proceed with a “demonstration test involving the collision of a locomotive and a rail cask attached to a railcar,” with the inclusion of a “fully engulfing fire” (Reyes 2004, p. 4). The paper described the test as representative of conditions that, in a “real-world accident,” would have a “small” probability of occurring (ibid).

In December 2004, the commission modified the plan for testing. Specifically, the commission authorized the staff to conduct a test that consisted of “a simulated rail crossing with a train traveling at an appropriate speed colliding at a ninety degree angle with a transportation cask on its rail carrier car in a normal transportation configuration” (Vietti-Cook 2004b, p. 1). Although the staff had recommended a test involving a fully engulfing fire, the commission said “no separate fire testing or immersion testing will be conducted on the cask” (Vietti-Cook 2004b, p. 1). The commission described the modified test as representing “a viable transportation accident” and felt that the test would be “one means of increasing public confidence in the viability of existing spent fuel transportation casks” (ibid). In 2005, the commission modified the plan yet again, instructing the staff to include a fully engulfing fire in the test (Vietti-Cook 2005, p. 1). The commission directed the staff to approach OCRWM management about providing financial support for the demonstration test, with a request to Congress being an option if OCRWM did not provide the necessary resources (ibid). As of June 2010, the NRC has not followed through with its plans to conduct full-scale testing. This issue, therefore, remains open.

Intermodal Shipments

Intermodal shipments became an issue because OCRWM decided to ship spent fuel and high-level waste by mostly rail, but currently 25 commercial reactor sites do not have rail capabilities. OCRWM has not yet identified how intermodal transport will be arranged. States are interested in where shipments will transfer from one mode to another and what kind of state oversight will be necessary for intermodal transfers. OCRWM and stakeholders began to identify the issues related to intermodal shipments to take place through the TEC/WG Rail Topic Group’s Intermodal Subgroup in 2007. The subgroup was unable to complete its work due to the termination of the TEC/WG in 2009.
OCRWM determined in 2004 that shipments from the 76 commercial reactor sites and five DOE sites to a federal repository would occur by “mostly rail” (DOE 2004, p. 18558). According to OCRWM, as of 2008, 25 commercial reactor sites did not have direct rail access (Thrower et al. 2008, p. 5). An additional six commercial sites did not have the capability to load rail casks: Crystal River, Saint Lucie, Pilgrim, Monticello, Ginna, and Indian Point. The Yucca Mountain Final EIS assumes that these sites would likely ship their inventory of spent fuel via legal weight truck.

In 2005, OCRWM announced plans to use TAD canisters for transporting spent fuel and disposing of it at the Yucca Mountain repository. According to OCRWM, TADs in overpacks would be too large and heavy to be shipped by legal weight or even overweight truck. Options for shipping these canisters include rail, barge, or heavy haul truck.

For the 25 sites that have the ability to load rail casks, but do not have direct rail access, OCRWM was considering the use of intermodal shipments utilizing heavy haul truck or barge to move materials from facilities to the nearest rail head. From there, casks could be loaded onto rail cars and shipped the rest of the way to the repository. OCRWM had not identified how it would arrange intermodal transport. For example, OCRWM never proposed locations at which shipments would transfer from one mode to another, nor did it work with stakeholders to identify the kind of oversight and procedures that would be necessary for intermodal transfers.

In 2007, the TEC/WG formed the Rail Topic Group’s Intermodal Subgroup to begin exploring and addressing the issues around intermodal shipments of spent fuel. The subgroup was charged with “identifying operational factors that complicate or increase the risk of intermodal transport from specific sites and developing recommendations for requirements and procedures to ensure safe and secure transfers of SNF/HLW at intermodal transfer stations” (TEC Intermodal Subgroup 2008b, p. 1). The subgroup convened conference calls between the summer of 2007 and fall 2008. There was one in-person meeting of the Intermodal Subgroup at the February 2008 TEC/WG meeting in San Antonio, TX.

The Intermodal Subgroup identified a series of questions and concerns that states have with regard to intermodal shipments. Several subgroup members attended a panel discussion on “Stakeholder Perspectives on the Intermodal Transportation of Used Fuel” at the Nuclear Energy Institute’s Dry Storage Information Forum held in May 2008. Specific topics about which states expressed concern included routing, permitting, regulatory and jurisdictional issues, protection of infrastructure, transfer logistics, and public relations (ibid.). Questions from the subgroup were posed to a panel of speakers who had experience with intermodal shipments and panel members’ answers were recorded in a question-and-answer document (TEC Intermodal Subgroup 2008a). Speakers from commercial shipping companies were able to describe some of the equipment and processes for conducting intermodal shipments and transferring heavy loads from one mode to another. State speakers on the panel described their experiences working with shippers and state and federal agencies in planning intermodal shipments of large reactor components.

In general, speakers expressed confidence that intermodal shipments could be carried out smoothly, and the panel participants had not run into many logistical issues in executing shipments. Shippers and state officials did stress that planning shipments several years in advance was the best way to avoid complications, recommending that involved parties be brought together to meet and discuss potential issues, such as man-made or naturally-caused interruptions to a shipment (ibid.).
The Intermodal Subgroup had planned to contact commercial shippers to further discuss the logistics of intermodal shipments and identify the factors that potentially complicate such shipments. The goal of these discussions would be to recommend procedures to minimize complications with OCRWM’s intermodal shipments of spent fuel. Because OCRWM cancelled TEC/WG activities, the Intermodal Subgroup did not complete a final work product.

Two members of the subgroup – Bob Halstead and Fred Dilger, working for Nevada’s Agency for Nuclear Projects – prepared a paper entitled “Shipping Site Intermodal Transportation” (Dilger and Halstead 2007). The authors shared their paper with the subgroup. The paper used data on shipping mode from the Yucca Mountain Final EIS to explore the possible implications for intermodal shipments. According to the paper, shipping sites that do not have direct rail access “pose a major transportation challenge” (Dilger and Halstead 2007, p. 1). Several aspects of intermodal transport were particularly troubling to the authors. Dilger and Halstead pointed out almost one-third (32.3 percent) of the total 63,000 (Metric tons of uranium) MTU of commercial spent fuel that would be shipped to the proposed repository over the first 24 years of operation would originate from the 24 shipping sites without direct rail access (ibid., p. 2).

As previously mentioned, sites that lack direct rail access would likely ship rail casks via heavy haul truck or barge to a conveniently located railhead. Seventeen sites could potentially ship by barge, resulting in as many as 1,575 barge shipments over 24 years. Dilger and Halstead made some assumptions about the ports that would be the destination for barge shipments and concluded that if all the sites that were capable of shipping by barge were to do so, “at least 18 states could be affected by coastal, inland waterway, and Great Lakes barge shipments of spent fuel” (ibid.).

The authors further speculated that, if OCRWM shipped the oldest fuel first, as many stakeholders have proposed, almost one-half (47.6 percent) of the spent fuel shipped in the first five years of repository operation would be intermodal shipments from sites without rail access. In addition, the six sites expected to ship by legal weight truck would also begin shipping early on in the program, meaning that many states would need to prepare for rail, truck, and intermodal shipments during the first several years of repository operations (ibid.). The paper made the argument that OCRWM should begin detailed planning for intermodal shipments immediately to address issues such as transfer locations and procedures (ibid., p.1).

Through the Intermodal Subgroup, OCRWM offered many detailed comments on the Dilger/Halstead paper (DOE 2008a). OCRWM objected to some of the claims made in the paper. For instance, OCRWM noted that the Dilger/Halstead paper was based on information from the 2002 Yucca Mountain Final EIS and should be updated data to reflect the data in the 2007 Supplemental EIS. In addition to noting that more recent data were available in the Supplemental EIS, OCRWM challenged Dilger and Halstead’s claims related to the number of potential barge shipments. The Dilger/Halstead paper assumes that only one cask would be transported on a barge. OCRWM countered that “a typical cask that has been loaded and prepared for shipment might weigh 200 tons on its transporter. A typical river barge can transport over 1,000 tons providing capacity for 5 or more loaded SNF casks” (ibid., p. 2).

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4 In their paper, Dilger and Halstead identified 23 sites without rail access. OCRWM has identified 25 sites without rail access. There are two reasons for the discrepancy. First, Dilger and Halstead considered Salem and Hope Creek to be one shipping site. Second, OCRWM’s 2002 Yucca Mountain Final EIS assumed that the Humboldt Bay site was served by rail, but the 2007 Supplemental EIS reported that the site is not. Dilger and Halstead used the 2002 data and thus their paper did not anticipate intermodal shipments from Humboldt Bay.
OCRWM said that it was premature to speculate about the shipping queue, as that was something that OCRWM would negotiate with the utilities.

OCRWM dealt generally with intermodal shipments in the “Transportation System Concept of Operations,” which states that intermodal shipments using heavy haul truck or barge would be utilized to carry rail casks to a point at which they could be transferred to a train (DOE 2006d, p. 14). The pre-decisional draft and Rev. 0 of the “National Transportation Plan” also dealt with intermodal transport in a fairly cursory manner, stating that the details of intermodal transfers would be included in the site campaign plans to be developed two years prior to shipments from a site. According to the pre-decisional draft, “OCRWM will develop a transportation operations plan that will outline the waste acceptance schedule, modal mix, cask usage, operational features of the system, and transportation services” (DOE 2007a, p. 42). This statement was omitted from Rev. 0 of the plan.

OCRWM took a more detailed look at intermodal transportation in the “TEC/WG White Paper: Intermodal Transportation of Commercial Spent Nuclear Fuel,” drafted in 2008 by OCRWM’s Office of Logistics Management and its contractors (Thrower et al. 2008). The paper focused on the general process for and equipment needed to lift, transfer, and move loaded casks of spent fuel. While the authors of the paper did not disagree with most of the factual information in the Dilger/Halstead paper, OCRWM expressed a different opinion on the feasibility of intermodal transport of spent fuel.

According to the paper, there are challenges to intermodal transportation, but these challenges can be and have been managed by commercial shipping companies.

The OCRWM paper took a preliminary look at how intermodal shipments of spent fuel could be carried out. OCRWM planned to develop a concept of operations document that would detail how intermodal shipments would be carried out and describe the equipment needed for heavy haul transport, barge movements, and intermodal transfers of spent fuel casks.

OCRWM recognized that the number of shipping sites lacking direct rail access could grow over time if rail service to reactor sites fell into disuse and rail infrastructure degraded. The program believed the money from the Nuclear Waste Fund could not be used to pay for infrastructure improvements, therefore the program would have to plan its shipments relying on public and private infrastructure in its present condition (ibid, p. 4).

OCRWM acknowledged that, “from a logistics planning standpoint, there will be complexities regarding lifting, transferring and moving weight-concentrated loads of commercial SNF from 72 different commercial nuclear sites located in 34 states” (ibid, p. 9). Citing what was then the earliest possible start of operations for Yucca Mountain, OCRWM stated, “Because the repository will not begin operations before 2017, there is ample time to resolve these technical issues” (ibid, p. 10).

The authors of the OCRWM paper cited the extensive experience utilities have moving large, heavy equipment, including reactor vessels, transformers and steam turbines, using multiple modes as evidence that intermodal shipments could be carried out safely. These operations utilized specialized equipment and frequently required more than one mode of transport. Utilities also utilized intermodal transportation to transfer spent fuel casks to, from, and around reactor sites as required for storage purposes (ibid., p.4).

OCRWM planned to identify the locations for intermodal transfer operations through consultation with the utilities, local railroads, local officials, and contracted specialized carriers and riggers. According to the OCRWM paper, consultation would begin at least one year prior to the initial shipments from a site,
with a final agreement on specific intermodal transfer locations being made as soon as the route was selected.

Finally, OCRWM pointed to the numerous “specialized carriers and riggers” in this country that have extensive experience conducting intermodal shipments. According to OCRWM, these shippers were capable of carrying out intermodal transportation “safely, securely, efficiently, and at reasonable cost” (ibid., p. 11). OCRWM concluded its intermodal paper by stating that the institutional, equipment, operational, and coordination challenges were “fully manageable” (DOE 2008a, p. 11).

Both the OCRWM and the Dilger/Halstead papers were still in draft form at the time that the Yucca Mountain repository program was cancelled. The Intermodal Subgroup had developed a list of state concerns regarding intermodal shipments of spent fuel, but the program was terminated before OCRWM began to work with stakeholders to develop strategies for addressing those concerns.

**Mix of Transportation Modes**

Although OCRWM’s environmental impact statement indicated the number of casks that would be transported by rail, truck, and heavy haul from each site, these numbers were intended specifically to support the environmental impact assessment. OCRWM never prepared a description, for transportation planning purposes, of what mode each site would use for shipping and how many shipments would take place. Shipping mode will dictate the number of shipments from each site and influence routing decisions, as well as impact the states’ training efforts prior to shipments. OCRWM has strived to maintain flexibility in its transportation planning as a way to deal with the “uncertainties and complexities” of the repository program. As observed by the NAS, “DOE’s desire for flexibility conflicts with the states’ preference for early and specific decisions on transportation” (NAS 2006, p. 226).

OCRWM determined in 2004 that shipments from the 76 commercial reactor sites and five DOE sites to a federal repository would occur by “mostly rail.” However, according to OCRWM, 25 commercial reactor sites do not have direct rail access (Thrower et al. 2008, p. 5). An additional six commercial sites do not have the capability to load rail casks. OCRWM is therefore considering the use of several different modes as well as intermodal shipments for repository shipments.

A key issue in transportation planning is the mode by which OCRWM will ship spent fuel and high-level waste. Early on in its transportation planning efforts, OCRWM made the decision to proceed with operational planning in a manner that would allow for shipment by rail, truck, and barge (DOE 1986c). OCRWM did not want to be constrained at that point by determining a percentage of shipments that would be conducted by each mode.

Trains can carry considerably higher payloads than legal weight truck or overweight truck, which means that fewer overall shipments would be needed. There is less routing flexibility with rail transport, however, and transit times may be longer. In 2004, OCRWM made the decision to ship by “mostly rail” (DOE 2004, p. 18558). Nevertheless, the program acknowledged that it would also need to use other modes of transport to some degree for repository shipments.

OCRWM has also explored the possibility of using multiple modes of transportation in a single shipment. These intermodal shipments could combine any of the transportation modes mentioned in this section. For more information, see the section on Intermodal Shipments.
“Legal weight truck” is the designation used for tractor trailers that do not exceed a fully loaded weight of 80,000 pounds. These trucks are commonly seen on the nation’s highways. Some benefits of shipping by legal weight truck include relatively low equipment costs, flexible routing, numerous potential carriers, and compatibility with shipping and receiving facilities. Drawbacks of utilizing this mode include the need for more shipments, because each truck can carry a relatively small number of spent fuel assemblies: two pressurized water reactor elements or five boiling water reactor elements.

“Overweight trucks” utilize additional wheels and axles to carry heavier payloads than legal weight trucks. With special permits, overweight trucks transporting spent fuel and high-level waste could weigh up to 120,000 pounds fully loaded, allowing for the transport of more fuel assemblies per shipment. The benefits of transporting by overweight truck are similar to those of legal weight truck, but drawbacks include the need to obtain permits, potentially slower travel speeds, and potential routing restrictions because of the weight of the packages. OCRWM did not consider the issue of permitting to be a potential obstacle, however, because a 1990 study conducted by the American Association of State Highway and Transportation Officials had documented that trucks with loaded weights between 80,000 and 109,000 pounds are routinely issued permits by the states (DOE 2007a, p. 8).

For even heavier loads – for example, shipping rail casks via truck – OCRWM would need to use heavy haul trucks (DOE 2006d). Heavy haul trucks could be used to transport rail casks from shipping sites that lack direct rail access to the nearest railhead, at which point casks would be transferred onto railcars for shipment to the repository. Like other overweight trucks, states must issue permits for each heavy haul truck shipment.

The final transportation mode that may play a part in OCRWM’s shipments is barge. This mode would likely be considered for shipping from reactors located on navigable waterways, especially if these facilities lack good rail or truck access. Barge shipments have been used in the past to transport heavy reactor components to nuclear facilities during construction and repair. Barges can carry substantially heavier loads than trains or trucks, but have slower transit times and routing constraints. Utilizing barge shipments is a point of controversy for some states. While the Northeast and South have expressed interest in exploring barge shipments as a way to avoid rail or truck shipments through heavily populated areas, “the Midwestern states recommend that no barge shipments take place on the Great Lakes” (MRMTC 2008a, p. 1). OCRWM reportedly conducted an analysis of barge as a shipping mode in 1985, but the program had not recently analyzed its shipping sites to determine which ones could viably ship by barge (DOE 1986c, A-90).

From the inception of the OCRWM transportation program, states and other stakeholders have consistently expressed an interest in OCRWM’s selection of shipping mode from the various nuclear sites. Stakeholders requested that OCRWM identify the process by which it will evaluate and select shipping modes, including any criteria, such as cost and risk, that might be used in modal selection. OCRWM committed to doing so. Stakeholders further asked that OCRWM identify the intermodal requirements that would be needed to conduct individual shipments by two or more modes. OCRWM planned to procure shipping casks that could be transported by rail, truck, or barge, to offer flexibility in mode selection. Finally, stakeholders requested that OCRWM include cask design features that would facilitate retrieval of the casks in the event of a serious transportation accident. OCRWM committed to review such design features and finalize cask interface design guidelines (ibid., p. A-91).
OCRWM had conducted several studies to evaluate the transportation infrastructure at commercial nuclear reactors in order to inform decisions about shipping mode and equipment needs. The Facility Interface Capability Assessment (FICA) was completed in 1992 and looked at utility capabilities for shipping spent fuel. The FICA was followed up in 2004 by a planning study to update the utilities’ the Facility Interface Data Sheets. The Near Site Transportation Infrastructure (NSTI) study, also completed in 1992, evaluated the road, rail, and barge access to each commercial nuclear plant (Viebrock and Mote 1992). OCRWM had planned to update the data from these studies as needed.

The Yucca Mountain Final EIS, issued in 2002, analyzed a “mostly rail” scenario and a “mostly truck” scenario. In a 2004 Record of Decision, OCRWM selected “mostly rail” as the preferred method of transportation for shipments to a national repository (DOE 2004, p.18561). In a 2005 policy statement, OCRWM declared its intent to have rail shipments occur via dedicated train, meaning that trains shipping waste to the repository would not be shipping any other commodity. Benefits of using dedicated train service included lower costs, shorter transit times, less time in rail yards, and greater scheduling flexibility (DOE 2005, p.1).

The Yucca Mountain Final EIS estimated that there would be approximately 9,600 rail and 1,100 truck shipments under the mostly rail scenario (DOE 2002, table J-1); however, the NAS pointed out that these estimates were based on the assumption that one rail shipment is equal to one waste package, when OCRWM has since stated that up to five railcars could travel together in one train (NAS 2006, p. 218). Thus the actual number of rail shipments may be significantly lower. The Final EIS assumed that six sites that lacked the capability to handle rail casks would ship by truck. A 1996 study commissioned by the state of Nevada looked at data from the FICA and NSTI and concluded that the most likely scenario would be for 17 commercial sites to ship via legal weight truck, accounting for at least 25 percent of the total shipping volume (Planning Information Corporation 1996, Section 11).

In 2006, in Going the Distance, the NAS praised OCRWM’s decision to conduct shipments according to a “mostly rail” scenario, citing operational and safety advantages for rail over truck transport. The NAS urged OCRWM to fully implement the mostly rail decision through several activities, including helping ensure that utilities have the facilities necessary to utilize rail transport. Provisions of the standard contracts with utilities require that OCRWM work with utilities to determine the mode of shipment. The NAS further encouraged OCRWM to utilize intermodal transport, including overweight truck and barge, in order to reduce the need for cross-country legal weight truck shipments of spent fuel. According to the NAS, updating the FICA and NSTI reports were two of the tasks that OCRWM must complete in order to fully implement the mostly rail scenario (NAS 2006, p. 227). The NAS recognized that OCRWM would need adequate resources to accomplish these and other tasks, and failure to do so could lead to a heavy reliance on trucks as a shipping mode. This would likely have the undesirable effect of reducing public confidence in OCRWM’s transportation program (ibid., p. 228).

The pre-decisional draft of OCRWM’s “National Transportation Plan” listed “Modal Mix” among the “resolved transportation issues”6 (DOE 2007a, p.7). However, the states will not consider this issue to be resolved until OCRWM identifies the shipping mode from each of its shipping sites.

Rev. 0 of OCRWM’s “National Transportation Plan” states that, while the plan was to ship spent fuel and high-level waste by mostly rail, “such materials can be shipped safely regardless of mode or type of service due to the stringent regulatory standards in place and the robust nature of the transportation

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6 The list of resolved transportation issues did not appear in Rev. 0 of the “National Transportation Plan” issued in January 2009.
packages involved” (DOE 2009, p. 4). According to OCRWM, the benefits of relying predominantly on rail as a mode of transport were cost-related and operational, rather than related to safety, and determination of shipping mode would be made based on site-specific considerations.

Rev. 0 of the “National Transportation Plan” described Site Campaign Plans being developed prior to the commencement of shipments, with the plans including information such as shipping mode, number of casks, number of shipments, route to be used, and the transportation provider. OCRWM anticipated developing these plans “in coordination with the shipping site, States, Tribes and commercial carriers at least two years prior to initiation of the campaign” (DOE 2007a, p. 17). However, decisions around mode and route will surely influence the training efforts undertaken by the states, which may begin more than two years prior to shipments.

According to OCRWM’s proposed policy for providing Section 180(c) funding to states and tribes, OCRWM anticipates making planning and assessment grants available four years prior to shipments (see the section on Section 180(c) Implementation). Training grants would be available for three years leading up to shipments (DOE 2008e, p. 64936). States and tribes would likely want decisions regarding the shipping mode and the routes to be made early enough to inform their requests for Section 180(c) funding.

**Overweight Trucks**

Among the drivers behind OCRWM’s development of high-capacity legal-weight trucks were the desire to reduce the impacts on roads of overweight trucks and to avoid the need for special permits issued by states. OCRWM’s decision to ship mostly by rail gave some added reassurance that overweight truck shipments would not be necessary. OCRWM’s Supplemental Environmental Impact Statement, however, indicated that overweight trucks might be back on the table.

The issue of overweight trucks was first identified in the 1986 Transportation Institutional Plan as one of the nine original discussion papers. OCRWM’s interest in overweight trucks stemmed from the desire to reduce the number of highway shipments that would be required to move spent fuel to NWPA facilities. In that early paper, OCRWM indicated it was studying the federal and state weight limits for highways, examining the costs and safety of overweight truck shipments, and looking into the link between vehicle “highway damage and vehicle weight” (DOE 1986c, p. A-7). The program pledged to work cooperatively with states on “evaluations of the feasibility of using overweight trucks for NWPA shipments and the potential for developing nationally uniform and stable State permit procedures” (ibid.). OCRWM expected to make a final decision on the use of overweight trucks in 1990, noting that the ability to reach national consensus on state permitting procedures would be a deciding factor (ibid., p. A-8).

In 1994, when OCRWM published its initial draft transportation plan, the program fully intended to use a combination of newly developed high-capacity legal-weight truck casks and rail casks, including MPCs. The report mentioned overweight trucks only in the context of “Contingency Plans for Early Shipment.” OCRWM listed two overweight truck designs – the TN-8 and TN-9 – as among the casks potentially available for use on a contingency basis, stating that, “if needed, some of these casks could be obtained to provide a very limited shipping capability” (DOE 1994c, pp. 3-22-23). By 1995, when OCRWM published its “Transportation Contingency Plan for Limited Capacity Shipment,” the decision had apparently been made not to utilize overweight trucks: “Over-weight trucks will not be used due to the
additional permitting requirements for over-weight shipments. Consequently, the IF-300, TN-8, and TN-9 were not considered for contingency use” (DOE 1995g, p. 7).

The 2007 pre-decisional draft of OCRWM’s “National Transportation Plan” likewise did not mention overweight trucks as a possible shipping option, solely referring to rail, legal weight truck, heavy-haul truck (for shipping rail casks to nearby railheads), and barge shipments (DOE 2007a, p. 14). The document listed the issue of overweight trucks among the “resolved transportation issues” (ibid., p. 8); however, the “resolved” issue pertained to whether it would be legal for OCRWM to use overweight truck shipments given the divisibility of the load. According to the plan, “The use of overweight trucks was determined to be acceptable for the OCRWM Program because the payload is not divisible and the packaging alone makes shipments overweight” (ibid.).

By 2008, however, it became clear that overweight truck shipments might, indeed, be part of the repository transportation program. The Supplemental EIS, published in 2008, corrected an error in the earlier Final EIS (2002), which had estimated the weight of trucks carrying high-capacity truck casks to be 80,000 lbs. Instead, in the later report, OCRWM acknowledged that trucks carrying casks “would be more likely to have gross vehicle weights in the range of 36,000 to 52,000 kilograms (80,000 to 115,000 pounds)” and would, therefore, be considered overweight (DOE 2008c, p. 6-5). OCRWM asserted that “the impacts from the use of overweight trucks for shipments of spent nuclear fuel would be similar to the impacts from the use of legal-weight trucks” (ibid.). While the environmental impacts of overweight trucks might, indeed, be similar, OCRWM anticipated additional work associated with their use: “Most states require transportation companies to obtain permits when their vehicles exceed weight limits to control time and place of movement. Local jurisdictions also often require overweight permits” (ibid., p. H-7). As noted in the Supplemental EIS, the purpose of such permitting was to protect highways and infrastructure such as bridges, to consider local traffic volume and patterns, and to protect the public that would be on the road. Because decisions on permitting were dependent upon each jurisdiction’s unique characteristics, state and local governments did not have uniform criteria for permitting shipments (ibid.).

The realization that truck casks would need to be shipped on overweight trucks resulted in the 2009 version of the “National Transportation Plan” including “overweight/legal weight truck” as a transport mode “for commercial SNF sites that do not have the capability to handle rail casks” (DOE 2009, p. 5). OCRWM indicated that it would make modal decisions on a site-specific basis.

Rail Access

As of 2008, 47 of the 72 sites on which commercial nuclear power plants were located had rail access (Thrower et al. 2008, p. 5). Some of these sites were served by major railroads, while others were served by small “shortline railroads.” No systematic assessment of the rail infrastructure had been completed for these sites, therefore the Federal Railroad Administration (FRA) initiated a study to evaluate the quality of track near or adjacent to nuclear reactors served by shortline railroads. OCRWM initially provided funding for the study, however the cancellation of the Yucca Mountain program left the study incomplete.

OCRWM determined in 2004 that shipments from the 72 commercial reactor sites and five DOE sites to a federal repository would occur by “mostly rail.” Since Yucca Mountain was not accessible by rail, OCRWM proposed constructing a rail line from Caliente, NV, to the site (DOE 2004). OCRWM also faced the potential problem of inadequate or non-existent rail infrastructure near commercial reactor sites to
make rail shipments possible. According to OCRWM, 25 commercial reactor sites did not have direct rail access (Thrower et al. 2008, p. 5). OCRWM recognized that the number of shipping sites that lacked direct rail access could grow over time if rail service to reactor sites degraded.

States and other stakeholders have expressed concern about rail access to commercial reactor sites. Mel Massaro of the FRA undertook a study of near-site rail infrastructure to determine the feasibility of utilizing track near reactor sites for spent fuel shipments. The study noted that 45 of the 73 nuclear power plants with rail access on site or nearby are served by Class One Railroads, which are the large freight railroads that account for most rail traffic in North America; the remaining 28 sites are served by non-Class One railroads. Track that serves these 28 reactor sites is instead owned and operated by shortline railroads, which are independent railroad companies that operate over relatively short distances. Shortline railroads are typically small in terms of both size and revenue (CSG-NE 2007, p.1).

Massaro began this project by surveying shortline railroads for information on track class, ownership, rail weight, restrictions, grade crossings, method of operation, and hazmat registration. The initial survey was to be followed up by a site visit by the FRA, OCRWM, railroad officials, and state personnel to evaluate track quality. Among the objectives of the Shortline Railroad Study, Massaro hoped to “Qualify each railroad’s present operational status against a safe acceptable standard” (Massaro 2008, p.2.)

The shortline study was funded in part by OCRWM, but funding for the project was pulled as a result of the drastic budget cuts suffered by OCRWM in 2009. The study was in the process of collecting information on track quality through a “physical and operational infrastructure survey.” Specifically, the study sought to obtain information on track ownership, nearest connection with a Class One Railroad, class of track, rail weight, grade crossings, and any equipment or track restrictions for that portion of track. Rail weight dictates how heavy a load can travel on that track. Track restrictions include clearance for tunnels and bridges, as well as sharp curves. Additionally, the survey inquired about hazardous materials registration or training. Track is classified on the basis of track condition, and the track class dictates how quickly trains can travel on that section of track. Track classes range from class one track, with a maximum speed of 10 miles/hour, to class five track, on which trains can travel up to 100 miles/hour. Higher classes of track are subjected to more frequent inspections (CSG-NE 2007).

Track owners can also designate certain segments of track as “excepted track,” which allows them to avoid complying with certain FRA standards. Excepted track is generally the lowest-quality track, and the maximum speed for travelling on this track is 10 mph. Additionally, no trains carrying passengers can travel on excepted track, which could have implications for inspectors travelling with spent fuel shipments.

Massaro undertook this project with the recognition that, while a reactor may have rail access “on paper,” the condition of the tracks near nuclear facilities may be poor, making their use for shipping radioactive materials undesirable. OCRWM has stated that “rail shipments will be the mode of choice for sites with rail access” (DOE 2009, p. 5). Preliminary findings from Massaro’s shortline railroad study indicate that some track may not be suitable for spent fuel shipments. This raises concerns that there may be more intermodal or truck shipments to a federal repository than currently anticipated.

Massaro also began to explore the idea of setting standards for minimum track class (i.e. class two track) for shipping spent fuel. Because the NWPA prohibits OCRWM from using money from the Nuclear Waste Fund to pay for upgrades of public or private infrastructure, another funding source would need to be identified if upgrades are needed. It is important to consider the time necessary to complete
upgrades on rail track. Improvements would need to be identified and undertaken well in advance of the proposed shipments. The cost and time required to complete rail infrastructure improvements raises the question of whether alternative modes of transportation (truck or barge) should be explored even from some sites that have rail access.

As of 2009, Massaro had conducted three site visits to nuclear power plants served by shortline railroads in the Northeast. A site visit to a Midwestern plant was tentatively planned when the funding for this project was eliminated. To resolve the issue of rail access, OCRWM or its successor will need to complete the analysis begun in the shortline study. In addition, it will be important for OCRWM, the FRA, the states, and other stakeholders to determine whether to establish standards for track quality on which spent fuel will be shipped. If standards are set and the rail track along shipping routes from nuclear reactors does not meet those standards, the options will be to upgrade the track or find another mode of transport from that shipping site. Upgrades to rail infrastructure will be both costly and time-consuming.

**Rail Service Analysis**

OCRWM identified early on the question of what kind of contracting mechanism it would use to procure rail services and whether to use dedicated trains or general freight. In a 2005 policy statement, OCRWM declared its intent to have rail shipments occur via dedicated train, meaning that trains shipping waste to the repository would not be shipping any other commodity. Benefits of using dedicated train service included lower costs, shorter transit times, less time in rail yards, and greater scheduling flexibility.

OCRWM explored the issue of whether to ship spent fuel and high-level waste via general freight or dedicated train in its 1986 *Transportation Institutional Plan*. On general freight or “regular-train service, trains typically carry a mixture of commodities for many customers and from several origins to several destinations” (DOE 1986c, p. A-83). Conversely, “dedicated train service generally involves the shipment of a single commodity for a single customer, from a single point of shipping origin to a single destination” (ibid.). A decision regarding shipping mode had not yet been made, and OCRWM was considering all modes of transportation and shipment configurations in its planning efforts to maintain flexibility. The program expected to make a decision regarding mode and type of rail service once a cost-benefit analysis had been completed.

OCRWM envisioned a transportation system in which general freight service would likely be used to transport spent fuel and high-level waste to a monitored retrievable storage facility, where spent fuel would be consolidated into larger casks and shipped to a repository. Some stakeholders had urged OCRWM not to ship in general freight, but instead use dedicated train service and implement measures such as maximum speeds for trains to promote safety, minimize exposure, and maximize OCRWM control over shipments.

In 1990, the FRA was directed by Congress to undertake a study “comparing the safety of using trains operated exclusively for transporting high-level radioactive waste and spent nuclear fuel ... with the safety of using other methods of rail transportation for such purposes” (FRA 2005, p. 1). This “dedicated train” study was to be completed “in consultation with the Department of Energy, the Nuclear Regulatory Commission, potentially affected States and Indian Tribes, representatives of the railroad transportation industry, and shippers of high-level waste and spent nuclear fuel” (ibid.). The FRA also
coordinated closely with PHMSA, which regulates the transportation of hazardous materials. The study was initiated in 1992, with a final report issued 13 years later in March 2005.

The FRA’s study entitled “Use of Dedicated Trains for Transportation of High-Level Radioactive Waste and Spent Nuclear Fuel” examined the potential reduction in risk that could be achieved by utilizing dedicated train service for shipments and considered the cost implications of doing so. In carrying out this study, the FRA looked at risks related to incident-free transportation as well as the risk posed by potential accidents. The study was conducted using worst-case scenarios.

The dedicated train study concluded that the non-incident risk of transporting spent fuel and high-level waste by rail is low regardless of which type of train is used. Exposure from potential shipments is benign in comparison to lifetime background exposure to radiation (ibid, p. 3). Regarding accident risk, the FRA study found that the risk of an accident that released radioactivity was extremely low due to NRC package requirements, the FRA’s inspection program, and railroad industry guidelines. However, the study concluded that the “use of dedicated trains would reduce both the probability of a cask being involved in a train accident and the possibility that other hazardous materials might be involved that could subject a cask to a fire environment with possible loss of shielding” (ibid, p. 4). Additional training for crews operating dedicated trains and enhanced operating procedures for these trains have the potential to further reduce the accident risk of shipments.

Additionally, this study concluded that the cost of utilizing dedicated train service for shipments is only marginally higher than that of general freight, and this cost can be partially offset by shorter transit times. The FRA notes that, historically, shippers have elected to use dedicated train service when transporting spent fuel and high-level waste by rail (FRA 2005, p. 3).

In July 2005, OCRWM announced its intent to “use dedicated trains for its usual shipments of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain repository site in Nevada, when the repository is operational” (DOE 2005, p. 1). In its Policy Statement for the Use of Dedicated Trains for Waste Shipments to Yucca Mountain, OCRWM made note of several significant safety, security, cost, and operational benefits of using dedicated train service:

- Decreased transit time that may reduce radiological risk
- Better monitoring from the locomotive and escort cars due to shorter train configurations
- Avoidance of time spent sitting in rail yards
- Reduced fleet size leading to lower costs for equipment and maintenance
- Better efficiency and flexibility in operations
- More predictable routing and scheduling than with general freight service
- Simplified transportation planning and operations (ibid.).

In its dedicated train policy statement, OCRWM maintained that shipments could be carried out safely and securely on general freight as well as dedicated train service. While the policy stated that OCRWM would use dedicated trains for its “usual rail transport” of spent fuel and high-level waste, it did not define what “usual rail transport” was, nor did it explain the circumstances under which general freight service might be used. The OCRWM policy statement further said that “DOE shipments have been and will continue to be made securely using both [dedicated train service] and general freight service” (ibid.).
In the 2006 report *Going the Distance*, the NAS recommended that OCRWM “fully implement its dedicated train decision before commencing the large-quantity shipment of spent fuel and high-level waste to a federal repository to avoid the need for a stopgap shipping program using general trains” (NAS 2006, p. 19). In explaining its recommendation, the NAS stated that, while dedicated train service did not appear to provide a radiological risk advantage over regular freight service, there were significant programmatic advantages in the areas of planning, operations, safety, security, and communications that made dedicated train service preferable. In addition, the public had shown a preference for dedicated train service for shipping spent fuel and high-level waste. The NAS believed that these advantages made it desirable for OCRWM to ship via dedicated train service.

Since OCRWM issued its 2005 policy statement, this issue has been considered closed, to a large degree. However, the cancellation of the Yucca Mountain program creates new uncertainty regarding whether spent fuel and high-level waste might be shipped via general freight train to interim facilities.

**Route Identification**

OCRWM’s Transportation Institutional Plan observed that, for the Yucca Mountain program, the “transportation of waste to facilities developed under the NWPA may be the most visible [program] element nationwide” (DOE 1986c, p. i). What makes the transportation element so visible, of course, is the presence of shipments traveling on highways and railways throughout the country. For this reason, route identification is perhaps one of the most important institutional decisions OCRWM will make. The states have been unanimous and consistent in their advocacy for consultation and cooperation in the route identification process. In 2004-2005, the Midwest undertook an ambitious project to identify possible rail and highway routes through the region, assuming Yucca Mountain as the destination. OCRWM did not follow up substantively on the Midwest’s project, nor did its own process of working through the TEC/WG move the process of route selection forward before the program was terminated in 2009.

When the Obama Administration put an end to the transportation activities that supported the Yucca Mountain program, OCRWM had produced numerous documents that addressed, in whole or in part, the topic of route identification. None of these documents, however, presented a map of proposed routes that the program might use for shipments to the repository. In the early years, before Yucca Mountain was officially designated for development as a repository, OCRWM attributed its reluctance to identify proposed routes to the lack of a final decision on the destination. In other words, the program did not wish to appear to prejudge the outcome of the site characterization process that was ongoing to determine whether Yucca Mountain was, indeed, suitable for development.

Once that decision was finalized in 2002, however, OCRWM made little progress in the way of identifying routes. What progress it did make was the result of repeated prodding by stakeholders such as the regional groups. The Midwestern Radioactive Materials Transportation Committee, for example, identified route selection as a “key issue” in 2004: “The Midwestern states recommend that OCRWM identify, as soon as possible, the shipping routes in order for the Midwestern states to assess their training and financial assistance needs” (MRMTC 2004, p. 2).

The NAS, in *Going the Distance*, weighed in on the subject of route selection after finding that OCRWM had neither “made public a specific plan for selecting rail and highway routes” nor “determined the role of its program management contractors in selecting routes or specific plans for collaborating with affected states, tribes, and other parties” (NAS 2006, p. 18). The NAS recommended that OCRWM
“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” (ibid.). The NAS further recommended that OCRWM involve states and tribes in route selection for the purpose of “obtain[ing] access to their familiarity with accident rates, traffic and road conditions, and emergency responder preparedness within their jurisdictions” (ibid.). The NAS noted that involving states and tribes “may improve the public acceptability” of the routes selected, thereby reducing the likelihood of route-related conflicts and associated “program delays” (ibid.).

To be fair, OCRWM did include maps of “representative truck and rail routes” in its final environmental impact statement on Yucca Mountain, as well as maps for each of the states (DOE 2002, pp. J-24-25, J-133+). In the same document, however, the program acknowledged that, “[at] this time, about 10 years before shipments could begin, DOE has not determined the specific routes it would use to ship spent nuclear fuel and high-level radioactive waste to the proposed repository” (ibid., p. J-23). Instead, OCRWM planned “to identify the preliminary routes that DOE anticipates using in state and tribal jurisdictions” for the purposes of implementing Section 180(c) (ibid.). The final environmental impact statement did not address the process OCRWM would follow to select routes, nor the type (if any) of institutional interactions that would take place as part of the route selection process.

OCRWM’s lack of progress in identifying routes was not due to a failure to grasp the problem. Early on, for example, in the Transportation Institutional Plan, OCRWM identified highway and rail routing as separate issues requiring resolution (DOE 1986c, p. A-5). For highway routing, the program planned to “sponsor regional routing workshops to assist in the determination of appropriate parameters for a transportation analysis” that would inform the development of environmental impact statements for “candidate repository sites,” Yucca Mountain being one (ibid.). The topics planned for discussion included “specific route factors that could be considered, and the availability of route-specific data” (ibid.). OCRWM intended to develop “route-planning criteria...as an element of transportation operational procedures contained in the OCRWM’s comprehensive transportation plan,” with the criteria directing “the selection of routes that conform to all DOT requirements” (ibid.). For rail routing, OCRWM noted that there were “no Federal regulatory requirements for rail routing,” therefore the program planned to consult with other federal agencies regarding the need for such requirements. OCRWM also planned to “develop appropriate rail-routing criteria for NWPA shipments” (ibid., pp. A-5-6).

In later years, various OCRWM reports document that the program intended to develop a “Route Selection Guidance Document” (DOE 1994a, p. 38) and/or a route selection policy (DOE 1994c, p. 5-2; DOE 1995e, p. 16). The OCRWM Transportation Report, for example, indicated that OCRWM would develop a “routing policy” that would “comply with DOT regulations” (DOE 1995e, p. 16). The report “Developing the Transportation System” also mentioned a “routing policy,” specifically to be developed with “[s]takerholder input and participation...through the TEC/WG” (DOE 1994c, p. 5-2). Using the input OCRWM would receive through the TEC/WG, from other DOE programs, and from other stakeholders, the program would develop a “DOE guidance document” on routing (ibid.).

regulatory structure, as well as then-current DOE policies and plans. In addition, the report nicely summarized the concerns that DOE programs had with regard to “extraregulatory” measures related to route selection (Section IV). Balancing DOE’s concerns, stakeholder groups – states, tribes, local governments, and environmental groups – had an opportunity to provide their own perspectives on route selection.

The paper documented an important aspect of route selection – namely, the fact that DOT regulations give the carrier the authority to select the routes for highway shipments (ibid., p. 6). Acknowledging that “in recent campaigns DOE has worked closer with the carrier and other federal, state, tribal, and local authorities in early identification of potential routes,” the paper noted that “[r]outing determinations are critically important to the Department, and as a matter of course DOE consults ...closely with the carrier and affected states in making the final selection” (ibid., p. 7). The section on states’ perspectives (Section V) addressed this same topic, beginning with a statement that, because of their primary role in protecting public health and welfare, “states have an interest on behalf of their citizens to become involved in route selection for all types and modes of radioactive materials shipments” (ibid., p. 9). The states identified “three main goals” for “the ideal route selection process:”

- Promote safety and public acceptance of the shipping routes by making the federal government, not a private company, accountable for route selection;
- Allow resources (inspections, emergency response, etc.) to be focused by reducing the total number of potential routes; and
- Give states and communities sufficient time to prepare for shipments by eliminating the uncertainty regarding which routes will be used (ibid., p. 10).

The states recommended the WIPP program as “the base model which most states would like to see DOE follow in planning its large scale shipping campaigns that involve high-level radioactive materials” (ibid.). The process involved DOE’s Carlsbad Area Office (now the Carlsbad Field Office) proposing “a preliminary set of routes to the affected states,” with the routes being “modified...based on state suggestions” (ibid.). As a final step, the “routes DOE selected in consultation with the carrier, states, tribes and other stakeholders were included as mandatory provisions within the carrier contracts” (ibid., p. 11). The paper concluded with two recommendations from the TEC/WG regarding routing. First, “DOE should develop a standardized, cooperative approach to route-selection for all unclassified shipping campaigns involving radioactive materials” (ibid., p. 15). This approach would be characterized by “timely initiation of the route-selection process;” proposals of preliminary and secondary routes; “full use of the regional, tribal, and local cooperative-agreement groups” in working with their members throughout the review and comment process; and inclusion of the “primary and secondary routes as a specific, enforceable provision in contracts with carriers” (ibid.). The topic group’s second recommendation was for the route selection process to “be aimed at achieving” the three goals identified by the states (ibid.).

A subsequent paper on rail routing, produced by the TEC/WG Rail Topic Group in 2004, compiled detailed information on current regulations and practices and “compare[d] aspects of the highway routing regulations as they might apply to rail routing,” but the paper did not achieve the same widespread status as the original 1998 routing paper (TEC Rail TG 2004, p. 2). Following the paper’s release, the Midwest initiated a project to identify, on a regional basis, a set of preliminary routes for shipping from Midwestern reactors. The Midwest conceived of the idea in November 2003, during a stakeholder meeting with then-Undersecretary Robert Card (MRMTC 2005, p. 1). According to the report, the Midwest’s rationale “was that, since states are in a better position than the federal
government to judge the quality of potential highway and rail routes through their jurisdictions, route selection for shipments under the NWPA should begin with a regional review of available routes” (ibid.). The Midwest spent 18 months on the project, which involved a work group of five states. The group held 10 conference calls and one meeting, and most work group members attended training on DOE’s routing model TRAGIS. The Midwest completed the project in December 2005 with a presentation to the OCRWM staff at a meeting with the Midwest’s work group.

The Midwest’s routing work group chose to use DOT’s HRCQ routing guidelines for evaluating both highway and rail routes. The primary route-selection criteria were the three DOT criteria:

- Radiation exposure to the general public from normal transport;
- Public health risk from accidental release of radioactive materials; and
- Economic risk from accidental release of radioactive materials (ibid., p. 32).

To further winnow the routes to a smaller set, the Midwest also formulated a set of secondary factors: urban centers transited, accident rate, track/road quality, and traffic density (ibid.).

Before the region presented its final report to OCRWM, the CSG Midwest staff informed the other regional committees about the possible impact the Midwest’s preliminary routes could have on their states (see, e.g., Sattler 2005). In addition, the committee presented the resulting route maps to the governors of each of the affected Midwestern states, describing them not as “proposed” or “acceptable” routes, but rather as a “starting point for discussions at the national level” (MRMTC 2005, p. 47). The final report from the project contains a very detailed summary of the methodology, data sources, and the timeline for the benefit of OCRWM and other groups that might undertake similar projects.7 In a letter commending the Midwest for its work, OCRWM staff expressed the hope that the region’s effort would “allow initiation of the national dialogue on route identification and, with input from [various stakeholder] groups, DOE will be able to fulfill its responsibility for identification of a national suite of routes that could be used for shipments to Yucca Mountain” (Lanthrum 2005, p. 1).

In 2006, OCRWM prepared a draft “process plan” on route identification and sought feedback from stakeholders. The purpose of the plan was to present OCRWM’s approach for conducting the route identification process (DOE 2006c, p. 1). According to the document, OCRWM planned to identify a “preliminary suite of routes by the end of 2007” (ibid.) and included a schedule for achieving this goal (ibid., p. 9). Much of the work was to be conducted through a new TEC/WG Routing Topic Group, which OCRWM formed in November 2006. After nine conference calls and three meetings, the group managed to produce very little, including a task plan (from which the timeline for activities was removed), a draft definition of “suite of routes,” and a set of draft routing principles (which were never officially adopted).

At its last meeting, in February 2008, the group was to begin working on a proposed “research activity” called the “Standard Problem” (TEC Routing TG 2008, p. 2). The idea was for topic group members to form small “analytical groups to look at possible ways for routing shipments from a small number (12) of regionally diffuse sites to the proposed repository at Yucca Mountain” (ibid.). The topic group members decided instead to defer work on the standard problem until “the rail carriers [could] perform the initial routing exercises for the 12 origin sites” (TEC 2008, p. 9). The rail carriers in attendance at the February

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7 The CSG Northeast High-Level Radioactive Waste Transportation Task Force undertook a route identification project using a different methodology than the Midwest. The staff presented the project’s preliminary findings at the fall 2006 TEC/WG meeting in Green Bay, Wisconsin, however no final report was issued.
The 2008 meeting expressed their hope about doing this initial work, but said that first they would have to assess “whether their involvement would present any potential antitrust issues” (ibid.). The topic group disbanded shortly after the meeting, therefore it is not known what work, if any, the railroads performed.

The most recent development involving route identification was the publication in 2008 of new DOT/PHMSA final rules on rail safety, which included requirements for rail carriers to compile annual data on shipments of various hazardous materials, including radioactive materials. Carriers must then “use the data to analyze safety and security risks along rail routes where those materials are transported, assess alternative routing options, and make routing decisions based on those assessments” (DOT 2008, p. 20752). The publication of the final rules came after OCRWM had ceased its public activities on route identification, therefore OCRWM did not work with its stakeholders to assess the impact the new rules might have on the selection of routes for the NWPA shipments.

The selection of routes will affect the implementation of Section 180(c), as well as state plans for training emergency responders and for inspecting and escorting shipments. The Midwest demonstrated that a preliminary analysis of possible routes can be accomplished in as little as 18 months. To reach final agreement among affected states, however, could take an additional two years or more.

**Transportation Infrastructure Improvements**

The transportation infrastructure near utilities and other shipping sites is the jurisdiction of state and local governments. Upgrades to this infrastructure might be necessary to make it possible for OCRWM to ship heavy spent fuel casks from the sites. It is not clear whether OCRWM will use the Nuclear Waste Fund to pay for infrastructure upgrades.

OCRWM’s *Transportation Institutional Plan* identified the issue of transportation infrastructure improvements as an institutional issue that was added to the original list of nine issues as a result of public comments. The document defined transportation “infrastructure” as referring to “physical transportation structures, including highways, bridges, rail-lines and rail-beds, and elements associated with navigable waterways” (DOE 1986c, p. A-94). The discussion paper in the *Transportation Institutional Plan* noted that questions had been raised about whether OCRWM would fund any improvements to transportation infrastructure and, if so, under what circumstances. Stakeholders had also raised concern about the need to establish “adequacy” standards for evaluating the quality of the infrastructure so as to maintain an appropriate level of quality to support shipments under the NWPA (ibid.).

In the discussion paper, OCRWM explained that the NWPA did not provide “statutory direction” regarding infrastructure in non-host states. Moreover, “waste shipments through non-host States are not expected to create any unique needs for infrastructure improvements, nor require maintenance in addition to that normally required for general transportation” (ibid., p. A-96). The discussion paper went on to state that “specific needs...for infrastructure improvements will be reviewed on a case-by-case basis” (ibid., p. A-95). OCRWM’s approach could be summed up as recognizing a potential need for funding near-site infrastructure improvements in order to make it possible to ship waste from sites to a

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8 A third topic identified in the discussion paper was what role the condition of transportation infrastructure would have on the siting of facilities under the NWPA. OCRWM pledged to address this issue during the NEPA process. Because this issue pertains more to disposal or storage site selection than to transportation near the point of origin or en route, it is not discussed in this paper. The issue does have relevance for discussions regarding the future siting of facilities for long-term waste management.
national repository. In fact, the discussion paper indicated that OCRWM would issue a statement on the extent of such improvements in “mid-1991, when a repository site is selected” (ibid., p. A-96). OCRWM appears to have had no intention, however, of paying for infrastructure improvements along major routes for which the repository shipments would create a negligible additional impact.

To assist in gathering information on the condition of transportation infrastructure near reactor sites, CSG Midwest began publishing a Highway Infrastructure Report. The first report was issued in 1990, with editions following in 1992 and 1994. The reports identified the state- or county-sponsored road work that had recently been completed, as well as plans for future repairs or improvements (CSG Midwest 1992, p. 1). It is unknown whether other regions were tasked with producing similar reports, or whether (and, if so, how) OCRWM used the information contained in the reports.

In February 1992, Nuclear Assurance Corporation released the final report of the OCRWM-sponsored NSTI Project. The project assessed the “capabilities of the existing near-site transportation networks to accommodate spent fuel shipments and to assess modal upgrade potential” (Viebrock and Mote 1992, p. 1-1). A total of 76 sites were surveyed from October 1989 to March 1991, with the project looking at the condition of the infrastructure within a 25-mile radius of the site (ibid., p. 3-1). The information collected during individual site assessments was stored in a database. According to the final report, two main conclusions resulted from the project:

- All sites had the capability to ship casks on legal-weight trucks (i.e., up to 80,000 lbs.).
- All sites were capable of supporting heavier casks – weighing at least 100 tons – by either rail or barge. Upgrades or extension of the existing infrastructure might be needed to support rail or barge shipments (ibid., p. 1-2).

In 2008, the FRA began a study of the short-line railroads that currently or formerly provided rail access to utility sites (Massaro 2008b). The FRA initiated the project in the Northeast on a pilot basis, with plans to expand to other regions and eventually to all sites (for more information, see the section on Rail Access). Funding for the project was terminated in 2009 as a result of the redirection of the Yucca Mountain project. If the FRA had been allowed to continue its work, the project would have produced invaluable information on the transportation infrastructure near the utility sites studied.

Looking ahead, the selection of highway and rail routes and infrastructure improvements are inextricably linked. If OCRWM or its successor bases route selection on the existing condition of near-site infrastructure, it is possible that some routes will be ruled out due to the poor condition of roads, rails, and barge facilities that provide access to the site. It will likely be the case that, where infrastructure is in need of repair to support shipments, OCRWM will need to fund infrastructure improvements. Otherwise, it would be unlikely for the states to take on the burden of improving roadways – or rail companies to invest in rail upgrades – unless the infrastructure has other uses that make upgrades a worthwhile investment.
The states have advocated for OCRWM to adopt requirements for high-quality carriers and drivers, including train crews, that are at least as stringent as those for truck shipments of transuranic waste to WIPP. Parallel requirements have not been established for rail shipments, although the states’ position is that these should be comparable to the standards for truck shipments. DOE describes the minimum carrier and driver requirements to which it will adhere in the DOE Manual. OCRWM describes additional carrier and driver requirements that will apply to spent fuel and high-level waste shipments in its Draft Request for Proposals (RFP) for transportation services for moving commercial spent fuel to the federal repository. OCRWM will need to augment its proposed standards if it is to meet the states’ expectations.

DOT establishes regulations that apply to commercial carriers, such as training for drivers that transport highway route controlled quantities (HRQC) of radioactive material, including spent fuel and high-level waste. These regulations require that drivers transporting HRCQ shipments receive written training on the specific DOT requirements pertaining to such shipments; the properties and hazards of the materials being shipped; and the procedures to be followed in the event of an accident or other emergency (DOE 1986c, p. A-98). Drivers must have received training within two years prior to transporting radioactive materials, and they must carry their certificate of training with them.

In September 1998, OCRWM issued a revised draft Request for Proposals (RFP) for transportation services for moving commercial spent fuel to the federal repository. The RFP laid out requirements for several areas of transportation, including carrier and driver qualifications. The RFP stated that carriers must develop training programs for truck drivers and locomotive engineers that comply with DOT’s 49 CFR. In addition to the training required by 49 CFR, driver and crew training should also cover, as appropriate (DOE 1998a, p. 8-6):

- 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
- public affairs and speakers bureau training
- first responder awareness training
- radiation worker “B” (or equivalent) training

Truck drivers must also receive training in CVSA’s enhanced inspection procedures. Rail crews must receive training in hazardous material handling in compliance with individual railroad operating rules.

Carrier and driver requirements are one of the 14 topics covered in the DOE Manual, which cites the same requirements in the 1998 RFP. While carriers bear the ultimate responsibility for following the relevant federal regulations for transporting radioactive materials, DOE monitors carrier performance and ensures that each driver possesses “a current commercial driver’s license (CDL) with a hazardous material endorsement and meet[s] applicable requirements in 49 CFR” (DOE 2008f, p. 25).
Rail carriers must also follow the applicable regulations in 49 CFR. The FRA sets minimum standards for driver and crew training, but additional training is frequently provided by carriers in accordance with industry standards. The DOE Manual commits to having DOE shipments meet standards and recommended practices set by the Association of American Railroads. The FRA mandates that workers receive job-specific training at least every three years. FRA regulations also require engineers and crews to undergo drug and alcohol screening.

According to the DOE Manual, “Regulatory conformity on the part of rail carriers in the area of rail safety (including crew training and preparedness and equipment inspection) is assured by rail industry rules, standards, and recommended practices which correspond with and in some cases enhance said regulations” (ibid., p. 26). Thus, DOE relies on the rail industry to be largely self-regulating in the area of rail safety. The states will likely seek additional assurances that rail crews and locomotive engineers are properly trained and qualified to conduct shipments.

The states have advocated for OCRWM to adopt requirements for carriers, drivers, and train crews for repository shipments that are at least as stringent as those for WIPP drivers. The WIPP PIG, developed jointly by the WGA WIPP Technical Advisory Group and DOE, describes the “issues, objectives, approaches and procedures” that govern highway shipments of transuranic waste through the Western states (WGA 2008c, p. i). “High-Quality Drivers and Carrier Compliance” is the very first transportation issue addressed in the WIPP PIG. In order to reduce the risk and consequences of accidents, the WIPP PIG sets stringent performance requirements for carriers and drivers. The WIPP PIG strives to reduce the possibility of transportation incidents by imposing stringent driver qualifications and training, requiring strict adherence to relevant regulations, and including provisions in carriers’ contracts that promote safety.

The WIPP PIG permits the WGA WIPP Technical Advisory Group to participate in the development of transportation contracts and the carriers’ management plans and the technical evaluation of carriers’ proposals. Safety requirements that are incorporated into the contract and management plan include “above minimum regulatory requirements for driver qualifications, driver performance, driver training, carrier performance, inspection requirements, and vehicle maintenance” (ibid., p. I-1). The contracts that DOE currently has with two commercial carriers require that designated trucks and drivers be used for WIPP shipments.

The WIPP transportation contract and carrier management plan include numerous requirements related to driver qualifications and training that go beyond what DOE commits to in the DOE Manual. These are listed in the document Model Safety Elements in the WIPP Transportation Contract and Corresponding Carrier Management Plan, and cover areas such as a minimum age and miles logged for drivers, carrier-developed driver training programs, driver pay, substance abuse policies, driver penalties, driver inspections of cargo, and the use of two qualified drivers per shipment (WGA 1996, p. 3). In addition, carriers and drivers must comply with applicable state and federal regulations, including 49 CFR; carry liability insurance; meet CVSA enhanced inspection standards; utilize TRANSCOM and the TRIPMASTER system or the equivalent; maintain a satisfactory rating from the Office of Motor Carriers for the contract period; and possess the authority to operate in all of the states that will be affected by WIPP shipments (ibid, p. 2). Checklists for driver and vehicle are used to verify compliance with these requirements.

The WGA WIPP Technical Advisory Group carries out a Compliance Audit Program to ensure that carriers comply with all applicable laws, regulations, and other requirements. DOE’s Carlsbad Field Office
ensures that contract carriers undergo performance audits each year; audits are typically conducted by the host state.

The expectations that the Midwestern states have for carrier selection and driver/crew compliance for shipments that travel through the region are expressed in the Planning Guide for Shipments of Radioactive Materials through the Midwestern States. The Midwestern states expect that shippers will select carriers with exceptional safety records to transport radioactive materials. The WIPP requirements should be used as the minimum standards for truck drivers. These include requiring drivers to have logged 100,000 miles in a semi-tractor/trailer combination and two years of uninterrupted commercial driving experience in the past five years. Drivers in long-duration shipping campaigns should be trained in CVSA Level VI enhanced inspection procedures, TRANSCOM, and awareness level first responder training. Shippers should also comply with NRC orders related to shipping radioactive materials in quantities of concern, which include background checks for carriers (MRMTC 2008b, p. 8). For rail shipments, the Midwestern states expect that locomotive engineers transporting radioactive materials will meet the requirements of the FRA’s Locomotive Engineer Certification, and that train crews will have received hazardous materials training (ibid., p.9).

It is the Midwestern states’ expectation that shippers will only utilize carriers with satisfactory DOT ratings, and, if the shipper is DOE or one of its contractors, satisfactory ratings from DOE’s Motor Carrier Evaluation Program. Finally, the states expect that if OCRWM is the shipper, the department will abide by all applicable agreements with the states and regional groups. All shippers are expected to share the carrier’s draft management plan to the corridor states for comment in advance of shipments (ibid.).

All shipments of transuranic waste to WIPP to date have travelled via truck. In December 2003, the WGA WIPP Technical Advisory Group issued a set of expectations that the Western states have for shipments of transuranic waste that may occur by rail. The “rail expectations” document includes expectations that relate to carrier qualifications. The Western states expressed their general expectation that OCRWM will ensure that rail shipments are conducted using standards, procedures, and protocols that are comparable to those used for truck shipments of transuranic waste. Rail carriers are expected to ensure that trains transporting transuranic waste are operated by qualified crews, and the FRA and/or the WGA lead states will verify that train crews are properly trained, certified, and experienced. Locomotive engineers are expected to meet the Locomotive Engineer Certification requirements. Carriers are expected to meet the requirements of 49 CFR, including the requirement that crew members receive hazardous materials training.

**Inspection and Enforcement**

States have the authority to inspect shipments of spent fuel and high-level waste that enter their jurisdictions. For truck shipments, the CVSA Level VI inspection program is well established and most states are able to honor the CVSA Level VI decal that is applied at the point of origin. This results in shipments being allowed to pass through without the need for en route inspections, except in states that have laws or policies requiring a state inspection. There is no rail equivalent to the CVSA Level VI inspection program. Because OCRWM has announced its intention to use “mostly rail” as the preferred mode of transport, it is important to establish a reciprocal rail inspection program to provide states with the same level of confidence in point-of-origin inspections as the CVSA Level VI program does for truck shipments. DOE’s TEC/WG developed a prototype for an acceptable reciprocal rail inspection program. OCRWM did not advance the proposed procedures beyond the developmental stage. In 2009, the Midwestern states led the
effort to carry this program forward to the pilot testing phase and, ultimately, to identify the appropriate organization to finalize the work that started with the TEC/WG.

In the 1986 *Transportation Institutional Plan*, OCRWM acknowledged the need for federal agencies to come together with states and tribes to resolve concerns related to “inspection-and-enforcement activities for shipments of radioactive waste” (DOE 1986c, p. A-6). OCRWM further observed that “issue resolution could be greatly assisted by the development of a standardized, cooperative inspection system” (ibid). Toward that end, OCRWM announced its intention to “contract with an organization having expertise in State safety inspections for highway transportation to assist in the development of a proposal for a uniform inspection system” (ibid). Tasks identified for this organization included working to “gain consensus and approval ...from appropriate State and Tribal authorities” as well as providing “support [to] OCRWM in briefing State and Tribal authorities on the proposed uniform system” (ibid). For rail shipments, OCRWM had a less aggressive plan to “support the definition of Federal, State, and Tribal inspection and enforcement roles for rail shipments...through the formation of a study group and workshops” (ibid, A-50).

OCRWM’s plans for action reflected the concerns raised by stakeholders at the OCRWM Transportation Institutional Plan Workshop held in November 1985. According to the *Transportation Institutional Plan*, some participants had identified the need for OCRWM to work with other federal agencies to review “the need to develop guides for uniform State-to-State inspection procedures and eventually standards for inspection and training for and by State inspection officials” (ibid, p. A-47). A reciprocal program, whereby states would honor the inspections done in previous states, would reduce the need for shipments to stop for additional inspections along the way to their destination. Stakeholders also identified the need to “coordinate existing Federal, State, and private training programs” (ibid, p. A-48). OCRWM indicated that a “comprehensive inspection-and-enforcement program for NWPA transportation is expected to be defined in 1993 and will be addressed as an element of the transportation plan” (ibid, p. A-49).

OCRWM’s plans for truck shipments ultimately resulted in the development of the CVSA Level VI Inspection Procedures and Out-of-Service Criteria. From 1986 through 1999, the program funded CVSA’s development of the Level VI program. Through the agreement, CVSA conducted a pilot study “to evaluate the soundness of the procedures” and performed inspections, which allowed the collection of data on inspections for analysis (CVSA 2005, p. 1). Finally, the agreement funded the development of a training curriculum and sessions to train state inspectors in the use of the new procedures (ibid). OCRWM ceased its support of the agreement in the late 1990s as part of the general scaling back of transportation activities.

Fortunately, DOE’s Carlsbad Office picked up the work in 1997 to support the transportation safety program that was moving shipments of transuranic waste to WIPP. As a result of DOE’s continued financial support, the CVSA Level VI inspection program eventually became established in DOT regulations. As of January 1, 2005, “all vehicles and carriers transporting Highway Route Controlled Quantities (HRCQ) of radioactive material [must] pass a CVSA Level VI Inspection, prior to the shipment being allowed to travel in the U.S.” (CVSA 2008, p. 2). Furthermore, shipments entering the U.S. must also pass a Level VI inspection “either at the shipment’s point of origin or when the shipment enters the U.S.” (ibid). The DOE Manual requires inspections of truck shipments of spent fuel, high-level waste, tritium-bearing reactor components, and transuranic waste to “be conducted in accordance with the CVSA Enhanced (Level VI) North American Standard Inspection Procedures” (DOE 2008f, p. 36).
Many states viewed OCRWM’s early support for the CVSA Level VI inspection program as a model for what the program should aspire to achieve for a reciprocal rail inspection program, as well. The need for a reciprocal program became especially pronounced when OCRWM made the decision to use “mostly rail” as its preferred mode of shipping spent fuel and high-level waste to the repository. States were concerned about the apparent disparity between the standards for inspection of truck shipments compared to rail and the lack of transparency regarding rail inspections. The DOE Manual, for example, requires shipments to undergo a rigorous CVSA Level VI inspection – a well-documented process that is understandable not just to duly trained state inspectors but to other state personnel, as well, thanks to CVSA making its detailed inspection procedures publicly available. For rail shipments of spent fuel and high-level waste, however, the DOE Manual is much less specific, requiring that inspections at the “origin facility... be performed by Federal, State, or carrier inspectors and... be conducted to ensure conformity with applicable Federal and State regulations, AAR (Association of American Railroad) rules, and industry standards” (DOE 2008f, p. 37). Not having ready access to AAR rules, industry standards, or even the applicable regulations in other states – and absent a detailed, written inspection log – it would be difficult for a state inspector or other official to know for certain what had transpired during previous inspections.

In 2006, the Rail Topic Group of DOE’s TEC/WG established an Inspections Subgroup to begin discussions about developing a reciprocal rail inspection program – in effect, filling the role of the “study group” OCRWM had envisioned forming when the Transportation Institutional Plan was written in 1986. Led by two Midwestern state representatives and the region’s staff, the Inspections Subgroup held numerous conference calls with state inspectors, FRA personnel, rail industry representatives, and OCRWM staff and contractors. These discussions led to group members developing a proposed set of forms for documenting the items that FRA-certified state inspectors would check during their inspection of rail shipments of spent fuel and high-level waste. The forms would also identify any significant findings. All the information obtained during the inspection would be shared with states “downstream” so that, if they exercised their right to inspect a shipment, they would know what their colleagues in other states had done and had found. The goal of the subgroup’s effort was to establish a reciprocal inspection program that would facilitate the movement of rail shipments from their point of origin to their destination with as few en route stops as possible for inspections.

In 2007, the subgroup wrapped up its work and presented the inspection forms to the full TEC/WG. Members of the group gave a presentation that year on the proposed program at the annual meeting of the Association of State Rail Safety Managers. It was the expectation of the TEC/WG Rail Topic Group members that OCRWM would move the proposed program forward in a manner similar to what had transpired with the truck inspection program – namely, OCRWM would “develop financial arrangements with a technical organization” to work with state inspectors on establishing a CVSA-like program for rail shipments (DOE 1986c, p. A-50). Unfortunately, OCRWM’s funding was severely cut due to the Obama Administration’s decision to terminate the Yucca Mountain project. All work on the inspection procedures being conducted by OCRWM and the TEC/WG Rail Topic Group ceased as a result of the funding cut.

In the 2008 edition of the Midwest’s Planning Guide, the MRMTC expressed the states’ hope that the prototype inspection process developed through the TEC/WG would “eventually be established as a

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9 The FRA maintains a Safety Compliance Oversight Plan that many cite as the federal government’s requirements for inspections of rail shipments (FRA 1998). The plan, however, specifies the steps the FRA or its state-certified inspectors must take in preparation for a shipment or shipping campaign involving spent fuel or high-level waste. It does not specify the steps inspectors must follow when they inspect rail shipments.
The MRMTC wrote to the FRA on January 19, 2010, to transmit the proposed forms and to explain the Midwestern region’s desire to see the states “develop, test, and codify a national reciprocal rail inspection protocol before large quantities of highly radioactive waste begin to move by rail” (Rasmusson and Schmidt 2010, p. 1). Among the benefits of a reciprocal rail inspection protocol cited in the Midwest’s letter was increasing inspectors’ understanding of “what their counterparts are checking when they conduct inspections,” with the likely result of increasing the “level of confidence in...previously conducted inspections” (ibid). The letter also identified three characteristics besides reciprocity that the Midwestern states felt were necessary for a rail inspection program to have the same effect as the CVSA procedures for truck: “a detailed listing of items checked and defects found; the ability to pass information along to inspectors in other states in a secure manner; and the signature of duly certified state inspectors who conduct the inspections” (ibid). The letter closed by encouraging the FRA to “provide the resources necessary to further develop this protocol through the pilot testing phase and, ultimately, to endorse the final protocol for use by FRA-certified state rail safety inspectors” (ibid, p. 2).

As of June 2010, the FRA has not responded to the Midwest’s letter. The rail inspections work group continues to have conference calls, with the states planning to pilot test the procedures. It is unclear how far this activity will be able to progress without a concerted effort by OCRWM (or another DOE program office) to identify and fund an appropriate “technical organization” to carry the work forward.

The CVSA Level VI inspection program was developed over a period of 13 years. It took almost 20 years to reach the point of being required in DOT regulations. The timeframe for resolving rail inspection issues will likely be even longer, given the nature of rail shipments traveling on privately-owned rails. It is for this reason that the Midwestern states attempted to move forward with the task of developing reciprocal rail inspection procedures long before any large-scale shipping campaign would take place. OCRWM or its successor will need to work to complete this activity prior to commencing large-scale shipping campaigns to move spent fuel or high-level waste by rail.

**SAFE PARKING**

Safe parking locations need to be identified along routes in consultation with the states. OCRWM also needs to specify in its transportation plan what criteria states should use for selecting safe parking and under what conditions OCRWM will request that shipments be diverted to safe parking.

Bad weather, hazardous road conditions, mechanical problems, and other unanticipated conditions sometimes necessitate the delay of radioactive materials shipments. In such instances, safe parking locations need to be identified. Safe parking is one of the 14 topics covered in the DOE Manual. According to the manual, “Safe parking is the process used to identify and designate parking locations..."
and to identify criteria for selecting parking areas if a predesignated location cannot be reached” (DOE 2008f, p. 38).

The manual requires DOE shippers to consult with the states and tribes through which shipments will pass to select safe parking locations prior to the commencement of shipments. Safe parking locations are to be designated in the transportation plan. State and tribal officials can also determine whether a route deviation, rather than safe parking, is necessary and inform the carrier through TRANSCOM or direct communication (DOE 2008b, p. 39).

When selecting safe parking locations, the DOE Manual identifies the two most important factors to consider: the desirability of a particular type of parking area and the ability of the driver/crew to reach that parking area. Safe parking areas should also provide “adequate separation from other vehicles carrying hazardous materials, required security (e.g., lighting), and adequate driver/crew services,” (ibid., p. 39). DOE or other federal facilities are viewed as the most desirable safe parking locations.

States and tribes may also identify facilities to be used for safe parking. Examples of good safe parking locations include weigh stations, state highway service facilities, and National Guard Facilities. If none of these facilities is reachable, carriers should use the following avoidance factors to identify a suitable safe parking location:

- heavily populated areas,
- heavily industrialized areas (e.g., refineries),
- hospitals and schools,
- areas with difficult access (e.g., no room for fire equipment),
- crowded parking areas (e.g., shopping malls),
- residential areas,
- highway shoulders, and
- areas with numerous pedestrians (ibid., p. 40).

In addition, carriers must not park within five feet of the traveled portion of a street or highway except for brief periods when the necessities of operation make this inevitable (ibid.)

According to the DOE Manual, for rail shipments, safe parking areas should be selected to provide adequate separation from other hazardous materials and to facilitate required security. The most desirable safe parking areas for rail shipments are DOE facilities. Other federal facilities and protected railroad sidings are also options for safe parking of rail shipments.

The identification of safe parking locations for radioactive materials is an important issue to the states. The WGA WIPP Technical Advisory Group and DOE’s CBFO have agreed to a set of criteria for selecting safe parking locations that are laid out in the WIPP PIG. Like the DOE Manual, the WIPP PIG states that locations should be selected based on “1) the desirability of a particular type of parking area; and 2) the driver’s ability to reach that parking area” (WGA 2008c, p. IV-1). The WIPP PIG further describes the hierarchy that should be used to select safe parking locations, with the top tier of preferred safe parking locations being DOE or Department of Defense facilities. The second choice for safe parking locations is comprised of facilities identified by the states for safe parking, such as ports of entry, which the states have provided to the CBFO. If a carrier cannot reach one of the locations listed in the first or second tier, the WIPP PIG provides criteria that the driver and state should use to select a safe parking location. In addition to those listed in the DOE Manual, WGA identifies three factors to avoid in selecting a safe
parking location: parked trucks carrying flammables or explosives, poorly lighted areas, or areas without driver services (e.g., food) (ibid., p. 2).

The Midwestern states describe their preferences for safe parking protocols in the regional Planning Guide. The objectives and avoidance factors for safe parking locations provided by the Midwestern states echo what is stated in the DOE Manual. Additionally, the Midwestern states request that the shipper’s security plan include safe parking locations on both sides of the borders between states.

**Security Planning**

*Like all other components of a comprehensive transportation plan, OCRWM never produced a draft security plan for state input. Recognizing that there are “need to know” considerations, OCRWM will need to involve the states in developing the security plan for repository shipments. Early efforts to discuss security planning made some progress but were unable to accomplish much due to unclear direction and questions regarding the appropriate scope of activity. OCRWM should take lessons from those efforts to increase the chances of success in the future.*

Section 6 of the DOE Manual requires shipping programs to provide security “in compliance with NRC requirements in 10 CFR Part 73 for shipments subject to an NRC license” (DOE 2008f, p. 22). For other DOE shipments, the manual requires shippers to provide security “in a manner that meets or exceeds NRC security requirements” (ibid.). The manual states that “[s]pecific NRC requirements are considered Safeguards Information,” however it is noted that developing a security plan is among the requirements.

Security was first identified as an OCRWM-related issue in the 1986 Transportation Institutional Plan in an original discussion paper on physical protection procedures. The paper discussed the distinction between NRC-licensee shipments and “DOE shipments of spent fuel generated in national defense activities and research and development,” with the former subject to NRC regulation while DOE provided its own guidance on “physical protection procedures” for shipments (DOE 1986c, p. A-22). The paper stated that “OCRWM has indicated its intent to comply with all NRC physical protection requirements that exist at the time of shipments of nuclear waste to NWPA facilities” (ibid., p. A-26). OCRWM intended to work with the NRC to address the “appropriate level of physical protection” necessary for NWPA shipments. As part of that coordination, OCRWM identified three issues for discussion that resulted from public comments on the Transportation Institutional Plan discussion paper:

- The need to reconsider the necessity for secrecy requirements related to routing and scheduling information.
- The potential need to reassess credible threats to shipments of radioactive waste and to ensure that physical protection requirements adequately protect against such threats.
- The potential need to develop physical protection requirements for shipments of high-level waste (ibid., p. A-27).

According to the Transportation Institutional Plan, OCRWM hoped to identify plans for addressing these three issues “by the spring of 1987” (ibid.).

Security planning did not advance very far in the 1990s because of a program redirection that made transportation a low priority. After Congress officially selected the Yucca Mountain site in 2002, the topic of security planning took on more urgency. In 2004, OCRWM initiated its discussions of security
with states, tribes, and other stakeholders in a closed-door session of a new Security Topic Group at the TEC/WG meeting in Minneapolis. The initial meeting was not well planned and caused some concern among stakeholders that were active on the TEC/WG, particularly those that were excluded from the meeting. One participant noted that, while several long-standing TEC/WG members had been refused admittance to the meeting because of concerns over sensitive information being discussed, the members of the hotel’s banquet staff were freely admitted into the room while those discussions were taking place.

OCRWM continued to support the Security Topic Group through 2006, holding three more meetings and monthly conference calls from May 2005 through August 2006. Over this time period, the group reviewed and provided comments on an OCRWM report entitled “DOE Spent Nuclear Fuel Transportation: Lessons Learned from Security Planning and Execution” (DOE 2006b). The OCRWM staff described the report as being “only for information purposes” (TEC Security Topic Group 2006, p. 2). Although brief, the report contained some very specific, useful suggestions that any shipper, including OCRWM, could follow to improve security planning. Among the recommendations, OCRWM identified the general need to “balance information sharing with information protection, and ensure all involved parties understand requirements for protecting information appropriately” (ibid., p. 1). The report also noted that it was important to “develop a system-wide process for providing notifications to points-of-contact in the States, Tribes, railroads and other organizations” and to “freely share non-sensitive information” with entities that were helping to plan shipments (ibid., p. 2).

As part of their work with the Security Topic Group, the regional groups, led by the Midwest, conducted a survey of the states on issues related to shipment security and other topics. The report included several recommendations for the states and OCRWM related to security planning and the protection of safeguards information. One recommendation encouraged OCRWM to “research the existing federal programs for training in protecting information to determine their strengths and weaknesses” (CSG Midwest et al. 2006, p. 2). The rationale for including this recommendation was that “slightly over half (18 of 35) the states reported that they do not have the resources necessary to train people on information security for a shipping campaign on the scale of the repository shipments” (ibid.). The survey also revealed that, while states “generally have established procedures for routine sharing of protected information, many states reported that they do not have specific procedures in place for sharing information in the event of an emergency” (ibid., p. 4). The report identified the development of model procedures as a possible task for the regional groups to undertake as part of their cooperative agreements with OCRWM (ibid.).

While the Security Topic Group made some small contribution to resolving the issue of security planning, the group was very limited in its ability to delve deeply into the topic because of concerns over clearances. From the 2004 TEC/WG meeting, OCRWM intended to discuss security planning only with stakeholders that had or could obtain the appropriate clearances. The program even considered assisting stakeholders with obtaining the necessary clearances so that they could engage in detailed discussions. Up until the time the group had its last conference call in August 2006, it had not been decided what the scope of activities would be or whether security clearances should be required.

One activity that some of the Security Topic Group members had hoped to undertake was a review of a security-related recommendation that came out of the NAS’s 2006 report Going the Distance. In the report, the NAS recommended that “an independent examination of the security of spent fuel and high-level waste transportation should be carried out prior to the commencement of large-quantity shipments to a federal repository or to interim storage” (NAS 2006, p. 8). The NAS thought such an
examination should “provide an integrated evaluation of the threat environment, the response of packages to credible malevolent acts, and operational security requirements for protecting spent fuel and high-level waste while in transport” (ibid.). While the study would necessarily involve safeguards information, the NAS encouraged the sharing of findings and recommendations with the public “to the fullest extent possible” (ibid., p. 9). This last recommendation was made “in the spirit of improving the quality of informed dialogue on this sensitive but important issue” (ibid., p. 216).

OCRWM never reached the point of developing a security plan – at least not one that was available to the public. The transportation plans developed over the years do refer to shipment security. The 1994 “Developing the Transportation System,” for example, stated that “in-transit physical protection will comply with the OCRWM Safeguards and Security Plan which augment (sic) the requirements of 10 CFR 73.37” (DOE 1994c, p. 3-29). In the pre-decisional draft of the “National Transportation Plan,” OCRWM committed to conduct security planning “in accordance with NRC regulations in 10 CFR 73, or equivalent DOE requirements” (DOE 2007a, p. 31). The 2009 version of the plan modified this commitment to say simply that OCRWM would “meet or exceed the requirements in 10 CFR Part 73” (DOE 2009, p. 19). The revised section also noted that OCRWM’s security planning would “include operational contingencies to address security concerns that may arise during transit” (ibid.).

TERRORISM AND SABOTAGE

Nevada has frequently raised concerns about the possibility of terrorism and sabotage in connection with repository shipments. The NRC imposes regulations to protect shipments through procedures designed to minimize the likelihood of an attack and limit the consequences should an attack occur. OCRWM has stated that it will adhere to all NRC security requirements, but OCRWM has not committed to taking any extra-regulatory measures to address the risk of terrorism and sabotage.

The state of Nevada has repeatedly included terrorism and sabotage concerns in its list of recommendations to OCRWM with regard to the safety and security of nuclear waste shipments. While OCRWM has acknowledged the risks of potential terrorist attacks on shipments of high-level waste and spent fuel, analyses performed by contractors for Nevada have shown the potential consequences of such an attack to be many times greater than those reported by DOE in the Yucca Mountain Final EIS. The state urged OCRWM to fully address terrorism concerns in its transportation planning for repository shipments (Halstead et al. 2008, p. 5). The state has also called on the NRC to carry out rulemaking that will ensure that terrorism and sabotage concerns are addressed (Halstead et al. 2005, p. 8).

In 1998, WGA passed a resolution calling on DOE to incorporate risk management for terrorism and sabotage into all transportation planning efforts. Specifically, WGA would like to see terrorism and sabotage risk management and countermeasures incorporated into any plans to operate a repository, interim storage facility, or intermodal transfer station (WGA 2008b). These plans should include provisions for handling the liability from potential damages from an act of terrorism or sabotage against a nuclear waste shipment. In its “Report Card,” WIEB gave OCRWM a grade of “F” because, according to WIEB, OCRWM had not committed to taking any extra-regulatory measures to address the terrorism risk, instead stating that it will rely on NRC oversight to ensure the safety of repository shipments (WIEB, p. 4).
In 1999, the state of Nevada petitioned the NRC to initiate rulemaking that would strengthen the regulations that protect spent fuel shipments from acts of terrorism or sabotage. The petition requested that NRC do the following:

- clarify the meaning of the term “hand-carried equipment;”
- clarify the definition of the term “radiological sabotage” to include actions against spent fuel shipments which are intended to cause a loss of shielding, release of radioactive materials or cause economic damage or social disruption, regardless of the success or failure of the action;
- amend the advance route approval requirements to require shippers and carriers of spent fuel to identify primary and alternative routes which avoid heavily populated areas;
- require armed escorts along the entire shipment route;
- amend 10 CFR 73.37(b) by adopting additional planning and scheduling requirements for spent fuel shipments that are the same as those required for formula quantities of special nuclear material;
- amend 10 CFR 73.37(d) to require that rail shipments of spent fuel be made in dedicated trains; and
- conduct a comprehensive assessment of the consequences of terrorist attacks that have the capability of radiological sabotage (NRC 2009, p. 3).

Nevada’s petition was endorsed by the eighteen Western states as well as five states from other regions of the country (Halstead et al. 2005). The NRC will attempt to address some of these concerns in an upcoming rulemaking expected in 2010.

NRC regulations attempt to minimize the threat and consequences of terrorist attacks or acts of sabotage (10 CFR 73.37). The regulations are intended to “1) minimize the possibilities for radiological sabotage of spent nuclear fuel shipments, especially in heavily populated areas, and 2) facilitate the location and recovery of spent nuclear fuel shipments that may have come under the control of unauthorized persons” (NRC 2009, p. 2). The regulations further encourage the early detection of potential threats, notification to emergency response agencies of acts of sabotage, and the impedance of sabotage attempts against spent fuel shipments in highly populated areas.

OCRWM described the NRC protections against sabotage or terrorism against spent fuel shipments in Appendix M of the Yucca Mountain Final EIS: advance shipment notification to states; procedures for safeguards emergencies; continual monitoring of shipments through a communications center; a written shipment log documenting significant events; advance arrangements with law enforcement agencies along the route; NRC approval of the shipping route; avoidance of unnecessary stops; escorts trained to determine if a threat exists and how to deal with it, who maintain visual surveillance of the shipment during stops and report regularly on shipment status; onboard communication equipment; protection of certain shipment information; and armed escorts in high-population areas (DOE 2002, p. M-24). In addition to the procedures that have been established to minimize the terrorist threat, the casks designed specifically for transporting spent fuel provide physical protection against acts of sabotage or terrorism. In fact, 90 percent of the gross weight of the casks will be shielding, while only 10 percent will be the weight of the spent fuel (DOE 2002, p. M-24).

Contractors for the state of Nevada laid out the state’s concerns regarding a potential terrorist attack on a spent fuel shipment in a paper delivered at the 2005 Waste Management Symposium. The authors asserted that, while the risk of an attack may be relatively low, the potential consequences would be high, and thus emergency response planners should plan for a successful terrorist attack that results in a...
significant release of radioactive material. They pointed to studies performed by OCRWM, the NRC, and the state of Nevada that suggest spent fuel casks are vulnerable to terrorist attacks that could result in the dispersal of radioactive material, and the health impacts of such dispersal would be major. One of the concerns expressed by the Nevada contractors is that, while shipping containers for spent fuel must be certified by the NRC, full-scale testing of the casks is not conducted (see the issue on Full-Scale Cask Testing). Instead, the NRC relies on scale testing and computer simulation. The authors believe that such simulations are not credible unless validated by testing of actual casks under accident conditions (Halstead et al. 2005, p. 3).

The importance of planning for an act of sabotage or terrorism against a spent fuel shipment will increase once the volume of shipments increases with the opening of a national repository or interim storage facility. The authors asserted that these shipments would be viewed as desirable targets for terrorists. Because the risk of a terrorist attack cannot be eliminated, Nevada has urged OCRWM and the NRC to plan for avoiding attacks but also mitigating the consequences of a potential attack. A major component of this planning would be emergency response training.

In the 2006 report Going the Distance, the NAS made recommendations aimed at reducing the risk of acts of terrorism and sabotage against shipments. The NAS found that “malevolent acts against spent fuel and high-level waste shipments are a major technical and societal concern” (NAS 2006, p. 214). The committee further noted that this risk is likely to increase once shipments to a repository or interim storage facility actually begin.

The committee that authored the NAS report was unable to complete an examination of transportation security because much of the necessary information was classified. The committee thus recommended that an independent group be given full access to security information and studies in order to complete a review of transportation security. The NAS recommended that this study evaluate the threat environment, the response of transportation packages to malevolent acts, and the current operational requirements related to transportation security. The group should be independent of the government and free from institutional and financial constraints in order to improve its objectivity and credibility with the public. In addition, the NAS recommended that the findings and recommendations from this group be made available to the public to the greatest extent possible (ibid., p. 215).

The NRC undertook several transportation security studies in response to the terrorist attacks of September 11, 2001; however, the results of those studies are classified. In 2007, the regional groups sent a letter to the NRC requesting increased access to spent fuel package security information (Owen et al. 2007, p. 1). The regions provided the NRC with a matrix detailing the type of information the states wish to receive, how the information would be used, how the information would be protected and limited to those with a “need to know,” and who would use it. Specifically, the states would like the NRC to share general consequence information, such as potential health effects and required response, detailed consequence information on dispersal and contamination, general information on the scenarios evaluated by the NRC, assumptions and inputs used to evaluate those scenarios, and credible threat information related to spent fuel shipments (ibid., pp. 1-3). As of June 2010, the NRC had not responded to or provided feedback on the regions’ matrix.
**SHIPMENT INFORMATION**

**Long-Term Planning Information**

The DOE Manual requires departmental programs to provide states with long-term planning information so they can prepare for shipments. This information could include fact sheets on shipments, casks, and facilities, but equally important for states would be a safeguards-compliant version of DOE’s Projected Shipment Report. OCRWM did not develop a detailed plan for what kind of long-term planning information it would share, how, and how often.

Section 4 of the DOE Manual describes “planning information” as “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” (DOE 2008f, p. 14). To facilitate the provision of such information to states, the manual directs the “cognizant DOE organization, field office and shippers” to “establish an ongoing dialogue...with State and Tribal agencies” (ibid.). The manual leaves it up to the responsible DOE office to determine what kind of information to provide, who should receive it, how frequently, and by what method (ibid., pp. 14-15). Among the type of information suggested were shipping mode, potential route, DOE/contractor point of contact, and the expected number of shipments (ibid., p. 15).

The manual specifically referenced the DOE “Prospective Shipments Module” (now “Projected Shipment Report” or PSR) as a suitable method for providing information on spent fuel, HRCQ, and other campaigns “after the NEPA process is completed” (ibid.). The Midwestern states have endorsed the PSR as a “tool for providing the states with information on upcoming shipments of spent nuclear fuel, transuranic waste, and other radioactive materials” (MRMTC 2008a, p. 12). Since 2005, the region has also suggested several ways to improve upon the existing PSR – even creating a prototype to demonstrate the type of improved functionality the states were seeking. The states’ suggestions include customizing the reports to make them state-specific; providing links to fact sheets, route maps, transportation plans, images of the shipping containers, and other shipment-related information; and identifying site points of contact so that states can obtain additional information.

In 2006, the Midwest led the regional groups’ effort to survey the states regarding their information needs. The survey was conducted for the purpose of informing the work of the TEC/WG Security Topic Group (see the section on Security Planning). States were asked about the specific pieces of information they might need in connection with truck shipments, train shipments, or both. Examples of the type of information include detailed route information, expected dose rates, safe parking locations, inspections already conducted, and the presence of state escorts in neighboring states (CSG Midwest et al., p. 6). The survey revealed that, throughout the country, states placed a high priority on receiving each of the pieces of information. The lowest ranking went to information on cask models, although even this piece of information was found to be moderately important (scoring 3 points out of 5, with 1 being the highest ranking). The states reported the need for the same type of information regardless of the shipping mode (ibid.). There was some variation with regard to how far in advance the states wished to receive information.

Starting in 2007, DOE stopped posting spent fuel shipments on the PSR reportedly due to security concerns. DOE cited NRC safeguard restrictions as the rationale, since the department has committed to meet or exceed NRC regulations for its shipments. In March 2008, the Midwestern and Western states joined together to seek an opinion from the NRC regarding whether the type of information
provided in the PSR would, indeed, violate safeguards concerns (Schroeder and Janairo 2008, p. 1). The NRC’s response indicated that “an annual table summarizing projected spent fuel shipments, containing data such as material, origin, pass thru states, destination, etc., would not be considered Safeguards Information” (Holahan 2008, p. 1). The letter went on to state that “dissemination of the information would be protected as ‘Official Use Only – Security Related Information’ by the NRC and would be released on a need-to-know basis” (ibid.). The NRC also acknowledged that “DOE has its own internal policies and procedures for identifying sensitive information...[t]herefore, DOE would make the final determination on the marking and protection of such information” (ibid., p. 1).

Going forward, it would be beneficial for OCRWM to work with the states to identify their information needs. Updating the regional groups’ survey would be a good first step. The Midwest, for its part, will continue to advocate for improvements to the PSR to make the document a detailed, complete record of upcoming shipments to which all DOE shipping programs routinely report.

Prenotification

The NWPA requires OCRWM to follow NRC regulations for notifying states and tribes about shipments. In addition to the required seven-day notification, for a large, sustained shipping campaign, the states will need timely information in advance to help them plan for inspections and escorts. Furthermore, with regard to tribal notifications, the NRC regulations currently do not allow for tribes to receive advance notification. In 2010, the NRC is preparing to issue for comment revised rules that would allow for tribal prenotification.

OCRWM identified the issue of prenotification in the Transportation Institutional Plan as an original discussion paper (DOE 1986c, p. A-15). At issue was how OCRWM would provide notification to states for shipments to NWPA facilities and for shipments related to research and development activities (ibid., p. A-17). The passage of the NWPA effectively eliminated prenotification of states as an issue by requiring OCRWM to “abide by regulations of the [Nuclear Regulatory] Commission regarding advance notification of State and local governments prior to transportation of spent nuclear fuel or high-level radioactive waste” (NWPA, Section 180(b)).

NRC regulations in 10 CFR 73.37 and, for smaller amounts of spent fuel, 71.97 require shippers to provide notification to state governors or their designees. If mailed, the notification must be postmarked at least seven days before a shipment; if delivered via messenger, the notification must arrive at least four days before the shipment. Shippers must notify the recipients by telephone if the schedule changes by more than six hours. The regulations also specify the type of information shippers must include in notifications. The combination of schedule and route information makes the notification safeguards information; therefore, strict rules apply to the further sharing of such information. NRC regulations prohibit recipients from releasing schedule information until 10 days after a shipment involving spent fuel that is subject to 10 CFR 73.37 (10 CFR 73.21(b)(2)(ii)).

The DOE Manual states that “DOE or its contractors will provide advance notification of non-classified shipments of SNF and HLW in accordance with applicable requirements” (DOE 2008f, p. 28). The manual further states that “DOE will strive to ensure that affected jurisdictions are provided with general knowledge several weeks in advance of upcoming shipments” (ibid.). This additional advance notice is particularly important for states that will be scheduling escorts and/or inspections of shipments. The states have suggested that, for repository shipments, they would benefit from a “rolling schedule” similar to the “eight-week schedule” that the Carlsbad Field Office provides for shipments of transuranic

10 NRC regulations do not actually require prenotification of local governments.
waste heading to WIPP. OCRWM did not reach the point of discussing with the states a way to develop a planning tool similar to the WIPP eight-week schedule that would be compliant with the NRC safeguards requirements, therefore this issue remains open.

An additional prenotification issue is the notification of tribal governments. For DOE shipments conducted under departmental orders, tribes have traditionally received advance notification. Because the NWPA requires OCRWM to follow NRC regulations, however, OCRWM would not be permitted to notify tribal governments about NWPA shipments without a change in NRC regulations. To effect such a change, the NRC published an advanced notice of proposed rulemaking on December 21, 1999, to solicit stakeholder input on the idea of requiring “licensees to notify Native American Tribes of shipments of certain types of high-level radioactive waste, including spent nuclear fuel, prior to transport to or across the boundary of Tribal lands” (NRC 1999, p. 71331). The rulemaking was proceeding when the terrorist attacks of September 11, 2001, occurred. The NRC postponed its work on the rulemaking and, as of June 2010, had not resumed its activities.

**Tracking**

OCRWM has committed to using some kind of real-time tracking technology for spent fuel and high-level waste shipments. DOE developed the web-based TRANSCOM system to track its high-visibility non-classified shipments. TRANSCOM could potentially be used to track repository shipments, although updates to the system would be needed. Alternatively, another new or existing technology could be used to track these shipments. The TEC/WG Rail Topic Group’s Tracking Subgroup developed recommendations for tracking and radiation monitoring, which may help OCRWM or its successor evaluate available technologies in the future.

According to the DOE Manual, for spent fuel and high-level waste shipments, “near real-time position tracking (i.e. tracking that is updated every 3-5 minutes) and communications for all shipments will be provided by TRANSCOM or a current OCRWM shipment tracking system with comparable or enhanced capabilities. The TRANSCOM or current equivalent OCRWM shipment tracking system users’ manual will discuss backup procedures to be used in the event of operational problems with the system” (DOE 2008f, p. 34).

The TEC/WG Rail Topic Group’s Tracking Subgroup developed a set of recommendations for tracking and radiation monitoring based on input solicited from the states. In drafting these recommendations, the Tracking Subgroup sent the states a questionnaire about their tracking needs and their experiences and satisfaction using the TRANSCOM tracking system. Additionally, at the September 2006 TEC/WG meeting, attendees were given the opportunity to view technology demonstrations on three alternate tracking systems. Participants were then asked to rate and compare these programs – IRRIS, Smart Car, and Tri-State – to the TRANSCOM system.

The Tracking Subgroup found that, in 2006, it was premature to decide whether TRANSCOM or another model should be used as the tracking system for repository shipments. The group did, however, identify 10 components that would be necessary for whatever tracking system was ultimately selected:

- Access for all states from shipment departure to arrival;
- A reasonable refresh rate of shipment status and location (two minutes is preferred);
- A quick and easy user log-in for as many users as necessary;
- The tracking unit located on the trailer or flatcar and not on the tractor or engine;
• Redundancy built into the system to ensure power for the unit and the server;
• A review of the operational procedures prior to the campaign starting;
• No shipments planned during scheduled system maintenance;
• A regularly scheduled users’ group meeting with all necessary stakeholders represented;
• Easy access to training and customer support; and
• A detailed contingency and back-up plan (ibid.).

Most of the states that responded to the tracking survey believed that TRANSCOM could adequately track repository shipments, provided the system received some upgrades and improvements. One key improvement requested by the states was faster mapping capabilities. States were also asked about the quality of information, timeliness of updates, and training and customer support provided by TRANSCOM. In general, users of the system expressed satisfaction with TRANSCOM. Some technology features that the states would like to see in an OCRWM tracking system were weather tracking or alerts, traffic accident notifications, the ability to track individual packages, and additional data layers that would show safe havens, rail sidings, hospital locations, and other route features.

There are several operational questions related to tracking that will need to be addressed prior to the commencement of repository shipments. Many shipments are likely to occur utilizing more than one mode of transport. DOE has stated that TRANSCOM is capable of tracking a shipment through an intermodal transfer, but procedures have not been developed or tested. Appropriate tracking protocols need to be developed, in consultation with transportation stakeholders, and adequately tested prior to shipments.

The Tracking Subgroup raised the issue of whether it is sufficient to track a train shipment carrying multiple casks of spent fuel, or whether each cask would need to be tracked. This question has not been resolved. Currently, several employees of Argonne National Laboratory are working on developing radio frequency identification (RFID) tags that could be attached to each individual cask and provide real-time monitoring. This technology could presumably be used on shipping casks if OCRWM and stakeholders determine that individual cask monitoring is desirable. For rail shipments, there is also the issue of tracking shipments as they travel on “dark territory,” or sections of track without the proper trajectory for signals.

In terms of policies and procedures, a detailed contingency plan needs to be developed for whatever tracking system is chosen. States would like the opportunity to review this plan in advance, and OCRWM would be responsible for keeping the document up to date and ensuring that everyone who needs it has access to it.
Emergency Notification

Emergency notification procedures are something OCRWM needs to work out with the states and tribes. Procedures for emergency notification are one of the 14 topics addressed in the DOE Manual. OCRWM may work with states and tribes to establish additional emergency notification procedures for shipments of spent fuel and high-level waste.

The DOE Manual requires emergency notification if any of the following occurs:

- a person is killed;
- a person requires hospitalization due to major injuries received as a direct result of the radioactive material or an accident;
- an evacuation of the general public;
- one or more major transportation arteries are closed or facilities are shut down as a direct result of the radioactive material cargo;
- fire, potential release, or suspected radioactive contamination involving a radioactive material shipment; or
- a security incident (i.e., sabotage, theft) (DOE 2008f, p. 42).

Additional events requiring notification can be specified in transportation plans for individual shipments or campaigns. DOE program offices may also decide to notify state and tribal contacts for events that do not meet the above criteria but may attract public or media attention. When there is uncertainty, the DOE Manual advises programs to err on the side of notifying points of contact.

According to the manual, DOE will be informed of a transportation event by the driver, dispatcher, escort, emergency response personnel, or through a satellite tracking system. If an emergency situation occurs, DOE requirements call for the notification of state and tribal points of contact, as well as the appropriate DOE offices, including the receiving site, the Radiological Assistance Program Regional Response Coordinator, and DOE headquarters. The WIPP Transportation Plan requires the notification of additional state points of contact for incidents involving transuranic waste shipments (ibid., p. 43). For OCRWM shipments, OCRWM must notify the NRC of emergency situations (ibid.). DOE headquarters will also provide notification to field offices, other federal agencies, and appropriate elected officials.

Notifications made by DOE will provide points of contact with a brief description of the transportation event, including location, date, time, hazards of the material being shipped, injuries, exposures, environmental releases, on-scene responders, and protective actions that have been recommended and/or implemented. Notifications will also inform the state points of contact of the other notifications that have been made (ibid., p. 44).

In order for the emergency notification procedures to work properly, DOE must maintain a current list of points of contact for emergency notifications. DOE sporadically solicits this information from the states through the state groups. However, a more formal process involving the regions could be useful to ensure that this information is kept current at all times. Furthermore, any additional emergency notification procedures specific to shipments of spent fuel and high-level waste carried out by OCRWM or its successor will need to be discussed extensively with the states.
Emergency Planning and Management

As part of its transportation planning activities, OCRWM did not prepare a draft emergency management plan as required by the DOE Manual. Emergency planning is one of the key interfaces with state governments, therefore this activity should be conducted in close coordination with the states.

The DOE Manual identifies emergency planning as encompassing “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” (DOE 2008f, p. 10). State and local governments bear the primary responsibility for protecting the health and safety of the public within their jurisdictions (MRMTC 2008b, p. 16). The states do this through planning and preparing for emergencies for all kinds of hazards, not just accidents involving radioactive waste shipments.

As a shipper, OCRWM has the responsibility for managing emergencies involving its shipments. DOE’s “Program Manager’s Guide to Transportation Planning” recommended that “program managers, transportation managers, and public information managers...work with their TEPP [Transportation Emergency Management Program] and emergency management coordinators to identify and address emergency preparedness requirements in the early stages of transportation planning” (DOE 1998c, p. 27). The guide identified DOE’s responsibilities as a shipper as including the provision of information identified in 49 CFR 172.600 and “adequate technical assistance for emergency response should the carrier fail to do so” (ibid., p. 27). DOE’s Radiological Assistance Program teams have long been available to assist in emergencies involving shipments of radioactive waste.

OCRWM expressed its intention to prepare an emergency management plan as part of the development of the transportation system. As envisioned, the plan would provide “requirements and guidelines to be followed by DOE management personnel in the event an off normal or emergency situation occurs during an en-route transportation activity” (DOE 2007a, p. 38). Like other DOE emergency response plans for shipments, OCRWM’s plan would include the following:

- A list of emergency response agency contacts in the states and tribes;
- Specific guidance directing appropriate response actions;
- Coordination with on-scene response personnel;
- Notifications and other communications with other government agencies at all levels;
- Guidance for actions to be taken by on-scene personnel; and
- Guidelines for briefing the media (ibid., p. 38).

Carriers would be required to develop their own emergency response plans (ibid.). The 2009 edition of OCRWM’s transportation plan confirmed these plans (DOE 2009, p. 23). DOE’s “Program Manager’s Guide” listed several resources available to DOE personnel, including resources for planning, training, and guidance documents (DOE 1998c, pp. 30-32). Although some of the referenced items may no longer be available, the TEPP program maintains a website with model plans and procedures (http://www.em.doe.gov/TEPPPages/TEPPHome.aspx). In addition, examples of emergency management plans from other DOE programs (such as DOE 2008j) are available to OCRWM transportation staff.
OCRWM’s “Benchmarking” report identified emergency planning as a program element that all shipping campaigns considered “vital” to the “implementation of a successful shipping campaign” and highlighted this activity as an important part of the contingency planning process (DOE 2007c, p. 14). OCRWM was unable to produce a draft emergency management plan prior to the Yucca Mountain program being terminated in 2009. Because emergency planning is not site-specific, OCRWM or its successor could prepare an emergency management plan in concert with the overall transportation planning process.

Emergency Response

In the mid-1980s, OCRWM identified the possible need for the program to develop guidance for emergency response to a transportation accident involving NWPA shipments. The program also reported on stakeholders’ concerns about financial assistance being available to help states, tribes, and local governments prepare for emergencies. This issue was effectively closed with the passage of Section 180(c) of the NWPA and the establishment of the National Incident Management System.

In its report Going the Distance, the NAS recognized “emergency responder preparedness [as] an essential element of safe and effective programs for transporting spent fuel and high-level waste” (NAS 2006, p. 20). To its credit, OCRWM had the same recognition back in 1986 when it published the Transportation Institutional Plan, which included the issue of emergency response. At issue, specifically, was stakeholders’ desire to see “OCRWM specify its expected role in coordinated emergency-response planning and the development of nationally uniform emergency-response capabilities for all transportation accidents involving radioactive and other hazardous materials” (emphasis in original) (DOE 1986c, p. A-57). In addition, stakeholders requested that OCRWM “specify the extent to which it will assist States, Indian Tribes, and local governments in the development of emergency-response capabilities for potential NWPA transportation accidents” (ibid., p. A-58). As part of the second issue element, OCRWM suggested that there might be a need to define “the appropriate emergency response actions to be taken by first responders,” to “identify training requirements, equipment requirements, and appropriate procedures for the maintenance of equipment,” and “to define sources and levels of financial assistance for emergency-response activities” (ibid., p. A-58).

As noted in OCRWM’s Strategy for OCRWM to Provide Training Assistance to State, Tribal, and Local Governments, with the passage of Section 180(c) of the NWPA, Congress mandated that OCRWM be the source of financial assistance for emergency-response activities, with funding available through the Nuclear Waste Fund (DOE 1992b, p. 6). As a result, this part of the emergency response issue – identifying a source of funding – is closed (see the section on Section 180(c) Implementation).

The issue element pertaining to the need for “nationally uniform emergency-response capabilities for all accidents involving hazardous materials” is also essentially closed. DHS established such uniform procedures in 2004 with the release of the National Incident Management System (NIMS). Ordered by Homeland Security Presidential Directive #5, Management of Domestic Incidents, “NIMS provides a consistent nationwide template to enable Federal, State, tribal, and local governments, nongovernmental organizations, and the private sector to work together to prevent, protect against, respond to, recover from, and mitigate the effects of incidents, regardless of cause, size, location, or complexity” (DHS 2008, p. i). The NAS recommended that OCRWM “work with the Department of Homeland Security to provide consolidated ‘all-hazards’ training materials and programs for first responders that build on the existing national emergency response platform” (NAS 2006, p. 21). The recommendation appears to focus more on innovative approaches to delivering training – e.g., having
DOE and DHS team up to provide the training – rather than suggesting that there was a need to improve upon the existing guidance or training (ibid., p. 256).

**Emergency Response Equipment**

*Early in the process of resolving the issue of Section 180(c) assistance, it was unclear whether OCRWM would allow states to purchase, maintain, and calibrate equipment. The latest version of the Section 180(c) policy and procedures does allow for equipment-related purchases, but there may be limitations.*

As part of the “emergency response” issue covered in OCRWM’s 1986 *Transportation Institutional Plan*, the program expected to “define specific needs for training and equipment to support all NWPA emergency-preparedness activities by 1993” (DOE 1986c, p. A-60). Included in this expectation was the possibility of establishing “guidelines for the maintenance and calibration of radiation-monitoring equipment” (ibid.). Years later, this level of detail was made unnecessary by advances in state programs for maintaining and calibrating their own equipment to established standards. The issue of emergency response equipment surfaced again, however, in connection with the development of a policy and procedures for implementing Section 180(c).

In 1998, OCRWM’s draft policy and procedures placed significant limitations on the use of Section 180(c) funding with regard to equipment. Specifically, the draft would have allowed states to buy equipment for training-related purposes only. Additionally, such purchases would be limited to no more than 25 percent of the total funding received during the first two years of receiving assistance, and only 10 percent of total funds once shipments began (TEC 180c TG 2005, Appendix C, p. 2). OCRWM’s rationale appeared to be that “most jurisdictions should already have the equipment needed for hazardous materials response because it can be assumed that most jurisdictions already have a hazardous materials response capability” (ibid., p. 7).

In its comments on the 1998 policy, the MHLRWC was generally accepting of the 25-percent cap, although it did express concern that an arbitrary cap would not “reflect the needs and differences of the states that will be involved in the program” (Flater 1998, p. 2). The committee recommended that OCRWM “consider raising the cap on equipment purchases to 25 percent per year of eligibility [i.e., lifting the 10-percent cap during shipping years], and expand the category to include equipment purchase, maintenance, and calibration” (ibid.).

In 2005, when the Section 180(c) Topic Group was actively revising the draft policy, the topic group members expressed their disagreement with OCRWM’s earlier reasoning and recommended that “there be no limit on the percentage of funds available to purchase equipment” (TEC 180c TG 2005, Appendix C, p. 7). Consistent with the desire to make the Section 180(c) program flexible, the members felt a better approach would be to allow the recipients of funding to make “their own equipment purchase decisions with a review by the Department of Energy in the grant application” (ibid., p. 8). The topic group members also recommended against trying to define “training-related equipment,” preferring instead to let each applicant justify any requests for funding to purchase equipment (ibid.). The recommendation that went to OCRWM management, therefore, was that “there be no caps on the percentage of the grant that can be used to purchase, calibrate, and maintain equipment as long as the equipment is training-related” (ibid.).
When OCRWM published the revised draft policy and procedures in 2007, it included in the list of allowable activities “Equipment purchases, calibration, and maintenance for training purposes” (DOE 2007b, p. 40143). The notice included a footnote that stated, “Grant funds can be used to purchase equipment for training purposes. They can also be used to calibrate and maintain equipment as long as the equipment is training-related and specific to the needs created by NWPA shipments” (ibid.). Earlier in the Federal Register notice, OCRWM’s policy statement gave a slightly different description of Section 180(c)-funded equipment purchases: “Equipment purchased with Section 180(c) funds is intended to be used for training to prepare for the specific hazards presented by shipments to a NWPA-authorized facility. If necessary, such equipment could then be used for inspections and for responding to emergencies” (ibid., p. 64934).

A revision to the revised draft, published in October 2008, included identical language. In its comments on the 2008 notice, the MRMTC noted the apparent inconsistency between the two statements OCRWM made with regard to equipment purchases – with equipment, on one hand, being solely related to training, and on the other, being available for use in responding to emergencies (Leuer and Rasmusson 2009a, p. 3). The Midwest requested clarification from OCRWM, however the Yucca Mountain project was terminated before OCRWM published responses to comments received on the 2007 and 2008 notices. The states, therefore, still need clarification regarding exactly what can be done with equipment purchased using Section 180(c) assistance. This issue should be resolved in conjunction with finalizing the policy and procedures on Section 180(c).

Emergency Response Training Standards

Under Section 180(c) of the NWPA, as amended, OCRWM is required to provide technical and financial assistance for training for public safety officials to states and Indian tribes through whose jurisdiction the Secretary plans to transport spent fuel or high-level waste to an NWPA-authorized facility. In the discussions around how to implement Section 180(c), the issue was raised of whether OCRWM should specify a level of training to assure that shipping routes were well prepared. There is a great deal of variation in the emergency response capabilities, training needs, protocols, and existing training programs among local jurisdictions throughout the country. The states believe they are in the best position to determine what level of training to provide to the appropriate personnel.

OCRWM published the first of five Federal Register Notices on Section 180(c) implementation and policy options in 1995. After soliciting and reviewing public comments on the 1995 notice, OCRWM published a Notice of Revised Proposed Policy and Procedures on April 30, 1998. The 1998 Draft Policy on Section 180(c) was very prescriptive with regard to the level of training to be provided, and who could receive that training. Under the 1998 draft policy, awareness level training was to be provided; operations and technician level training could be provided only if funds remained after awareness level training was completed (DOE 1998b).

Years later, when OCRWM was working to finalize the Section 180(c) policy, the TEC/WG Section 180(c) Topic Group recommended that OCRWM allow grant recipients flexibility in determining the appropriate level of training to provide. This recommendation was made to help ensure that jurisdictions could develop training for NWPA shipments in the context of their existing training programs and emergency response structure and protocols. States and tribes would be required to describe in their application package what training they planned to provide, and how it was consistent with their current emergency response plans and procedures (TEC 180c TG 2005, Appendix C, p. 8). OCRWM published a revised
proposed Section 180(c) policy in the *Federal Register* on July 23, 2007, which incorporated the recommendation that OCRWM let the recipients of the grant decide who should be trained along the shipping routes, to what level, and with what curriculum.

The most recent proposed Section 180(c) policy was published for comment in the *Federal Register* on October 31, 2008. In this revised proposed policy, OCRWM retained the approach of giving states and tribes discretion over the level of training to provide. Some language was revised in the 2008 proposed policy to clarify that the role of OCRWM’s assistance under Section 180(c) was to “help State, Tribal, and local officials prepare for OCRWM shipments” rather than “ensure that State, Tribal, and local officials are prepared for OCRWM shipments” (DOE 2008e, p. 64935). This change recognizes that it is the duty of the states and tribes to ensure that local officials are adequately prepared for OCRWM shipments, and OCRWM’s role is to assist them in fulfilling that obligation.

OCRWM, therefore, provides little guidance around the type and level of training to be provided using Section 180(c) funds. According to the current proposed policy, Section 180(c) training “should be to the level of detail and to the degree necessary to prepare for shipments to a NWPA-authorized facility,” and should be compliant with the appropriate OSHA standards. The policy further states that “[a]ny deficiency in basic emergency response capability may be addressed through consultation and technical assistance,” which establishes a collaborative approach to ensuring that personnel along the shipping routes are adequately prepared (ibid., p. 64942).

**Medical Preparedness**

*In the earliest published version of the Section 180(c) policy and procedures, OCRWM specifically prohibited the use of funding to train hospital emergency room personnel. By the time the 2007 version of the revised policy was published, OCRWM had removed this restriction.*

The draft policy and procedures on 180(c) implementation published in 1998 omitted hospital personnel as eligible recipients of training assistance under Section 180(c). OCRWM did indicate that “medical emergency responders” could receive training in connection with NWPA shipments (DOE 1998b, p. 23757).

The issue of eligibility for hospital personnel was a major topic of discussion when the Section 180(c) Topic Group began its work in 2004. The members of the topic group objected to the omission of hospital personnel from the 1998 policy. The discussion paper on allowable activities observed that the “Topic Group felt strongly that hospital personnel should be eligible for training if a jurisdiction felt that was necessary” (ibid., Appendix C, p. 6). Much of the discussion paper on “definitions” (Appendix D) was devoted to providing the rationale for including hospital personnel as public safety officials for the purposes of Section 180(c) implementation. The discussion paper noted that “there were no arguments presented against the inclusion of hospital personnel” in the definition of “public safety official” (TEC 180c TG 2005, Appendix D, p. 2); earlier, however, the paper noted that “DOE’s Office of General Counsel has stated that hospital personnel would not be eligible for Section 180(c) funds” (ibid., p. 1).

In the 2007 notice of revised policy and procedures, OCRWM listed among the allowable activities “training for emergency medical personnel, including hospital emergency medical personnel” (DOE 2007b, p. 40143). This wording remained in the 2008 policy and procedures (DOE 2008e, p. 64937). Provided OCRWM maintains this wording through subsequent revisions to the draft policy and procedures, this issue can be considered closed.
Of the major transportation institutional issues, OCRWM has made the most progress in resolving the issue of assistance to states and tribes. Required by Congress in Section 180(c) of the NWPA, OCRWM must provide financial and technical assistance to states and tribes that will be affected by shipments to NWPA facilities. The assistance is intended to help states and tribes train local public safety officials. After a rough start in the mid-1990s to develop a policy for implementing Section 180(c), OCRWM revised its approach in 2004 and worked instead through the TEC/WG to modify the original proposal in a way that met the needs of the states and tribes. The program had been looking ahead to pilot testing the procedures when the Yucca Mountain program was terminated. While the effort to resolve the issue of Section 180(c) assistance fell short of getting 100 percent agreement on aspects of the policy and procedures, the example still stands as a model for resolving other significant institutional issues.

The NWPA as originally passed did not include any provision for preparing the communities along the shipping routes to handle emergencies involving shipments of spent fuel or high-level waste. Congress corrected this oversight in the 1987 amendments to the act with the inclusion of Section 180(c):

“The Secretary [of Energy] shall provide technical assistance and funds to States for training for public safety officials of appropriate units of local government and Indian Tribes through whose jurisdiction the Secretary plans to transport spent nuclear fuel or high-level radioactive waste [to facilities authorized by the NWPA]. Training shall cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations” (NWPA, as amended, Section 180(c)).

The Nuclear Waste Fund would be the source of funding for this assistance.

Following the passage of the amendments act, OCRWM moved fairly swiftly to develop its program for implementing Section 180(c), developing a preliminary strategy in 1989-91 and publishing a draft for comment in January 1992 (DOE 1992b, p. 5). An original “rough outline” of the strategy was developed in cooperation with several cooperative-agreement groups, including the three regional groups that had been organized by that time (WIEB, SSEB, and CSG Midwest) (ibid., p. 7). OCRWM published the final strategy in November 1992 after public comments were received. In the strategy document, OCRWM committed to an “interactive process” for “resolving planning issues to provide a viable training assistance program strategy” (ibid., p. 6). The program cited the Transportation Institutional Plan as laying the foundation for “issue discussion and resolution processes” that informed the 180(c) strategy, particularly with regard to emergency response and inspection/enforcement. OCRWM observed that, with the passage of the NWPA amendments, “the commitments OCRWM had initiated regarding emergency response, inspection, and enforcement became mandates” (ibid.).

The strategy document described the issue-resolution process OCRWM intended to follow. Notably, the report identified the newly organized TEC/WG as “an ideal forum for predecisional input on implementing Section 180(c)” (ibid., p. 7). The report stated that the TEC/WG would “be an active partner in developing the Section 180(c) program” by providing “a forum for review and comment on component documents” (ibid., p. 8). Furthermore, the report stated that “Working group members may be asked to contribute to sections of the implementation plan where their expertise would be helpful, particularly in balancing training needs with existing training assistance” (ibid.).
OCRWM’s plan for implementing Section 180(c) included developing a policy options paper, a policy statement, and an implementation plan. Throughout the entire process, OCRWM intended to work “in consultation with participating States and Indian Tribes,” making use of Transportation Coordination Group meetings, TEC/WG meetings, and workshops to solicit input (ibid., pp. 8, 10). Once these documents were complete, OCRWM would “publish a notice of proposed rulemaking embodying the draft policy statement and a discussion of the proposed implementation plan” (ibid., p. 8). Following a comment period, OCRWM would “issue the final rule,” following which the final step would be “to implement training assistance” (ibid.). OCRWM envisioned a phased approach to rolling out Section 180(c) assistance, going from program start-up to ramp-up as the transportation system moved to full-scale implementation (ibid., p. 12). The third phase would be ongoing monitoring and retraining.

Regarding the latter, OCRWM noted the “rapid turn-over rate of State, Tribal, and local emergency response and transportation regulatory personnel” as a reason to plan for retraining. The program committed to accommodating the states’ and tribes’ “need for resources…to retrain” (ibid.). The approach was timed so that OCRWM would be able to implement Section 180(c) “for shipments to an MRS facility in 1998” (DOE 1991, p. 117). Assistance would begin early in 1995, with retraining starting up in mid-1996 (DOE 1992b, p. 5).

Shortly after publishing the strategy document, OCRWM released its preliminary draft paper “Options for Providing Technical Assistance and Funding Under Section 180(c) of the Nuclear Waste Policy Act, as Amended.” The executive summary of the paper noted that “many options are available for providing funds and technical assistance,” and that “[a]ny reasonable decision by OCRWM could be supported under the provisions of 180(c)” (DOE 1992, p. v). The paper cited “the NWPA’s emphasis on consultation and cooperation [and] OCRWM’s commitments in the Strategy document” as reasons for the program to seek comments from “the various groups that have been contributing to issue discussion and resolution” (ibid.). The paper presented five groups of options for providing the funding:

- Use established Federal agency programs other than DOE;
- Establish agreements with State, Tribal, and other organizations;
- Establish a DOE grant program;
- Establish an OCRWM grant program; and
- Select a mixed group of options comprising elements from the previous four groups (ibid.).

The authors stated that the paper was guided by “two key principles”:

- OCRWM will strive to develop a program with enough flexibility to accommodate the wide variety of State, Tribal, and local assistance needs.
- OCRWM training assistance will be integrated into established Federal, State, and Tribal assistance structures, where possible (ibid., p. 37).

Before OCRWM published a final version of the options paper, OCRWM announced it would no longer pursue monitored retrievable storage as part of its program strategy (Wentz 1995, p. 4). OCRWM did proceed with the publication in the Federal Register of a “notice of inquiry” on 180(c) implementation in January 1995 (DOE 1995b). This notice “briefly described various options to delineate policies and procedures” for implementing Section 180(c) (DOE 1995c, p. 36793). The MHLRWC comments on these notices expressed three principal concerns, starting with the need for OCRWM to “place a high priority on developing a policy and procedures for implementing Section 180(c)” (Borchert 1995, p. 1). The Midwestern states were concerned about the possibility of OCRWM shipping spent fuel “through our
region without providing the states with sufficient time to prepare adequately for monitoring and response activities” (ibid.).

At the time the Midwest sent its letter, the consortium Private Fuel Storage was moving forward with plans to develop a private interim storage facility. The states had identified a deficiency in Section 180(c) in that it applied only to shipments to NWPA-authorized facilities, not private ones. Therefore, a second key point expressed by the Midwest was that Section 180(c) assistance “must apply to all large-scale shipping campaigns involving civilian spent nuclear fuel” (emphasis in original) (ibid.). Finally, the region felt that Section 180(c) assistance should be “administered directly to tribes in the same manner as states” in order to be consistent with respect to the tribes’ status as sovereign nations (ibid.). According to the Midwest’s letter, the Midwestern, Southern, and Western states were in agreement on these three issues. In comments on specific aspects of the assistance program, the Midwest highlighted the “pivotal role of route selection” in making it possible for OCRWM to meet its obligation to provide funding and technical assistance for training (ibid., p. 4).

OCRWM ultimately published a more detailed notice of inquiry (DOE 1995c), a notice of proposed policy and procedures (DOE 1996), a notice of revised proposed policy and procedures (DOE 1997b), and yet another notice of revised proposed policy and procedures (DOE 1998b). The Midwestern region, as well as other groups, responded with comments each time. In the 1998 notice, OCRWM stated that the notice “details the policy and procedures by which the Department currently intends to implement Section 180(c),” and that the plans would “remain in draft form until program progress or legislation provides definitive guidance as to when shipments will commence” (ibid., p. 23753). Upon receiving that guidance, “OCRWM may finalize these policy and procedures or will consider promulgating regulations on Section 180(c) implementation” (ibid.).

Four years later, in 2002, OCRWM received the direction it needed in the form of Congress passing S.J. 34, a resolution “Approving the site at Yucca Mountain, Nevada, for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel, pursuant to the Nuclear Waste Policy Act of 1982.” With the reestablishment of its cooperative agreement with OCRWM in 2002, the Midwestern committee identified the publication of a final policy and procedures for Section 180(c) implementation as a “key issue” for the region (MRMTC 2004, p. 3). As of June 2004, OCRWM had begun organizing a TEC/WG Topic Group to work on the Section 180(c) policy and procedures. All of OCRWM’s cooperative agreement groups would participate in that activity. OCRWM had also indicated its intention of republishing the draft policy and procedures for comment in 2005, however that activity was deferred until the Section 180(c) Topic Group could complete its work.

Starting in July 2004 and running through 2005, the TEC/WG Section 180(c) Topic Group worked aggressively to review the prior work on Section 180(c) and devise recommendations for changing the draft policy. As part of their contribution to the topic group’s work, early in 2005, the four regional groups jointly developed a set of “Principles of Agreement Among States on Expectations Regarding Preparations for OCRWM Shipments” (Niles et al. 2005). The principles identified the states’ expectations “for a fully functioning transportation program for spent nuclear fuel and high-level radioactive waste” (ibid., p. 3). First among the principles was the states’ position that “the overall objective of the 180(c) program must be to assist states in developing the capability to help prevent accidents and respond in a timely, appropriate fashion to accidents involving spent fuel and high-level radioactive waste shipments” (ibid.). Other principles addressed the need for predictable funding amounts; awarding funding to states at least three years prior to shipments commencing; and certainty regarding the routes and the schedule for shipping so that states could plan accordingly. These points,
as well as others like the need for states to have “maximum flexibility,” were consistent with the positions taken by the regional groups during the 1990s. An additional concern was that, since Section 180(c) applied only to training, OCRWM should make assistance available to the states not just for training but also for “operations activities as long as shipments continue along a shipping corridor” (ibid.) (see the section on Transportation Safety Program Funding).

The work of the Section 180(c) Topic Group entailed developing a set of issue papers on 11 topics. On eight topics, the group members, including OCRWM, were able to reach consensus: Funding distribution mechanism; timing and eligibility; allowable activities/training (including a discussion of hospital personnel and equipment); definitions; pass-through requirements; contingency plans; promulgating rules on 180(c) implementation; and matching funds (TEC 180 TG 2005, Executive Summary, p. 2). With regard to timing and eligibility, OCRWM agreed to notify the state governors of their eligibility to receive assistance four years prior to the start of shipments. A planning grant (up to $200,000) would be available in the first year a state received assistance, with training grants being awarded starting three years before shipments (ibid., Appendix B, p. 3; Appendix H, p. 4). Consistent with the emphasis on flexibility, states would have the option of applying for assistance with less lead time, if they chose to do so.

The group was unable to reach consensus on funding allocation, state fees, and how to fund operational activities (not training related) (ibid., Executive Summary, p. 2). With regard to the funding allocation, three of the four regional groups agreed to a formula proposed in the Federal Register notice that would calculate a variable component of the training grant using a formula. The factors in the formula would be the number of shipments, route miles, affected population, and the number of shipping, receiving, or transfer sites. The Western states alone objected to this formula-based approach, requesting instead that OCRWM base the training awards solely on the needs identified by the states. The difficulty in reaching consensus on the issue of state fees resulted from OCRWM being reluctant to accept the topic group’s recommendation that state fees not be deducted automatically from a state’s allocation. Instead, the topic group favored having OCRWM decide on a case-by-case basis whether and, if so, how much to deduct from state training grants, with states being required to submit information in their applications to explain what portion, if any, of the fee revenue was typically spent on training (ibid., Appendix I, p. 2).

In addition to the discussion papers, the topic group prepared a policy statement and began work on a draft application package and guidance document. The intention was for the “180(c) Issue Paper Package” to be presented to OCRWM management in July, with a Federal Register notice to be published in December 2005. OCRWM missed the December 2005 goal, however it did eventually publish a notice of revised proposed policy on July 23, 2007. At the time, OCRWM planned to solicit comments from the public, then pilot test the procedures. The idea was to incorporate lessons learned from the pilot test into the policy and procedures, with a final policy being published in the Federal Register thereafter (OCRWM 2008d, p. 2).

In its comments on the revised plan, the MRMTC noted that it was pleased with the extent to which the revision reflected the input of the Section 180(c) Topic Group. Missing from the plan, however, were three recommendations from the topic group:

- OCRWM should “commit to funding the same kind of transportation safety programs that are in place for WIPP shipments;”
OCRWM should “issue a policy and then promulgate a rule for implementation of the policy and grant application;” and

- The policy and procedures should “address contingency re-routing so that the states and tribes will have some assurance that shipments will proceed safely even if circumstances require the use of different routes” (Owen and Beetem 2007, p. 2).

The Midwest also noted that the draft did not address the question of what would happen with funding in the event of a lapse in shipments (ibid.). In its comments on what would be the last Federal Register notice on Section 180(c) implementation (DOE 2008e, published on October 31, 2008), the Midwest reiterated these same concerns (Leuer and Rasmusson 2009a, p. 2). OCRWM was unable to conduct a pilot test of the procedures before funding for the transportation program was eliminated. As a result, OCRWM did not finalize the policy and procedures, or the grant application package, before the Yucca Mountain program was canceled.

Section 180(c) implementation remains open as an issue. The Midwest, for example, continued to list Section 180(c) as a “key issue” related to the OCRWM program until the time of the program’s demise (MRMTC 2008a). The work on this issue stands, however, as an excellent model for how OCRWM or its successor should work to resolve other institutional issues related to the transportation program – indeed, other types of nuclear-waste related issues, such as storage. As noted in a paper authored by OCRWM staff and topic group participants, the process was characterized by:

- Direct, frequent interactions between OCRWM and its stakeholders;
- Topic groups that recruit members with a broad range of experience;
- Program staff that are willing to substantively discuss input from stakeholders;
- Aggressive schedules; and
- A commitment from program management, staff, and stakeholders to stay on track (Macaluso et al. 2006, p. 6).

While there is always room for improvement, the process of developing the proposed policy and procedures – and the draft product itself – reflected a rare commitment by OCRWM not just to listening to stakeholder feedback but to actually incorporating it.
Human Factors

Since its inception, the NWTRB has encouraged OCRWM to pay more attention to human factors and their contribution to the risk of the repository system, including transportation. The Board has noted that the majority of accidents in hazardous materials transportation are attributable to human error. The Board recommended that OCRWM establish a human factors program, staffed by trained professionals, to address human factors in the design of the national transportation program. Initially, the Board was impressed by OCRWM’s efforts to incorporate human factors considerations into its program. In recent years, there was little mention of the topic from either party.

In its first report to Congress and the Secretary of Energy, the NWTRB identified system safety, human factors, and risk assessment and management as the three issues of concern relating to the transportation of spent fuel. According to the Board, “a human factors program provides a life-cycle application of what is known about human psychological, physiological, and physical limitations in the design and operation of systems to optimize system safety and operability” (NWTRB 1990a, p.23). Such a program would be staffed by human factors scientists and engineers, and would address design issues such as human error. Human factors programs are recognized as contributing substantially to nuclear safety. The NWTRB observed that OCRWM did not have a human factors program, and thus there were no human factors professionals working on the transportation system. Because the majority of hazardous materials transportation accidents are caused by human error, the Board recommended that DOE establish a human factors program for transportation activities as well as other repository activities.

In its second report to Congress, the NWTRB again encouraged OCRWM to include systems safety and human factors engineering programs to help ensure the safety of transport operations. The Board recognized that spent fuel shipments have historically had a very good safety record. However, the Board pointed out that shipments to a federal repository will occur in greater volume than any previous shipping campaign, which will result in more people being aware of and affected by high-level waste and spent fuel shipments. In addition, new facilities and technologies will be utilized in the federal repository program, and these changes may present new opportunities for accidents. According to the Board, “The opportunity exists now for all parties involved in the high-level nuclear waste management system to address these changes and their effects before, rather than after, they occur. These parties include the DOE, the utilities, the Nuclear Regulatory Commission, the Department of Transportation, and the states” (emphasis in original) (NWTRB 1990b, p. 21).

In its third report to Congress, the Board recognized that OCRWM had begun to incorporate human factors considerations into transportation planning, and had directed its contractors to acquire human factors personnel. The Board noted again in its fifth report to Congress that OCRWM had made progress incorporating human factors considerations into the cask development and transportation system design. At this point the Board recommended that OCRWM develop supporting documentation for a human factors program, including a human factors program requirements document and a human factors design requirements document (NWTRB 1992a, p. xv).

The NWTRB’s sixth report to Congress found that OCRWM had continued to make progress incorporating human factors into the transportation program, and human factors engineering
requirements were being documented and placed in the technical baseline. In its 1994 Findings and Recommendations, the Board was encouraged that OCRWM had incorporated human factors and system safety principles into the request for proposals for the multipurpose canister procurement (NWTRB 1995, p.9). There was no further mention of human factors in subsequent NWTRB reports or OCRWM documents.

While the NWTRB was impressed with OCRWM’s efforts early on to address the Board’s recommendations on system safety, little has been done to address the issue in recent years. In OCRWM’s “National Transportation Plan,” issued January 2009, there is no mention of human factors. The successor to OCRWM should develop a comprehensive approach to addressing human factors in managing transportation risk.

**System Safety**

From its inception, the NWTRB repeatedly urged OCRWM to consider the effects of all decisions on the safety of the system as a whole. Transportation was included in the recommendation. In early reports, the Board encouraged OCRWM to establish a system safety program, staffed by dedicated personnel, to improve the safety of its repository program. In subsequent reports, the Board indicated that OCRWM had been receptive to this recommendation. In recent years there has been little mention of the topic from either party.

Like the issue of human factors, system safety was identified early on by the NWTRB as an issue of concern relating to the transportation of spent fuel. According to the Board, a system safety program is “one that provides a life-cycle application of safety engineering and management techniques to the design of system hardware, software, and operations...staffed by professional system safety engineers whose duties are dedicated to safety” (NWTRB 1990a, p. 23). The Board expressed concern that OCRWM neither had such a program, nor personnel dedicated solely to providing system safety management and engineering. According to the Board, a system safety program for repository design and transportation operations is essential and would help to assure Congress and the public that appropriate attention has been given to safety.

In its second report to Congress, the Board recommended that OCRWM develop programs to address system safety and human factors as a way to enhance the safety of the proposed national transportation program (NWTRB 1990b, p. 21). In subsequent reports the Board noted that OCRWM had made progress incorporating system safety and human factors into its transportation planning efforts (see the section on Human Factors).

Although the NWTRB was impressed with OCRWM’s efforts early on to address the recommendations on system safety, little has been done to address the issue in recent years. System safety is not mentioned in OCRWM’s “National Transportation Plan,” issued January 2009. System safety is an issue that should be considered when developing a national transportation program.

**Top-level System Studies**

The NWTRB repeatedly urged OCRWM to conduct system studies of the entire repository program, including transportation. According to the Board, “system studies of the nuclear waste management system are those in which the major components are not fixed a priori” (NWTRB 1992b, p. 13). The Board was concerned that program decisions that would impact the entire
The NWTRB’s *Report to the U.S. Congress and the Secretary of Energy: January to December 1993* states, “The Board has consistently stated that because the functions of storage, transportation, and disposal are strongly interconnected, the DOE should use systems analysis when making decisions about different parts of the waste management system” (NWTRB 1994, p. 17). In its reports, the Board urged OCRWM to conduct system studies of the entire repository program so that decision making around various components of the program would take into account the effects on other program components.

The recommendation that OCRWM conduct top-level system studies of the waste management program was included in its *Fifth Report to Congress and the Secretary of Energy*. The Board expressed concern that individual decisions were being made about the components of the system in order to meet program deadlines, which could result in “a process that locks in the waste management system configuration before the merits of possible alternatives have been properly evaluated” (NWTRB 1992a, p. 22). The Board’s recommendation was to conduct top-level system studies in a timely manner so that the results could be used to inform major component acquisition decisions. The system study would evaluate the tradeoffs among different system designs and provide a rationale for decision making across the entire waste management program.

In its *Sixth Report to Congress and the Secretary of Energy*, the NWTRB repeated the recommendation that OCRWM conduct top-level system studies, and stated that this should be done in an iterative and timely manner to enhance sound program decision making. This report included discussion from a meeting that was held that year with the NWTRB, OCRWM, and OCRWM’s management and operations contractor at which system studies was among the topics discussed. At that point, the management and operations contractor was in the process of conceptualizing its system study. The Board was concerned that certain key decisions, such as the need to have a monitored retrievable storage (MRS) facility open by 1998, had already been made, thus limiting the overall flexibility in program design. The Board asserted that top-level system studies were most useful when performed prior to making any major decisions or assumptions. The programmatic decisions that OCRWM had already made created constraints on the system that led the Board to conclude that OCRWM’s system study was not truly a “top-level system study” (NWTRB 1992b, p. 14). The Board continued to make the case for high-level system studies, stating that “unconstrained, iterative top-level studies need to be pursued because they will illuminate overall problems, identify enhancements, evaluate alternatives, and provide for contingencies, thus promoting sound program planning” (ibid., p. 15).

The Board also expressed concern that OCRWM was operating under tight target dates, which were compromising the ability to adequately evaluate design options and incorporate improvements. One of the Board’s recommendations was to let scientific analysis, rather than target dates, drive decision making in the repository program. In May 1994, the Board again raised the concern that an analysis of the entire waste management system, including storage, transportation, and disposal, had not been completed. At that point, OCRWM had presented the concept of the multi-purpose canister (MPC), and the Board believed that a system study could assist in decision making related to MPC development (NWTRB 1994a, p. 19).
In 2004, in its Letter Report to the U.S. Congress and the U.S. Secretary of Energy, the Board made three recommendations, one of which was that OCRWM’s “transportation planning and development effort should adopt a ‘systems’ approach, addressing both strategic and operational considerations” (NWTRB 2004a, p. 8). The Board noted that OCRWM had made progress in taking a systematic approach to transportation planning, but needed to improve the integration among all the components of the waste management system.

One year later, in its 2005 Letter Report to Congress and the Secretary of Energy, the Board identified “systems assessment” as an important issue that would continue to be of interest. The Board again noted the interdependency among the components of the waste management system, “including accepting waste at utility or DOE defense-complex sites; handling, transporting, processing, and storing the waste; and emplacing the waste underground” (NWTRB 2005a, p. 2). According to the Board, this interdependence should be taken into account when conducting performance assessments or proposing changes to the waste management program.

System studies and system assessments were not mentioned in key OCRWM documents such as “Developing the Transportation System” (1994), “Transportation System Concept of Operations” (2006), or “National Transportation Plan” (2009).

Thinking ahead to the future, a new or revived transportation program may result from the recommendations of the Blue Ribbon Commission on America’s Nuclear Future. Whatever agency or body is assigned responsibility for managing the nation’s spent fuel and high-level waste should heed the Board’s advice and take the opportunity to conduct top level system studies early on in the process of designing an integrated waste management system.

**Transportation After Very Long-Term Storage**

*Delays in opening the repository will lead to longer periods of on-site storage for spent fuel in dry casks than was originally anticipated. The consensus is that very long-term storage does not in itself pose a problem because the robust nature of the casks will safely store spent fuel for 100 years or more. In 2009, however, after the Obama Administration announced its intention to cancel the Yucca Mountain repository, the NWTRB began to examine the implications for keeping spent fuel in dry storage for hundreds of years. Included in that examination are the potential impacts on the ability to transport spent fuel that had been stored in casks for such lengthy periods of time.*

*In addition to the NWTRB, other stakeholders that should be involved in resolving this issue include technical experts; state government officials who either have dry storage facilities in their jurisdictions or will be affected by shipments of spent fuel; and local communities that may be faced with situations in which spent fuel becomes “stranded” due to an inability to transport it.*

The NWTRB summer meeting in June 2009 featured a panel of technical experts discussing the “research and data needs for very-long-term dry storage of commercial spent nuclear fuel” (NWTRB 2009a, p. 4). The Board defined “very long-term” as meaning “greater than 120 years.” In his summary letter to Congress and to Energy Secretary Steven Chu reporting on the meeting, Board chairman B. John Garrick wrote that, based on the panel discussion, “the technical basis for designing and operating dry-storage systems for a very long term warrants improvement” (Garrick 2009, p. 2). One of the concerns
expressed by the Board was “the condition of the spent fuel in the canisters because it must be shipped, possibly repackaged, and eventually disposed of (or reprocessed) after a long period of dry storage” (ibid.). Dr. Garrick further stated that the Board would prepare a white paper on this topic.

During the panel, a Board member observed that, while it is reasonable to assume safe storage for 100 years, “what happens when you have to ship the fuel after 100 years?” (NWTRB 2009b, p. 213). John Kessler from the Electric Power Research Institute responded that, as long as utilities have “maintained [a] helium environment [inside the casks], it’s not going to change the property of the fuel” (ibid., p. 213). Robert Eizinger, an NRC staff member with decades of experience on storage issues, later echoed the board member’s concern when he said “we shouldn’t ask the question can we store [spent fuel] for ‘X’ number of years, but rather can we store it for ‘X’ number of years and still maintain the fuel in a transportable condition” (ibid., p. 231).

In November 2009, the GAO issued a report that examined the “key attributes, challenges, and costs” of three alternatives for long-term management of spent fuel and high-level radioactive waste (GAO 2009). The report suggested that, by giving spent fuel and high-level waste time “to cool and become less radioactive,” longer on-site storage “could reduce transportation risks…since the nuclear waste would be cooler and less radioactive when it is finally transported to a repository” (ibid., p. 36). The report acknowledged, however, that the NRC had brought up the possibility that “waste or waste packages might degrade over time,” thereby “possibly increasing the risks of release” (ibid., pp. 36-37). Such a concern could extend to handling for both repackaging and transportation.

At the 2010 Dry Storage Information Forum sponsored by the Nuclear Energy Institute, it was reported that EPRI, the NRC, and DOE’s new Office of Used Fuel Disposition were collaborating on a research program to address whether casks can safely store spent fuel for periods beyond 120 years and still maintain the fuel in transportable condition (MRMTC 2010a). Called the “Extended Storage Collaboration Program,” the study’s findings will not be available until after the Blue Ribbon Commission on America’s Nuclear Future issues its own recommendations for a national policy to replace the one laid out in the NWPA.

**Transportation Implications of Storage Solutions**

*Once the opening date of Yucca Mountain began to recede far into the future, proposals for federal centralized interim storage began to surface. The most recent of these proposals came in 2008, when the House Appropriations Committee suggested that OCRWM look into the possibility of using an existing or new federal site to store spent fuel from 11 decommissioned reactors. The Midwestern states were among the stakeholders that voiced concern about interim storage proposals possibly resulting in spent fuel and high-level waste being shipped following a very aggressive schedule that would not permit time for a consultative, collaborative transportation planning process. The states also opined that, in selecting a storage site, transportation should be a consideration to avoid shipments being transported twice over unnecessarily long distances.*

OCRWM was first faced with the possibility of a Congressionally-designated interim storage site in the mid-1990s, as the federal government approached the 1998 date of spent fuel acceptance specified in the standard disposal contracts with utilities. Responding to this possibility, in 1995, OCRWM prepared a “Transportation Contingency Plan for Limited Capacity Shipment (Revision 1)” (DOE 1995g). The purpose of the report was to “define and discuss those activities which must take place...to ensure that...
spent nuclear fuel shipments could begin earlier than 2010,” which was then the estimated date of repository operations (DOE 1995g, p. 1). OCRWM found it “most logical” to rely “primarily...on transport by highway” to conduct the shipments (ibid.).

Section 1.2.6 of the report addressed OCRWM’s plans for the institutional program. In this section, OCRWM “recognizes that the success of the [transportation program] depends on both safety and stakeholder understanding of and confidence in program activities and objectives” (ibid., p. 4). OCRWM committed to “identifying, evaluating, and adequately incorporating safety factors into program decisions” (ibid.). Section 2.1.6, on Institutional Considerations, provided detail on the actions that OCRWM would need to take in order to identify routes, implement Section 180(c), develop NRC-approved physical protection measures, establish a uniform inspection procedure for truck shipments, and further develop the OCRWM risk management program. OCRWM anticipated spending three years planning and conducting institutional activities prior to shipments starting, including “12 to 18 months of intense effort” (ibid., p. 21).

A decade later, in 2008, the target date for opening the repository had shifted from 2010 to 2017 and beyond. Concerned about the lack of progress and the federal government’s growing liability for the cost of the utilities’ continued on-site storage of spent fuel, the Appropriations Committee of the U.S. House of Representatives directed OCRWM to develop a plan for demonstrating that it could “move forward in the near term with at least some element of nuclear waste policy” (U.S. House of Representatives Appropriations Committee 2007, p. 88). The plan was to consider transporting spent fuel currently stored at 11 decommissioned reactor sites to a federal facility, other existing reactor sites, or “a competitively-selected interim storage site” (ibid.).

Responding to the Appropriations Committee’s charge, in December 2008, OCRWM released its “Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel” (DOE 2008g). In the report, OCRWM found that it lacked authority under the NWPA to implement interim storage before the Yucca Mountain repository became operational. OCRWM identified four specific legislative changes that would need to be made before the program could initiate the demonstration project envisioned by the House Appropriations Committee:

- Direction to take spent fuel from decommissioned reactors;
- Establishment of an expedited site selection and development process;
- Authorization to construct and operate the facility or, if the facility were to be regulated by the NRC, provisions for an expedited siting and licensing process; and
- Funding reform to ensure OCRWM would have sufficient funding to carry out its activities (ibid., pp. 15-16).

OCRWM’s report focused mainly on the legal restrictions that would prevent it from carrying out the plan suggested by the Appropriations Committee. The transportation section – less than a full page in length – mentioned cask procurement, estimated costs, and the shipping schedule needed to make 294 shipments of spent fuel over a four-year period (ibid., pp. 12-13). Unlike the plan in 1995, the 2008 report would have OCRWM making shipments by train. Also unlike the 1995 report, the report to congress did not address the transportation planning process. The timeline in the report did indicate that OCRWM anticipated spending a little over one year planning shipments, but no mention was made of consultative planning with the states (ibid., p. 14). Following the yearlong planning effort, OCRWM anticipated spending five years acquiring the necessary transportation resources. Although the report did not make the observation, OCRWM could, in theory, spend those five years not only procure...
hardware but also conducting the institutional planning that the states feel is necessary to support a campaign of this magnitude.

OCRWM estimated the costs (in 2009 dollars) of carrying out 294 shipments to be $232 million over the five-year period of acquisition and operations. It is worth noting that keeping the states engaged in planning through the existing four regional cooperative agreements would reasonably cost on the order of $6 million or 3 percent of the cost of purchasing casks and conducting shipments, assuming $600,000 per year for 10 years (six years of planning followed by four years of operation).

Concerned that OCRWM might receive direction to implement interim storage, in 2008, the MRMTC codified “transportation implications of storage solutions” as one of the region’s “key issues.” The region stated that, “For any federal solutions, OCRWM must consider the impacts of transportation when selecting storage locations” (MRMTC 2008a, p. 1). In April 2009, the Midwestern states joined their counterparts in the West and the Northeast in cautioning the program about the need to prepare for accelerated institutional planning. The comments came in the context of the regions’ input on OCRWM’s draft “National Transportation Plan” issued in January 2009. Among the joint comments, the regions stated that, “Ideally, DOE’s transportation plan would be applicable to any large-scale campaign to move spent fuel, regardless of the origins and destination. Such a plan would make the work valuable not just for the limited case of a Yucca Mountain repository but also for whatever alternative plan or plans Congress and the current administration develop (e.g., alternatives that utilize public or private regional storage facilities)” (Niles et al. 2009, p. 2). Because of budget cuts related to the Obama Administration’s plan to cancel the Yucca Mountain repository, OCRWM did not respond to the comments it received on the “National Transportation Plan.”

At the end of 2009, the GAO issued a report that examined three alternatives for long-term management of spent fuel, one of which was centralized interim storage. The report identified transportation as a “third challenge to centralized storage” because “nuclear waste would likely have to be transported twice” unless the storage facility were co-located with the repository (GAO 2009, p. 32). The NWPA forbids any such co-location. The GAO’s observation is consistent with the Midwestern states’ concern about spent fuel traveling much longer distances than necessary to reach a final disposal location.

There is little that the states can do to resolve this issue other than to continue their vocal support for having transportation factor into the identification of a site or sites for interim storage. The states can also advocate for OCRWM or its successor to involve them in planning shipments to a temporary storage facility. As an interim measure, the states can also remain engaged in transportation planning for ongoing shipments conducted by DOE’s Office of Environmental Management, with the goal of influencing the planning process and, ideally, setting a precedent for how shipments of commercial spent fuel will be conducted if federal interim storage becomes a reality. Finally, to implement any plan for centralized interim storage, OCRWM would first need to obtain authorization and funding from Congress. The states, therefore, may have an opportunity to use the political process to influence any interim storage enabling legislation so that their concerns related to transportation are adequately addressed.

**Transportation Management Structure**

*Through the NWPA, as amended, the responsibility for licensing and operating a geologic repository for the disposal of spent fuel and high-level waste was assigned to OCRWM, including*
the responsibility for developing and utilizing a national transportation system by which to ship waste from commercial and DOE sites to a federal repository or storage site. OCRWM has received much criticism for its delays in developing and managing the repository program. Management challenges have been identified as one of the main causes for the delays in the repository program. Over the nearly three decades of OCRWM’s existence, several stakeholder groups, oversight bodies, and OCRWM itself have examined the management structure of OCRWM and presented suggestions for improving this structure.

Reports by the NWTRB and the NAS have explored the internal and external management challenges that OCRWM has faced. Within an underfunded repository program, the transportation program did not fare well, being assigned a low priority within OCRWM, thereby making it difficult to enter into long-term contracts required to develop the transportation infrastructure. Changes to the structure of the transportation program to increase its autonomy and ensure adequate funding would greatly improve the chances for developing a successful transportation system by which to ship the nation’s spent fuel and high-level waste.

The document that deals with OCRWM’s transportation management structure in the most detail is Going the Distance, the NAS report on the safe transport of spent fuel and high-level waste in the United States. In the report, the NAS found that under the current organizational structure, OCRWM’s transportation program will have a very difficult time carrying out a large, decentralized, long-lasting, and complex shipping campaign that involves numerous stakeholders from the public and private sectors. The NAS found that OCRWM’s transportation staff “are working within a difficult organizational structure and in a political environment that could make success close to impossible” (NAS 2006, p. 272).

The NAS identified specific challenges facing the transportation program, including limited control over its budget and limited flexibility over the commercial spent fuel acceptance order (ibid., p. 260). Unpredictable and inadequate funding has made it impossible to invest in the necessary transportation infrastructure according to schedule. The inability to dictate a shipping queue will make it very difficult for the transportation program to operate effectively (see the section on Shipment Scheduling). In addition, the entire OCRWM transportation program has been built around the assumption that OCRWM will be shipping waste to a repository at Yucca Mountain; the federal government may instead move commercial spent fuel to one or more interim storage sites to fulfill its obligations under the NWPA, and the current program may not have the flexibility to adapt to a changing mission.

In order to successfully carry out a complex, national shipping campaign, the transportation program must examine the interconnections among the components. The NAS “saw clear evidence that the current organizational structure for the transportation program is impeding such an integrated approach because, as noted previously, the program does not have the autonomy and funding necessary to execute its mission” (ibid., p. 272). Specifically, the NAS noted that under the current structure, the transportation program competes within OCRWM for funding (ibid., p. 262). The entire OCRWM program has been underfunded, which has led to decisions being made based on funding availability rather than on a technical basis.

The NAS recommended changing the management structure of DOE’s transportation program to improve the chances of success. The committee offered several potential alternatives for changing the management structure, but the primary objectives in making the changes were to provide the program with greater budgetary flexibility, more planning authority, and flexibility to support a changing mission.
The NAS described three alternative management structures that could be set up to meet these objectives.

The first alternative management structure would involve creating a Nuclear Waste Transportation Administration, quasi-independent DOE program office that could be given the authority to tap the Nuclear Waste Fund without prior Congressional authorization. This structure would have the advantage of giving the transportation program more autonomy to pursue its mission by removing the budget, schedule, and personnel constraints imposed by OCRWM management. It would provide the predictability and continuity in funding necessary to make the long-term commitments to develop the national transportation infrastructure. Creating this quasi-independent DOE office would be allowed under the provisions of the NWPA, but Congressional action would be needed to make the Nuclear Waste Fund available to the Nuclear Waste Transportation Administration (ibid., p. 267).

The second option for changing the management structure of the transportation program would be the creation of a quasi-government corporation that would operate like a private sector organization, but be partially owned by the government. This organizational structure is utilized by British Nuclear Fuels Limited and the French company AREVA, which are both private companies owned partially by their governments (ibid., p. 268). Under this structure, the corporation would be given authority to take title to commercial spent fuel for the purpose of transportation. DOE would take title to the shipped materials at the destination, which could be a repository or interim storage facility. This arrangement would have the advantage of bringing private-sector efficiencies to the transportation program, and would eliminate the current situation in which the government is regulating itself. One potential disadvantage of this structure is that the corporation could be less accountable to the public, but the NAS suggested that this could be addressed by including public participation requirements in the corporation’s charter. Changes to the NWPA would be required in order to utilize this quasi-corporate model (ibid.).

The third alternative examined by the NAS is to create a fully private corporation operated by the nuclear industry. This alternative would have most of the same advantages and disadvantages as the quasi-government corporation option. It might be the best way to address the issue of the spent fuel shipping queue because it would create the collective economic incentive for spent fuel owners, who are also corporate owners, to maximize the efficiency of the transportation program. This model would also require changes to the NWPA.

General changes to OCRWM’s management structure had earlier been recommended by the NWTRB. In a 1993 Special Report to Congress and the Secretary of Energy, the Board found that “The large number of organizations involved in the U.S. program and the diffuse nature of its organizational structure create substantial challenges for program managers. As a result, management problems seem to be adversely affecting some critical technical aspects of the program” (NWTRB 1993, p. v).

The Board noted that, in most other countries, either spent fuel producers bear the responsibility for waste management, including storage, transportation, and disposal, or a government corporation has been established to carry out these activities. These countries’ programs appeared to have greater accountability and more effective management than OCRWM’s. The Board recommended a thorough, independent review of the OCRWM management structure to help eliminate inefficiencies in the program (ibid.).
In the 1994 “Developing the Transportation System,” OCRWM examined several organizational structures for the transportation system, utilizing contractors to differing degrees. The options identified in the document were as follows:

- DOE owned, DOE managed, DOE operated;
- DOE owned, DOE managed, contractor operated;
- DOE owned, contractor managed, contractor operated;
- Contractor owned, contractor managed, contractor operated; and
- Federally-chartered corporation (DOE 1994c, p. 3-26).

OCRWM released versions of its draft Request for Proposals (RFP) for the Acquisition of Waste Acceptance and Transportation Services for the OCRWM in November 1997 and September 1998 (DOE 1998a, p. 1). In the draft RFP, OCRWM proposed utilizing four Regional Servicing Contractors, each responsible for waste acceptance and transportation activities in a specific servicing region. While this approach would allow OCRWM to delegate many transportation-related activities to a private contractor, the program would retain responsibility for stakeholder interactions, policy decisions, final route selections, and providing Section 180(c) funds to states and tribes through which shipments would travel. The requirements of the National Environmental Policy Act would also be carried out by OCRWM (ibid, p. C-3).

At the time the first draft RFP was published, the four regional groups had recently reached consensus on three key transportation issues at a joint meeting, and these issues were included in the Midwestern states’ comments on the draft RFP. The four regions agreed that privatization could benefit the transportation program as long as OCRWM were to maintain control over the institutional program. The Midwest therefore praised OCRWM’s decision to retain responsibility for stakeholder interactions. The regions had also agreed that route selection should be carried out by OCRWM and the states, and thus the Midwestern states’ comments expressed support for OCRWM’s decision to retain control over final route selection (MRMTC 1998).

The final area on which the four regions had reached consensus was transportation planning. The states advocated the position that for all of DOE’s transportation programs involving radioactive materials, the department should have a consistent approach to resolving issues with the states. The regions believed that the WGA WIPP PIG should serve as the model for all DOE transportation planning. The Midwestern states expressed concern that the approach detailed in OCRWM’s RFP, under which each Regional Servicing Contractor would develop its own transportation plan, would be fragmented, inefficient, and unnecessarily burdensome to the states (MRMTC 1998).

OCRWM incorporated several of the comments it received on the November 1997 RFP in a draft RFP issued in September 1998. At that time OCRWM did not solicit additional comments because it planned to further revise the draft document once a repository site was selected and approved (DOE 1998a).

In 2005, OCRWM undertook a “Benchmarking” project in order to identify, document, and better understand best practices for radioactive materials logistics enterprises. The goal of the project was to help OCRWM in developing a national transportation program for shipping spent fuel from reactor sites to a federal repository. The first phase of the benchmarking project examined logistics operations for WIPP, the Naval Nuclear Propulsion Program, and the FRR program. In 2007, OCRWM published the “Project Status Report and Interim Findings” from its benchmarking project. Two relevant areas that
were examined in the report were the transportation business model, including management organization, and contract management and outsourcing (DOE 2007c).

The benchmarking report’s key findings with regard to management organization were as follows: 1) build multidisciplinary teams to manage logistics; 2) include representatives from the origin and destination sites on logistics teams; 3) keep logistics management hands-on and delegation chains short to allow the organization to respond rapidly and effectively when issues arise with transportation operations (DOE 2007c). With regard to contract management and outsourcing, the benchmarking report found that OCRWM should consider federal experience with outsourcing strategies. Activities that are not typically outsourced by federal agencies included stakeholder relations, contracting with origin and destination sites, and responsibility for the safety, security, and reliability of the transportation system. OCRWM concluded that mission-critical elements of the logistics enterprise should remain under control of the federal agency (ibid.).

Developing a transportation system by which to ship radioactive waste from origin sites to a federal repository or interim storage site will require competent management and adequate, sustained, and predictable funding. Qualified parties that have examined this issue have concluded that OCRWM’s transportation program will need to be given greater autonomy to complete its mission and greater access to the Nuclear Waste Fund. At least one, and possibly both, of these changes will require congressional action. It is in the best interest of the states, as well as OCRWM, for the transportation program to be well-managed and well-funded.

Two key decisions have yet to be made regarding the transportation program’s management structure, the first of which is whether the transportation program should remain within OCRWM or be handed over to a private or quasi-private entity. If the transportation program stays within OCRWM, the program will need to determine the extent to which it will contract with private companies for the provision of transportation services. The states feel strongly that certain key responsibilities should remain with OCRWM, and the states would presumably be involved in OCRWM’s decisions regarding which activities should be provided by contractors. If it retains control of the transportation program and receives the necessary funding, OCRWM would do well to continue its benchmarking efforts related to logistics management.

**TRANSPORTATION RISK MANAGEMENT PROGRAM**

The NWTRB repeatedly urged OCRWM to improve its understanding of transportation risk and to develop a full-fledged program dedicated to managing that risk. Because transportation of high-level waste and spent fuel is perceived by the public as risky, the NWTRB encouraged OCRWM to address both actual and perceived risks, and to involve stakeholders extensively in the identification and analysis of risks. This recommendation has been echoed by the NAS. OCRWM has addressed its approach to risk management in several transportation-related documents, most notably the “Transportation Risk Management Approach, Preliminary Draft” issued in 1995. While this document included plans for a comprehensive risk management program, none was ever developed.

The NWTRB has consistently highlighted transportation risk management as an area of public concern that warranted greater attention from OCRWM. The Board repeatedly stated that although the actual risks associated with transporting spent fuel and high-level waste are low, the perceived risks by the public could present an obstacle for OCRWM in developing and carrying out a national transportation
program for highly-radioactive material. The Board therefore urged OCRWM to take measures to enhance public confidence in transportation of spent fuel (NWTRB 1998, p. 14).

In 1990, in its First Report to the U.S. Congress and the U.S. Secretary of Energy, the NWTRB identified “Risk Assessment and Management” in the transportation program as an issue of concern. The Board recommended that OCRWM initiate a system safety program that utilized a Management Oversight Risk Tree and RADTRAN, a model used to assess the risks of transporting radioactive materials under both incident free and accident conditions (NWTRB 1990a, p. 26).

The Board’s Third Report to the U.S. Congress and the U.S. Secretary of Energy concluded that “[t]he transportation of high-level radioactive waste is, and is perceived by the public to be, an activity of high safety concern” (NWTRB 1991, p. 20). The Board encouraged OCRWM to address these concerns by taking steps that would improve overall safety and enhance public confidence.

In 1997, the Board held a meeting on the waste management system, with analyses of the risks associated with transporting spent fuel being one of the three topics discussed. Afterwards, in its 1997 Findings and Recommendations, the NWTRB again concluded that the risks associated with transporting spent fuel are and will continue to be low. They recommended that in order to maintain a good safety record, a heightened safety program may be needed in the civilian nuclear waste management program (NWTRB 1998, p. 14).

The Board’s May 2005 Report to Congress and the Secretary of Energy revisited the topic of risk management. One of the key findings in this report was that OCRWM had made substantial progress in the area of transportation planning. In the report, the Board concluded that OCRWM’s approach to transportation security risk assessment appeared to be organized appropriately, and that, once available, results of the risk assessment should be merged into an integrated all-hazards risk management approach. The Board again highlighted the need to make risk assessment and risk communication iterative processes conducted with stakeholders (NWTRB 2005b, p. 8).

In addition to the NWTRB, the NAS also addressed risk management. In Going the Distance, the NAS found that, while the health and safety risks of transporting spent fuel are low, the risks perceived by society presented a challenge to the success of the national transportation program. The NAS recommended that the transportation program act early to develop mechanisms for gathering diverse, quality information on perceived risks and risk management. Specifically, the committee recommended the establishment of a “transportation risk advisory group that is explicitly designed to provide advice on characterizing, communicating, and mitigating the social, security, and health and safety risks that arise from the transportation of spent fuel and high-level waste to a federal repository or interim storage” (emphasis in original) (NAS 2006, p. 181).

OCRWM has defined a risk as “an uncertain event or condition that, if it occurs, affects a project or program’s objectives, including cost, schedule, or overall scope of work” (DOE 2007a, p. 19). A risk is comprised of the likelihood of the risk to occur, referred to as probability, and the consequences if the event does occur, referred to as impacts. OCRWM defined risk management as “a process of integrating scientific information and societal values into a decisional framework” (DOE 1995h, p. 1). Risk management is required for DOE projects and programs under Department of Energy Order 413.3 and 413.301, which describe the department’s approach to risk management. According to DOE Directive 413.3, “Risk Management is an essential element of every project. The DOE risk management approach must be analytical, forward looking, structured, informative, and continuous” (DOE 2006a, p. 32).
OCRWM has issued several documents that touch on the office’s approach to managing risk as it relates to the national transportation program. In the 1994 “Developing the Transportation System,” OCRWM acknowledged that a transportation risk management program would need to be developed to “aid decision making in transportation system design and operations, and to limit environmental, safety, and health impacts” (DOE 1994c, p. 5-6). Through this program, OCRWM would identify the risks associated with the transportation of spent fuel and high-level waste and implement appropriate mitigative measures to address these risks. OCRWM envisioned that this process would be conducted in open consultation with stakeholders, and would include strategies for risk communication. OCRWM planned to issue a draft transportation risk management strategy in 1994.

In OCRWM’s 1995 Transportation Contingency Plan for Limited Capacity Shipment, the program reiterated that a risk management program was currently under development. Stakeholders had requested that a risk management program, including capabilities for risk communication, risk assessment, risk reduction, and risk monitoring, be developed well in advance of the start of shipment operations (DOE 1995g).

OCRWM described its approach to managing transportation risks in its “Transportation Risk Management Approach, Preliminary Draft,” which was issued May 31, 1995. This document describes the process that OCRWM planned to follow in order to manage the environmental, health, and safety risks associated with its transportation activities. According to this document, “The risk management process is a means of communicating, identifying, assessing, mitigating, reducing, and monitoring risks in an environment of open communication and active participation with stakeholders” (DOE 1995h, p. 1).

The approach to risk management described by OCRWM included five major elements. “Risk communication and stakeholder interfaces” refers to the ways in which OCRWM incorporates input from stakeholders, including states, Tribes, communities through which shipments might travel, environmental groups, nuclear utilities, vendors, and other federal agencies. OCRWM identified cooperative agreements and the TEC/WG as the primary avenues through which OCRWM would communicate with stakeholders on transportation-related issues. The second element is “Risk identification,” which describes the dynamic process that involves gathering stakeholder input, examining historical data on risks associated with transportation activities, using modeling to extrapolate potential risks from various data sources, reviewing applicable statutory and regulatory requirements, exploring the programmatic risks such as uncertainties around policies, funding, and budgets, and obtaining expert judgments (ibid., p. 4).

“Risk assessment” would be accomplished by acquiring appropriate data and developing risk assessment tools to analyze potential transportation risks. “Risk reduction” would be achieved by implementing measures to mitigate or reduce potential risks. These measures could be policies, procedures, recommendations, modifications to equipment, maintenance, or inspections. Finally, “risk monitoring” involves continually monitoring the effectiveness of risk reduction measures to ensure continuous improvements in risk management (ibid., p. 5).

OCRWM concluded the “Transportation Risk Management Approach” document by acknowledging that public acceptance of transportation activities will be achieved by incorporating stakeholder input and utilizing appropriate and reliable methods for risk management. OCRWM stated its intent to develop a “Transportation Risk Management Implementation Plan” to describe how the transportation risk management results would impact project decision-making. That document was never developed.
OCRWM’s most recent discussion of its approach to risk management was in the pre-decisional draft of the “National Transportation Plan” circulated in July 2007. In the draft plan, OCRWM stated that its risk management program would focus on technical, cost, schedule, and programmatic risks, all of which could be influenced and mitigated (DOE 2007a, p. 19). OCRWM proposed the following approach to the risk management process:

- Identify the risks that have the potential for adversely impacting the program;
- Assess each risk to determine its relative impact on the program, with the goal of prioritizing risks for further handling;
- Define options for handling or responding to the risk through avoidance, mitigation, management, or transfer to minimize the threats to achieving the program mission; and
- Monitor the status of known risks and continuously evaluate the program to identify, analyze, and handle new risks (ibid.).

The draft plan’s section on risk management did not include language on stakeholder involvement in identifying risks.

OCRWM did not develop a “Transportation Risk Management Implementation Plan” to detail its methods for managing transportation risk. Also, OCRWM did not engage in a substantial way with stakeholders in the areas of risk identification and risk communication. These topics would presumably be addressed in the “Transportation Risk Management Implementation Plan,” if developed.

Looking ahead, when OCRWM or its successor resumes work on a national transportation program, the “Transportation Risk Management Approach” from 1995 will need to be updated. The approach described in the document would seem to satisfy many of the later recommendations of the NWTRB and the NAS. However, in addition to stating its approach and issuing a risk management plan, OCRWM would need to actually establish a program for identifying, assessing, and managing transportation risks. To fully satisfy these recommendations, the risk management program would need to be established early with active involvement of stakeholders, be transparent, and utilize appropriate and reliable methods of analysis.
REFERENCES


MHLRWC. 1993. “Full-scale Testing of Spent-Fuel Shipping Casks (Resolution 93-1).”

MHLRWC. 1994. “Comments on the OCRWM Transportation Plan (Preliminary Draft).”

MHLRWC. 1995. “Comments on OCRWM’s Transportation Subsystem Operations Plan (Rev. 0).”

MRMTC. 2004. “OCRWM Key Issues” (draft for comment).


MRMTC. 2008a. “OCRWM Key Issues.”


DOE. 1992a. “Options for Providing Technical Assistance and Funding Under Section 180(c) of the Nuclear Waste Policy Act, as amended (Preliminary Draft).” Oak Ridge, TN: ORNL/SAIC.


DOE. 2006a. “DOE Order 413.3: Program and Project Management for the Acquisition of Capital Assets.”

DOE. 2006b. “Spent Nuclear Fuel Transportation: Lessons Learned from Security Planning and Execution.”

DOE. 2006c. “Summary Approach for Determining National Routes for OCRWM Shipments (draft).” DOE/OCRWM.


DOE. 2007d. “Report from AREVA, NC Site Visit and Interview.” DOE/OCRWM.

DOE. 2008a. “Comments on Dilger/Halstead Intermodal Paper.” DOE/OCRWM.


DOE. 2008d. “Helping communities prepare for transportation of spent nuclear fuel and high-level radioactive waste through their jurisdictions: Section 180(c) of the Nuclear Waste Policy Act” DOE/OLM-0510-revH (draft fact sheet). DOE/OCRWM.


DOE. 2008h. “Stakeholder Interaction: Getting stakeholders involved in transportation planning” (draft fact sheet). DOE/OLM-0509_revG DOE/OCRWM.


DOE. 2009. “National Transportation Plan – Revision 0.” DOE/OCRWM.


Dilger, Fred, and Bob Halstead. 2007. “Shipping Site Intermodal Transportation.” December 11.


Flater, Donald A. 1998. Letter to Lake Barrett, transmitting comments from the Midwestern High-Level Radioactive Waste Committee on the notice of revised draft policy and procedures for implementing Section 180(c). August 1.


Leuer, Kevin, and Melanie Rasmusson. 2009a. Letter to Dr. Frank Moussa providing comments from the Midwestern Radioactive Materials Transportation Committee on DOE’s Notice of Revised Proposed Policy and Procedures on “Safe Transportation and Emergency Response Training; Technical Assistance and Funding (October 31, 2008).” January 16.


Massaro, Mel. 2008b. “Ginna/Ontario Midland Railroad (Report on Shortline Study).” FRA.

Midwestern Legislative Conference (MLC). 1995. “Resolution on Testing of Spent-Fuel Shipping Casks.” Traverse City, MI.

MLC. 2003. “Resolution on Full-Scale Testing of Shipping Casks for Spent Nuclear Fuel.” Milwaukee, WI.


Niles, Ken, Barbara Byron, Kevin C. Leuer, Melanie Rasmusson, Martin L. Vyenielo, John Giarrusso, Jr. 2009. Letter to Frank Moussa providing comments from the West, Midwest, and Northeast on Rev. 0 of OCRWM’s National Transportation Plan.


NWTRB. 2009b. “*Transcript of the Spring Board Meeting.*” June.
Owen, Robert, and Jane Beetem. 2007. Letter to Corinne Macaluso, providing comments from the Midwestern Radioactive Materials Transportation Committee on DOE’s Notice of Revised Proposed Policy and Request for Comments on Safe Routine Transportation and Emergency Response Training; Technical Assistance and Funding.


Rasmusson, Melanie, and Paul Schmidt. 2010. Letter to Jo Strang, FRA Associate Administrator for Safety, regarding the states’ desire to see the establishment of a reciprocal rail inspection program. January 19.


S. 2589, the Nuclear Fuel Management and Disposal Act.


TEC. 2004. “Summary of the September 2004 TEC/WG Meeting in Minneapolis, Minnesota.”

TEC Intermodal Subgroup. 2008a. “States’ Concerns with Intermodal Shipments and Responses from the NEI panel.” May 14.


TEC Rail TG. 2006a. “Rail Planning Timeline (Rev. 4).”

TEC Rail TG. 2006b. “Tracking Subgroup Recommendations and Appendices.”


TEC Section 180(c) Topic Group (TEC 180c TG). 2005. “Section 180(c) Policy and Procedures Executive Summary and Issue Papers.”


