TASK 21.0 REVIEW OF TRANSPORTATION RECOMMENDATIONS AND RELATED ASSUMPTIONS CONTAINED IN REPORTS OF THE BLUE RIBBON COMMISSION ON AMERICA’S NUCLEAR FUTURE IN COMPARISON TO RECOMMENDATIONS OF THE NATIONAL ACADEMIES OF SCIENCES, INTERNATIONAL STANDARDS, BEST PRACTICES AND LESSONS LEARNED FROM OTHER RADIOACTIVE WASTE/MATERIALS SHIPPING CAMPAIGNS

FINAL REPORT

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Alvin H. Mushkatel, Ph.D.

Alvin Mushkatel, Ph.D.
alvin.mushkatel@asu.edu
15032 N. Moon Valley Dr. Phoenix, Arizona 85022
Submitted on behalf of Urban Environmental Research, LLC
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Executive Summary

The Blue Ribbon Commission’s (BRC) Final Report, issued in January of 2012, is a recent effort by federal authorities to redirect the nation’s programs for managing spent nuclear fuel and high-level radioactive waste [2]. Because of the myriad of studies and recommendations for remedying the management of these programs, the Nevada Agency for Nuclear Projects (Agency) requested that an assessment be prepared comparing the major recommendations made in federal reports and by various regional organizations and entities. This Report represents the results of this comparative assessment.

The substantive evaluation concentrated on the BRC report recommendations for the nation’s waste management program. However, seven other entities’ reports and recommendations were examined as well. The comparative evaluation of the recommendations of these reports in tabular form can be found in Appendix A. Four major areas of evaluation for comparison were utilized and include:

1. Societal transportation risk management,
2. Storage and waste packaging,
3. Transportation mode, routing and scheduling, and shipping
4. Shipment safety, regulations, and emergency preparedness.

Each of these four topical areas is composed of subtopics and the recommendations concerning each subtopic is listed in the four tables of the report and discussed. The anchor point for the evaluation is the BRC recommendations and how the earlier recommendations of reports from the National Research Council/National Academy of Sciences, the International Atomic Energy Agency, papers examining lessons from the Western Isolation Pilot Project, papers and recommendations from the Western Interstate Energy Board and Western Governor’s Association, the Federal Railroad Administration and the Council of State Governments’ Midwestern CSGM Radioactive Materials Transportation Committee Project, compare to the BRC recommendations. These various reports and organizations’ recommendations were not selected from the multitude of such materials dating back to the beginnings of the program more than thirty years ago to be representative. Rather, they were selected for either their
timeliness in-light of the BRC recommendations, or because of their utility in the context of the lessons that should have be learned, and must be understood and assimilated, moving forward.

The major conclusion of this review is that over time considerable consensus, or at least wide spread agreement about radioactive waste management policy recommendations has evolved. Most importantly, while there has evolved a growing acceptance of the necessity of these policy and program recommendations; there has remained a conspicuous lack of their implementation. Furthermore, the recent DOE Strategy for the Management and Disposal of Used Nuclear Fuel, (the Implementation Strategy report) that was to lay out the steps for implementing the BRC recommendations, raises considerable concern. The concern is that this lack of implementation of the apparent consensual policy recommendations will continue as the Implementation Strategy neglects BRC recommendations in several important areas discussed in the report. Finally, the recently released Draft Nuclear Waste Administration Act of 2013 appears at this early stage to lessen only some of the concerns surrounding the implementation of the BRC Recommendations that are raised by the DOE Strategy Report as it to does not address some areas identified by the BRC report as critical to Congressional action.

As implementation efforts move forward, it is vital to systematically track areas where consensus has emerged as reflected in the BRC report. Efforts at implementation should be analyzed to determine how they compare to these consensual areas and BRC recommendations to identify areas where action is still required, as well as where the implementing efforts differ from what has been recommended.

Introduction
The Blue Ribbon Commission’s (BRC) Final Report, issued in January of 2012, is a recent effort by federal authorities to redirect the nation’s programs for managing spent nuclear fuel and high-level radioactive waste [2]. Because of the myriad of studies and recommendations for remedying the management of these programs, the Nevada Agency for Nuclear Projects (Agency) requested that an assessment be prepared comparing the major recommendations made in federal reports and by various regional organizations and entities. This Report represents the results of this comparative assessment.
In order to curtail the scope of the comparative examination, two specific limitations were agreed upon in discussions between the Agency and the contractor. These discussions focused on a matrix prepared by the contractor of the major recommendations grouped by topic. The matrix revealed that recommendations, in just the areas of transportation of spent nuclear fuel (SNF) and high-level radioactive waste (HLW), could be classified into over eighteen topical areas. These recommendations had been garnered from eight agencies or organizations, federal and regional committees, and other entity reports, position papers or recommendations. Hence, the resulting matrix of recommendations includes 8 times 18 or 144 cells (at a minimum) and was far beyond the intended scope of the task. Fortunately, not all cells contained recommendations, and after discussions with the Agency, only a subset of these recommendations was analyzed in this report. A summary of all of the recommendations discussed in this report may be found in Appendix A.

Following a discussion of this matrix with the Agency, two specific limitations were placed on the study by the Agency: 1. Limiting the topics covered in the comparative examination to include four major topical areas largely revolving around transportation recommendations, and 2. Concentrating the analysis on the areas where recommendations varied despite their similar focus.

The four topical areas discussed and analyzed in the four tables in the report include:

- 5. Societal transportation risk management,
- 6. Storage and waste packaging,
- 7. Transportation mode, routing and scheduling, and shipping
- 8. Shipment safety, regulations, and emergency preparedness.

The recommendations included in the discussion of this report originate from several studies and reports that include:

Nuclear Future Washington DC. (BRC Transportation Subcommittee, 2012) [2A],


c. The International Atomic Energy Agency (IAEA) *Safety Standards: Regulations for the Safe Transport of Radioactive Materials* (IAEA, 2009) [4],


e. Two papers from the Western Interstate Energy Board’s (WIEB) High-Level Waste Committee evaluating the past efforts and making recommendations for the future of the program, and/or commenting on the Draft BRC Report (WIEB, 2000 [8], 2011 [9]),

f. U.S. Department of Transportation’s Federal Railroad Administration’s (DOT) perspective on the transportation of nuclear waste, (U.S. DOT, 2004) [10],


These various reports and organizations’ recommendations were not selected from the multitude of such materials dating back to the beginnings of the program more than thirty years ago to be representative. Rather, they were selected for either their timeliness in-light of the BRC recommendations, or because of their utility in the context of the lessons that should have been learned, and must be understood and assimilated moving forward. This report will clarify some areas of agreement, disagreement and areas of ambiguity in the four topical areas under examination. Much of this writing
effort took place waiting for the report from the Department of Energy (DOE) on the status of spent nuclear fuel and high-level waste BRC recommendations and the path forward that was to be presented in Las Vegas at a DOE RadWaste Summit in early September 2012, that was cancelled. Only on January 11th, 2013, did the DOE finally issue the long awaited Strategy Report for implementing the BRC recommendations [19]. Hence, the timing for this report to the Agency is fortuitous and allows us to take stock of the current status of recommendations as the next assessment by the DOE on how to move the Nation’s used nuclear fuel and high-level waste policy forward has just been issued.

1.0 The 2006 NAS Report and the 2012 BRC Report
Table 1 provides many of the recommendations found in the 11 reports examined that deal explicitly with the topical areas of: 1. the organizational structure of institutions that will be, or have been, charged with managing the nation’s nuclear waste policies, 2. the siting processes that need to be used for storage and disposal of these wastes (SNF and HLW), and 3. facets of social risk management. In short, the consideration of Table 1 will begin our examination of the recommendations related to the future of radioactive waste transportation and disposal in the U.S. Interestingly, it was the groundbreaking 2006 NAS Going the Distance report that first provided a series of important recommendations with regard to societal risk management that are developed upon by the BRC. This close relationship between the NAS report and the BRC report recommendations deserves a brief discussion prior to initiating our examination of the specifics of the recommendations.

The 2006 NAS report recommendations are discussed throughout the BRC report. In addition, the status of the NAS report recommendations as of January 2012 are provided in the BRC report. The BRC Subcommittee on Transportation recommendations to the larger full BRC were all accepted and included as part of the final BRC report except one which is noted in Appendix A. The Subcommittee report also contains a table detailing the status of the NAS’s recommendations, that were included in the BRC’s report (2A, P. 64-65, 2, P. 82-83). The question of whether the
BRC has adopted or accepted all of the NAS report recommendations requires some discussion before examining these two reports’ recommendations. In developing a vision and strategy for the back end of the nuclear fuel cycle (discussed below), the BRC adopts both core interests and objectives, and core values and principles to guide their study. None of the core interests and objectives (including public and occupational health and safety, environmental protection, cost effectiveness, and non-proliferation and national security are remotely at odds, and are entirely consistent with the recommendations contained in the 2006 NAS report. Furthermore, the underlying values and principles of the BRC approach necessary for the development of a successful strategy for managing nuclear waste explicitly includes ethical responsibility, fairness, transparency, values of those affected by the program and the broader public, informed participation, and changing the institutional leadership and governance of the program. All of these core values and principles are entirely consistent with the direction of the NAS recommendations. As the BRC notes, the best hope of a successful program is not changing the objectives of the waste programs but the approach.

Clearly, some facets of the program addressed in the NAS report are not explicitly addressed in the BRC report because of their different focus. More importantly, at no time did the BRC report or the BRC Transportation Subcommittee report provide any effort to dispute or take issue with an NAS report recommendation. Rather, as noted, the BRC report tracks (see Appendix A) the status of the NAS recommendations allowing the reader to determine what if any progress has been made since 2006. So, while the BRC report may recommend changes of strategy and principle that are greater in scope than what the NAS report recommends, a great deal has taken place since the 2006 NAS report with regard to the program and DOE’s effort to withdraw its license application. Hence, the recommendations from the two reports should be treated separately as they have a different focus. However, when addressing similar issues, the two reports’ underlying direction, analysis, and strategy recommended for the program appear entirely consistent whether the BRC explicitly or formally adopts the NAS recommendations or not.
1.1.1 The BRC Recommendations on Organizational Structure

The BRC report, as can be seen in Table 1 p. 21, recommends the creation of a new single purpose organization to develop and implement a focused, integrated program for the transportation, storage, and disposal of nuclear waste [2, p.60]. In keeping with the BRC report when referring to management three activities are being included: transportation, storage and disposal [2, p. 145 fn 158]. The management of the program according to the BRC would be best implemented by a corporate organization much like the Tennessee Valley Authority (TVA), which is a federally charted and mission-oriented corporation [2, p. 61]. However, it is key that the new organization possesses the independence and resources to carry out its mission [2, p. 62]. These last attributes have been listed as a recommendation in Table 1 for the BRC. While the specific organizational structure of a new agency may vary depending on Congressional action, one clear key to its success is the independence and resources to carry out its charge. The specifics of the various alternative structures for the new organization are less important than the actual reasons for its necessity. The alternative structure of the recommended new organization is not discussed in depth here (but can be found in both the BRC and NAS reports).

As noted, the BRC call for a new organization is the result of several factors. The BRC develops core interests, core values and principles that it believes are essential to a successful waste management program. The BRC recommendation states that Congress needs to charter a new organization to manage the consolidated and HLW program is rooted in these core interests and core values and principles guiding the BRC and its report.

These core values and principles guiding the BRC throughout its study are discussed below under the siting process in some depth. Here it is important to simply identify many of them which include, ethical responsibility, fairness and inclusiveness, transparency, values of those affected by the program and adaptability, informed participation through understanding and communication about the program and risk, and governance and leadership [2, p.6-8]. Throughout the BRC report these core values and principles guide the Commission in its recommendations, and form themes.
throughout the report from which we may view the recommendations of the BRC, and their realization is critical to the ultimate success of the program. The call for a new organization to run both the consolidated (interim) and permanent disposal of nuclear waste programs is in no small way because these core values and principles can no longer be achieved under the DOE and OCRWM’s leadership.

The BRC report is not the first scientific committee/commission to call for a new organization to be responsible for the leadership of the program. Indeed, the NAS committee in 2006 (discussed below) also called for the transfer of the HLW transportation program to an outside entity and provided an analysis of three potential new organizational structures. The BRC recommendations surrounding not only a new organizational structure, but a new siting process to form an integrated new program structure and process however, is the most far reaching. In fact, the BRC recommendations concerning these elements of the program, along with the values and principles that are identified to guide the new program closely resemble what various stakeholder and affected parties have been calling for over the past decades. In particular, they resemble much of what the State of Nevada has requested for the last 25 years. So what factors resulted in the BRC leaving DOE behind and recommending that movement forward could only be achieved through a new organization?

The BRC acknowledges the lack of trust that exists in the federal government’s ability to meet its program management responsibilities. The Commission roots this distrust, in part, in the decision in 1987 to characterize only one site in Nevada thereby altering the compromise underlying the 1982 Nuclear Waste Policy Act (NWPA) [2, p. 3]. Added to this distrust was the decision by DOE’s to withdraw its application for Yucca Mountain. As the BRC notes, this action and the record of the last few decades “... indicates that the current approach is not well suited to conducting a steady and long term effort, and to building and sustaining the degree of trust and stability necessary... of an integrated waste management strategy” [2, p. 61]. The BRC believed that it was important to signal a clear break with a history of decades of missed deadlines and changing commitments. Additionally, the BRC recommended that this new organization be directed by a board nominated by the President and confirmed by Congress. These
recommendations for a new organization to oversee waste management, and a new siting process (see below) are but two of many recommendations by the BRC that require legislative Congressional action. The BRC is not anxious to lay blame for the failures, as some of these failures are a direct result of the Congressional budgetary process that is discussed. Rather, the question that guides the Commission is how can we get the program back on track and move it forward. While the BRC is not a sitting body, as its charge makes clear, it nevertheless makes recommendations concerning the permanent disposal of HLW in involving deep geologic disposal [2, p. 27-31].

The inability of the Office of Civilian Radioactive Waste Management (OCRWM) and DOE to regain trust in the program they manage, in large part, results in the recommendation for a new organization and siting process. It is essential to break “with the often troubled history of the U.S. waste management program”, and in so doing “it can begin repairing the legacy of distrust left by decades of missed deadlines and failed commitments” [2, p. 61]. The BRC also believes that a new organization with a small agenda can move more quickly and not need to balance multiple agendas or policy priorities.

1.1.2 The BRC Siting Process Recommendations
The BRC recommendation on siting is the first report from a key commission that seems to embrace the State of Nevada’s and other key stakeholder entities’ position concerning not only DOE’s failure in management of the program, but also the abject distrust DOE had engendered. Indeed, the BRC embraces these positions by rooting any new siting process, for both permanent and consolidated storage in its ethical principles and values (as noted above). The BRC recommends a New Consent Based Approach to siting (Table 1). Key to this approach is that it be adaptive, staged, flexible, and transparent, and fair. The approach must earn broad public support and partner with state, and tribal governments, as well as with local governments [2, p. 68]. To its credit, the BRC is consistent in developing core principles and values to be adhered to and then recommending changes that are consistent with these values. When confronting the issue of what consent means or how it is to be determined in this new process, the BRC becomes ambiguous. For example, the BRC indicates that the
consent based process has to ultimately be answered by the potential host jurisdiction [2, p. 57.] The BRC also suggests that one good gauge of consent might be the willingness of the affected parties and the state to enter into legally binding agreements with the facility operator. Hence, whether consent might be overt approval through an election referendum, or some overt act by a Governor or legislature, or some other process is simply not adequately addressed by the BRC which remains ambiguous on this point.

The recommended siting process by the BRC also leaves how the potential (some might argue inherent) conflicts that arise in a siting process that is to reflect values and processes that are adaptive, staged, flexible, transparent, and fair ought to be resolved. For example, Halstead and Williams examining the recommended siting process agree with the importance of a consent based process, but take issue with the BRC when it suggests that flexibility or an adaptive process means that the development of standards need not delay progress in early siting stages [13, p. 3]. Rather they argue that a siting process should not be initiated until the new recommended program’s organization has completed “ . . a public process resulting in acceptable site selection criteria, and the NRC (Nuclear Regulatory Commission) and EPA have final standards and regulations in place”. Hence, a potential conflict between public health and safety standards and a flexible siting process has already emerged. Interestingly, just as the BRC is arguing for this new siting process based upon flexibility and adaptive stages, it additionally notes that “…we also believe that attention to process must not come at the expense of progress and we are sympathetic to the numerous comments we received asking to include a more detailed specific set of milestones in our final report [2, p. x]. Clearly, the conflict inherent in the issue of progress versus process is far from resolved in the BRC report, and we can only hope that the other lesson learned that appeared in the Draft Report, but is not found in the Final BRC report, has not been forgotten. That lesson of caution stated “ Any attempt to force a top-down, federally mandated solution over the objections of a state or community-far from being more efficient-will take longer, cost more and have lower odds of success (Draft 2, p. vi).
The second and third recommendations of the BRC on siting are also essential to the report and must be viewed together with the new siting process that has been recommended (See Table 1). The second recommendation examined focuses on the need to move the program ahead by developing one or more consolidated (interim) storage facilities [2, p. xii, 32-39, 2A, p. iii, 32-36]. The third recommendation under the siting process in Table 1 entails the necessity of making prompt efforts to develop a new geological disposal facility [2, p. xi, 32-38]. The BRC report argues that the program for SNF storage in the U.S. has been ad hoc and a comprehensive and coordinated effort is needed [2, p. 32]. The BRC distinguishes between disposal which involves the permanent disposal of waste in a geologic disposal facility and a consolidated storage facility involving the interim storage pending its ultimate disposition through reuse or disposal [2, p.35]. The BRC report argues that the two together are needed to increase the capacity and development of the waste program, as well as getting the waste management program back on track. Some of the reasons for this two pronged approach besides increased capacity include: 1). to address the growing financial and legal liabilities emanating from the DOE’s failure to meet its waste acceptance obligations in a timely manner, 2). to increase the confidence in the safety and security of current storage arrangements and to alleviate some of the pressure on some utilities to increasingly pack spent fuel rods in wet storage more tightly, 3). to allow for the addressing of any increased concerns about safety and security in the wake of the Fukushima disaster [2, p. 32]. Of course, the BRC believes this strategy will also increase trust in the new organization’s ability to manage the waste program as small successes in developing the needed elements of a consolidated storage site and transportation program prove to be successful. In addition, the new organization will gain needed experience in all of the required components of siting facilities and transportation of waste.

The BRC report reminds us, regardless of what happens at Yucca Mountain, the U.S. inventory of SNF will soon exceed the amount that can legally be emplaced at the site until a second repository is in operation [2, p. 32-38]. Consolidated storage provides not only needed additional storage capacity, and flexibility and adaptability (two core principles that should guide the program), but also the development of these facilities do
not require additional Congressional approval. In fact, the BRC argues their
development may be carried out under the provisions of the Nuclear Waste Policy Act
(NWPA) provisions covering the development of the MRS facility [2, p.37]. Hence, the
BRC recommends the development of the consolidated storage sites and facilities
without further delay [2, p. 30]. The BRC believes that important steps will be taken
toward restoring trust in the waste program from the rapid development of consolidated
storage facilities.

The BRC acknowledges the lack of trust that exists in the federal government's ability to
meet its cleanup and management responsibilities. The Commission roots this distrust,
in part, in the decision in 1987 to characterize only one site in Nevada thereby altering
the compromise underlying the 1982 Nuclear Waste Policy Act (NWPA) [2, p. 3]. Added
to this distrust was DOE's decision to withdraw its application for Yucca Mountain. As
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Hence, the BRC recommended the new organization be directed by a board nominated
by the President and confirmed by Congress. These recommendations for a new
organization to oversee waste management, and a new siting process (see below) are
but two of many recommendations by the BRC that require legislative Congressional
action.

The BRC recommended organizational structure and siting changes are lacking in many
details when addressing issues surrounding their implementation. The responsibility for
implementing the restart of the consolidated and HLW disposal program along the lines
recommended rests with Congress. The lack of implementation detail, for example, is
evident when the BRC provides little insight into how Congress is to be convinced to
move the programs in the recommended direction other than to try and show the
financial rationality of such program changes, and by imploring that the utility waste
disposal fees be used for their intended purpose [2, p. 74-80]. Similarly, how one

develops a new HLW program that is wrapped in ethical responsibility, fairness, transparency, reflect the values of those directly affected by the program or obtain informed participation, values which may periodically be at odds or at least result in strenuous competition among affected parties, is unclear. These values and the BRC recommended direction for the program are in many ways precisely what that critics of the DOE programs have been articulating for decades. The absence of an explicit implementation strategy and detail is a shortcoming in the context of the decades long wait for this recommended new direction for the programs. Unfortunately, many of these changes in organizational structure and siting process are changes that require Congressional legislation or amendments to existing legislation [2, p. viii].

1.2. The NAS and Organizational Structure and Societal Risk Management

One area of recommendations in the studies being examined encompasses societal risk management. Until recently, many reports have failed to include this area of analysis when assessing the status of radioactive waste management. Indeed, the 1980s Nevada Socio-Economic team reports published by the Agency were critical in leading the DOE and other agencies to begin to examine this facet of their program management. Societal risk entails not only the direct relationship between the frequency (or likelihood) of an event and the number of people affected, but also what is labeled as social risk [1]. Social risk can have direct impacts on one’s well-being including impacts on health or economic well-being such as loss in property. Additionally, social risk may have perception based impacts that may include loss of trust in governmental institutions, and/or confidence in the regulator, increased anxiety and stress, loss of a sense of security and safety, reduced property values (etc.) (see below) [1, 2, p. 151].

1.2.1 The NAS Recommendations on Organizational Structure

Part of the importance of the 2006 NAS recommendations is derived from the fact that for the first time an outside independent scientific body formally recommended transferring (removing) from DOE responsibility for transporting SNF and HLW to a federal repository [3]. The NAS Committee responsible for the report argued that the program is deeply embedded in an organizational structure that is not capable of the necessary flexibility required to implement the transportation program and that DOE’s
other responsibilities to other elements of the repository program were hampering transportation efforts (flexibility and adaptability, it should be noted, were important factors required by the BRC for its core values and principles to be realized by the program). The NAS report recommended (see Table 1) three alternative organizational structures that should be considered for managing the program: including a quasi independent office in DOE with separate reporting directly to upper level management within DOE; a quasi-government corporation; and a fully private organization operated by the commercial nuclear industry [3, p. 260-261].

Perhaps a more insightful, but less sensitive way of stating this NAS recommendation is simply that DOE’s organizational structure was found to be incapable of adequately managing the transportation component of the repository program. Had the NAS report examined more than the transportation component of the program, it might have expanded upon its recommendation to include reorganization of the entire program under a different structure as the State of Nevada has recommended since the late 1980s and as the BRC recommends. However, the significance of this NAS recommendation should not be understated given its origin, or the direction of many of the NAS other recommendations that appear to be consistent with Nevada’s long held positions, or the fact that the 2006 NAS report clearly provided the groundwork for the BRC recommendations. Prior to the NAS recommendation on organizational structure, only Nevada and the State Regional Groups (SRGs) articulated the necessity of an organizational restructuring under a new agency. However, after the NAS report this necessity was legitimated so when the BRC made its recommendation it appears to be a logical step to perhaps everyone but the federal agency.

1.2.2. The NAS Recommendations on Social Risk

The NAS 2006 report addresses social risk explicitly, and Table 1 presents some of its recommendations associated with this topic. Social risk, the NAS report notes, can result in direct social and economic impacts (discussed above) or they may be perception based impacts [3, p. 149-161, 180-182]. In discussing the relation of these two types of social risk impacts, the NAS report notes that the direct effects of risk can be amplified or dampened depending on the perceptions of the public about such risk
(for example transporting nuclear waste). Public trust and confidence in the government agencies involved can be critically important to whether risk perception is amplified or dampened. The NAS believes research shows that transportation planners and managers can take steps to manage social risks. These steps may result in greater transparency and openness of transportation planning, and possibly increase trust and confidence in programs [3, p. 181].

The NAS report in discussing social risk appears almost like a cookbook approach at times—you mix a bit of trust and confidence and obtain lower risk perceptions resulting in less direct impact from transporting waste. Yet, these risk perceptions and the loss of trust in the managing or governing institutions or programs may be developed and reinforced over decades, and are not easily managed or transformed. Despite this oversimplification, the NAS recommendations in Table 1 concerning social risk represented a giant leap forward for a report from the NAS focusing on the transportation of radioactive waste. The NAS specifically made two recommendations aimed at gaining high quality information and advice about social risks and their management; a). expand the membership and scope of the existing advisory group the Transportation External Coordination Working Group or TEC allowing DOE to gain outside advice on social risk including impacts and management, and b). establishing a “transportation risk advisory group”. This transportation risk advisory group would provide advice on “. . .characterizing, communicating, and mitigating the social security, and health and safety risks. . .” that arise from transporting HLW or SNF to a consolidated or permanent storage site [3, p. 181]. In addition, the NAS suggested that the Nuclear Waste Technical Review Board (NWTRB) scope might be expanded to include this function, and that this advisory group operate openly and be composed of risk experts including the social sciences.

The NAS recommendations for social risk, according to the BRC report that tracked the status of the recommendations, found no specific changes by DOE or other agencies as a result of the NAS recommendations [2, p. 82]. The TEC was defunct by 2012, and did not have its scope expanded to include the NAS recommended functions. In addition, the NWTRB while periodically examining issues of transportation risk, did not have an
external risk advisory group added to its organizational structure. The lack of change is not a surprise as the DOE program continued on its course with the usual upheavals and changes in direction. Indeed, as Nevada investigators have long been aware, the frequent abrupt changes in program direction, in leadership, and staff often resulted in a lack of institutional memory and other instability in the program that reinforced the public’s risk perceptions and lack of trust in the program. The effort by DOE to withdraw its license application for the repository is just the most recent of these directional changes albeit the most abrupt since 1987. Yet, additionally, the NAS social risk recommendations appear so generic and pedestrian given the knowledge that existed about social risk then and now, that they reflect just how reticent the DOE was in making any changes along these lines. Hence, placed in the context of the DOE management of these programs and how the agency may have viewed social risk factors, the NAS recommendations appear to be a giant step forward. However, the NAS recommendations really only represented an incremental step in the context of the program at that time, and the rest of the risk management world that had been aware of the importance of these steps decades earlier.

1.3 The WIPP Recommendations on Social Risk

The recommendations concerning social risk arising from the reports on the Waste Isolation Pilot Plant (WIPP) in New Mexico emanate from the reports listed above [5, 6, 7]. All three of the papers examined indicated that a strong public opinion or outreach program that honestly reported risks and sought public input to key elements of the WIPP program had been extremely important in establishing the ground work of trust for the WIPP program (Table 1). In addition, the paper that assesses WIPP 10 years after it opened suggested that altering the commonly held perception that shipping nuclear waste was dangerous and that the citizens did not trust the government to assure safety was critically important to the WIPP success [5, p. 4]. Finally, one of the WIPP assessments suggests that the public information campaign was important in keeping the public informed about the shipping campaign and all that was being done for to ensure safety gradually altering public perceptions of risk [7, p. 102]. Hence, the recommendations for these three reports emphasize the importance of keeping the public well informed and developing a safety program early on.
1.4.1 The WGA-WIEB Recommendation on Siting
The Western Governors’ Association (WGA) through Policy Resolution 11-3 [12], and the Western Interstate Energy Board’s Committee on High-Level Waste (WIEB) through comments to the BRC, also took strong positions on any future siting process [9]. As seen in Table 1, the WIEB comments on the Draft BRC report referred the Commission members to the WGA Policy Resolution 11-3 noting the policy adopted called for no centralized interim storage facility being located within a western state without the written consent of the governor [12, p. 3]. In addition, both the WGA in its policy resolution, and the WIEB comments on the Draft BRC report note their growing concern over regional fairness and how it will be represented in an integrated national policy. The issue of equity and fairness are core principles and values for guiding the BRC recommendations, but there is little reference to issues of regional-east vs. west, location of producers versus the storage of waste-economy in the BRC report. Halstead and Williams also emphasize this regional fairness argument pointing out in their work that in the last 25 years, no consolidated or permanent storage site has been sought in any state of the 35 states north of the 100th Meridian where over 90% of the nation’s SNF has been generated [13, p. 6]. In short any siting process that is consent based, transparent, phased, adaptive, science based, and governed by partnership arrangements with states, tribes and local communities, that the BRC endorses, needs to address this complex issue of regional equity.

1.4.2 The WGA-WIEB Recommendation on Social Risk
The WIEB Report Card recommended that WIPP had been so successful that the DOE should follow its public information program to gain support and alter perceptions [8]. The efforts by New Mexico and the DOE in keeping the public informed about shipments and gaining public confidence and trust is identified as a model worthy of emulation by some of the papers reviewed [5, 6, 2]. Clearly the WGA-WIEB report card endorses the WIPP public information program but also believes that additional efforts will be needed in any program of this size being contemplated for consolidated and permanent disposal (Table 1).
1.5 The CSGMW Recommendation on Social Risk

Janairo and Bailey writing for the Council of State Governments, Midwestern Office suggest that the OCRWM or a successor organization can utilize new technologies to communicate with the public and stakeholder groups (Table 1) about elements of the program [11, p. 9]. In “crafting” the public information program the views of the states and stakeholders should be reflected. The CSG, Midwest Office (CSGMW) paper reflects back to the 1993 Secretary of Energy’s Advisory Task Force on Radioactive Waste Management report, a two year study on how the DOE “might strengthen public trust and confidence in the civilian radioactive waste management program [14, and 11, p. 9]. The authors note that the report found that DOE not only found a widespread lack of trust in DOE’s waste management activities, but also possessed a constricted view of what was necessary for trustworthiness. Hence, DOE had not adopted a consistent approach for restoring trust and confidence, and rarely considered the consequences of its actions on public confidence and trust. Rather than consultation and collaboration with states and affected stakeholders, DOE actions were often review-and-comment functions as late as 2009 [11, p. 9]. The authors suggest that establishing public confidence requires a web site with complete information on transportation topics, meetings with the public about what is of interest to them, and reaching out for feedback after meeting to further reflect the needs of the public (Table 1). Obviously, such steps are just the beginning to the development of public confidence and altering public perceptions about risk.

1.6 Social Risk Management Summary

The review of the social risk management recommendations in Table 1 reveals consistent themes concerning the necessity of restoring trust in the radioactive waste disposal programs. Increasingly, there is a belief that the DOE is not the right agency for getting the programs back on the right track, altering the public’s risk perceptions or managing the transportation or radioactive waste. Hence, while these reports may vary in scope and focus, their recommendations seem to strike very similar chords about social risk management.
Table 1 Siting Process & Consolidated Storage Disposal Facility

<table>
<thead>
<tr>
<th>Report</th>
<th>Organizational Structure</th>
<th>Siting Process &amp; Consolidated Storage Disposal Facility</th>
<th>Social Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Ribbon Commission Report</td>
<td>A new single purpose organization is needed to develop and implement a focused, integrated program for the transportation, storage, and disposal of nuclear waste [2, p. 60]. The organization is independent and has the attributes and resources to carry out its mission. [2, p. x, 62; 2A, p. vii].</td>
<td>1). New Consent Based Approach to Siting (Recommendation #1) that is adaptive, staged, flexible, transparent, and consent based approach. Partnership with state, local, and tribal governments [2, p. viii; 2A, p. viii, 60-69]. 2). Prompt Efforts to Develop One or More Consolidated Storage Facilities [2, p. xii; 2A, p. iii, 32-36]. 3). Prompt Efforts to Develop a New Geological Disposal Facility (Recommendation #4) Regardless of what happens with Yucca Mountain, US inventory of spent nuclear fuel will soon exceed the amount that can be legally emplaced at this site until a second repository is in operation [2, p. xi, 27-29].</td>
<td>Be proactive in formally assessing and managing social risks. Expand Transportation External Coordination (TEC) Working Group to include this issue, establish external risk advisory group, potentially under NWTRB auspices. [2, p. 82; 3, p. 181].</td>
</tr>
<tr>
<td>NAS Going the Distance</td>
<td>DOE and Congress should transfer responsibility for spent fuel transportation to an outside entity. [2, p. 83; 3, p. 261] Recommendation includes three options for a new organizational structure: 1) a quasi-independent DOE office reporting directly to upper level DOE management 2) a quasi-government corporation 3) a fully private organization operated by the commercial nuclear industry [3, p. 261].</td>
<td></td>
<td>WIPP kept the public well informed and used public opinion to better formulate shipping [7, p. 102]</td>
</tr>
<tr>
<td>WIPP</td>
<td>Consent based approach emphasizing cooperation and consultation with states and communities, requiring written consent of host state governor, ensure regional fairness [9, 12].</td>
<td></td>
<td>DOE should follow the WIPP program to develop a safety and public information program [8].</td>
</tr>
<tr>
<td>WGA-WIEB</td>
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<tr>
<td>Report</td>
<td>Organizational Structure</td>
<td>Siting Process &amp; Consolidated Storage Disposal Facility</td>
<td>Social Risks</td>
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<tr>
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</tr>
<tr>
<td>CSG Midwest</td>
<td></td>
<td></td>
<td>To adequately inform the public, organization 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. [11, p. 9]</td>
</tr>
</tbody>
</table>
2.0 Storage and Waste Packaging

Table 2 provides information concerning the recommendations on waste packaging and casks contained in the eleven reports examined. The recommendation list is short because of both the focus of the reports being examined are largely on other issues, and the widespread *agreement* on the topic in the reports examined. However, despite the brevity of the discussion in the reports on the waste packaging, the issue of storage and packaging of SNF is central to the BRC report recommendations as seen below.

2.1 The BRC on Storage and Packaging of Waste

The BRC distinguishes between disposal and storage [2, p.vii], as noted earlier. Disposal means permanent disposal at a repository in the BRC report. However, storage of SNF for an interim period prior to permanent disposal acquires the term consolidated storage in the BRC report. For the BRC the use of consolidated storage is one of the keys for getting the SNF program back on track.

The BRC recommends (Table 2, Page 29) that the U.S. government proceed to develop consolidated storage capacity without further delay [2. P.39]. Consolidated storage site(s) is a key step for the program, and the BRC refers to such consolidated storage as the “…*fundamental policy question for spent fuel storage*” [2, p. 35]. There are several reasons the BRC believes the development of consolidated storage is the fundamental policy question confronting the nation. Briefly, the reasoning includes much of the following. First, the BRC believes that permanent disposal capacity will require a lengthy period and that consolidated storage sites can be developed much quicker. Hence, development of these sites is recommended and transfer of the waste should be made to federal control pending reuse or ultimate disposal [2, p. 35]. In short, the federal government can begin to meet its waste acceptance obligations and begin to develop credibility again.

Second, significant cost savings can be achieved by developing such sites and transferring “stranded” SNF from shutdown reactor sites to the consolidated storage site(s). The nine shut down reactor sites where reactor fuel is in storage have in fact become long-term storage sites without ever consulting the host communities it is
argued. However, these communities have no benefits that a host community might have if it were a dedicated storage site. It is these conditions associated with these closed or shut down sites that results in an additional recommendation by the BRC discussed below, “…namely that SNF at these sites be first in line for transfer to the consolidated storage site” [2, p. 36].

The next reason the BRC believes that consolidated storage would support the repository program is by giving the agency responsible for planning and executing the program valuable experience in all aspects of a repository program except deep burial of the waste. Third, lessons learned from the Fukushima accident suggests that consolidated storage provides an additional storage option for hot fuel should it be necessitated as clearly needed following the Japanese accident. Waste at the consolidated storage sites also offers scientists additional research opportunities about how waste systems in use at different sites operate over time by observing them once they are at the consolidated storage sites. Perhaps most importantly a consolidated storage site would allow for and act as the catalyst for the development of a standardized cask system. While not a formal recommendation by the BRC, the discussion of standardization of cask systems is clearly of key importance to both the arguments supporting consolidated waste sites and the entire waste management program [2, p. 39]. At some sites there is little ability to monitor the condition of waste in storage, as well as limited ability to handle the waste; some standardization of the waste packaging or casks used in transport is very desirable according to the BRC.

2.2 The BRC Transportation and Storage Committee Recommendation

This issue of standardization of the cask system for storage (Table2) receives great emphasis by the BRC Transportation and Storage Subcommittee (BRCTS). The BRCTS reminds the reader of both efforts by DOE to standardize the cask system with first, the multi-purpose canister (MPC) and later for the repository in the license application the transportation-aging-disposal (TAD) canister [2A, p. 15]. The development of a standardized cask would facilitate the interim storage of waste and subsequent transport of it to consolidated storage. Neither of these two canisters were
ever fully implemented despite some success in their specification development and work with the utilities.

The BRC, as noted above, stresses the importance of research on the waste containers and systems in use. As can be seen in Table 2, the BRCTS provides an even more extensive recommendation regarding how essential additional research is in this area. The BRCTS recommendation number 2, not only calls for high standards of safety and security for densely arrayed fuel in wet storage, as well as additional research on sabotage and terrorism. In addition, the BRCTS as part of this recommendation suggests full scale cask testing [2A, p. v, 14-15]. This portion of the second recommendation on full scale cask testing receives scant discussion by the BRCTS (or the BRC for that matter). Rather it appears to be incorporated from the NAS 2006 recommendations (discussed shortly) that are listed on pages 64-65 of the BRCTS report. Once again, the NAS recommendations are not formally adopted by the BRC or its subcommittee. However, the discussion of full scale cask testing in the BRCTS suggests that at least the subcommittee is accepting what appears to be agreement on this topic.

2.3 The NAS Committee Recommendation

Indeed, there does not appear to be any widespread disagreement on the wisdom of full scale cask testing (a long held State of Nevada position) any longer. As can be seen in Table 2, the NAS recommendation on packaging requires the full scale cask testing and modeling under extreme conditions as part of an integrated analysis [3, p. 108]. The NAS specifically does not recommend full scale cask testing to destruction as part of the program to validate package performance. The BRC notes that this recommendation by the NAS was planned to be implemented by the NRC but was never started because of a lack of funding and eventual cancellation of Yucca Mountain.

Perhaps of even greater interest is the second recommendation by the NAS on the topic of storage that does not appear to be tracked or absorbed into the recommendations of the BRC or the BRCTS. Specifically (as can be seen in Table 2), the NAS recommended that the NRC should build on recent progress that has been made in understanding the performance of waste packages in long duration fires [3, p. 107]. In
addition, the NAS called for the NRC to undertake additional analysis of very long duration fire scenarios that “. . . bound expected real-world accident conditions for a representative set of package designs that are likely to be used in future large-quantity shipping programs’ [3, p. 107]. The NAS further recommended that based on the results of such tests the NRC implement operational controls and restrictions on SNF and HLW shipments as necessary to reduce the chances that such fire conditions might occur [3, p. 107].

This NAS recommendation on long duration fires is in part based on the Committee’s understanding of not only how important it is that the waste packages shipments be safe, but also that the public perceive the shipments as safe. Clearly, the NAS Committee understood just how important it was for members of the public to perceive the shipments were safe, especially those living along transportation routes [3, p. 101]. The BRC report, as we have discussed, also makes it clear how important the perception of safety is to rebuilding trust in the program and for the new entity that will be running the program. This development of trust can only result if the core values designed into the new program are reached and it is essential if the program is to succeed. Yet, for some reason the BRC report does not contain a formal recommendation on this topic, and only tracks the NAS recommendation status. Despite the fact the BRC tracks the NAS recommendations and their current status, this NAS recommendation on package performance in long duration fires is not recommended by the BRC or its subcommittee the BRTSC. This lack of inclusion in the BRC report is perplexing especially in-light of its importance to the various stakeholder groups which have made not only full scale cask testing, but also testing in extreme conditions including very long duration fires a key component of their studies (Table 2). The lack of a key recommendation by the BRC on full scale testing is particularly perplexing in-light of the BRC tracing the history of DOE and the NRC positions on cask testing and noting that both the NRC and DOE agreed to do full scale cask testing with a scenario involving a locomotive traveling at high-speed followed by a hydrocarbon fire [2, p. 84]. The DOE had decided to include an emergency response exercise with its testing, but funding evaporated for it in 2009. Apparently, the BRC committee decided such a
recommendation outside of its purview because there seemed to be a consensus on this issue by 2009.

2.4 The International Atomic Energy Agency on Cask Storage

The International Atomic Energy Agency (IAEA) also has standards regarding cask or storage requirements for SNF as can be seen in Table 2. The recommendations in Table 2 for the IAEA are but a few of what might be selected from the IAEA 2009 Safety Standards because the IAEA document used for this report represents a litany of standards for the safe transport of radioactive materials. The regulations establish requirements that must be satisfied to ensure safety for persons and property, as well as the environment in the transport of radioactive materials [4, p. 2]. The IAEA standards impose performance standards on package designs depending on the hazard of the contents of the package, and by imposing requirements on the “...design and operation of packages and on the maintenance of packaging “, including consideration of the radioactive contents [4, p. 2]. The approach ensures safety by adopting regulations that assure safety when complied within a graded approach that have three severity levels: a. routine conditions of transport (incident free), b. normal conditions of transport (minor mishaps), and c. accident conditions of transport. As such, there are a very large number of regulations that might be included in this report. In part the large number of standards when compared to the other reports and materials used in this report are also a function of the fact that the IAEA document examined is an actual standards document for the transport of radioactive waste. This purpose is very different from the other reports being examined here. Rather than dropping the IAEA standards from the analysis because of its lack of comparability, a few general observations will be drawn from the IAEA standards. Hence, in the interest of parsimony only one or two regulations that permit comparisons directly to the other reports are utilized.

Table 2 provides the first of these IAEA comparable standards. Namely the IAEA standards make it clear that performance testing for models is acceptable depending on the waste being packaged and shipped. Under certain circumstances a variety of tests involving free drops, leaching and leakage, and testing the integrity of the containment and shielding system are required [4, p. 87-105]. However, it is not clear that the IAEA
requires full scale cask testing, but more importantly it does not in its 2009 standards require testing for extreme very long duration fires. Hence, it appears that the IAEA in 2009 was not consistent with the NAS recommendations for this type of cask testing.

2.5 The Western Interstate Energy Board (WIEB) on Packaging

The WIEB also weighed in on the issue of cask testing in 2000 when it issued a report card on DOE’s program [8]. The WIEB called for DOE to commit to full sale cask testing (Table 2) and to agree to go along with the WGA Resolution 99-014 that in part, asked DOE to commit to full-scale cask testing of casks to be used in shipping SNF/HLW [8, p. 6]. The DOE at that time had indicated that it did not intend to conduct full scale destructive testing of transportation casks. Hence, as early as 1999, the issue of full scale testing of casks had formally been raised by one of the key stake holder groups at the regional level, and the request denied by DOE. In this context, the WIEB/WGA call for full scale testing is consistent with both the NAS, and the BRCTS recommendations and quite possibly, as discussed above, the BRC.

2.6 The Council of State Governments, Midwestern Office Recommendation

The Council of State Governments, Midwestern Office (CSGMW) paper by Janairo and Bailey provides an instructive history of efforts to obtain DOE agreement to test full scale cask model. DOE planned on only ¼ model testing of rail casks and ½ model testing of truck casks that was a part of the DOE Transportation Institutional Plan of 1986 [as noted by 11, p. 39]. The CSGMW had called on DOE to undertake full scale cask testing with a resolution in 1993, joining the State of Nevada in this request and soon joined by the WGA in 1999. However, DOE continued to oppose this testing. In addition, the CSGMW called upon the Nuclear Regulatory Commission to conduct these tests as the regulator rather than DOE as the agency charged with program implementation [11, p. 40]. In 2005 the NRC adopted this recommendation including the engulfing fire, and its staff was directed to seek DOE funding for the testing, but the Yucca Mountain license application was withdrawn halting further action on the NRC negotiation with DOE to fund this testing. Table 2 provides the CSGMW recommendation on full scale cask testing which is fully consistent with the other major organizations that focused on this issue.
Table 2 Storage & Waste Packaging

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>Storage &amp; Waste Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRC Transportation Sub-Committee</td>
<td>All near term forms of storage meet high standards of safety and security for the multi-decade-long time periods that they are like to be in use. Research should be focused on degradation phenomena, vulnerability to sabotage and terrorism, full scale cask testing, and other matters (Recommendation #2) [2A, p. v, 14-16; 2, p.41].</td>
</tr>
<tr>
<td>NAS Going the Distance</td>
<td>Full scale cask testing in extreme conditions should be utilized [2, p. 82,84; 3, p. 81, 108] 2. The Nuclear Regulatory Commission should build on recent progress in understanding package performance in very long duration fires [3, p. 107].</td>
</tr>
<tr>
<td>IAEA</td>
<td>Testing for different types of radioactive materials shipments can rely on performance tests with models when appropriate [4, p. 105-106].</td>
</tr>
<tr>
<td>WIPP</td>
<td>Packaging approved by NAS, must meet NAS and DOT radiation limits. Different types of containers for different waste [2, p. 87].</td>
</tr>
<tr>
<td>WGA-WIEB</td>
<td>DOE must commit to full scale testing of casks before any transportation of SNF/HLW [8].</td>
</tr>
<tr>
<td>CSG Midwest</td>
<td>Advocate of full scale cask testing, by the Nuclear Regulatory Commission [11, p. 38].</td>
</tr>
</tbody>
</table>

3.0 Mode of Transport, Routing and Scheduling and Shipping

Examining these three topical areas, mode of transport, routing and scheduling and shipping in one section offers a considerable challenge. It is difficult to keep these topics analytically separate. However, they do belong together for discussion as they involve the method or mode of how the waste will be transported, the selection of routes for
shipment of the waste, and the scheduling of the radioactive waste to be transported. Hence, analytically these topics appear to be part of the same continuum and are treated together in Table 3. While the issue of the mode of transport and routing are long standing issues that have been discussed, the issue of the scheduling the shipments has only had limited discussion. The reason for this comparative lack of attention on scheduling of waste shipment is that until recently it has been assumed that the Standard Disposal Contract (Standard Contract) governed the timing of these shipments. The Standard Contract appears to give utilities considerable latitude over which waste would be shipped when [3, p. 224-225]. However, the issue of which waste will be shipped or queuing has received a good bit of attention lately (at least since the NAS 2006 report) and will be examined under the heading shipping. [15].

3.1 The NAS Recommendations
Table 3 provides the NAS recommendations regarding the mode of transportation, routing and scheduling, and shipping of SNF and HLW. Table 3 provides references at the end of the entry identifying where each recommendation may be found, as has been done in the other tables. As discussed earlier, both the BRC and the BRCTS have included in their reports the recommendations of the NAS 2006 report without formally adopting the NAS recommendations. In addition, the BRC and BRCTC also provide current assessments of the status of each of the NAS recommendations. Our earlier discussion suggested that this failure to formally adopt the NAS recommendations was largely a function of the supposed differing focus of the reports namely, not to study the Yucca Mountain siting as the BRC was not a siting body. Despite their charge, the BRC and its Transportation and Storage Subcommittee examine the principles that must be adhered to in order to site consolidated or interim storage facilities. In addition, as discussed at length above the BRC makes it clear that the principle or core values that it adheres to are essential in any siting and that the goal it pursues of an integrated waste management program will only be realized if these core values and principles are realized.

The NAS recommendations as discussed above were shown to be entirely consistent with the principles and recommendations of the BRC and its subcommittee on
transportation and storage. Hence, it appears there must be other reasons besides just the focus of the commission explaining why the BRC did not formally incorporate the NAS recommendations. In any event, Table 3 notes where the NAS recommendation may be found in the BRC report. All of the entries for the BRC in this manner might also be repeated for the BRCTS but in the interest of parsimony these are left out of the table. Where appropriate the status of the NAS recommendation is provided as reported on in the January 2012 BRC report, even though these recommendations are not formally adopted by the BRC.

3.1.1 The NAS Recommendation on Mode of Transport
The NAS committee strongly endorsed DOE’s “mostly rail” mode of transportation option for shipments because rail reduces the number of shipments needed, and because rail shipments have a greater physical separation from other vehicles and reduced interactions with people along the routes. In addition, the NAS believed there was a clear public preference for the rail option and that operational logistics were simpler and more efficient than truck [3, p. 217]. Table 3 provides the reader with the NAS recommendations. In addition, to endorsing the DOE rail transport decision, the Committee urged DOE to complete construction of the Nevada rail spur, obtain needed rail packages and conveyances and work with utilities to ensure facilities at the plants are available for the mostly rail option to be implemented [3, p.217]. As part of this recommendation the NAS urged DOE to expand the use of intermodal transportation (combining heavy-haul truck, legal weight truck and barge is the NAS example) to reduce the number of cross-country truck shipments [3. P. 217].

The NAS committee further noted that it could not find evidence for a radiological risk based advantage for dedicated trains over general trains transport. However, the NAS did find advantage of dedicated trains for operations, safety, security, communications, planning and public preference [3, p. 232]. Hence, the next NAS recommendation listed under Mode of Transportation in Table 3 is that DOE should fully implement its dedicated train option before large quantity shipments started [3, p. 233]. In fact, as the NAS points out the DOE announced in July 2005, that it would use dedicated trains ending this long controversy and DOE’s opposition to this option. Hence, this
recommendation had already been accepted by DOE when the NAS committee made it in the report except that as the Committee notes there might have been some wiggle room for DOE in the wording of its announcement. Hence, NAS tied its recommendation of dedicated train shipments be fully implemented before large-quantity shipments begin quite purposefully [3, p. 236].

3.1.2 The NAS Recommendations on Routing and Scheduling
The NAS recommendations on routing and scheduling shipments also may be viewed in Table 3. The NAS committee found that current DOE methods for selecting highway routes for transport of waste of foreign reactor spent fuel were risk based and used standard risk methodology. It seemed clear that DOE intended to use these same methods in route selection of SNF and HLW and the NAS commended its past activity in route selection. The NAS recommended that DOE continue to ensure the effective involvement of states and tribal governments involving routing and scheduling of current spent fuel shipments [3, p. 209-210]. The NAS recommendation is actually a bit more focused than the recommendation specified here in that it refers only to research reactor fuel and SNF from foreign reactors. However, the discussion around the recommendation makes it clear that the NAS committee believes this approach of consultation with States and tribal governments is key to transportation to a repository site. The NAS believed this consultation especially critical because the states are invested with the responsibility of selecting routes within their border consistent with DOT regulations.

For this recommendation on the involvement of states and tribal governments in route selection, Table 3 lists a citation for the BRC report. However, there is no formal listing of this recommendation for the BRC report. Rather, two considerations make it clear that the BRC did everything but formally list this as a recommendation. In fact, what the BRC actually did was to give this approach of consultation greater importance than a recommendation by making it a core value/principle in its strategy. The BRC discusses at length the importance of its consent based approach, and makes it clear that the approach entails a meaningful consultative role for states and trial governments that
also involves significant delegation of authority from the federal level. For example, the BRC notes:

“All affected levels of government must have, at a minimum, a meaningful consultative role in important decisions; additionally both host states and tribes should retain—or where appropriate be delegated—direct authority over aspects of regulation, permitting, and operations where oversight below the federal level can be exercised effectively and in a way that is helpful in protecting the interests and gaining the confidence of affected communities and citizens” [2, p. xi].

In addition, the BRC approach actually extends the NAS envisioned roles for state and tribal governments. This extension is clear in the BRC discussion of the role of state, tribal and local governments in early planning for future transportation of waste. The BRC notes that the lead time in the order of a decade may be necessary to plan and coordinate a large scale transportation operation. Part of this decade long lead time according to the BRC should be utilized by DOE or the new agency to ensure institutional arrangements are in place and tested. “This means early efforts are needed to undertake planning activities that involve state, tribal and local officials” according to the BRC [2, p.85]. In addition, the BRC notes the past working relationships that DOE has established through cooperative agreements with state regional groups (SRGs) and with local authorities and encourages the responsible governmental entity to build upon these collaborations. In particular, despite the issue of scale difference that is noted in the report, the BRC appears enamored with the WIPP experience and the success attained in part because of partnering with the WGA, state of New Mexico, and SRGs [2, p. 85-87]. Hence as shown here, despite the BRC’s lack of a formal recommendation on the issue of the involvement of state and tribal governments, the BRC report makes it clear just how critical such partnerships are to the success of the future waste management program.

The next recommendation from the NAS committee on routing and scheduling of shipments, in Table 3, is that DOT should ensure that states which designate routes for shipment of SNF rigorously comply with requirements that such designations be based on sound risk assessments [2, p. 211]. As the NAS committee points out in many
instances states have examined data to determine risk associated with portions of routes within their borders, even though this is not required. Once again the BRC tracks this NAS recommendation in its report, and notes that the current system that has extensive oversight by the NRC, DOT and state and tribal officials is proven [2, p. 83]. The BRC further notes, consistent with its recommendations for the new organization that will lead the program, that the new organization in charge of the waste management program should be subject to independent regulation of its transport operations just like any private enterprise performing similar functions. In short the new organization should receive no special regulatory treatment assuring regulatory clarity and transparency two of the core principles of the BRC strategy. In this context, the NAS recommendation, once again, while not formally adopted by the BRC is entirely consistent with the BRC core principles and values; specifically transparency, clarity and fairness. However, the BRC and NAS make this recommendation also because the system of state involvement in such route designations and their designation based on risk studies has resulted in a safe system for public health.

The third recommendation by the NAS related to routing and scheduling also can be viewed in Table 3 and is strongly related to the first NAS recommendation listed under Routing and Scheduling in the Table as discussed above. Specifically, this third recommendation calls upon DOE to identify and make public its suite of preferred routes as soon as practicable in order to support state, tribal and local planning and preparedness. This recommendation is also strongly associated with recommendations listed in Table 4 under planning and emergency preparedness where its elements are discussed in greater depth. Never the less, the NAS is recognizing in this recommendation the critical support provided by state, tribal and local governments in safe transportation of SNF and their need for information to prepare and perform this function. Once again the BRC notes this recommendation for tracking purposes and indicates that implementation of this NAS recommendation had started with DOE using established practices for a formal route assessment [2, p. 83]. The effort was halted when the funding ceased but DOE continued to consult with states and tribal governments on routing issues. Again the BRC does not adopt this recommendation formally, but the discussion of routing, emergency planning and preparedness, and the
role states, tribal governments (SRGs) must play in this portion of the program make it clear that the NAS recommendation is key or underlies the BRC position. (This assertion will be discussed and again demonstrated below when discussing the BRC findings and recommendations on Section 180(c) of the Nuclear Waste Policy Act (NWPA).

3.1.3 The NAS Recommendation on Shipping

While discussed briefly above, the NAS recommends that the older fuel should be the first shipped to a repository or storage site [3, p. 238]. The actual recommendation by the NAS calls upon the DOE to negotiate with commercial spent fuel owners to ship older fuel first to a federal repository or federal interim storage site except where storage of younger fuels can reduce risk through shipment first. Indeed, the NAS committee noted that if needed, because the negotiations failed, Congress should consider legislative remedies requiring oldest fuel shipments be first [3, p. 238]. In part this recommendation is based upon a GAO study showing that shipping older fuel first would significantly reduce radiological risk and cost of shipping. The GAO argued, according to the NAS committee report, that the reduction of the number of shipments by moving larger quantities of SNF could reduce risk by reducing the number of shipments resulting in fewer opportunities for terrorists or transportation accidents [3, p. 242]. Partially, as a result the NAS committee recommended shipping the older fuel first.

The NAS committee as part of its recommendation also suggested that within the context of its current contracts with commercial spent fuel owners, DOE should initiate a pilot program for relatively short, logistically simple movements of older fuel from closed reactors. This program would allow DOE a way of demonstrating its ability to carry out its responsibilities while learning lessons from this pilot program that will help it prior to engaging in a full-scale transportation program [3, p. 238]. The NAS committee indicated that such a program of shipping older fuel would first require changes in the queue process as originally envisioned. Specifically, the NWPA indicated that DOE was required to accept fuel based on the amount and order in which it was discharged from its owner’s reactors. Hence, each time a nuclear power plant discharges fuel from its
reactor, its owner according to the NAS receives an allocation in the “acceptance queue” to ship an equal amount of SNF to the repository [3, p. 239]. The DOE when it started its shipping campaign would begin at the start of the queue and work its way through it during its shipping campaign to the federal repository. But, such a method of queue for the SNF does not account for either economies of scale that can be realized or for minimizing risk from reducing the number of shipments.

The BRC also tracks this recommendation for shipping fuel, and makes its own formal recommendation about shipping spent fuel. First, the BRC report suggests that the NAS recommendation called for shipping the “oldest” fuel first [2, p.83]. However, the NAS recommendation actually appears to call for shipping “older fuel” first [2, p. 238]. Why this discrepancy occurs is unclear, but the general direction of the BRC discussion clearly shows support for the NAS recommendation, and extends it by its own recommendation (also discussed above under Storage and Waste Packaging for the BRC). The BRC recommends, “spent fuel currently being stored at shut down reactor sites be “first in line” for transfer to a consolidated storage facility” [2, p. 36]. The BRC bases its recommendation on the costs of additional storage and security time for the existing or stranded spent fuel at shut down reactors. Importantly, the BRC report, based on a study it commissioned, suggests these cost savings are sufficient enough to pay for the consolidated storage facility. [2, p. 35].

Hence, both the NAS and BRC recommend that older or oldest fuel from closed reactors be shipped first. The BRC notes that DOE had not implemented the NAS recommendation, and obviously DOE did not implement the BRC recommendation given the status of the repository program. The issue of the queue, the oldest vs. older fuel first issue and the needed changes in the standard contract are viewed here as key to safety, lowering risk, fairness and minimizing cost and increasing savings [15, passim]. These issues have all started to be examined in some depth, and additional treatment of them is beyond the scope of this report but Williams’ work is instructional [15].
3.2 The IAEA Routing and Scheduling Requirements

The IAEA 2009 Safety Standards is a standards and regulations guide for the safe transport of radioactive materials. As such, there are far too many standards and regulations, rather than recommendations, to cover in this report. Hence, the approach used has been to draw into this examination a few directly comparable requirements to the recommendations that are being examined in the other reports being analyzed. Table 3 contains one standard for routing and shipping from the IAEA work. Specifically, the notification requirement for authorities of the country of origin to notify each country through or into which the shipment is to be transported prior to the shipment, and preferably seven days prior to shipment [4, p. 78]. This requirement is probably concomitant to the recommendations of the NAS discussed above under Routing and Scheduling and calling on the DOE to involve state and tribal governments in decisions about routing and scheduling of shipments. In addition, the DOE has cooperated with states and tribal governments with regard to notification in shipments of foreign reactor fuels and continues according to the BRC to work with these entities concerning the scheduling of shipments. Hence, the IAEA standard seems quite consistent with what were the plans for the DOE program going-forward.

3.3 The WIPP Recommendations on Routing and Scheduling

The WIPP experience was identified by both the NAS and the BRC as a program from which a much could be learned. In the case of the BRC, the Commission found a great deal in the program to emulate. The largest portion of the WIPP features that the BRC identified fall under the emergency preparedness and planning heading and are discussed below [2, p. 87]. Yet, the BRC also believes that the WIPP transportation system was successful, in part due to the long standing and highly successful model for partnering with states in addressing issues of transport of nuclear materials [2, p. 85]. Other analysis of WIPP, along with testimony to the BRC offered by the New Mexico Environment Department, suggest the same thing namely that the cooperative partnership that exists between the Western states and DOE helps to understand the success in WIPP transportation safety program [6, 5]. Indeed, it is difficult to suggest that cooperation between the federal entity charged with responsibility for a program and the SRGs are not a key element partially explaining success in this effort.
However, there is a great deal of difference between the WIPP program and the large scale national transportation program that DOE had proposed for the HLW and SNF. Just how much more complex the national rail and highway transportation programs are than the transuranic waste shipments to WIPP requires additional analysis. However, the WIPP difficulties in first establishing transport protocols for shipments and drivers for different weather conditions, is well documented by Niles and Moore [5]. In addition, it is relatively easy to forget that the WIPP took far longer to open than anyone thought it would. As the New Mexico Department of the Environment points out the preliminary siting of the repository started in 1975, surface construction began in 1981, but the first shipment of waste was not received until 1999 [6, p.1]. These are substantial periods of time for a repository that would contain far less dangerous material than either a consolidated storage or permanent disposal facility. It also suggests a far more conflictual process than the one the BRC or NAS assumes and one that has been described as such elsewhere [7]. While the WIPP model may provide some valuable lessons learned, additional analysis is needed to determine what can be generalized to the larger national transportation program needed for SNF, as well as not forgetting some of the conflicts that needed to be overcome along the way. Obtaining affected party participation in such a national program, gaining trust for the program and other challenges are acknowledged by all.

The second WIPP recommendation listed in Table 3 specifically deals with the criteria that should be utilized in selection of routes. The routes should be chosen not on the basis of their being the fastest or shortest, but rather their being the safest [7, p. 102]. This recommendation is entirely consistent with the NAS recommendation on the topic calling on the DOT to ensure that state designation of routes utilize sound risk assessment practices and not rely upon selecting routes with fastest drive times[3, p.211].

3.4 The WGA-WIEB Recommendations on Routing and Scheduling
The WGA-WIEB recommendations can be viewed in Table 3. The WGA Resolution 99-014 and the WIEB Report Card that was sent to the Secretary of Energy in February of 2000, taken in tandem, provide the WGA-WIEB perspective on transportation/shipping
of waste [17, and 8]. In the Report Card the WIEB indicated that early coordination and effective communications with state, tribal and local governments is essential to the ultimate success of the transportation program echoing the WGA resolution [8, p.5, and 17, p. 3]. In addition, the recommendation is further buttressed by the WGA resolution, which suggests that early coordination, and effective communication with states, tribes and local governments were key to any transportation program. This recommendation or resolution is entirely consistent with the NAS recommendation discussed above.

The WGA-WIEB recommendations in Table 3 also points to the WIPP program as a model for developing primary and secondary routes for transport by working through its regional cooperative agreement groups or CSRGs [17, p. 3, and 8]. The WIPP experience was also identified by both the BRC and the NAS even more explicitly as a potential model for the larger national shipping program involving HLW and SNF. In this context the NAS recommendation discussed above under routing and scheduling mirrors these earlier WGA-WIEB recommendations. Reflecting the concern during this period the WGA-WIEB recommended that private contractors hauling the waste should be required to use these designated routes rather than allow them the freedom to select routes themselves. Today in the atmosphere of cooperation, coordination and conciliation there seems little need to include such a recommendation, but in 1999-2000 some of the DOE suggestions concerning the privatization of shipping campaign among different trucking companies without much concern for coordination with states, tribes or local entities provided an atmosphere that required such a recommendation. The wisdom of this thinking can be seen in the later NAS recommendations on the topic, as well as the BRC emphasis on cooperation and coordination through all aspects of its recommendations for a new program direction. Formalization of cooperative relationships in designating routes (etc.) seems wise as the atmosphere of cooperation can disappear quickly.

The third recommendation from the WGA-WIEB dealing with routing and scheduling in Table 3 calls upon DOE to commit to preparing a comprehensive transportation plan, developing responsible criteria for selecting shipping routes, and developing a sound methodology for evaluating optimal mixes of routes and transportation modes [8]. The
transportation mode issue has been discussed above, and the NAS did indeed suggest that risk assessment methodologies that DOE had relied upon should be expanded and that the DOE ensure that states comply with the requirements of sound risk assessments as well. In short, the WGA-WIEB recommendations in the 1999-2000 time periods appear to all have been adopted by other committees and commissions at a later point. This assertion is not to suggest that the WGA-WIEB were somehow prescient, but rather that their emphasis upon cooperation and coordination was more firmly rooted in the reality of the task at hand rather than a top down autocratic approach that denies fundamental processes within the intergovernmental system. The success of the transportation program would not be the result of federal mandates or dictates. The WGA-WIEB seemed to understand this point very well and whether its recommendations resulted from a better understanding of the experience with WIPP, or just from their position in the federal system, their recommendations appear insightful for their time. Interestingly, many of these recommendations mirror Nevada comments and recommendations for the program as well, albeit with a different working relationship with the DOE and less critical in tone.

3.5 The U.S. DOT Federal Railroad Administration (FRA) Transportation of Nuclear Waste Subcommittee on Railroads (TNWSR), Committee on Transportation and Infrastructure, Recommendation on Transportation Mode

Table 3 provides the recommendation of Alan Rutter, the Administrator of the Federal Railroad Administration, that was made before the House of Representatives TNWSR on March 5, 2004 concerning the mode of transport that should be used for shipments of SNF to the repository [10]. The Administrator recommended the use of railroad transportation for SNF and HLW casks indicating rail was well suited for moving these materials safely and efficiently. Roughly 1,200 packages of SNF had been shipped over the nation’s rails from 1957 through 2004. This recommendation for mostly rail in the shipping campaign is consistent with the NAS recommendation, as well as DOE’s plan. On the issue of whether such train shipments should be through dedicated trains or general trains, the FRA was less clear and still was evaluating the option in 2004. Eventually, the DOE does adopt the plan to ship via dedicated trains, and the NAS strongly recommended dedicated trains as did the State of Nevada.
In addition, to the modal recommendation, the FRA also suggested that rail shipping safety could be enhanced with the cooperation of the federal, state and local governments (Table 3). Comments elsewhere have suggested that the railroads have been less than cooperative themselves when states and local governments have attempted to enlist their cooperation in extra regulatory safety measures [5]. Niles and Moore report that the rail carriers resisted working cooperatively with the states to develop specific procedures and protocols when rail was being considered for shipments to WIPP [5]. This resistance of the rail carriers along with DOE’s failure to work cooperatively on the procedure development for rail shipments (unlike highway shipments where DOE did coordinate with states), provided a continuing challenge for making WIPP’s transport program applicable to rail [5]. In any event, at least the FRA Administrator believed that such cooperation of these governmental entities was critical to the success of a rail shipping campaign. The recommendation mirrors that of a number of the other committees and commissions discussed in this section.

3.6 The Council of State Governments, Midwestern Office (CSGMW) Recommendations

The CSGMW provides recommendations on the mode of transportation, routing and scheduling, and the shipping campaign as can be seen from Table 3. As a prelude to discussing these recommendations, their critique of DOE’s past efforts at obtaining consultation and cooperation of the states and the SRGs specifically in the 2009 DOE National Transportation Plan is particularly illuminating in-light of all of the different commissions and committee recommendations mirroring these terms and including this consultation, cooperation and coordination in their recommendations. Perhaps consistent with past DOE practices, Janerio and Baily compare its working with DOE to a review and comment process [11, p.11]. Yet, these authors also consider a truly cooperative and consultative process to be key to the success of a new or revamped program. In short, the new processes that are established under any new organizational structure must be examined and scrutinized on an on-going basis to make sure that these processes really do become cooperative and consultative.
3.6.1 The CSGMW Recommendation on Transportation Mode

The first recommendation from the CSGMW listed in Table 3 under the transportation mode heading suggests that DOE’s planned reliance on intermodal shipments requires additional study and involvement of state, tribal and local governments in the process of planning and oversight. Pointing out that the NAS committee praised DOE’s plan to utilize intermodal shipments (heavy haul trucks, and barges for example), the CSGMW paper points to the difficulties of such intermodal shipments. CSGMW notes, the reliance on rail as the preferred shipment mode provides a challenge for the 25 reactor sites without direct rail access, as well as the 6 commercial sites without the ability to load rail casks (11, p.41]. Drawing on the work of Dilger and Halstead in 2007, the CSGMW suggests that the sites without direct rail access “pose a major transportation challenge” to the program. Several other problems emerge from what appears to be an incomplete and not well thought out intermodal recommendation by DOE. These problems include the large amount of waste that will be initially shipped from these sites without direct rail access during the first 24 years of shipping to the fact that some states would have to prepare for intermodal shipments, rail and highway shipments simultaneously. While the NAS may be correct that there are no technical barriers to shipping HLW waste that cannot be overcome, clearly the NAS would identify these issues as requiring some additional work and thought if still part of future plans.

3.6.2 The CSGMW Recommendations on Routing and Scheduling

The second and third recommendation by the CSGMW can be found in Table 3 under the heading routing and scheduling. The first of these two has been touched upon above and requires no additional discussion as it pertains explicitly with advocating that transportation planning take place in a consultative fashion on a regional level, with appropriate interactions among the regional stakeholder groups (SRGs) [11, p. 34]. The second recommendation calls for the development and cooperative use of a comprehensive database to analyze transportation data that is crucial for planning, procurement and safety [11, p. 13-14]. The CSGMW paper traces the efforts by the DOE to first develop models for route selection from HIGHWAY for truck shipments to INTERLINE for rail and barge shipment. These two efforts were combined to assess transportation risks with a computer program called RADTRAN, which was used by
DOE to calculate transportation risks in its EIS on Yucca Mountain. DOE later succeeded in combining INTERLINE and HIGHWAY into a single model called TRAGIS, a GIS based system capable of calculating primary and alternative routes by train, truck or barge [11, p. 13]. Yet, potential users of TRAGIS pointed out that while it was an improvement over RADTRAN, it still provided only limited information on route characteristics that would help state personnel in evaluating potential impacts of shipments along different routes.

Because the models being developed by DOE did not meet many of the state needs, WIEB attempted to develop a model that would combine the functions of TRAGIS and RADTRAN into a GIS based system called IRRIS. IRRIS did permit the states to address far more questions of significance concerning potential risk and impacts of shipping along alternative state routes, and various “best practice choices” like from the impact of shipping oldest fuel first, to impacts associated with dedicated trains or what impacts various routes had on emergency planning or response planning needs [11, p. 14]. However, its development was cut short by the funding cutoff in OCRWM’s program. The CSGMW recognizes that technical developments may have advanced swiftly and that IRRIS may no longer be the best model available for state, tribe and local needs. Hence, it calls for the development of such a database and modeling as needed. Interestingly, whether the solution being implemented for HLW and SNF is consolidated storage or permanent disposal, both require transportation of waste that will require states to engage in transportation planning that will benefit from such a database and modeling.

3.6.3 The CSGMW Recommendations on Shipping

The CSGMW focuses some attention on the issue of oldest vs. older fuel first, noting that the State of Nevada through the work of Halstead and others has long advocated that risk can be reduced by shipping either the oldest fuel first, and if this is not feasible then the older fuel first [11, p.17]. The CSGMW agrees with this Nevada recommendation, but raises the issue of DOE’s Standard Contract and whether it will permit a shipping schedule based on the age of the fuel. Obviously, the CSGMW work did not have the benefit of the BRC recommendation and discussion on this topic. In
any event, the CSGMW recommendation for shipping oldest or older fuel first is consistent with these two reports’ recommendations. In addition, the CSGMW indicates that efforts be undertaken to obtain cooperation from the utilities who own the waste to allow for implementation.

The CSGMW discussion of its recommendation on shipping older or oldest fuel first explicitly identifies the issue of the queue for the shipping of waste that was discussed above. In this context, the CSGMW call for the cooperation of the utilities relies on the NAS discussion noting that the “order for accepting commercial spent fuel” was “not designed with a transportation program in mind” [as cited in 11, p. 19, or 3, p. 239]. The GAO numbers used by both the NAS committee in 2006, and the CSGMW indicate that if older fuel is shipped first and each container is filled a reduction in the number of shipments by 17% can be achieved [16, p. 19]. Additional benefits of shipping oldest or older fuel first that are identified include a reduction in the number of routes, which reduces the number of first responders who must be trained, and results in risk reduction from terrorist attacks because of the reduced number of shipments.

The second CSGMW recommendation on shipping in Table 3 pertains to the importance of greater oversight of shipments of SNF and HLW by the Nuclear Regulatory Commission (NRC) [11, p. 15-16]. The CSGMW notes that DOE is not a NRC licensee and is technically not bound by NRC regulations and rules. The NWPA stipulates that DOE will utilize NRC approved casks in its shipments and follow NRC rules concerning advance notification of shipments. OCRWM has indicated that it will follow or “comply with all applicable DOT, NRC and DOE safety and security standards that exist at the time of the shipment, as well as all applicable safety requirements of state, tribal and local government consistent with federal requirements” [as cited by 11, p. 15]. Yet, the Midwest states have identified the NRC regulation of transportation as one of the region’s “key issues” [11, p. 15]. In other CSGMW documents, as well as the report discussed here, the recommendation is for greater NRC oversight that includes the same safeguards and security criteria, for example including regulations, orders, and additional security measures, as NRC regulated shipments. This recommendation by the CSGMW is very revealing. Not only does this recommendation reveal the
CSGMW focus on assuring safety through NRC oversight, but also the organization’s distrust of allowing DOE to continue to be self regulating relying only on its stated intention to comply with the NRC regulations.

The final recommendation by the CSGMW found in Table 3 on shipping advocates seasonal scheduling of shipments and taking advantage of good weather conditions for shipments with northern shipments occurring in the summer months, and winter shipping from the southern sites [11, p. 31]. The CSHMW Planning Guide for Shipments of Radioactive Materials through the Midwestern States explicitly makes this recommendation, and the report discussed here calls upon the OCRWM and DOE to cooperate with the affected states and their shipping sites to plan for a seasonal shipping campaign [11, p. 31]. Hence, once again the importance of cooperation and coordination with the states, tribal and local governments can be clearly seen in the recommendation.

Table 3 Mode of Transportation Routing & Scheduling and Shipping

<table>
<thead>
<tr>
<th>Mode of Transportation</th>
<th>Routing and Scheduling</th>
<th>Shipping</th>
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<tr>
<td>NAS Going the Distance</td>
<td>1. Use of Railroads. Mostly rail has clear advantages; DOE should complete the Nevada rail line and examine how to reduce the need for cross-country truck shipments by expanding intermodal service [2 p. 83, 3, p. 217]. 2. DOE should fully implement its dedicated train decision before large-quantity shipments begin [2p. 83, 3 p. 217, 232,233]. 1. DOE should continue to ensure systematic involvement of states and tribal governments in decisions about routing and scheduling for current spent fuel shipments [2, p. 82,85, 3, p. 210]. 2. Regulation Compliance - DOT should ensure states rigorously comply with requirements for sound risk assessments in designating routes, not just chosen by fastest time [2, p. 82, 3, p. 211]. 3. DOE should identify and make public its suite of preferred routes as soon as practicable to support state, tribal, and local planning and preparedness, following the research reactor fuel program's process of involvement [2, p. 83, 3, p. 228].</td>
<td>DOE should ship older fuel first to a repository or storage facility. Conduct a pilot campaign by shipping fuel from shutdown reactors first [2 p. 83, 2A, p. vi, 238; 3 p. 238].</td>
</tr>
<tr>
<td>IAEA</td>
<td>Must notify competent authorities of the country of origin and each country through/into which the shipment is to be transported. (4, pg 78)</td>
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<tr>
<td>WIPP</td>
<td>1. Has longstanding highly successful model for partnering with states to achieve shared success in addressing issues related to the transport of nuclear materials. (BRC pg 85) 2.</td>
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Identify and select safest routes, not just by fastest time or shortest distance [7, p. 102].

| WGA-WIEB | 1. Early Coordination and effective communications with state, tribal, and local governments is essential to the ultimate success of any nuclear waste transportation safety program [8]. 2. DOE should follow the WIPP program to develop a proposed set of primary and secondary shipping routes by working through its regional cooperative-agreement groups. DOE should require the use of these routes through mandatory contract provisions with any private contractors [8]. 3. DOE must commit to: 1) prepare a comprehensive transportation plan that includes the analysis of all needed transport-safety activities in a single document 2) develop responsible criteria for selecting shipping routes 3) develop a sound methodology for evaluating optimal mixes of routes and transportation modes [8]. |

| Transportation of Nuclear Waste Sub-Committee | 1. Recommends: 1) The use of railroad transportations for HLW Casks 2. Currently evaluating if dedicated trains is appropriate for transportation of HLNW [10, Par. 24]. 1. Advocates of conducting transportation planning in a consultative fashion on a regional level, with appropriate interactions among the regions and other stakeholder groups [11, p. 34]. 2. Develop and cooperatively use a comprehensive database to analyze transportation data that is crucial for planning, procurement and safety [11, p. 13-14]. 1. The CSG Midwest has not concluded whether it is appropriate to ship oldest or older fuel first, but agrees there are many benefits to shipping older, or oldest first, and believes that the owners of the waste will need to cooperate [11, p. 17]. 2. Advocates greater NRC oversight for shipping of SNF and HLNW [11, p. 15]. 3. Following the Standard Disposal Contract would result in highly inefficient shipping schedule. The managing organization will need to negotiate with utilities to produce a more efficient shipping queue [11, p. 1]. 3. CSG Midwest advocates for seasonal scheduling to take advantage of good weather conditions in the North and the South [11, p. 31]. |

| CSG Midwest | 1. Advocates greater NRC oversight for shipping of SNF and HLNW [11, p. 15]. 3. Following the Standard Disposal Contract would result in highly inefficient shipping schedule. The managing organization will need to negotiate with utilities to produce a more efficient shipping queue [11, p. 1]. 3. CSG Midwest advocates for seasonal scheduling to take advantage of good weather conditions in the North and the South [11, p. 31]. | Promote rail safety with the effort of Federal, State, and Local governments working together to insure the continued safe and secure transportation of nuclear materials by rail [10, Par. 5]. | Intermodal shipments need to be addressed: 1) Where will they transfer 2) What kind of oversight will be necessary 3) The role of states, tribes and local governments [11, p. 40]. |
4.0 Shipment Safety, Regulations, and Emergency Preparedness and Planning

Many of the organizational categories that have been developed for the tables in this report overlap to some degree. The reason for this overlap is not only the difficulty in differentiating analytically among so many categories, but also the lack of conceptual crispness in the recommendations in these many reports that have been made by different committees and commissions. Each of these different reports issued by a myriad of committees, commissions, boards, associations, and councils is from their own peculiar position in the intergovernmental system. This position, be it a federal commission, a committee of the National Research Council, states, or a regional association, not only helps define what is important and should be focused upon, but also influences how different recommendations should be worded and classified. These differences in lexicon result in a lack of crisp distinction between and among the categories that are being imposed by us on the various recommendations. Hence, there is overlap in some of the recommendations and sometimes a recommendation entails more than just one element of the program resulting in that it can be classified into a number of different categories. To the extent the reader has noticed this overlap, and is troubled by it, apologies are offered. However, other than discussing some of the recommendations in more than one place in the report, there is little that can be done without losing some of the content of the recommendation, or changing the wording of the original recommendation. This latter course of action, changing the wording of the original recommendation to achieve clear distinctive categories in this paper, has been avoided as much as possible for fear of altering the meaning of the original recommendation. Hence, in the discussion that follows for Table 4, just as with previous tables, there will be some overlap from previous discussion of earlier recommendations.

4.1.1 The BRC Recommendation on Shipment Safety

The first entry for the BRC recommendations in Table 4 is strictly speaking not a formal recommendation of the BRC and again deviates from our approach of only adding explicitly stated recommendations. However, the BRC explicitly identifies the importance of working with states, tribes and local governments in the WIPP program, and suggests that working with these entities was critical to transportation safety and success of the program [2, p. 86]. In addition, the BRC notes the DOE has largely been
successful in its efforts to build these relationships with the SRGs in its transportation program. Finally, the BRC concludes about the DOE program with SRGs that “Any new entity charged with managing spent fuel and waste in the future should emulate and build on this success” [2, p.86]. The observations by the BRC seem a bit naïve concerning the failure to acknowledge the difficulty confronted in obtaining these working relationships, as both New Mexico and the SRGs in the DOE transportation planning effort had to “break arms” to get admitted to the table, and to obtain any meaningful role in transportation planning. Yet, the BRC has realized how important this cooperation is in ensuring transportation shipment safety and cites the Niles and Moore work on WIPP and their observations about the factors resulting in WIPP shipment safety [2, p. 86, 87, and 5]. Hence, the first BRC recommendation in Table 4 (Page 61-63) closely follows its findings in this area, and throughout its report, and is entirely consistent with its own principles and values. For these reasons, and because the relationship with the SRGs in transportation planning and implementation is so critical to the success of the program, Table 4 lists the following recommendation: New waste management organization should work with SRGs on transportation planning and issues to enhance the safety of shipments.

4.1.2 The BRC Recommendation on Transportation Security/Safety/Drivers and Transportation Regulations

The next entry in Table 4 for the BRC appears under the heading for transportation security, safety, drivers and regulation (transportation). The recommendation suggests that the new waste management organization (replacing DOE) should be “subject to independent regulations of its transport operations in the same way that any private enterprise performing similar functions would be” [2, p.83]. This recommendation is entirely consistent with the discussion of the purpose, roles and functions of the new waste management organization discussed in Section 1 of this report, and with the principles and values discussed throughout the BRC report and in Chapter 7. In order to achieve a restoration of trust in the program, and develop it in the new managing organization, it is essential that the shipments of waste meet the same shipping and security standards as private entities. Hence, the BRC recommends that DOE not be self regulating but rather meet the DOT, NRC, and other regulations that exist in its
shipments. By doing so the BRC believes that the new managing organization can achieve regulatory clarity and transparency [2, p. 83]. This particular aspect of the recommendation was discussed previously under recommendations by CSGMW for shipping, but can also be classified under this heading under regulations or transportation regulations for obvious reasons.

4.1.3 BRC Recommendations on Emergency Preparedness and Planning

The BRC breaks new ground through its recommendations concerning emergency preparedness and planning showing considerable understanding of the needs of the SRGs and reflecting their comments and concerns that had been largely ignored by DOE (discussed below). Table 4 lists three significant and specific recommendations concerning this critical activity. First, the BRC recommends the early implementation by DOE of Section 180 (c) as currently defined by the Nuclear Waste Policy Act (NWPA) supported by the Nuclear Waste Fund even before a potential storage site is identified [2, p. 86, xiii]. The BRC believes that procedures and regulations should be finalized for providing this technical assistance funds to local governments and tribes for training pursuant to Section 180 (c), and that this assistance be independent of, and begin prior to progress on facility siting [2, p. 86]. Because such assistance should be tied to transportation routes to and from a facility site, and these sites and routes are not yet known, the BRC recommends this assistance start with “first in line” shut down reactor sites where the older fuel is stored. Hence, the recommendation is tied to an earlier BRC recommendation (NAS as well) consistent with the development of planning the program [2, p. 86]. The assistance should be separate from progress on facility siting in part, because it is an essential element of reestablishing trust with the SRGs and the shipments from the shut down reactors will be a relatively small transportation program—baby steps—to increase confidence in the program.

The second, recommendation in Table 4 for the BRC dealing with emergency preparedness and planning is a major change in the way Section 180 (c) has been viewed by OCRWM and the DOE. It calls for Congress to amend Section 180 (c) to expand the authority and responsibility for the new waste management organization
(similar to those in the WIPP Land Withdrawal Act). The changes needed are far reaching and include:

A). A program to provide information to the public about the transportation of SNF or HLW to or from the repository or consolidated storage facility,
B). Authority and direction to assist states, tribes and local governments through monetary grants or contributions in-kind (subject to appropriation) in acquiring equipment for responding to an incident involving shipments covered by law,
C). Broad authority and direction to provide in-kind financial technical and other assistance (subject to appropriations) to states and tribes whose jurisdictions would be traversed by shipments of SNF to interim storage or a repository for the purpose of transportation safety programs related to such shipments that are not otherwise addressed in law [2, p. 86-87].

Part A of the recommendation expands the nature of Section 180 (c) to include not just technical assistance but also in this case public information about consolidated storage sites as well as a repository site. This expansion of the program is considerable and contrary to the DOE’s efforts over at least the last decade of constraining at every opportunity the nature of the meaning of Section 180 (c), as well as the uses that could be made of such funding with the proviso that Congressional action is needed for this change. Part B of the recommendation reflects an important and fundamental change, in likelihood designed to assist in altering the relationship between SRGs and the new organizational structure for the program. The change recommended is to fund through grants or contributions in-kind (subject to appropriation) states, tribes and local governments in acquiring equipment for responding to an incident involving shipments covered by law [2,p. 87]. Clark County comments on the then proposed OCRWM Plan for the Implementation of Section 180 (c) Revised Policy makes it clear just how ludicrous the OCRWM’s effort to implement Section 180 (c) was viewed by SRGs. Not only did Clark County criticize the narrow definition of public safety needs, the insufficient funding proposed to prepare and train local public safety personnel, and the inadequate methods of determining local needs, but it also pinpointed the failure to
include any equipment needs of SRGs under the OCRWM interpretation of Section 180 (c) [18, p. 2-5]. Clark County noted that, “DOE should acknowledge its responsibility to local public safety agencies to ensure that they have the full array of resource necessary to protect the public health and safety” if shipments of SF and HLW commence [18, p. 4-5]. “It would be difficult to see the value of training local responders on equipment they did not possess, could not afford and could receive no assistance from the federal government in obtaining”, the County further noted.

Part C of this second recommendation by the BRC recommends broad authority and direction to provide in-kind financial and other assistance (subject to appropriations) to states and tribes whose jurisdictions would be traversed by shipments of SNF to interim storage or a repository for the purpose of transportation safety programs related to such shipments not otherwise addressed in law [2, p. 86-87]. Largely a catch all for any other shipments not previously covered or other transportation assistance not specifically mentioned. This part of the recommendation is to provide the authority for the new organization to provide assistance and training it deems needed. Such major changes in Section 180 (c) require Congressional amendment or legislation, but they also require Congressional commitment to making our nuclear waste program a success rather than allowing on-site storage to continue and exploiting the program for its monies that can be put on the plus side each year of a budget balance sheet.

The third recommendation by the BRC reflects the importance of learning from the Fukushima disaster events and building on that knowledge. The recommendation of the BRC calls upon the NAS to conduct an independent investigation of the disaster (separate from the NRC studies) and to determine what the implications are for safety and security of current storage arrangements in the U.S. [2, p. 44]. Obviously this recommendation also could be classified under storage and waste packaging in this report and placed in section 2 of this report. However, studying the Fukushima disaster for lessons learned concerning storage risk, in order to determine what mitigation, if any, efforts might be needed or undertaken in the U.S. also constitutes the basis for emergency planning and preparedness. Indeed, the study, when undertaken, results seem likely to have major implications for emergency preparedness. Hence, the
recommendation can be classified in at least two different categories and for discussion purposes it has been placed under emergency preparedness rather than cask storage. As the Commission noted, the lessons learned from the accident may well involve lessons that relate to unanticipated problems with extended fuel storage, a better understanding of dry cask storage, corrosion rates, security requirements for storage sites and transportation, and perhaps enhanced security including “hardened” on site storage [2, p. 44]. In short, the Fukushima disaster may well offer lessons that cut across almost all aspects of nuclear waste programs and it seems appropriate that the recommendation of the BRC be placed under emergency preparedness.

4.2 The NAS Recommendations on Shipment Safety
Table 4 arrays the recommendations made by the 2006 NAS committee on shipment safety. There is considerable overlap in the first recommendation listed for the NAS. The recommendation is in part based upon the NAS committee’s concern for the lack of testing on casks under extreme conditions (long duration engulfing fires) and shipment safety. The remedy is to test the casks under these conditions, which are discussed in section 2 under storage and waste packaging of this report in the NAS recommendations. As the NAS points out, full scale cask testing under extreme events/hazards, has major implications for shipment safety as well as storage. Hence, the NAS also makes two recommendations for shipment safety because of the potential of this possible scenario. In this case the NAS first recommends (Table 4) “transportation planners and managers should undertake detailed surveys of transportation routes to identify potential hazards that could lead to or exacerbate extreme accidents involving very long duration, fully engulfing fires” [3, p. 178,107, and 2, p. 82]. The recommendation recognizes the possibility of a particular scenario involving a long duration fire, which was discussed in detail previously under the storage and waste packaging section, but here focuses on the risk it may pose to shipment safety. As such, the previous discussion of cask testing and safety need not be repeated, but the NAS is recommending detailed surveys of transportation routes to identify the existence of hazards that may exacerbate such extreme accidents.
The second recommendation for the NAS under shipment safety recommends that planners and managers take steps to avoid or mitigate such extreme hazards prior to the start of shipments [3, p. 178, 2, p. 82]. This recommendation simply builds on the previous NAS recommendation suggesting mitigation or avoidance of these types of risk prior to shipping beginning.

The third recommendation of the NAS Committee regarding shipment safety calls for the establishment of a risk advisory group [3, p.11]. There are two parts to this recommendation with the first recommending the expansion of an existing advisory group to obtain outside advice on social and other types of risk (Transportation External Coordination Working Group) that was discussed in Section 1.2.2 and in Table 1. The second part of recommendation stresses the importance of an external risk advisory group to provide advice on characterizing, communicating and mitigating social, security, and health safety risks [3, p.11]. The importance of this recommendation is also discussed in Section 1.2.2 under social risk, but clearly the NAS recommendation entails more than just the social risk component and is desirous of outside expertise on a wide variety of different types of risk so that they may be mitigated.

4.2.1 The NAS Recommendations on Transportation Security/Safety/Drivers and Transportation Regulations

The NAS makes two explicit recommendations concerning the issue of transportation security after determining that no fundamental technical barriers to safe transport of spent nuclear fuel or high-level radioactive waste existed that could not be overcome [3, p. 213]. First, an independent examination of the security of SNF should be carried out prior to the commencement of large-quantity shipments to a federal repository [3, p.215; 2, p. 82, 84-85]. The examination the NAS recommends should be carried out by a group that is both independent of the government and is technically knowledgeable (Table 4). Such a group should be given access to classified documents when necessary for the examination and the results of their evaluation be made available to the public. Hence, the NAS committee once again is attempting to build a more open process that will result in regaining trust in the program while increasing the safety and security of the transportation of waste.
The second recommendation by the NAS committee occupies this intersection of space between increased shipment security and the openness of information to the public (table 4). Hence, the recommendation is for the Department of Homeland Security, the DOE, the DOT and the NRC to complete the job of developing, applying consistent and understandable criteria for protecting sensitive information about SNF and HLW transportation and shipments [3, p. 257-258; 2, p.83]. This recommendation reflects the NAS committee’s concern that both the security of shipments must be protected, but that the public’s right to know must also play a role in the development of clear criteria as to what needs to be protected information concerning shipments. The recommendation calls upon the relevant federal agencies to develop understandable criteria for what needs to be protected information and what does not.

4.2.2 The NAS Recommendations on Emergency Preparedness and Planning

The NAS recommendation on emergency planning and preparedness are somewhat time bound by the period they were drafted during DOE’s efforts to issue guidelines for implementing Section 180 (c) of the NWPA (Table 4). Hence, as can be seen in the NAS report discussion on the topic of Section 180 (c) and emergency preparedness the Committee focuses on the proposed planning grants, past experiences with WIPP, and the communities training needs along potential shipment routes [3, p. 248-251]. The overarching recommendation that the DOE immediately implement Section 180 (c) of the NWPA to provide funding and technical assistance to corridor states and tribes has yet to be implemented [3, p. 248]. The NAS Committee believes that such implementation of this overarching recommendation should proceed by DOE first establishing a cadre of professional emergency responders with expertise and training in responding to accidents involving HLW. Second, the NAS report recommended DOE work with DHS to provide consolidated “all hazards” training materials and build on the existing national emergency response platform for first responders. Third, that DOE include trained emergency responders on escort teams that accompany SNF and HLW shipments so that they gain experience in these shipments and also can offer their insights about shipment safety from a responder perspective. Finally, the NAS report recommended that these responder programs be used by DOE as outreach.
mechanisms to communicate about plans and programs for transporting waste to a repository with communities along planned shipping routes.

Obviously, the BRC recommendations concerning Section 180 (c) and the emergency preparedness and planning element of the program go much further in empowering and focusing on local emergency response and community needs (see discussion above). Indeed, at times it appears that the NAS Committee is more concerned with how to obtain local acceptance of the flawed guidelines announced by DOE in its effort to implement Section 180 (c) than it is with the safety and response needs of the communities along the planned routes. Hence, the NAS report does not address the failure to provide local responders and communities with adequate equipment in DOE’s interpretation of Section 180 (c) and its planned implementation of the program. Indeed, communities were voicing their concerns and anger over such failure in the policy to the DOE and other groups as noted by the NAS report [3, p. 252]. Hence, while the NAS noted the importance of going further than what was legally prescribed as was done in the WIPP shipments, it did not recommend to the DOE that they do so with regard to implementing Section 180 (c) or finding ways to funnel needed equipment and other needs to local communities. The BRC however addressed these needs directly and called for Congressional action to amend Section 180 (c) and provide for other emergency response needs as well. In this sense the NAS recommendations are somewhat disappointing on this topic.

4.3 The IAEA Recommendation on Shipment Safety

The 2009 IAEA Safety Standards culled for this report consists of standards and regulations for safe transport of radioactive materials, and as such differs from the other reports reviewed here. There are a large number of safety standards specific to shipments in the IAEA report. The recommendation used for this section of the report deals specifically with the importance of inspecting shipments. The recommendation is for periodic inspections of shipments, and as necessary repaired and maintained in good condition so that they continue to comply with all relevant requirements and specifications even after repeated use [4, p. 16]. Indeed, one other requirement is that shippers and manufactures’ provide facilities for authorities to inspect during the
manufacture of shipping containers (etc) for quality assurance and conformance to design requirements.

4.3.1 The IAEA Recommendation on Emergency Preparedness and Planning

The IAEA recommendation/requirement for emergency preparedness and planning is very general and leaves this responsibility to the national or international requirements. Hence, the IAEA indicates that in the event of accidents during the transport of radioactive material, emergency provisions, as established by relevant national and/or international organizations, shall be observed to protect persons, property or the environment [4, p. 15-16]. In short, the individual European nations regulations and response capacity will be used to prepare and plan for an emergency. In the event of an incident, these individual nations’ response capacities will be relied upon, as well as those of international organizations. This arrangement is not very different from the U.S. except that the regulations are federal (national) and they supersede any local requirements.

4.4 The WIPP Recommendation on Shipment Safety

The WIPP shipment safety lessons resulted in a recommendation dealing with adverse weather and road conditions, and one dealing with shared responsibility for the vehicle inspection and enforcement programs (Table 4). Specifically, the avoidance of bad weather and accompanying road conditions as a key to avoiding accidents was seen as a key lesson learned and recommendation from the WIPP experience [7, p. 80; 5, p. 6]. Niles and Moore are particularly emphatic on this point, noting that none of the accidents involving WIPP vehicles occurred because of bad weather or road conditions as opposed to large truck property damage-only crashes where 12.2 % occurred during bad weather conditions, and 22.2 percent took place during bad road surface conditions [5, p. 6]. They credit the WIPP protocols and criteria for safety with the avoidance of accidents.
The second recommendation from the WIPP papers under review suggests the importance of shared vehicle and shipment inspection and enforcement activities for radioactive material transportation by state and federal agencies [7, p.80; 5, p.6]. The inspection program by state personnel provide another level of verification (other then just federal assurance) of regulatory compliance and it is argues that over time will also result in increased public confidence and trust.

4.4.1 The WIPP Recommendations on Transportation Security/Safety/Drivers and Transportation Regulations

The recommendations on transportation safety, driver safety and regulations (Table 4) that are lessons learned from the WIPP experience are drawn on heavily by both the NAS and the BRC reports [2, p.87]. The WIPP protocols involving driver safety and defensive driving instruction proved key components of driver safety according to Niles and Moore [5]. In addition, requiring driver safety requirements that went beyond DOT requirements for carrying hazardous cargo also proved vital [5, p.6; 7, p. 75]. Driver training after being hired, stringent penalties for not performing procedures correctly and riving in pairs all contributed to driver safety in WIPP, as did bad weather protocols and safe parking requirements [, p. 75]. Finally, regular checking of the truck every 150 miles or three hours were viewed as important to safe transport. Importantly, the WIPP experience strongly suggests that going beyond requirements and standards is what is required for safe shipments by all three papers examining the WIPP experience that are viewed here. Exceeding such standards also has the additional benefit of gaining public confidence and trust in the program as it goes forward.

Additionally, the BRC which vests so much importance in the WIPP experience as a guide to a future national transportation program should take heed from the assessment of WIPP at 10 Years by Niles and Moore [5]. The caution the reader on many of the problems in obtaining continued program adherence to requirements as time went on in the WIPP program. More importantly, in viewing the transferability of the WIPP lessons to a national program were the efforts by the WGA to obtain rail carrier and DOE cooperation on translating the WIPP Transportation Safety Program Implementation Guide that were quickly rebuked [5, p. 8].
4.4.2 WIPP Recommendation and Emergency Preparedness and Planning

The WIPP reports under review are less focused on emergency preparedness and planning than they are with overall program goals, elements and reasons for success to date. Nevertheless, two clear recommendations for emergency preparedness and planning emerge from one of the reports that are repeated in the BRC report. The first recommendation in this area suggests that emergency equipment, training and emergency plan exercises are key elements to emergency preparedness and planning [7, p. 86; 2, p.87]. This recommendation is usually the mantra of all emergency managers and is the core of preparedness. The second recommendation provides a lesson that needs to be stressed for any national transportation program of SNF or HLW. Specifically, the WIPP shipments traversed state boundaries and travelled through a multitude of jurisdictional borders. As such, the importance of medical and other mutual aid agreements was clearly reinforced to emergency planners, as was the importance of having other state mutual aid agreements in place in the event of an incident on the border [7, p.86]. A national program of transportation will present considerable challenge in obtaining the necessary and important mutual aid agreements among all of those potentially affected entities, and thought and preparation should be devoted to the best way to proceed in obtaining this cooperation.

4.5 The WGA-WIEB Recommendation on Shipment Safety

The WIEB report card for DOE strongly endorsed the DOE utilizing the WIPP program as a model or framework for transportation planning and shipment safety [8, p.5]. The WIPP Program Implementation Guide is suggested as a potential model for this activity. This recommendation is also reinforced or can be found in the WGA Resolution 99-014 that also calls upon the DOE to propose a set of primary and secondary routes through its regional cooperative-agreement groups.

4.5.1 The WGA-WIEB Emergency Preparedness and Planning Recommendation

The focus of the WIEB recommendations on emergency preparedness and planning in its DOE report card is the assistance program or Section 180 (c) of the NWPA. This assistance program was a source of considerable irritation among the SRGs and among local entities. The specific recommendations provided by the WIEB to correct
this situation and provide the needed assistance can be seen in Table 4. The first of
these recommendations is to prohibit shipments of HLW and SNF if Section 180 (c)
funds had not been made available to states/tribes at least three years prior to the start
of shipments [8, p.4]. The WIEB recommendation for a prohibition of shipments is
irrespective of whether DOE alters the shipping schedule, or whether the shipments are
privately or publicly owned. If the funding assistance has not been available three years
prior to the shipments, it should be prohibited. Second, the WIEB recommends State
and Tribal assistance to develop plans with minimum elements necessary to ensure
safe routine transportation of shipments [8, p.4]. Included in these plans should be the
identification of procedures for dealing with emergency response situations, current
capabilities along each transportation corridor, activities needed to ensure safe
shipments, and performance measures for evaluation of the preparedness programs.

The third recommendation by the WIEB The annual implementation grants to
states/tribes should be based on 75% of the funds for the projected shipment mileage in
the entity, and 25% funded to ensure minimum funding levels for programs. The fourth
recommendation calls upon DOE to permit flexibility in the use or expenditure of Section
180 (c) consistent with the state/tribal plans. Finally, the WIEB calls upon DOE to
establish Regional Training Advisory Teams of states and tribes to review and
coordinate plans along transportation corridors, and to establish a similar National
advisory organization on progress and needed additional action [8, p.4]. In short, the
recommendation is not only aimed at procuring the needed resources to make
emergency planning and preparedness work and be successful, they also are designed
to assist DOE in implementing its transportation program by assuring adequate
preparedness and training to protect the public. It is these types of specific
recommendations that are required to implement a program. It is these types of specific
recommendations that DOE should provide for implementing the BRC report
recommendations.

4.6 The Transportation of Nuclear Waste Subcommittee Recommendation on Shipment
Safety
The Federal Railroad Administrator, Alan Rutter testifying before the Transportation of
Nuclear Waste Subcommittee on Railroads, Committee on Transportation and
Infrastructure strongly recommended that a Safety Compliance Oversight Plan (SCOP) be developed for the rail shipment of all SNF or HLW (Table 4) regardless of whether Yucca Mountain became a permanent repository for the nation (10, Paragraph 10]. SCOPs had been developed for the rail shipments of Foreign Research Reactor Fuel shipments, as well as for the rail shipments of waste from the Three Mile Island disaster. These SCOPs would or should have as their key elements according to the Federal Rail Administrator: 1. Coordinated planning of the most viable routes, 2. Ensuring appropriate training of railroad employees and emergency responders, 3. Enhancing and focusing the Federal Railroad Administration’s safety inspections and monitoring activities on all facets of the rail shipments of used nuclear fuel (10, Paragraph 12]. Once again the detail needed to guide implementation of specific program elements is provided to allow for the goals of safe shipments to be reached. In this case, the FRA simply notes the key elements of the SCOPs that are needed, but additional detail on how they are to be completed and past successful models are available.

4.7 The Council of State Government Midwest Recommendation on Shipment Safety
The CSGMW recommendation on shipments safety found in Table 4 suggests that a reciprocal rail inspection program be established to provide state with the same level of confidence in the safety of the shipment point of origin inspections as the Commercial Vehicle Safety Alliance (CVSA) Level VI enhanced inspection procedures has done for WIPP shipments by truck [11, p. 60]. An additional benefit of such inspections (often multiple by shippers/regulators and states) is the development of trust in the safety of the program. This recommendation is entirely consistent with the WIPP recommendations on rail/truck shipment safety.

4.7.1 The Council of State Government Midwest Recommendation on Transportation Security/Safety/Drivers/Regulation
The CSGMW makes three recommendations regarding transportation/driver safety and security. First, the CSGMW advocates that security planning involve states and localities for repository shipments [11, p.65]. This recommendation recognizes not only the importance of the state perspective and expertise, but also that of localities. Indeed, the locals may very well bring a type of specific information concerning local conditions
that is lacking in the state perspective. The second recommendation by the CSGMW is somewhat unusual in that it recommends that route selection and oversight of safety be given to the National Academy of Sciences (NAS). This recommendation is for a non-governmental entity to be vested with oversight responsibilities and is highly unusual. Obviously this recommendation is designed to buttress the confidence in the program’s safety, or alternatively to begin to develop such confidence by taking this safety oversight and route selection out of the hands of governmental agencies [11, p.65].

The final CSGMW recommendation addresses driver/carrier (truck and rail) requirements and qualifications. The recommendation is for these requirements to be as least as stringent as those in existence for WIPP transuranic waste truck shipments to Carlsbad. These recommendations all envision a partnership among the governmental entities/regulators at all levels for the purpose of safely shipping used nuclear fuel.

Table 4 Shipment Safety, Regulations & Emergency Preparedness & Planning: Shipment Safety & Transportation Security/Safety/Drivers/Regulation

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Shipment Safety</th>
<th>Transportation Security/Safety/Drivers/Regulation</th>
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<tbody>
<tr>
<td>Blue Ribbon Commission Report</td>
<td>New waste management organization should work with SRGs on transportation planning and issues to enhance the safety of shipments</td>
<td>New waste management organization should be subject to independent regulations of its transport operations in the same way that any private enterprise performing similar functions would be [2, p. 83].</td>
</tr>
<tr>
<td>NAS Going the Distance</td>
<td>1. Transportation planners should undertake detailed surveys of potential routes and identify hazards that may exacerbate extreme accidents such as a fully engulfing fire [3,p.178] 2.The NRC should analyze very long duration fires, implement regulatory controls to reduce the changes of a spent fuel shipment being involved in such a scenario [2, p. 82; 3, p. 107,178] 3.Establish a transportation risk advisory group that is explicitly designed to provide advice on characterizing, communicating, and mitigating social, security, and health and safety risks [3, p. 11].</td>
<td>Undertake full examination of spent fuel transport security by independent, cleared technical experts [2, p. 82, 84-85; [3, p. 215]. Federal agencies should develop clear and consistent guidance on what and how information about transportation should be protected, and commit to open access to information that does not need such protection [2, p. 83; [3, p. 257].</td>
</tr>
<tr>
<td>IAEA</td>
<td>Periodic inspections to check necessity for repairs and to maintain good condition so that they continue to comply with all relevant requirements and specifications, even after repeated use [4, p. 16].</td>
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<tr>
<td>WIPP</td>
<td>Avoiding bad weather and road conditions key to avoiding incidents [7, p. 80; 5, p. 6]. Inspection and enforcement activities for radioactive material transportation are shared by federal and state agencies. Implementation of the inspection program by state personnel will provide independent verification of regulatory compliance, enhancing public confidence in the safety of the WIPP</td>
<td>Driver requirements should go beyond DOT standards for carrying hazardous cargo [5, p.6]. Additional relevant WIPP instruction and training after being hired should be mimicked in other programs [7, p.75]. Stringent penalties for not performing correct procedures. WIPP checked truck every 150 miles or 3 hours and drivers drove in pairs</td>
</tr>
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</table>
### WGA-WIEB
Doe should look to the WIPP program as a model in developing a framework for transportation planning and shipment safety similar to the WIPP Program Implementation Guide [8, p. 5]

### Transportation of Nuclear Waste Sub-Committee
Utilize SCOP (Safety Compliance Oversight Plan) to insure the safety of all known future rail shipments of NF and HLW [10, Par. 10]. The SCOP will consist of: 1. Coordinated planning of the most viable routes, 2. Ensuring appropriate training of railroad employees and emergency responders, 3. Enhancing and focusing the Federal Railroad Administration’s safety inspections and monitoring activities on all facets of the rail shipments of used nuclear fuel (10, Paragraph 12).

### CSG Midwest
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 [11, p. 60].

### Table 4 Continued

<table>
<thead>
<tr>
<th>Blue Ribbon Commission Report</th>
<th>Emergency Preparedness and Planning</th>
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<tr>
<td>1. Early implementation of the Section 180 (c) program as currently defined by the NWPA should be initiated by DOE and should be supported by the Nuclear Waste Fund even before and potential or disposal site is identified [2, p. 86, xiii].</td>
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<tr>
<td>a. DOE should finalize procedures and regulations for providing technical assistance funds to local governments and tribes for training pursuant to Section 180 (c),</td>
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<td>b. Begin to provide such funding independent from progress on facility siting</td>
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<td>2. Recommends legislation to amend Section 180 (c) to expand authority and responsibility of the new waste management organization (similar to those in the WIPP Land Withdrawal Act) to include:</td>
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<tr>
<td>a. A program to provide information to the public about the transportation of SNF or HLW to or from the repository or consolidated storage facility,</td>
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<td>b. Authority and direction to assist states, tribes and local governments through monetary grants or contributions in-kind (subject to appropriation) in acquiring equipment for responding to an incident involving shipments covered by law,</td>
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<tr>
<td>c. Broad authority and direction to provide in-kind financial technical and other assistance (subject to appropriations) to states and tribes whose jurisdictions would be traversed by shipments of SNF to interim storage or a repository for the purpose of transportation safety programs related to such shipments that are not otherwise addressed in law [2, p. 86-87].</td>
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<tr>
<td>3. The BRC recommends that the NAS conduct an independent investigation of the events at Fukushima and their implications for safety and security requirements of current storage arrangements in the US [2, p.xii, 44, 2A, p. iii].</td>
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<th>NAS Going the Distance</th>
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<tr>
<td>Immediately implement Section 180(c) of the NWPA to provide funding and technical assistance to corridor states and tribes [2, p. 83, 86; 3, p. 248]. DOE should proceed to (1) establish a cadre of professionals from the emergency responder community who have expertise and training in response to SNF and HLW accidents; (2)</td>
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work with the DHS to provide consolidated "all hazards" training materials and programs for first responders to build on the existing national emergency response platform; (3) include trained emergency responders on the escort teams that accompany SNF and HLW shipments; (4) use emergency responder preparedness programs as an outreach mechanism to communicate about plans and programs for transporting waste to a repository with communities along planned shipping routes [3,p.248-251]

### IAEA

The IAEA requires that in the event of accidents during the transport of radioactive material, emergency provisions, as established by relevant national and/or international organizations, shall be observed to protect persons, property or the environment [4, p. 15-16]

### WIPP

1). Emergency equipment and training/exercises are very important to preparedness, and 2), medical and other mutual aid agreements should be in place between states for incidents near borders [2, p. 87; 7, p. 86].

### WGA-WIEB

Adopt in regulations a mutually acceptable assistance program that would: 1) Prohibit shipments if 180(c) funds/assistance have not been made available to states/tribes at least three years prior to the start of shipments, 2) Provide for the development and funding of state/tribal plans that identify: the minimum elements necessary to ensure safe routine transportation and procedures for dealing with emergency response situations, the current capabilities along each corridor, the activities needed to achieve minimum elements, and performance measures to evaluate programs implemented under the plan; 3) Provide annual implementation grants to states/tribes with 75 percent of the funds allocated by the number of projected shipment miles in the jurisdiction and 25 percent allocated to ensure minimum funding levels and program capabilities; 4) Provide flexibility in the expenditure of Section 180(c) funds pursuant to the state or tribal plans; 5) Establish Regional Training Advisory Teams of states and tribes to review and coordinate plans along shipment corridors and a National Training Advisory Committee to report to DOE on progress and needed additional actions [8, p.4].

### 5.0 Conclusions, Key Findings and Recommendations

The major conclusion of this review is that over time considerable consensus, or at least widespread agreement about radioactive waste management policy recommendations has evolved. Most importantly, while there has evolved a growing acceptance of the necessity of these policy and program recommendations; there has remained a conspicuous lack of their implementation. Furthermore, the recent DOE Strategy for the Management and Disposal of Used Nuclear Fuel, or the Implementation Strategy report that was to lay out the steps for implementing the BRC recommendations, raises considerable concern that this lack of implementation of the apparent consensual policy recommendations will continue [19, passim]. Finally, the recently released Draft Nuclear Waste Administration Act of 2013 (NWAA), appears at this early stage to lessen only some of the concerns surrounding the implementation of the BRC recommendations that are raised by the DOE Strategy Report [20, passim]. Each of these observations will be examined in turn [20 passim].
The review of the BRC recommendations, as well as the other seven agencies reports and recommendations, in the area of transportation of SNF and HLW reveals several important observations concerning the degree of agreement or consensus that exists about components of the nation’s nuclear waste management program. First, as can be seen from the tables and discussion, important recommendations emanate from the State(s), regional entities and local governments often prior to their acceptance by the federal government or the DOE. The analysis revealed a substantial degree of consensus in the recommendations found in the reports examined. Importantly, the recommendations of the various SRGs that appear initially to be either dismissed or unfeasible by the DOE, have gained overtime widespread acceptance among all of the agencies and organizations examined in this report. One exception to this observation in some areas appears to be the DOE, but even this lead agency for nuclear waste management has agreed to a large number of other agency, SRG and other institutions’ recommendations as time has passed. For example, the State of Nevada recommendation concerning full scale cask testing was initially rejected by the DOE. Later this recommendation was adopted by WGA-WIEB reports and policies, the CSGMW, and finally the NAS. DOE eventually does agree to full scale cask testing under extreme conditions including long duration fires under the supervision of the NRC, but as we have seen these tests were cut short because of funding cuts.

The area of full scale cask testing is one of many recommendations that initially percolated up from entities in the federal system and gained wide spread acceptance over time. The idea of a consent based siting process that is central to the BRC recommendations. In addition, this process is key to the January 2013, DOE Strategy for the Management and Disposal of Used Nuclear Fuel (SMDUNF) that lays out the implementation strategy for the BRC report. Yet, Nevada has advocated such a process since at least the mid 1980s, and the WGA and WIEB also have also long recommended such a process. Indeed, while the NAS report stops short of such a recommendation as we have seen, it however does suggest an alternative organization to DOE for waste management is desirable and that state and local input into all important aspects of the program were essential to the restoration of trust and eventual success (Table 1). Indeed, the importance of trust in getting the radioactive waste
management program back on track, and the idea that an alternative institution or organization to DOE might be required to accomplish this percolates from below the federal level. This recommendation was discussed at length among the SRGs, Nevada and other entities and eventually is articulated by the NAS in its report, and built into the or at least a central component of the BRC recommendations.

The importance of state, local, tribal governments, and SRGs input and assessments of transportation related highways conditions, as well as assuring security of the shipments, and driver safety is now widely accepted as critical to a successful transportation program. This consensus is apparent in Table 4. Whether such a program is modeled after the WIPP Transportation Program Implementation Guide, or other models, a key is the involvement of the affected state, local and tribal governments. Again this consensus has evolved over time and reaches its culmination with first the NAS recommendations on this topic, and then the BRC making it a key component of its recommendations for the program. As the Council of State Governments Mid West’s review, discussed in Section 4, makes clear, the DOE has consistently attempted to view the role of these state, local and tribal entities as one of review and comment. Whatever form this state, local and tribal involvement may take in the implementation of these recommendations, and there are several forms possible, the central role these entities should play will be difficult to dispute given the consensus revealed on this element of the program.

In other areas as well, the discussion in this report and the tables containing the organizations and entities’ recommendations reveals a consensus concerning the changes needed in the nation’s nuclear waste management program. An additional example of this consensus concerns Section 180 (c) of the NWPA. This part of the Act appears to have restricted federal aid in emergency preparedness and planning to technical assistance and planning. As revealed in Table 4, almost every entity has recommended it be expanded to include equipment and in-kind or cash payments to expand on the preparedness of affected states, local and tribal governments. The efforts by the DOE to establish a grant program through the states for Section 180 (c) were particularly upsetting to these entities in both the amount of monies set aside for
the initial planning process, as well as the process of distribution to the states. Hence, the discovery that Section 180 (c) requires change is not unexpected despite some aspects of the change requiring Congressional action. Yet, there is once again a near consensus on the importance of altering Section 180 (c).

Finally, overtime a consensus has emerged concerning many facets of the program involving transportation issues including the mode of transit, the routing and scheduling and determination of which waste should be transported first. The mostly rail preference is now widely accepted among the agencies examined in this report. However, this mode of transit also raises significant questions concerning waste stored at sites where rail shipment is not feasible, and there remain significant issues about shipment of this waste. With regard to routing and scheduling, a consensus has emerged concerning the importance of working these issues out with state, local and tribal governments and with some limitations employing the WIPP model and lessons learned in moving the program forward. Finally, there appears to be agreement, or at least a lack of opposition to the importance of shipping oldest or older spent fuel first. This last element of agreement involving changing the current queue and the Standard Contract will require Congressional action as noted by the NAS and WIEB report and recommendations.

From a new organization needed to manage the nation’s nuclear waste program, to a consent based program, a near consensus of opinion has emerged for managing the nation’s nuclear waste as reflected in the recommendations discussed in this report. While there is some surface disagreement about some specific needed programmatic details, there is a virtual consensus on why the BRC terms “core principles and values” that should guide the new program. Most importantly, there is a consensus about how the details should be worked through and that entails state, local and tribal participation.

The second element discussed in this conclusion is the DOE Implementation Strategy report. In the context of growing widespread agreement as reflected in the various recommendations for the program, the DOE Implementation Strategy report is particularly disappointing [19]. The Implementation Strategy report was published by the DOE one year after the BRC report and recommendations were finalized. As such, expectations were high that the DOE would publish more than just a “….framework for
moving toward a sustainable program to deploy an integrated system . . .” [19, p. 1].
Certainly, the Implementation Strategy report helps in providing a statement of where
the DOE agrees with the BRC recommendations, by either addressing specific
recommendations directly, or ignoring them in the DOE report. However, what is largely
missing in the DOE report are the implementation specifics including standards, criteria
and other means for selecting among competing alternatives or processes. In fact,
virtually nothing addresses such key issues as the potential for continued geographic
inequity in siting the pilot, consolidated or interim storage facility, and the HLW
repository. The DOE assures the reader that it “…… is undertaking activities within
existing Congressional authorization to plan for eventual transportation, storage and
disposal of used nuclear fuel. Activities range from examining waste management
system design concepts, to developing plans for consent-based siting processes, to
conducting research and development on the sustainability of various geologies for a
repository” [19, p.2].

Yet, in all of this activity the DOE reports it has undertaken in which state, local, SRG or
tribal governments have participated or been brought into the process? It would appear
from the absence of their mention in the report that DOE included none of these sub-
federal actors and institutions. The answer to this fundamental question demonstrates
the continued DOE failure to understand the key recommendation or underlying
principle of not only the BRC report, but also the NAS recommendations and almost all
of the other reports examined here. Specifically, participation of these entities should
not take place at the end of programmatic decisions about design or the other concerns
DOE assures us it is addressing, but rather such participation is critical at the beginning
of such processes and decisions. To engage these sub-federal actors later in the
process is to place them in a position of simply reviewing and commenting and that is-a
role that they and the BRC have rejected as inadequate. It is also a role that has been
associated with opposition and/or at the least a myopic program.

The lack of detail and specifics in the DOE Strategy report is clear in the discussion of
consent-based siting. After indicating its agreement with the BRC report’s discussion of
consent, the DOE informs the reader that the Strategy “…..endorses the proposition
that prospective host jurisdictions must be recognized as partners” [19, p. 9]. The Strategy report adds that “Public trust and confidence is a prerequisite to the success of the overall effort”…and that public perceptions must be addressed regarding the program’s ability to transport, store and dispose of used nuclear fuel and high-level nuclear radioactive waste in a manner that is protective of the public’s health, safety, and security and protective of the environment [19, p. 9]. Even if we accept the DOE’s endorsement of the BRC’s initial delineation that “a good gauge of consent would be the willingness of the host (jurisdictions) to enter into legally binding agreements ….that can protect the interests of their citizens”, the DOE has added virtually nothing to our understanding in this Strategy [19, p.9]. For example, which jurisdictions must accept the siting, which will have a role in siting decisions, how will the steps to consent be delineated and through what processes? Many other questions are not answered or even noted as having been considered in the DOE development of the Strategy.

When an agency or institution consistently fails to be able to address key issues in developing and implementing a program to the point where critical recommendations from key organizations recommend the program be placed in a different agency, it is probably not a good idea to have the failed agency develop a corrective implementation strategy. Yet, the Strategy report is written by the very agency that could not correct the program’s direction and was seen as a major problem in the program for decades by the very state, local and tribal governments that it now indicates are a key to the program’s success or failure. It is probably fair to suggest that credibility and trust will not be restored in waste programs as long as the DOE is directing the strategy for implementing the BRC and other report recommendations.

The final aspect of the conclusions is aimed at the recently released Draft Nuclear Waste Administration Act (NWAA). The draft Act is a product of a bipartisan group of U.S. Senators, and represents the initial step by Congress to implement the recommendations of the BRC. The draft Act does not, however cover all aspects of the BRC recommendations. For example, changes in Section 180 (c) of the NWPA that are recommended by the BRC are not a part of this Draft Act, and neither are changes needed in the Standard Contract necessary to change the queue for waste shipments.
Both of these areas had specific BRC recommendations associated with them that as was discussed, required Congressional action to alter and fix. [20]. In addition, the Draft Act which calls for a new Nuclear Waste Administration headed by a Presidential appointee without the governing board discussed in the BRC report, or for that matter also discussed in the NAS report [2, p. x, 61-62]. The comment period on the Act is open until May 24, 2013. It is too early to critique this effort as comments are still being received and the Senators have also released Supplementary Questions or specific questions for stakeholders and interested parties on various issues of nuclear waste. In short, the Draft is still in the process of change, and until the details of the NWAA are clearer, and the comment period has ended additional critique should be judged premature.

This report has shown that a good deal of consensus about critical elements of the nation's nuclear waste policy has developed over time. Perhaps in the context of this consensus a new opportunity exists to move forward. However as noted, the key to program change and success will be in how the consensual policy recommendations identified and discussed in this report are implemented. The key to tracking implementation is the type of analysis contained in this report which allows each of the BRC recommendations, as well as previous reports' recommendations to be compared to what the responsible program agency and Congress are doing to implement the program. By comparing these implementing actions to the recommendations the areas of difference may be identified. In addition, such comparisons will permit the identification of areas where action is needed or lacking. This tracking of implementation should be done systematically especially in-light of the brief analysis of both the Implementation Strategy report by Doe and the Draft NWAA where significant recommendations and areas important in the BRC report were not included.
Citations


<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Blue Ribbon Commission Report</th>
<th>NAS Going the Distance</th>
<th>BRC Transportation Sub-Committee</th>
<th>IAEA</th>
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<tbody>
<tr>
<td><strong>Organizational Structure</strong></td>
<td>A new single purpose organization is needed to develop and implement a focused, integrated program for the transportation, storage, and disposal of nuclear waste [2, p. 60]. The organization is independent and has the attributes and resources to carry out its mission. [2, p. x, 62; 2A, p. vii].</td>
<td>DOE and Congress should transfer responsibility for spent fuel transportation to an outside entity. [2, p. 83; 3, p. 261] Recommendation includes three options for a new organizational structure: 1) a quasi-independent DOE office reporting directly to upper level DOE management 2) a quasi-government corporation 3) a fully private organization operated by the commercial nuclear industry [3, p. 261].</td>
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<td><strong>Siting Process &amp; Consolidated Storage Disposal Facility</strong></td>
<td>1). New Consent Based Approach to Siting (Recommendation #1) that is adaptive, staged, flexible, transparent, and consent based approach. Partnership with state, local, and tribal governments [2, p. viii; 2A, p. vii, 60-69] 2). Prompt Efforts to Develop One or More Consolidated Storage Facilities [2, p. xii; 2A, p. iii, 32-36]. 3). Prompt Efforts to Develop a New Geological Disposal Facility (Recommendation #4) Regardless of what happens with Yucca Mountain, US inventory of spent nuclear fuel will soon exceed the amount that can be legally emplaced at this site until a second repository is in operation [2, p. xi, 27-29].</td>
<td>Full scale cask testing in extreme conditions should be utilized [2, p. 82; 3, p. 81, 108] 2. The Nuclear Regulatory Commission should build on recent progress in understanding package performance in very long duration fires [3, p. 107].</td>
<td>All near term forms of storage meet high standards of safety and security for the multi-decade-long time periods that they are like to be in use. Research should be focused on degradation phenomena, vulnerability to sabotage and terrorism, full scale cask testing, and other matters (Recommendation #2) [2A, p. v, 14-16; 2, p.41].</td>
<td>Testing for different types of radioactive materials shipments can rely on performance tests with models when appropriate [4, p. 105-106].</td>
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<td><strong>Storage &amp; Waste Packaging</strong></td>
<td>1. The US Government proceed to develop consolidated (interim) storage capacity without further delay [2, p.36]. 2. &quot;Spent fuel currently being stored at shutdown reactor sites be first in line&quot; for transport to storage facility [2, p.36].</td>
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<td><strong>Mode of Transportation</strong></td>
<td>1. Use of Railroads. Mostly rail has clear advantages; DOE should complete the Nevada rail line and examine how to reduce the need for cross-country truck shipments by expanding intermodal service [2, p. 83, 3, p. 217]. 2. DOE should fully implement its dedicated train decision before large-quantity shipments begin [2p. 83, 3 p. 217, 232,233].</td>
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<td><strong>Routing and Scheduling</strong></td>
<td>1. DOE should continue to ensure systematic involvement of states and tribal governments in decisions about routing and scheduling for current spent fuel shipments [2, p. 82,85, 3, p. 210] 2. Regulation Compliance - DOT should ensure states rigorously comply with requirements for sound risk assessments in designating routes, not just chosen by fastest time [2, p. 82, 3, p. 211]. 3. DOE should identify and make public its suite of preferred routes as soon as</td>
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<td>Must notify competent authorities of the country of origin and each country through/into which the shipment is to be transported. [4, pg 78]</td>
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<td>Shipping</td>
<td>DOE should ship older fuel first to a repository or storage facility. Conduct a pilot campaign by shipping fuel from shutdown reactors first [2 p. 83, 2A, p. vi, 238; 3 p. 238].</td>
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<td><strong>Shipment Safety</strong></td>
<td>New waste management organization should work with SRGs on transportation planning and issues to enhance the safety of shipments [2, p.67-68].</td>
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<td><strong>Transportation Security/Safety/Regulation</strong></td>
<td>New waste management organization should be subject to independent regulations of its transport operations in the same way that any private enterprise performing similar functions would be [2, p. 83].</td>
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<td><strong>Emergency Preparedness and Planning</strong></td>
<td>Immediately implement Section 180(c) of the NWPA to provide funding and technical assistance to corridor states and tribes [2, p. 83, 86; 3, p. 248]. DOE should proceed to (1) establish a cadre of professionals from the emergency responder community who have expertise and training in response to SNF and HLW accidents; (2) work with the DHS to provide consolidated &quot;all hazards&quot; training materials and programs for first responders to build on the existing national emergency response platform; (3) include trained emergency responders on the escort teams that accompany SNF and HLW shipments; (4) use emergency responder preparedness programs as an outreach mechanism to communicate about plans and programs for transporting waste to a repository with communities along planned shipping routes [3, p.248-251].</td>
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appropriation) in acquiring equipment for responding to an incident involving shipments covered by law,
c. Broad authority and direction to provide in-kind financial technical and other assistance (subject to appropriations) to states and tribes whose jurisdictions would be traversed by shipments of SNF to interim storage or a repository for the purpose of transportation safety programs related to such shipments that are not otherwise addressed in law [2, p. 86-87].
3. The BRC recommends that the NAS conduct an independent investigation of the events at Fukushima and their implications for safety and security requirements of current storage arrangements in the US [2, p.xi, 44, 2A, p. iii].

Funding
Access to utility waste disposal fees (Nuclear Waste Fund) for their intended purpose (Recommendation #3) including: 1) The Administration should promptly (by fiscal 2013) offer to amend DOE’s contract with nuclear utilities so the utilities remit only the portion of the annual fee that is appropriated for waste management each year and place the rest in a trust account. 2) Congressional legislation is also needed in the long term to transfer unspent balance in the Fund to the new waste management organization so that it can carry out its civilian nuclear waste obligations independent of annual appropriations. 3) It is urgent that the OMB should work with the congressional budget committees and the CBO to change the budgetary treatment of annual fee receipts so that these receipts can directly offset appropriations for the waste program. (BRC pg xi) (BRC Transpo SC pg ix)

Research, Development and Demonstration
Support for Advances in Nuclear Energy Technology and for Workforce Development (Recommendation #7) Involving: 1) Sustained public and private sector support for R&D on advanced reactor and fuel cycle technologies. 2) Increased efforts by the NAS to develop a regulatory framework for advanced nuclear energy systems and increase federal funding 4) Jurisdictions of safety and health agencies should be clarified and aligned. (BRC pg xii)

Sources
2. NAS: http://www.nap.edu/openbook.php?record_id=11538&page=R1
<table>
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<tr>
<th><strong>Organizational Structure</strong></th>
<th><strong>WIPP</strong></th>
<th><strong>WGA-WIEB</strong></th>
<th><strong>Transportation of Nuclear Waste Sub-Committee</strong></th>
<th><strong>CSG Midwest</strong></th>
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<tr>
<td><strong>Siting Process &amp; Consolidated Storage Disposal Facility</strong></td>
<td>Consent based approach emphasizing cooperation and consultation with states and communities, requiring written consent of host state governor, ensure regional fairness [9, 12].</td>
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<td>Advocate of full scale cask testing, by the Nuclear Regulatory Commission [11, p. 38].</td>
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<td><strong>Storage &amp; Waste Packaging</strong></td>
<td>Packaging approved by NAS, must meet NAS and DOT radiation limits. Different types of containers for different waste [2, p. 87].</td>
<td>DOE must commit to full scale testing of casks before any transportation of SNF/HLW [8].</td>
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<td>Intermodal shipments need to be addressed: 1) Where will they transfer 2) What kind of oversight will be necessary 3) The role of states, tribes and local governments [11, p. 40].</td>
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<td><strong>Mode of Transportation</strong></td>
<td>1. Has longstanding highly successful model for partnering with states to achieve shared success in addressing issues related to the transport of nuclear materials. (BRC pg 85) 2. Identify and select safest routes, not just by fastest time or shortest distance [7, p. 102].</td>
<td>1. Early Coordination and effective communications with state, tribal, and local governments is essential to the ultimate success of any nuclear waste transportation safety program [8]. 2. DOE should follow the WIPP program to develop a proposed set of primary and secondary shipping routes by working through its regional cooperative-agreement groups. DOE should require the use of these routes through mandatory contract provisions with any private contractors [8]. 3. DOE must commit to: 1) prepare a comprehensive transportation plan that includes the analysis of all needed transport-safety activities in a single document 2) develop responsible criteria for selecting shipping routes 3) develop a sound methodology for evaluating optimal mixes of routes and transportation modes [8].</td>
<td>1. Advocates of conducting transportation planning in a consultative fashion on a regional level, with appropriate interactions among the regions and other stakeholder groups [11, p. 34]. 2. Develop and cooperatively use a comprehensive database to analyze transportation data that is crucial for planning, procurement and safety [11, p. 13-14].</td>
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<td><strong>Routing and Scheduling</strong></td>
<td>1. Promote rail safety with the effort of Federal, State, and Local governments working together to insure the continued safe and secure transportation of nuclear materials by rail [10, Par. 24].</td>
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<td><strong>Shipping</strong></td>
<td>1. The CSG Midwest has not concluded whether it is appropriate to ship oldest or older fuel first, but agrees there are many benefits to shipping older, or oldest first, and believes that the owners of the waste will need to cooperate [11, p. 17]. 2. Advocates greater NRC oversight for shipping of SNF and HLNW [11, p. 15]. 3. Following the Standard Disposal Contract would result in</td>
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<td>Shipments Safety</td>
<td>Avoiding bad weather and road conditions key to avoiding incidents [7, p. 80; 5, p. 6]. Inspection and enforcement activities for radioactive material transportation are shared by federal and state agencies. Implementation of the inspection program by state personnel will provide independent verification of regulatory compliance, enhancing public confidence in the safety of the WIPP shipping campaign [7, p. 78].</td>
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<td>Doe should look to the WIPP program as a model in developing a framework for transportation planning and shipment safety similar to the WIPP Program Implementation Guide [8, p. 5].</td>
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<td>Utilize SCOP (Safety Compliance Oversight Plan) to insure the safety of all known future rail shipments of NF and HLRW [10, Par. 10]. The SCOP will consist of: 1. Coordinated planning of the most viable routes, 2. Ensuring appropriate training of railroad employees and emergency responders, 3. Enhancing and focusing the Federal Railroad Administration’s safety inspections and monitoring activities on all facets of the rail shipments of used nuclear fuel (10, Paragraph 12).</td>
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<td>Transportation Security/Safety/Drivers/Regulation</td>
<td>Driver requirements should go beyond DOT standards for carrying hazardous cargo [5, p.6]. Additional relevant WIPP instruction and training after being hired should be mimicked in other programs [7, p.75]. Stringent penalties for not performing correct procedures. WIPP Checked truck every 150 miles or 3 hours and drivers drove in pairs [2, p. 87; 7, p. 75; 5, p. 6].</td>
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<td>Adopt in regulations a mutually acceptable assistance program that would: 1) Prohibit shipments if 180(c) funds/assistance have not been made available to states/tribes at least three years prior to the start of shipments, 2) Provide for the development and funding of state/tribal plans that identify: the minimum elements necessary to ensure safe routine transportation and procedures for dealing with emergency response situations, the current capabilities along each corridor, the activities needed to achieve minimum elements, and performance measures to evaluate programs implemented under the plan; 3) Provide annual implementation grants to states/tribes with 75 percent of the funds allocated by the number of projected shipment miles in the jurisdiction.</td>
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<td>1). Emergency equipment and training/exercises are very important to preparedness, and 2). medical and other mutual aid agreements should be in place between states for incidents near borders [2, p. 87; 7, p. 86].</td>
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and 25 percent allocated to ensure minimum funding levels and program capabilities; 4) Provide flexibility in the expenditure of Section 180(c) funds pursuant to the state or tribal plans; 5) Establish Regional Training Advisory Teams of states and tribes to review and coordinate plans along shipment corridors and a National Training Advisory Committee to report to DOE on progress and needed additional actions [8, p.4].

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<th>Funding</th>
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<td>DOE should follow WIPP to develop flexible funding resources and cooperative agreements between their civilian, power and defense agencies as a means for supporting WGA and DOE application of lessons learned through the WIPP safety program. (WIEB Report Card)</td>
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