REPOSITORY TRANSPORTATION PLANNING, RISK MANAGEMENT, AND PUBLIC ACCEPTANCE: LESSONS LEARNED

Robert J. Halstead

State of Nevada, Agency for Nuclear Projects, Suite 118, 1761 E. College Parkway, Carson City, NV, 89706, bearhalstead@aol.com

Fred C. Dilger, PhD.

Black Mountain Research 1869 Desert Forest Way, Henderson, NV, 89012, fcd5@cox.net

The recent termination of the proposed Yucca Mountain repository provides both an opportunity and a need to re-examine the United States' historical experience planning large-scale, long-duration, cross-country shipping campaigns for spent nuclear fuel and high-level radioactive wastes. This paper reviews the past three decades, and identifies lessons learned which might be applied to future transportation planning for geologic repositories and centralized storage facilities. Key issues for risk management and public acceptance include shipment visibility, consideration of transportation in site selection and facility licensing, collaborative system planning, extra-regulatory safety measures, enhanced physical protection regulations, and alternative organizational structures.

I. REPOSITORY TRANSPORTATION STUDIES

Systematic assessment of repository transportation impacts dates to the 1980 Generic Environmental Impact Statement on Commercially Generated Radioactive Waste Management prepared by the U.S. Department of Energy (DOE). DOE and some potential repository host states began detailed transportation studies even before passage of the Nuclear Waste Policy Act (NWPA) in 1982. The NWPA created the DOE Office of Civilian Radioactive Waste Management (OCRWM), and directed OCRWM to begin planning for two geologic repositories, a monitored retrievable storage (MRS) facility, and the associated transportation system.

OCRWM promulgated site selection guidelines in 1984 that required consideration of favorable and potentially adverse transportation conditions for repository construction and operation. OCRWM evaluated transportation impacts in the 1986 environmental assessments (EAs) for the first repository candidate sites, and in the 1986 draft area recommendation report for the crystalline repository project. During this period OCRWM also sponsored national and regional meetings on high-level nuclear waste transportation issues, prepared a number of generic transportation studies, and addressed transportation in its Mission Plan and Mission Plan Amendments.

The NWPA required OCRWM to provide financial and technical assistance to potential repository host states. These states prepared detailed comments on DOE's transportation documents, and in some cases prepared independent transportation risk and impact analyses. OCRWM funding also supported transportation planning activities by state regional groups, such as the Western Governors' Association (WGA) and the Western Interstate Energy Board (WEIB), governmental groups such as the National Conference of State Legislatures, Native American tribal governments, and local governments. Other federal agencies, particularly NRC and DOT; electric utility and nuclear industry organizations; and environmental and public interest organizations; all issued publications and sponsored meetings on nuclear waste transportation, focused primarily on the OCRWM repository program, but also concerned with the proposed MRS facility in Tennessee and the proposed Waste Isolation Pilot Plant (WIPP) in New Mexico.

The Nuclear Waste Policy Amendments Act (NWPAA) of 1987 designated Yucca Mountain in Nevada as the sole candidate site for a geologic repository. Before the termination of the Yucca Mountain project in 2010, OCRWM produced hundreds of technical references regarding the repository transportation system, in support of three major environmental impact statements that together devoted more than 4,600 pages to transportation. The State of Nevada, Nevada and

California counties, Indian tribes, and other states and state regional groups (SRGs), prepared or sponsored hundreds of transportation reports, commentaries, journal articles, conference presentations, and hearing statements.

Lessons learned from the Yucca Mountain program can be found in the licensing proceeding contentions admitted by the Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board in May 2009. Other lessons can be found in relevant NRC-sponsored transportation reports and proceedings, including the Package Performance Study, various transportation accident fire studies, the current NRC proposed rule for enhanced physical protection of spent fuel shipments (10 C.F.R. 73.37), and NRC studies regarding transportation implications of extended at-reactor storage, and integrated regulation of spent fuel storage and transportation.[1] The lessons learned also include the findings and recommendations of the National Academy of Sciences (NAS) 2006 report.[2]

II. LONG-TERM, NATIONWIDE VISIBILITY

Transportation will likely be "the most visible element nationwide" of any future nuclear waste management system, affecting much of the nation for a half-century or more.

OCRWM recognized the potential significance of repository shipments in 1986. [3] Two decades later, transportation analyses for the now-terminated Yucca Mountain project document the potential scope of impacts. Accepting OCRWM assumptions – one repository, no new reactors, license extensions for all operating reactors, a total spent nuclear fuel (SNF) and high-level radioactive waste (HLW) inventory of about 150,000 MTU, mostly rail (95 percent) transportation of commercial SNF, and all rail transportation of DOE SNF and HLW - there would likely be about 7,000 train shipments (3-5 casks per train) and 5,000 truck shipments (one cask per truck) over about 50 years. On an annual basis, there would about 100-150 train-load shipments and 100 truck shipments, compared to about 10-15 train-loads and 10-15 truck shipments per year currently. The number of rail shipments could be substantially reduced by use of larger capacity casks; the number of truck shipments could be four times greater if 20 percent of the inventory were to be moved by truck. (Ref. 1)

An extraordinary number of people, communities, and political jurisdictions would have been impacted by shipments to Yucca Mountain. Most of the nation's spent fuel and high-level waste is currently stored at 76 sites in 34 states. The "representative routes" identified by DOE, from these sites to Yucca Mountain, would have traveled 22,000 miles of railways and 7,000 miles of highways, traversing 44 states, the District of Columbia, 33 Indian nations, and about 836 counties with a population of about 161 million. (2005 Census estimates) Between 10 and 12 million people live within one-half mile (800 meters) of these rail and highway routes. And these routes would have affected most of the nation's congressional districts (330 in the 110th Congress). (Ref. 1)

III. REPOSITORY SITE SELECTION

Transportation requirements, especially access to mainline railroads and the national interstate highway system, must be addressed early in the process of any future repository site selection.

An important lesson from the Yucca Mountain program is that critical transportation requirements, such as mainline rail access and interstate highway access, must be addressed in the earliest phases of site selection for repositories and for storage facilities. Without direct rail access, delivery of spent fuel and high-level radioactive waste to a national facility would require either tens of thousands of cross-country over-weight truck (OWT) shipments or many thousands of heavy-haul truck (HHT) shipments from an intermodal transfer facility. Access to the interstate highway system is also highly desirable, for delivery of spent fuel and high-level waste, and repository construction materials and supplies, and for access by workers and emergency services.

Congressional designation of Yucca Mountain as the only repository candidate site in 1987 ignored known problems with rail access construction and impacts, as well as challenging highway access. DOE had previously evaluated Yucca Mountain in accordance with the repository siting guidelines for transportation (10 CFR 960.5-2-7). The site exhibited no favorable conditions for rail construction, and presented three potentially adverse conditions: relatively high construction costs; relatively difficult terrain; and local conditions (proximity to military facilities and potential military aircraft over-flights) "that could cause the transportation-related costs,

---

[1] A comprehensive listing of repository transportation references is provided in R. HALSTEAD, F. DILGER, D. BALLARD, "Yucca Mountain Transportation Planning: Lessons Learned, 1984-2009," *Proc. WM2011 Conf.*, Phoenix, AZ, February 27-March 3, 2011 (forthcoming).

[2] Committee on Transportation of Radioactive Waste, *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*, The National Academies Press, Washington, DC (2006).

[3] OCRWM, *Transportation Institutional Plan*, DOE/RW-0094 (August 1986).

environmental impacts, or risk to public health and safety from waste transportation operations to be significantly greater than those projected for other comparable siting options."[4]

In the 1986 Yucca Mountain EA, OCRWM calculated that rail access could be attained by constructing a 100-mile railroad, originating in the Las Vegas area, at a cost of $151 million (1985$). By 2008, OCRWM was proposing construction of the Caliente rail alignment, a 300-plus-mile railroad, longer than the distance between Washington DC and New York City, crossing 8 mountain ranges, and costing $2.7 billion or more. Even if built, the Caliente rail line to Yucca Mountain would not have eliminated rail shipments of SNF through downtown Las Vegas, a major concern in Nevada. Additionally, Yucca Mountain had poor access to the national interstate highway system, which led DOE to propose routing all over-weight truck shipments to Yucca Mountain through the Las Vegas Valley. (Ref. 1)

Any future repository site selection effort should begin with a reconsideration of the transportation conditions contained in the 1984 repository siting guidelines for transportation (10 CFR 960.5-2-7). Initial site screening should focus on proximity to mainline railroads; proximity to interstate highways; and proximity to military installations, hazardous materials facilities, or other facilities that might impact transportation safety and security; as well as the geologic characteristics necessary for repository locations.

IV. REPOSITORY LICENSING

Transportation impacts, including the full range of radiological and non-radiological impacts typically addressed in an environmental impact statement, will likely be addressed in any future NRC repository licensing proceeding.

The NRC review of transportation impacts as part of the DOE license application for Yucca Mountain will likely affect any future effort to obtain an NRC license for a geologic repository. The position adopted by the NRC suggests that transportation requirements and impacts must be comprehensively assessed in the license application, particularly in the supporting environmental impact statement.

The role of transportation in future license applications may well have already been established:

> Transportation of nuclear waste is a foreseeable consequence of constructing a nuclear waste repository. As California persuasively argues, "[w]ithout transportation of the waste to it, Yucca Mountain would be just a very large, fancy, and expensive hole in a mountain." The Commission, for example, has stated that there can be "no serious dispute" that the NRC's environmental analysis in connection with licensing nuclear facilities should extend to "related offsite construction projects – such as connecting roads and railroad spurs." Likewise, there can be no serious dispute that the NRC's NEPA responsibilities do not end at the boundaries of the proposed repository, but rather extend to the transportation of nuclear waste to the repository. The two are closely interdependent. Without the repository, waste would not be transported to Yucca Mountain. Without transportation of waste to it, construction of the repository would be irrational. Under NEPA, both must be considered. [5]

Based on this determination, the NRC Atomic and Safety Licensing Boards admitted 46 NEPA transportation, or transportation-related, contentions: 17 submitted by the State of California, 16 submitted by the State of Nevada, 8 submitted by California and Nevada Counties, 3 submitted by the Nuclear Energy Institute, and 2 submitted by the Timbisha Shoshone Tribe. These admitted contentions address virtually every aspect of repository transportation, including construction and operation of the Caliente rail alignment to Yucca Mountain.

As part of the Yucca Mountain licensing process, NRC staff reviewed and adopted the DOE SEIS, including the transportation impact calculations for the mostly rail transportation scenario.[6] The SEIS evaluated transportation radiological impacts in four categories: (1) "incident-free" exposures to members of the public residing near transportation routes, cumulative total up to 2,500 person-rem dose and 1.5 latent cancer fatalities, and

[4] R.J. HALSTEAD, ET AL, "Transportation to Yucca Mountain: Critical Issues," *High-Level Radioactive Waste Management, Proceedings of the Second Annual International Conference*, Las Vegas, NV, Vol. 1, 647-656 (April 28-May 3, 1991).

[5] NRC, Atomic Safety and Licensing Boards, Memorandum and Order Identifying Participants and Admitted Contentions, Docket N0. 63-001-HLW (May 11, 2009).

[6] NRC, U.S. Nuclear Regulatory Commission Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain, Pp. 3-13, 3-15, 5-1 (September 5, 2008).

in certain special circumstances (for example, 0.016 rem to a person in a traffic jam); [Pp.6-20, 6-21, 8-41] (2) "incident-free" exposures to transportation workers such as escorts, truck drivers, & inspectors, cumulative total up to 13,000 person-rem and 7.6 latent cancer fatalities (by administrative controls, DOE would limit individual doses to 0.5 rem per year; the allowable occupational dose is 5 rem per year); [Pp.6-21, 8-41] (3) release of radioactive material as a result of the maximum reasonably foreseeable transportation accident (probability about 5 in one million per year), involving a fully engulfing fire, 34 rem dose to the maximally exposed individual, 16,000 person-rem population dose and 9.4 latent cancer fatalities in an urban area, and cleanup-costs of $300,000 to $10 billion; [Pp.6-15, 6-24, G-56] and (4) release of radioactive material following a successful act of sabotage or terrorism, using a high-energy density device, resulting in 27-43 rem dose to the maximally exposed individual, 32,000-47,000 person-rem population dose and 19-28 latent cancer fatalities in an urban area, and cleanup costs similar to a severe transportation accident. [Pp.6-27, CR-467] California and Nevada contentions specifically challenged the NEPA sufficiency of DOE's transportation radiological impact evaluations. If the licensing proceeding should resume, these impacts would be further explored in great detail.

V. TRANSPORTATION PROGRAM PLAN

A comprehensive transportation program plan should be developed in consultation with affected states, Indian tribes, and state regional groups, following the recommendations of the Western Governors' Association and incorporating experience with the WIPP transportation program.

Another lesson from the Yucca Mountain experience is the importance of developing a comprehensive transportation program plan in consultation with affected states, Indian tribes, local governments, and state regional groups. In 2009 the DOE Office of Civilian Radioactive Waste Management published a National Transportation Plan (NTP) for the proposed Yucca Mountain repository.[7] After spending more than 25 years and more than $780 million (2007$) on transportation planning,[8] OCRWM issued a 28-page NTP that was barely an outline of a plan, lacking programmatic, technical, and financial details.

Beginning in the 1980s, the Western Governors' Association (WGA) adopted and reconsidered at three-year intervals, a series of resolutions on waste management generally, and SNF and HLW transportation in particular. These resolutions were specifically addressed to DOE, and emphasized the need for a comprehensive transportation plan that did not take safety for granted. WGA representatives, in cooperation with representatives of the Western Interstate Energy Board (WIEB), carried the same message to meetings of the DOE Transportation External Coordination (TEC) Working Group, for 17 years, beginning in 1992. The TEC meetings, co-chaired by OCRWM and DOE's Office of Environmental Management, provided a useful forum for stakeholder discussions. However, issue resolution was limited (a notable exception - rail operations safety), and the TEC made little progress in collaborative planning, compared to the WIPP program. The transportation plan that OCRWM finally produced in 2009 ignored most of the WGA recommendations.

Any future repository transportation planning effort should begin with the detailed recommendations of the Western Governors' Association. "In order to develop a safe and effective system accepting commercial spent nuclear fuel and HLW at any facility, the federal government must expand its focus beyond siting, and develop, in coordination with states and tribes, a logical and timely transportation program. This requires policy commitments from DOE and other federal agencies to:

a. Fix the shipping origins and destination points as early as possible;
b. Ensure the availability of rail and truck shipping casks;
c. Conduct full scale testing of casks to be used to transport spent nuclear fuel and HLW;
d. Prepare a comprehensive transportation plan that includes the analysis of all needed transport safety activities in a single document;
e. Develop responsible criteria for selecting shipping routes;
f. Develop a sound methodology for evaluating optional mixes of routes and transportation modes; and
g. Conduct a thorough review of the risks of terrorism and sabotage against spent fuel and HLW shipments and work with state governments to assume that adequate safeguards are in place prior to shipments occurring."[9]

The WGA policy resolution also calls on DOE or any other operator of a repository or storage facility to

[7] OCRWM, *National Transportation Plan*, *Revision 0*, DOE/RW – 0603 (January 2009).

[8] OCRWM, *Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program, Fiscal Year 2007*, DOE/RW-0591 (July 2008).

[9] *Western Governors' Association Policy Resolution 08-6,* Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste (2008).

consider specific elements of the WIPP transportation program, including: (1) a safety and public information program similar to that developed with Western states; (2) the WIPP Transportation Safety Program Implementation Guide; (3) the WIPP example of working through its regional cooperative-agreement groups to propose a set of shipping routes to affected states and tribes for their review and comment, resulting in identification of a set of primary and secondary routes; (4) a tracking system, such as TRANSCOM, capable of notifying the vehicle operator, DOE, states and tribes of current location, potential bad weather and road conditions, and occurrence of incidents; and (5) the responsibility of the generators of spent nuclear fuel and HLW and the federal government, not the states and tribes, to pay for all costs associated with assuring safe transportation, including emergency response, shipment escorts and inspections, and route evaluations. (Ref. 8)

VI. RISK MANAGEMENT

Any future repository transportation program should adopt the National Academy of Sciences 2006 recommendations for managing nuclear waste transportation health and safety risks and social risks; once implemented, the adoption of these measures should be effectively communicated.

In 2003, the National Academies of Sciences and Engineering appointed a Committee on Transportation of Radioactive Waste to conduct "an independent, objective, and authoritative analysis" of SNF and HLW transportation. The NAS report, "Going the Distance?", published in 2006, thoroughly examined the history of spent nuclear fuel transportation in the United States, including recent DOE spent fuel shipments to federal facilities, the current DOE transuranic waste shipments to WIPP, and the proposed Yucca Mountain transportation system. (Ref. 2)

The NAS report's findings on transportation safety, and the report's specific recommendations for management of technical and social risks, provide a template for resolving public concerns about SNF and HLW transportation safety, in a manner that could achieve stakeholder confidence. The NAS report's principal finding on transportation safety:

> The Committee could identify no fundamental technical barriers to the safe transport of spent nuclear fuel and high-level radioactive waste in the United States. Transport by highway (for small-quantity shipments) and by rail (for large quantity shipments) is, from a technical viewpoint, a low-radiological-risk activity with manageable safety, health and environmental consequences when conducted in strict adherence to existing regulations. However, there are a number of social and institutional challenges to the successful initial implementation of large-quantity shipping programs that will require expeditious resolution as described in this report. Moreover, the challenges of sustained implementation should not be underestimated. (Ref. 2)

The NAS report qualified its findings on risk:

- The radiological risks associated with the transportation of spent fuel and high-level waste are well understood and are generally low, with the possible exception of risks from releases in extreme accidents involving very-long-duration, fully engulfing fires.
- The finding that spent fuel transportation risks are "generally low" at present does not necessarily mean that such risks will continue to be low in the future. Future risks depend on a number of factors (e.g., the care taken in fabricating transport packages and executing transportation operations).
- The social risks … which can result in lower property values along transportation routes, reductions in tourism, and increased anxiety, have received substantially less attention than health and safety risks, and some are difficult to characterize. (Ref. 2)

Any future nuclear waste transportation program should implement the specific recommendations of the NAS report, or explain why they should not be implemented:

- 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, and mitigate such hazards before the commencement of shipments
- Expand membership and scope of existing DOE advisory group (TEC) to obtain outside advice on social risk, including impact management
- Establish transportation risk advisory group explicitly designed to provide advice on characterizing, communicating, and mitigating the social, security, and health and safety risks of transportation
- Undertake additional analyses of very long duration fire scenarios, develop measures to prevent shipments from encountering such fires
- Use full-scale package testing as part of integrated package performance program (testing to destruction should not be required)

- Continue involvement of states and tribal governments in routing and scheduling of foreign and DOE research reactor spent fuel shipments
- Ensure state designation of highway routes are supported by sound risk assessments, and affected states fulfill their regulatory responsibilities
- Implement mostly rail option, using intermodal transportation to allow the shipment of rail packages from plants that do not have direct rail access, and avoid extended truck transportation program
- Publicly identify DOE suite of preferred highway and rail routes to a federal repository as soon as practicable, with involvement by states and tribes
- Fully implement DOE dedicated train decision before commencing the large-quantity shipments to a federal repository (avoid general trains)
- Negotiate with commercial spent fuel owners to ship older fuel first, except where storage risks at specific plants dictate otherwise. Should these negotiations prove to be ineffective, Congress should consider legislative remedies.
- Immediately begin to execute DOE emergency preparedness responsibilities defined in section 180© of the NWPA, and include emergency responders in program planning and communication with affected communities
- DOE, DHS, DOT, and NRC should develop criteria for protecting sensitive information about transportation, and commit to open sharing of information that does not require such protection, and facilitate timely access to open information
- Examine options for changing the organizational structure of the DOE repository transportation program (Ref. 2)

A number of the NAS recommendations are the same as, or very similar to, the recommendations of the Western Governors Association. The NRC has substantially implemented the NAS recommendations regarding analyses of very long duration fire scenarios.

VII. SHIPMENT REGULATION

All future repository shipments of SNF and HLW should be fully regulated by the NRC, in the same manner as shipments by other NRC licensees.

Shipments of SNF and HLW to Yucca Mountain would not have been regulated by NRC, except for use of NRC-certified casks and shipment notification to states, as specifically required by the NWPA. As former NRC Chairman Richard Meserve explained in 2002, "If DOE takes custody of the spent fuel at the licensee's site, DOE regulations would control the actual spent fuel shipment. Under such circumstances, the NRC's primary role in transportation of spent fuel to a repository would be certification of the packages used for transport. … However, if NRC licensees are responsible for shipping the spent fuel not only must the transport container be certified by the NRC, but also the shipment must comply with NRC regulations for the physical security of spent fuel in transit (10 CFR Part 73). NRC licensees are subject to inspection for compliance with the NRC's transportation safety and security regulations. The NRC also issues Quality Assurance (QA) program approvals for radioactive material packages that apply to the design, fabrication, use and maintenance of these packages. Activities conducted under an NRC QA program are also subject to NRC inspection."[10]

OCRWM compliance with the NRC physical protection requirements has been a major concern for stakeholders since 1999, when the State of Nevada filed a petition for rulemaking requesting that NRC strengthen the pre-shipment planning, route approval, armed guard, and other provisions of 10 CFR 73.37. In 2010 NRC, issued for public comment a proposed rule which substantially adopts five of Nevada's seven requested amendments to the current regulations, and rejects one request (use of dedicated trains for all rail shipments). In separate actions, NRC in 2007 adopted changes to the Design Basis Threat that satisfied Nevada's original request, and in 2009 denied Nevada's request for a comprehensive assessment of the consequences of terrorist attacks. The major outstanding issue at present is that OCRWM repository shipments would continue be exempt from NRC regulations.

Both DOE and NRC have long sought to assure stakeholders that DOE self-regulation would meet or exceed NRC physical protection requirements. Stakeholders are concerned that DOE may exempt itself from NRC standards "if there is a determination that national security or another critical interest requires different action."[11] Stakeholder concerns have been fueled

[10] R.A. MESERVE, RESPONSES TO QUESTIONS FROM SENATOR DURBIN (Letter dated March 22, 2002) NRC-Durbin-ML021060662.pdf (May 10, 2002).

[11] NRC, "Physical Protection of Irradiated Reactor Fuel in Transit," 10 CFR 73, Proposed Rule, Federal Register, Vol. 75, No. 197, 62695-62716 (October 13, 2010).

by the DOE position, regularly asserted during TEC meetings, that OCRWM shipments would be in compliance as long as their physical protection requirements were "the equivalent" of 10 CFR 73.37. Stakeholders believe DOE self-regulation lacks a credible inspection and enforcement mechanism, fails to ensure independent performance of critical security tasks such as route approvals, and fails to ensure DOE compliance with the NRC enhanced Design Basis Threat adopted in 2007.

NRC regulation of repository shipments could also resolve safety and security concerns that grew out of the DOE proposal to use TAD canisters as part of the Yucca Mountain transportation system. In any future off-site disposal or storage program, using dual-purpose or multi-purpose canisters intended for repository disposal or long-term storage, there would likely be similar calls for NRC to monitor and inspect canister loading, closure, and transfer operations at the shipping sites, as well as off-site transportation.

VIII. ORGANIZATIONAL STRUCTURE AND TRANSPORTATION INSTITUTIONAL ISSUES

In examining options for changing the organizational structure of the federal program for managing spent fuel and high-level waste, particular attention should be given to transportation institutional issues and the success of the WIPP transportation program.

In 2010, the Obama Administration terminated the Yucca Mountain project, and appointed a Blue Ribbon Commission on America's Nuclear Future (BRC) to review current nuclear waste management policies and make recommendations for a new plan, including additional legislation or amendments to existing laws. The BRC is considering various approaches to storage, transportation, reprocessing, and disposal, and alternative organizational structures for the federal program. The OCRWM has been defunded, and its staff disbanded, although it still exists in statute.

The BRC review of the larger waste program has superseded consideration of the NAS 2006 recommendation for reorganization of the OCRWM transportation program. NAS had recommended transferring repository transportation responsibilities to either a quasi-independent DOE office reporting directly to upper-level DOE management, a quasi-government corporation, or a fully private organization operated by the commercial nuclear industry. Over the past year, the BRC has heard testimony from a variety of sources advocating a similar array of options for reorganizing the entire NWPA program.[12] Many statements to the BRC have emphasized removing the program from DOE and echo a common sentiment from the 1980s: "The most compelling reason for taking the program out of DOE … is loss of state, tribe, and public confidence."[13] Proposals to turn the waste program over to a federally chartered corporation, and possibly separate the civilian and defense waste management efforts, have come from many individuals and interests.[14]

The examination of options to reorganize the NWPA program will confront difficult institutional challenges. Any effort to take the program away from OCRWM will need to overcome major legal obstacles, including transfer of the current standard contracts, liabilities resulting from OCRWM failure to take title to spent fuel, and transfer of the Nuclear Waste Fund. Any effort to remove the nuclear waste program from politics, both at the national level, and with states, tribes, and local governments, must confront the reality that nuclear waste, nuclear power, and nuclear weapons are inherently controversial. Any effort to replace DOE with a non-governmental entity must address the challenge of on-going intergovernmental relations with perhaps 44 states, the District of Columbia, 33 Indian nations, 836 counties, and 330 congressional districts, all of which could be affected by transportation for half a century or more.

The examination of options should objectively consider the DOE role in the WIPP transportation experience. During the same decades that the Yucca Mountain transportation system was being debated, DOE began shipments to WIPP. The successful transportation of transuranic wastes to the Waste Isolation Pilot Plant in New Mexico provides important lessons for national transportation of spent fuel and high-level waste. These lessons include the need for advance planning (particularly early selection of shipment routes), intergovernmental cooperation (especially DOE cooperative activities with state regional groups, such as the WGA), extra-regulatory safety measures to prevent accidents, full-scale testing of transport packages, and sustained Federal funding to support law enforcement and emergency response activities. However, the WIPP model is not fully applicable to spent fuel transportation. Transuranic waste, even the remote-handled portion, is

[12] See the Commission's charter, meeting agendas, testimony, and documents on-line at http://www.brc.gov.

[13] R. HALSTEAD, M. WISE, T. EVANS, "Rethinking the Nuclear Waste Program: Lessons from the Crystalline Repository Project," *Proc. WM88 Conf.*, Tucson, AZ, Vol.2, Pp. 901-914 (1988).

[14] See for example Nuclear Energy Institute, "A Federal Corporation Should Be Developed to Manage Used Nuclear Fuel," (September 2010) at http://nei.org.

considerably less dangerous than spent nuclear fuel; the wastes shipped to WIPP are owned by DOE and shipped from sites managed by DOE; and to date, trucks have been used for all WIPP shipments. Additionally, public acceptance of WIPP shipments is influenced by attitudes towards national defense and environmental remediation of nuclear weapons facilities.

IX. CONCLUSIONS

The Yucca Mountain repository program has been terminated. The lessons learned during the past 30 years should be applied to any future transportation planning for geologic repositories and centralized storage facilities. Resolution of stakeholder concerns about safety and security will be crucial to the success of any future program. Implementation of the National Academy of Sciences recommendations for risk management, the Western Governors' Association recommendations for collaborative planning, and NRC regulation of all spent nuclear fuel and high-level radioactive waste shipments, would address stakeholder concerns and provide a basis for public acceptance.

REFERENCES

1. R. HALSTEAD, F. DILGER, D. BALLARD, "Yucca Mountain Transportation Planning: Lessons Learned, 1984-2009," *Proc. WM2011 Conf.*, Phoenix, AZ, February 27-March 3, 2011 (forthcoming).
2. Committee on Transportation of Radioactive Waste, *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*, The National Academies Press, Washington, DC (2006).
3. OCRWM, *Transportation Institutional Plan*, DOE/RW-0094 (August 1986).
4. R.J. HALSTEAD, ET AL, "Transportation to Yucca Mountain: Critical Issues," *High-Level Radioactive Waste Management, Proceedings of the Second Annual International Conference*, Las Vegas, NV, Vol. 1, 647-656 (April 28-May 3, 1991).
5. NRC, Atomic Safety and Licensing Boards, Memorandum and Order Identifying Participants and Admitted Contentions, Docket N0. 63-001-HLW (May 11, 2009).
6. NRC, U.S. Nuclear Regulatory Commission Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain, (September 5, 2008).
7. OCRWM, *National Transportation Plan, Revision 0*, DOE/RW – 0603 (January 2009).
8. OCRWM, *Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program, Fiscal Year 2007*, DOE/RW-0591 (July 2008).
9. *Western Governors' Association Policy Resolution 08-6*, Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste (2008).
10. R.A. MESERVE, RESPONSES TO QUESTIONS FROM SENATOR DURBIN (Letter dated March 22, 2002) NRC-Durbin-ML021060662.pdf (May 10, 2002).
11. NRC, "Physical Protection of Irradiated Reactor Fuel in Transit," 10 CFR 73, Proposed Rule, *Federal Register*, Vol. 75, No. 197, 62695-62716 (October 13, 2010).
12. The Blue Ribbon Commission on America's Nuclear Future, (January 2010) at http://www.brc.gov.
13. R. HALSTEAD, M. WISE, T. EVANS, "Rethinking the Nuclear Waste Program: Lessons from the Crystalline Repository Project," *Proc. WM88 Conf.*, Tucson, AZ, Vol.2, Pp. 901-914 (1988).
14. Nuclear Energy Institute, "A Federal Corporation Should Be Developed to Manage Used Nuclear Fuel," (September 2010) at http://nei.org.