

U.S. Nuclear Waste Technical Review Board
Performance Evaluation
Fiscal Year 2004

**NUCLEAR WASTE TECHNICAL REVIEW BOARD
PERFORMANCE EVALUATION
FISCAL YEAR 2004**

Evaluating the Board's Performance

The Board believes that measuring its effectiveness by directly correlating Board recommendations with improvements in the technical and scientific validity of Department of Energy (DOE) activities would be ideal. However, the Board cannot compel the DOE to comply with its recommendations. Consequently, a judgment about whether a specific recommendation had a positive outcome as defined above, may be (1) subjective or (2) an imprecise indicator of Board performance because implementation of Board recommendations is outside the Board's direct control. Therefore, to measure its performance in a given year, the Board has developed the following performance measures.

1. Did the Board undertake the reviews, evaluations, and other activities needed to achieve the goal?
2. Were the results of the Board's reviews, evaluations, and other activities communicated in a timely, understandable, and appropriate way to Congress and the Secretary of Energy?

If both measures are met in relation to a specific goal, the Board's performance in meeting that goal will be judged effective. If only one measure is met, the performance of the Board in achieving that goal will be judged minimally effective. Failing to meet both performance measures without sufficient and compelling explanation will result in a judgment that the Board has been ineffective in achieving that performance goal. If the goals are deferred, that will be noted in the evaluation.

The Board will use its evaluation of its own performance from the current year, together with its assessment of current or potential key issues of concern related to the DOE program, to develop its annual performance objectives and performance-based budget request for subsequent years. The results of the Board's performance evaluation are included in its annual summary report.

Board's Performance Evaluation for 2004

On the basis of the following evaluation and consistent with the performance measures described in the previous section, the Board's performance for 2004 was found to be effective overall. However, the Board did not have access to TSPA results in 2004. Consequently, performance goals related to reviewing that important aspect of the DOE program were partially met or deferred. Several other performance goals were not possible to meet fully because the DOE did not undertake activities in those areas in 2004. When that is the case, it is noted under the evaluation of the specific performance goal.

The reliability and completeness of the performance data used to evaluate the Board's performance relative to its annual performance goals is high and can be verified by accessing the referenced documents on the Board's Web site: www.nwtrb.gov.

The Board's performance goals for fiscal year (FY) 2004 were developed to achieve the general goals and strategic objectives in its strategic plan for the years 2004-2009. The goals also have been established in accordance with the Board's statutory mandate and reflect congressional action in 2002 authorizing the U.S. Department of Energy (DOE) to proceed with developing an application to be submitted to the Nuclear Regulatory Commission (NRC) for authorization to construct a repository at Yucca Mountain. The Board's performance goals reflect the continuity of the Board's ongoing technical and scientific evaluation and the Board's efforts to evaluate program activities taking into account the interdependence of components of the repository system and the waste management system.

For purposes of this evaluation, the Board's performance goals for FY 2004 have been organized and numbered to correlate with appropriate strategic objectives in the Board's strategic plan for FY 2004-2009.

1. Performance Goals and Evaluation Related to the Natural System

1.1.1 Review the technical activities and agenda of the DOE's science and technology (S&T) program.

- *Evaluation of 1.1.1:* The Board held a panel meeting on January 20, 2004, at which it received an update on the S&T program. In a May 3, 2004, letter to the DOE, the Board commended the S&T program for including on its agenda study of the Peña Blanca analogue site in Chihuahua, Mexico. The Board commented on the importance of the S&T program in a letter to the DOE on November 30, 2004, and in its report to Congress and the Secretary of Energy dated December 30, 2004.

1.1.2. Monitor the results of flow-and-transport studies to obtain information on the potential performance of the saturated zone as a natural barrier in the repository system.

- *Evaluation of 1.1.2:* The Board held a two-day panel meeting on March 9-10, 2004, at which one day was devoted to reviewing activities undertaken by the DOE related to saturated zone flow and transport. The Board sent a letter to the DOE on May 3, 2004, in which it commented extensively on fluid flow and radionuclide transport and the potential of the natural barriers to provide a barrier to the migration of radionuclides. Understanding the interaction of the components of the natural system and how they act together to isolate waste was identified as a Board priority in its December 30, 2004, report to Congress and the Secretary of Energy.

1.1.3. Review DOE efforts to confirm estimates of natural-system performance and pursue independent lines of evidence, including tests of models and assumptions.

- *Evaluation of 1.1.3:* On March 9-10, 2004, the Board held a two-day panel meeting on the natural system at Yucca Mountain. During these two days, the Board heard several presentations on the DOE's approach to estimating the performance of the natural barriers and on supplementing those estimates with additional lines of evidence. Several of the presentations dealt with assumptions underlying the modeling of the natural system. In a May 3, 2004, letter to the DOE, the Board pointed out that unsaturated zone fluid flow and transport predictions are influenced significantly by assumptions inherent in the formulation of the active fracture model. The Board also noted that updating the site-scale model on the basis of these calculations could affect predictions of radionuclide transport times. In the same letter, the Board observed that multiple lines of evidence could be used to supplement conceptual understanding, models used to represent the concepts, and the scenarios predicted by the models. Understanding the interaction of the components of the natural system and how they act together to isolate waste was identified as a Board priority in its December 30, 2004, report to Congress and the Secretary of Energy.

1.2.1. Review DOE efforts to resolve questions related to possible seismic events and igneous consequences.

- *Evaluation of 1.2.1:* The Board received DOE updates on seismic issues at meetings held May 18, 2004, and September 20, 2004. In follow-up letters to the DOE, the Board noted that the DOE had made progress in developing realistic estimates of ground motions. The Board encouraged the use of sound physical principles to limit ground motions, the integration of technical and scientific studies and activities, and the submission of study results to external peer review. In its December 30, 2004, letter to Congress and the Secretary, the Board noted progress in this area. At its September 20, 2004, meeting, the Board was briefed by representatives of the Electric Power Research Institute on the results of preliminary short-term tests with synthetic magma indicating that the metal used for the waste packages (Alloy-22) may have significant corrosion resistance to some magmas. In a November 30, 2004, letter to the DOE following that meeting, the Board noted that the composition of magmas at Yucca Mountain vary widely. Consequently, the Board believes that the EPRI tests are early indicators, but do not provide a sufficient technical basis for determining the corrosion resistance of the waste package in magma. In the same letter, the Board reiterated that if the repository design is modified to mitigate the effects of igneous activity, such modifications should be evaluated for their effects on repository operation and performance. The Board listed volcanic consequences as an area requiring further study in its December 30, 2004, report to Congress and the Secretary.

1.3.1. Evaluate geologic, hydrologic, and geochemical information obtained from the enhanced characterization of the repository block (ECRB) at Yucca Mountain.

- *Evaluation of 1.3.1:* The Board noted in its letter to the DOE dated November 30, 2004, that because several significant scientific issues related to a fundamental understanding of the Yucca Mountain site remain unresolved, maintaining access to the ECRB is important. The Board also observed that water collected in the ECRB and the possible presence of chlorine-36 continue to raise questions about water flow inside Yucca Mountain.

1.3.2. Evaluate data from the drift-scale heater test.

- *Evaluation of 1.3.2:* In the Board's November 30, 2004, letter to the DOE, the Board observed that the Drift-Scale Test, which was planned for 8 years, is currently in its "cool down" phase. Observations of hydrogeologic changes in response to heat fluxes in this test will be needed to evaluate models predicting repository performance.

1.3.3. Review plans and work carried out on possible analogues for the natural components of the repository system.

- *Evaluation of 1.3.3:* In its May 3, 2004, letter to the DOE, the Board observed that the Peña Blanca site in Chihuahua, Mexico, could be used as an analogue to test and evaluate Yucca Mountain modeling approaches, the conceptual understanding of the natural systems at the site, and the scenarios predicted by the models. The Board commended the S&T program for its plans to test Yucca Mountain modeling approaches at the Peña Blanca site.

1.3.4. Recommend additional work needed to address uncertainties, paying particular attention to estimates of the rate and distribution of water seepage into the repository under proposed repository design conditions.

- *Evaluation of 1.3.4:* The Board's May 3, 2004, letter to the DOE contains extensive comments on work that could be undertaken or continued to address uncertainties related to the natural system, including large-scale hydraulic tests, improvements in characterization of the saturated alluvium, and a better empirical basis for predicting matrix diffusion. The letter also identifies areas of substantial unresolved uncertainty related to the natural system, including colloid-facilitated transport, the active fracture modeling approach, and boundary fluxes, and makes recommendations to reduce the uncertainties. In its July 28, 2004, letter to the DOE, the Board lists examples of uncertainties that need to be addressed to characterize better environments in repository tunnels post closure. Those uncertainties include the conceptual basis for the drift-scale thermohydrologic seepage analysis, the source of water in the ECRB, the effects of drift degradation, and potentially unrealistic parameters in the performance-assessment calculations of seepage.

1.4.1. Evaluate tunnel-stability studies undertaken by the DOE.

- *Evaluation of 1.4.1:* The Board observed in its July 28, 2004, letter to the DOE that the extent to which the DOE has characterized accurately the likely waste package environments (i.e. repository tunnel environments post-closure) is unclear at this time. The Board identified accurate characterization of repository tunnels as an area requiring additional attention and a major focus of the Board's ongoing technical and scientific review in its report to Congress and the Secretary, dated December 30, 2004. In its July 28, 2004, letter to the DOE, the Board identified tunnel stability as an uncertainty that needs to be addressed related to postclosure repository tunnel environments.

1.5.1. Review the DOE's efforts to integrate results of scientific studies on the behavior of the natural system into repository designs.

- *Evaluation of 1.5.1:* In its November 30, 2004, letter to the DOE, the Board observed that if the repository design is modified to mitigate the effects of igneous activity, such modifications should be evaluated for their effects on repository operation and performance. In a May 3, 2004, letter to the DOE, the Board reiterated its view that an integrated explanation is needed of how elements of the repository act as a system to isolate waste. The Board noted in an April 5, 2004, letter to the DOE that changes in the subsurface design will affect postclosure waste-package temperatures and could exacerbate "cold trap" effects near and in the repository tunnel turnouts. The Board went on to recommend that temperature and relative humidity calculations be revised to reflect repository design changes. The Board commented on the need for thorough integration and close cooperation among diverse technical disciplines (e.g., geochemists and corrosion scientists/engineers) in its July 28, 2004, letter to the DOE.

2. Performance Goals and Evaluation Related to the Engineered System

2.1.1. Monitor the DOE's studies related to the relative contribution of engineered barriers to repository performance.

- *Evaluation of 2.1.1:* At the Board's meeting on September 20, 2004, the DOE updated the Board on the total system performance assessment (TSPA) process. The TSPA includes estimates of repository performance based on the contributions of various elements of the repository system. The Board identified TSPA as a priority area of evaluation in its December 30, 2004, report to Congress and the Secretary.

2.2.1. Review thermal testing and rock stability testing related to potential conditions in repository tunnels.

- *Evaluation of 2.2.1:* The Board heard DOE presentations on predicted conditions in repository tunnels during the thermal pulse at its May 18-19, 2004, meeting. In its July 28, 2004, letter to the DOE, the Board identified drift degradation as an important uncertainty affecting the accurate characterization of repository tunnel environments after closure of the repository.

2.2.2. Evaluate data from studies of the effects of corrosion and the waste package environment on the predicted performance of materials being proposed for engineered barriers.

- *Evaluation of 2.2.2:* The Board devoted most of its meeting on May 18-19, 2004, to a review of DOE activities related to corrosion testing and repository tunnel environments. In a July 28, 2004, letter to the DOE, the Board concluded that a key corrosion issue raised by the Board in 2003 was addressed by DOE data and analyses, indicating that tunnel conditions during the thermal pulse will likely not lead to the initiation of localized corrosion of waste packages due to deliquescence of calcium chloride salts. This conclusion also was included

in the Board's report to Congress and the Secretary of Energy, dated December 30, 2004. In its July letter and December report, the Board also commented on additional corrosion issues, including the corrosion resistance of Alloy-22 in magma, the possibility of stress corrosion cracking of the titanium drip shield, and the need to carry out corrosion tests in environments that closely approximate expected conditions in repository tunnels. At its September 30, 2004, meeting, the Board was briefed by representatives of the Electric Power Research Institute on the results of preliminary short-term tests with synthetic magma indicating that the metal used for the waste packages may have significant corrosion resistance to some magmas. In a November 30, 2004, letter to the DOE following that meeting, the Board noted that the composition of magmas at Yucca Mountain vary widely. Consequently, the Board believes that the EPRI tests are early indicators, but do not provide a sufficient technical basis for determining the corrosion resistance of the waste package in magma. The Board suggested that further testing was needed in this area.

2.3.1. Review the progress and results of materials testing being conducted to address uncertainties about waste package performance.

- *Evaluation of 2.3.1:* See evaluation of 2.2.2.

2.3.2. Evaluate the DOE's efforts in identifying analogues for corrosion processes.

- *Evaluation of 2.3.2.* The Board is unaware of any DOE activities related to identifying natural or engineered analogues for corrosion process in 2004.

2.4.1. Monitor the DOE's development of analytical tools for assessing the differences between repository designs.

- *Evaluation of 2.4.1.* On January 20, 2004, the Board held a panel meeting on repository design, at which it received various updates and briefings on DOE activities in this area. The Board commented extensively on repository design in an April 5, 2004, letter to the DOE following the panel meeting. The Board is unaware of any DOE activities related specifically to developing analytical tools for assessing differences in repository designs. At the Board's meeting on September 20, 2004, the DOE updated the Board on the total system performance assessment (TSPA) process. The TSPA includes estimates of repository performance *overall*. The Board identified TSPA as a priority area in its December 30, 2004, report to Congress and the Secretary.

2.4.2. Evaluate the accuracy and completeness of the technical bases for repository and waste package designs and the extent to which the DOE is using the technical bases for modifying repository and waste package designs.

- *Evaluation of 2.4.2.* On January 20, 2004, the Board held a panel meeting on repository design, at which it received various updates and briefings on DOE activities in this area. The Board commented extensively on repository design in an April 5, 2004, letter to the DOE following the panel meeting.

2.4.4. Evaluate the integration of the subsurface design and layout with thermal management and preclosure facility operations.

- *Evaluation of 2.4.4.* On January 20, 2004, the Board held a panel meeting on repository design, at which it received various updates and briefings on DOE activities in this area. The Board observed in an April 5, 2004, letter to the DOE following the panel meeting that changes that have been made in the subsurface repository design will affect postclosure waste-package temperatures. In its November 30, 2004, letter to the DOE, the Board encouraged the DOE to analyze how the aging of spent fuel in surface storage at Yucca Mountain would be used to achieve thermal goals as part of a clearly-articulated thermal management strategy. The Board also stated in that letter that it believes that waste handling and surface storage at Yucca Mountain should be viewed and analyzed as parts of an integrated waste management system that begins when waste is accepted for shipment at reactors and other sites and ends after placement of the waste in a repository. This thought was reiterated in the Board's December 30, 2004, report to Congress and the Secretary.

2.5.1. Assess the integration of scientific studies with engineering designs for the repository and the waste package.

- *Evaluation of 2.5.1.* In the Board's July 28, 2004 letter to the DOE, the Board emphasized the need for thorough integration and close cooperation among technical disciplines working on the Yucca Mountain program. In its November 30, 2004, letter to the DOE, the Board noted the need to integrate scientific and engineering activities, and to use TSPA to evaluate changes in engineering design or operations for their effects on the overall repository system. The Board noted specifically that repository design changes made to mitigate igneous activity should be evaluated for their effects on repository operation and performance.

3. Performance Goals and Evaluation Related to Repository System Performance and Integration [Note: TSPA results were not presented by the DOE to the Board in 2004. The Board looks forward to receiving the results of TSPA in 2005. In the meantime, to be prepared to evaluate TSPA results, Board members and staff are reviewing analysis and modeling reports and technical basis documents that will be used to support TSPA-LA.]

3.1.1. Identify which technical and scientific activities are on the critical path to reconciling uncertainties related to the DOE's performance estimates.

- *Evaluation of 3.1.1:* The Board observed in a letter to the DOE dated November 30, 2004, that the DOE had made progress in developing realistic estimates of ground motions. The Board commented to the DOE in a July 28, 2004, letter that a significant corrosion issue had been addressed. These observations were reiterated in a report to Congress and the Secretary on December 30, 2004. In that report, the Board also identified a number of issues that require additional attention, including a better understanding of the natural system, an improved understanding of postclosure repository tunnel environments, other corrosion issues, resolution of discrepancies between chlorine-36 studies, improvements in the modeling of volcanic consequences, and work undertaken by the S&T program.

3.1.2. Determine the strengths and weaknesses of TSPA.

- *Evaluation of 3.1.2:* The Board held a meeting on September 20, 2004, at which it received a comprehensive update from the DOE on the TSPA process. Following the meeting the Board sent a letter to the DOE observing that the presentations at the September meeting highlight the critical need to complete the testing and validation of the process computer models and methods that support TSPA. The Board suggested that TSPA could be used to determine the effects of changes in repository design on other components of the repository system. The Board also indicated that it would like to review the results of TSPA, the technical and integration problems associated with TSPA and model validation activities, and how TSPA activities will be affected by potential changes in the regulatory compliance period. TSPA was identified as a Board priority for the coming year in the Board's December 30, 2004, letter to Congress and the Secretary.

3.1.3. Evaluate the DOE's treatment of seismic and volcanism issues in TSPA.

- *Evaluation of 3.1.3:* See evaluation of 3.1.2.

3.2.1 Evaluate the DOE's quantification of uncertainties and conservatisms used in TSPA.

- *Evaluation of 3.2.1:* The Board noted in its May 3, 2004, letter to the DOE that the DOE's approach of dealing with uncertainties related to the performance of natural barriers by making very conservative assumptions tends to emphasize more-rapid advective transport processes. To address this problem, the Board recommended that the DOE work to increase its fundamental understanding of the behavior of the natural system.

3.2.2. Review new data and updates of TSPA models, and identify models and data that should be updated.

- *Evaluation of 3.2.2:* The Board noted the critical need to complete the testing and validation of process computer models and methods that support TSPA in its November 30, 2004, letter to the DOE.

3.3.1. Evaluate the DOE's efforts to create a transparent and traceable TSPA.

- *Evaluation of 3.3.1:* See evaluation of 3.1.2.

3.3.2. Evaluate the DOE's efforts to develop simplified models of repository performance.

- *Evaluation of 3.3.2:* The Board is unaware of any DOE activities in this area in 2004.

3.3.3. Evaluate the DOE's efforts to identify analogues for performance estimates of the overall repository system.

- *Evaluation of 3.3.3:* In its May 3, 2004, letter to the DOE, the Board observed that the Peña Blanca site in Chihuahua, Mexico, could be used as an analogue to test and evaluate Yucca Mountain modeling approaches, the conceptual understanding of the natural systems at the site, and the scenarios predicted by the models. The Board commended the S&T program for its plans to test Yucca Mountain modeling approaches at the Peña Blanca site.
- 3.4.1. Evaluate the DOE's efforts to analyze the contribution of the different engineered and natural barriers to waste isolation.
- *Evaluation of 3.4.1.* A Board panel held a two-day meeting on March 9-10, 2004, at which the DOE presented substantial information related to the contribution of the natural barriers to waste isolation. The Board also participated in a field trip following the meeting. In its May 3, 2004, follow-up letter to the DOE, the Board observed that analyses presented by the DOE suggest that the natural system provides an effective barrier to migration of some radionuclides. However, the Board noted several key hydrogeologic features central to the analyses that are not well understood or are poorly constrained. The Board also reiterated its long-held view that an integrated explanation is needed of how elements of the repository act as a system to isolate waste and recommended that the DOE work to improve its basic understanding of how the natural barriers will perform. The DOE's analysis of the overall contribution of engineered and natural barriers is imbedded in the DOE's TSPA. The Board looks forward to receiving the results of the TSPA, which will illuminate the DOE's analysis of the contributions of the different barriers.
- 3.5.1. Evaluate technical aspects of value engineering (providing a needed function reliably and at the lowest cost) and performance-related trade-off studies, including criteria, weighting factors, and decision methodologies for such studies; how technical uncertainties are taken into account; and what factors are included or excluded from such studies and why.
- *Evaluation of 3.5.1:* This performance goal applies specifically to work conducted under a contract to produce a prototype waste package. The contract was awarded by the DOE later than anticipated. Consequently, the work was not undertaken in 2004.
- 3.6.1. Recommend additional measures for strengthening the DOE's repository safety case.
- *Evaluation of 3.6.1:* In a May 3, 2004, letter to the DOE, the Board restated its long-held view that an integrated explanation is needed of how elements of the repository act as a system to isolate waste. The Board suggested that such an explanation should be based on a fundamental understanding of the system and that multiple lines of evidence and argument can be used to supplement and evaluate TSPA models. These comments were reiterated in the Board's December 30, 2004, report to Congress and the Secretary.
- 3.7.1. Evaluate the DOE's efforts to develop a feedback loop among performance-confirmation activities and TSPA models and data.

- *Evaluation of 3.7.1:* The Board did not receive information from the DOE on performance-confirmation activities in 2004.

3.7.2. Monitor the DOE's proposed plans for performance confirmation to help ensure that uncertainties identified as part of the site recommendation process are addressed.

- *Evaluation of 3.7.2:* See evaluation for 3.7.1.

4. Performance Goals and Evaluation Related to the Waste Management System

4.1.1. Evaluate the operation of the entire repository facility, including the surface and subsurface components.

- *Evaluation of 4.1.1:* The Board held a panel meeting on January 20, 2004, devoted in its entirety to issues related to the design of the repository, including the surface and subsurface components. On April 5, 2004, the Board sent a follow up letter to the DOE, in which the Board commented extensively on technical and scientific factors affecting the DOE's repository design.

4.1.2. Monitor the identification of research needs to support improved understanding of the interaction of components of the waste management system.

- *Evaluation of 4.1.2:* The Board referenced the importance of integrating design and operational factors in its letter to the DOE dated April 5, 2004. Specifically, the Board noted that design changes that have been made could affect waste package temperatures and create "cold trap" effects in the repository. The Board recommended that temperature and relative humidity calculations be revised to reflect design changes. The Board held a panel meeting on January 21, 2004, at which it received updates on the status of DOE transportation activities. In a March 28, 2004, follow-up letter to that meeting, the Board observed that waste acceptance may emerge as a key transportation planning consideration. The Board suggested that the DOE work with the utility industry on this important issue. The Board received updates on DOE transportation planning activities at a meeting held May 18-19, 2004, and a panel meeting held October 13-14, 2004. The Board was updated on repository design issues at its September 20, 2004, meeting. In the Board's November 30, 2004, letter to the DOE, the Board stated its view that waste handling and surface storage at Yucca Mountain should be viewed and analyzed as parts of an integrated waste management system. The Board noted that the DOE's presentations on waste handling operations illustrated the vital importance of integrating waste management activities as part of facility design. The Board suggested that among other things, the implications of aging of the waste at the Yucca Mountain site should be explained as part of a clearly-articulated thermal management strategy. In its letter to the DOE dated December 1, 2004, the Board suggested that to achieve successful integration of transportation planning activities, it is important for the DOE to identify the entity responsible for each system component as well as the integration of those components. The Board also observed that DOE presentations at the Board's October meeting indicated that substantial work remains to be done on integrating

waste management system components. Similar comments were included in the Board's December 30, 2004, report to Congress and the Secretary. In the same letter, transportation activities and integrating the waste management system were included among Board priorities for the coming year.

- 4.1.3. Review the technical and scientific basis of the DOE's analyses of component interactions in various scenarios, including the degree of integration and redundancy across functional components over time.
 - *Evaluation of 4.1.3:* See evaluation of 4.1.2.
- 4.1.4. Evaluate the effects of reduced receiving capacity at the repository surface facility on the nationwide transportation system.
 - *Evaluation of 4.1.4:* The Board suggested that the DOE undertake a review and inventory of infrastructure and facility needs in its letter to the DOE dated March 29, 2004.
- 4.1.5. Review criteria for waste acceptance for storage to ensure that accepted material has been characterized suitably for subsequent disposal.
 - *Evaluation of 4.1.5:* In its March 29, 2004, letter to the DOE, the Board suggested that the DOE and the utility industry work together to facilitate the determination of cask requirements and transport logistics that are compatible with the waste to be shipped. The Board also recommends a thorough review of waste inventory and acceptance assumptions.
- 4.2.1. Monitor the DOE's efforts to implement Section 180 (c) of the NWPA.
 - *Evaluation of 4.2.1:* The Board observed in its March 29, 2004, letter to the DOE that emergency response capability is seen by states and local communities as a vital component of transportation safety and security. The Board also noted that it will be important for the DOE to demonstrate that it has invested adequate preparation time and financial resources to emergency preparedness. Emergency-response was discussed at the Board's panel meeting on October 13-14, 2004. In a December 1, 2004, letter to the DOE following that meeting, the Board noted the difficulty of forecasting disruptive events, but suggested that the DOE's approach to security risk assessment appears to be organized appropriately. The Board observed that the DOE's 180(c) program appears to be based too much on funding formulas and not enough on ensuring adequate emergency-response capability. The Board recommended that the DOE define a minimally acceptable level of emergency response along each transport route.
- 4.3.1. Monitor the DOE's progress in developing and implementing a transportation plan for shipping spent nuclear fuel and high-level radioactive waste to a Yucca Mountain repository.

- *Evaluation of 4.3.1:* The Board reviewed DOE transportation activities at its meetings held January 21, May 18-19, and October 13-14, 2004. In its March 29, 2004, letter to the DOE, the Board stated that the DOE's transportation strategic plan lacks the necessary detail for truly understanding the DOE's transportation planning effort. In a letter dated July 28, 2004, the Board noted that the DOE had made real progress in planning a transportation system. The Board's December 1, 2004, letter to the DOE includes more extensive comments on the DOE's transportation plans. For example, the Board suggests that the DOE needs to focus its attention on transportation options within the state of Nevada for both rail and truck. In particular, the Board suggests that contingency plans need to be developed for higher levels of truck use in the event that a rail spur is not build or is delayed.
- 4.3.2. Review the DOE's efforts to develop criteria for decisions on transportation mode and routing.
- *Evaluation of 4.3.2:* The Board notes in its December 1, 2004, letter to the DOE that the DOE should ensure that the technical issues involved in route selection are identified and that sound methods for addressing the issues are developed and applied.
- 4.3.3. Evaluate logistics capabilities of the transportation system.
- Evaluation of 4.3.3: The Board suggested that the DOE undertake a review and inventory of infrastructure and facility needs in its letter to the DOE dated March 29, 2004.
- 4.3.4. Monitor progress in implementing new technologies for improving transportation safety for spent nuclear fuel.
- *Evaluation of 4.3.4:* The Board reviewed the DOE's model for estimating transportation risk at its meeting held October 13-14, 2004. The Board commented on this issue in a letter to the DOE dated December 1, 2004.
- 4.3.5. Evaluate the DOE's plans for enhancing safety capabilities along transportation corridors, and review the DOE's planning and coordination activities (e.g., route selection), accident prevention activities (e.g., improved inspections and enforcement), and emergency response activities.

Evaluation of 4.3.5: See evaluation of 4.1.2.