Appendix G
U.S. Nuclear Waste Technical Review Board Fiscal Year 2002-2007 Strategic Plan

Statement of the Chairman

The U.S. Nuclear Waste Technical Review Board was established as an independent agency of the United States Government on December 22, 1987, in the Nuclear Waste Policy Amendments Act. Congress charged the Board with evaluating the technical and scientific validity of activities undertaken by the Secretary of Energy, including characterizing a site at Yucca Mountain, Nevada, for its suitability as the location of a permanent repository for civilian spent nuclear fuel and high-level radioactive waste. The Board also reviews activities related to packaging and transporting such waste. In creating the Board, Congress realized that an unbiased technical and scientific evaluation of the credibility of site evaluation and other high-level radioactive waste management activities would be crucial to public acceptance of any approach for disposing of the waste.

The Board strives to provide Congress and the Secretary of Energy with completely independent, credible, and timely technical and scientific program evaluations and recommendations achieved through peer review of the highest quality. The Board's technical and scientific findings and recommendations are included in reports that are submitted at least twice each year to the Secretary of Energy and Congress. The Board can make recommendations but cannot compel the Department of Energy to comply.

The attached strategic plan includes the Board's goals and objectives for 2002 through 2007. *If* the site is approved for repository development, much important technical and scientific work related to gaining a better understanding of potential repository performance will continue. In addition, the Department of Energy will need to finalize a repository design, establish a program for confirming projections of repository performance, and develop and implement plans for a waste management system, including transportation and packaging of the waste. Because many crucial technical and scientific decisions will be made throughout this period, we believe that the Board's ongoing independent technical and scientific review of these efforts will continue to be critically important.

On behalf of the Board,

Jared L. Cohon
Chairman

Mission

The Board's mission, established in the Nuclear Waste Policy Amendments Act (NWPAA) of 1987 (Public Law 100-203), is to ". . . evaluate the technical and scientific validity of [high-level radioactive waste management] activities undertaken by the Secretary of Energy, including site-characterization activities; and activities related to the packaging or transportation of high-level radioactive waste and spent nuclear fuel." By law, the Board shall cease to exist not later than one year after the date on which the Secretary begins disposal of high-level radioactive waste or spent nuclear fuel in a repository.

Vision

By performing ongoing technical and scientific review and evaluation of the highest quality, the Board makes a unique and essential contribution to the Secretary of Energy's efforts to implement the Nuclear Waste Policy Act (NWPA). If the recommendation of the site is approved, the Board will continue to perform critical technical and scientific peer review of technical and scientific work related to gaining a basic understanding of the potential performance of the Yucca Mountain site, of performance-confirmation work and repository design efforts, and of activities related to the waste management system, including transportation and packaging of the waste.

Values

To achieve its goals, the Board conducts itself according to the following values:

- The Board strives to ensure that its members and staff have no conflicts of interest—real or perceived—related to the Secretary's efforts to characterize the Yucca Mountain site or to package and transport spent nuclear fuel and high-level radioactive waste.
- The Board members arrive at their conclusions on the basis of objective evaluations of the technical and scientific validity of the Secretary's activities.
- The Board's practices and procedures are open and conducted so that the Board's integrity and objectivity are above reproach.
- The Board's findings and recommendations are technically and scientifically sound and are based on the best available technical analysis and information.
- The Board's findings and recommendations are communicated clearly and in time for them to be most useful to Congress, the Secretary, and the public. The Board encourages public discussion of its findings and recommendations at its meetings.

The NWTRB's General Goals and Strategic Objectives

The national goal for radioactive waste management established by Congress in the Nuclear Waste Policy Act of 1982 (NWPA) and the Nuclear Waste Policy Amendments Act of 1987 is safe disposal of civilian spent nuclear fuel and high-level radioactive waste in a permanent geologic repository at a suitable site or sites. In the acts, Congress directed the U.S. Department of Energy (DOE) to characterize a site at Yucca Mountain, Nevada, to determine its suitability as the potential location of a permanent repository for spent nuclear fuel and high-level radioactive waste. Congress charged the U.S. Nuclear Waste Technical Review Board with reviewing the technical and scientific validity of the Secretary of Energy's activities associated with implementing the NWPA, including characterizing the Yucca Mountain site and packaging and transporting the waste. The Board's general goals have been established in accordance with its congressional mandate.*

* In February 2002, the Secretary of Energy and the President recommended the Yucca Mountain site for repository development. If the State of Nevada disapproves the recommendation, Congress will debate a "Resolution of Approval" later this year. The Board's goals and objectives will be revised to reflect the outcome of these deliberations.

General Goals

To accomplish its congressional mandate, the Board has established four general goals.

1. Ensure that technical and scientific activities undertaken by the DOE related to characterizing and analyzing the natural components of a potential Yucca Mountain repository and predicting the performance of a potential repository establish a sound technical basis for a decision on whether to recommend the site for repository development.

2. Ensure that technical and scientific activities undertaken by the DOE related to evaluating and designing the repository and waste packages are well integrated and establish a sound technical basis for designing the repository system, including the engineered barrier system (EBS).

3. Ensure that technical and scientific activities undertaken by the DOE related to packaging, handling, and transporting spent nuclear fuel and high-level radioactive waste to a potential repository are well integrated and establish a sound technical basis for designing and operating a waste management system.

4. Ensure that technical and scientific performance-confirmation activities undertaken by the DOE establish a sound technical basis for operating a repository, reducing uncertainties related to repository performance, and revising repository and waste package designs. (Will apply only if the site recommendation is approved.)

Strategic Objectives

To achieve its general goals, the Board has established the following long-term objectives.

1. Objectives Related to the Natural Components of the Repository System and Predicting Repository Performance

1.1. Evaluate the technical and scientific validity of DOE studies, testing, and analyses supporting a decision on whether to recommend the Yucca Mountain site.

1.2. Evaluate the analyses and investigations pertaining to hydrologic and other natural processes at the Yucca Mountain site and at related analogue sites that establish the foundation for predicting repository performance.

1.3. Review the technical and scientific validity of models used to predict repository performance.

1.4. Evaluate the DOE's progress in developing a safety strategy for the Yucca Mountain site.

1.5. Monitor progress in completing development of standards and regulatory guidelines for a potential Yucca Mountain repository.

1.6. Review the *Record of Decision* and maintain awareness of legal challenges to the final environmental impact statement (EIS) for a potential Yucca Mountain repository.

2. Objectives Related to the Engineered Components of the Repository System

2.1. Evaluate repository and waste package designs, including the technical bases for the designs.

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

2.3. Assess the integration of science and engineering in the DOE program, paying particular attention to the effects of site-characterization studies (e.g., modeling, testing, and analyses of thermal and mechanical effects) on repository and waste package designs.

3. Objectives Related to the Waste Management System

3.1. Evaluate the accuracy and reasonableness of analyses, methods, and major assumptions used by the DOE in estimating health and safety risks associated with transporting spent nuclear fuel and high-level radioactive waste.

3.2. Review the adequacy of DOE plans for developing the transportation infrastructure and deter-

mine the effort needed to develop a large-scale transportation capability.

3.3. Review the adequacy of the DOE's plans for safely handling and packaging spent nuclear fuel and high-level radioactive waste for transport to a permanent repository.

3.4. Evaluate the effectiveness of the DOE's efforts to integrate the various components of the waste management system (packaging, handling, transport, storage, and disposal of the waste).

3.5. Review the DOE's plans for addressing public safety concerns and for enhancing safety capabilities along transportation corridors. This includes activities related to development of plans (e.g., route selection), coordination, accident prevention (e.g., improved inspections and enforcement), and emergency response.

4. Objectives Related to Confirmatory Testing
(Will apply only if the site recommendation is approved)

4.1. Monitor performance-confirmation activities, including performance-confirmation planning, undertaken by the DOE that are designed to reduce uncertainties related to repository performance.

4.2. Monitor performance-confirmation activities undertaken by the DOE, and evaluate the need to revise repository or waste package designs on the basis of the results of such activities.

Achieving the Goals and Objectives

Congress granted significant investigatory powers to the Board in the NWPAA. In accordance with the NWPAA, the Board may hold such hearings, sit and act at such times and places, take such testimony, and receive such evidence as it considers appropriate. By law, no nominee to the Board is employed by the DOE, the national laboratories, or DOE contractors performing activities related to spent nuclear fuel or high-level radioactive waste. The Board has adopted strong procedures that go even further to ensure that the Board avoids even the appearance of a conflict of interest.

Subject to existing law, the DOE is directed to provide all records, files, papers, data, and information requested by the Board, including drafts of work products and documentation of work in progress. According to the legislative history, in providing this access, Congress expected that the Board would review and comment on DOE decisions, plans, and actions as they occurred, not after the fact. The Board believes that it has adequate powers under current law to achieve its goals and objectives.

Much of the Board's information-gathering is done at open public meetings where the DOE, its contractors, and other program participants present technical information. The Board's five panels meet as needed and are organized around specific issue areas. The full Board meets three or four times each year. The Board also gathers information through field trips to the Yucca Mountain site, visits to contractor laboratories and facilities, and informal meetings with individuals working on the project. Although the Board's information-gathering activities are carried out primarily to further the Board's review, they have the collateral benefit of promoting communication and integration of technical information within the DOE program and facilitating the dissemination of information among interested parties outside the program. Analyses of the information gathered by the Board are performed by its members, the Board's professional staff, and consultants hired to supplement the expertise of the Board and the staff.

In February 2002, the Secretary of Energy recommended the Yucca Mountain site for repository development to the President. The President then recommended the site. The State of Nevada will now decide whether to disapprove the recommendation. If the recommendation is approved, the DOE will eventually apply to the Nuclear Regulatory Commission (NRC) for a license to construct and operate a repository at the site. If the license is approved, the expectation is that testing will continue at the site to increase confidence in predictions of repository performance. The Board has reviewed the analytical processes as well as the technical information used by the DOE in making decisions about site recommendation. The Board also will review the technical and scientific validity of activities related to confirmatory testing and to transportation and

packaging of spent nuclear fuel and high-level radioactive waste. The Board reports the results of its reviews at least twice each year to Congress and the Secretary of Energy. Additional communication occurs as needed. Such communications are available to the public either by request or on the Board's Web site at www.nwtrb.gov.

Crosscutting Functions

Several entities and agencies share responsibility for the ultimate national goal established by Congress of packaging, transporting, and disposing of spent nuclear fuel and high-level radioactive waste in a geologic repository at a suitable site. Although there may be cross-cutting areas of interest, the Board's role is unique among those involved in managing high-level radioactive waste. For example:

- **Congress and the Administration**, **including the Secretary of Energy**, make policy decisions on what the national goals will be and how they will be implemented. The Board's role in this process is to help ensure that policy-makers receive unbiased and credible technical and scientific analyses and information.

- **State and local governments** comment on and oversee DOE activities. The Board's oversight activities are different in that they are (1) unconstrained by any stake in the outcome of the endeavor besides the credibility of the scientific and technical activities, (2) confined to scientific and technical evaluations, and (3) conducted by individuals nominated by the National Academy of Sciences and expressly chosen by the President for their expertise in the various disciplines represented in the DOE program.

- **Federal agencies** that have roles in achieving a safe waste management program include the DOE, the NRC, the Environmental Protection Agency (EPA), the Department of Transportation (DOT), and the United States Geological Survey (USGS). The DOE is responsible for developing and implementing the waste management system and for planning and conducting research activities related to disposal, packaging, and transportation of spent nuclear fuel and high-level radioactive waste. The NRC is the regulatory body authorized to license the construction and operation of the repository to ensure protection of public health and safety and the environment. The EPA is the agency given the responsibility to issue health-based safety standards. The DOT is responsible for regulating the transportation of the waste. The USGS participates in site-characterization activities at the Yucca Mountain site. The Board's role is unique among these federal agencies: perform ongoing, independent review and oversight of the technical and scientific validity of the Secretary of Energy's activities relating to civilian radioactive waste management, including site characterization and packaging and transportation of spent nuclear fuel and high-level radioactive waste, and communicate its findings and recommendations to Congress, the Secretary of Energy, and the public. The Board's evaluation of the technical and scientific validity of the Secretary's activities related to civilian radioactive waste management complements and enhances the work of other agencies involved in achieving the national goal.

Key External Factors

Some factors that are beyond the Board's control could affect its ability to achieve its goals and objectives. Among them are the following:

- **The Board has no implementing authority**. The Board is by statute a technical and scientific review body that can only make recommendations to the DOE. Congress expected that the DOE would accept the Board's recommendations or indicate why the recommendations could not or should not be implemented. However, the DOE is not legally obligated to accept any of the Board's recommendations.

  To increase its effectiveness, the Board has developed procedures for increasing the relevance of its findings and recommendations for Congress, the Secretary, DOE program managers, and the public. The Board's recommendations and the DOE's responses are included in Board reports to Congress and the Secretary. If the DOE does not accept

a Board recommendation, the Board's recourse is to advise Congress or reiterate its recommendation to the DOE, or both.

- Legislation could affect nuclear waste policy. Congress has considered nuclear waste legislation several times in the last few years. The effects of such legislation, if enacted, on the program or the Board's activities are not currently known.

The Board will evaluate the status of these external factors, identify any new factors, and, if warranted, modify the "external factors" section of the strategic plan as part of the annual program evaluation described below.

Evaluating Board Performance

The Board believes that measuring its effectiveness by directly correlating improvements in the DOE program with Board actions and recommendations would be ideal. However, the Board has no implementing authority, so it cannot compel the DOE to comply with its recommendations. Consequently, a judgment about whether a specific recommendation had a positive outcome for the DOE program is, in most cases, (1) subjective and (2) an imprecise indicator of Board performance because implementation of Board recommendations by the DOE is outside the Board's direct control. Therefore, to measure its performance in a given year, the Board has developed performance measures. For each annual performance goal, the Board considers the following.

- Were the reviews, evaluations, and other activities undertaken under the auspices of the goal completed?
- Were the results of the 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, the Board's performance in meeting the annual 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.

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 establish its annual performance objectives and develop its budget request for subsequent years. The results of the Board's performance evaluation are included in its annual summary report.

Congressional and Stakeholder Consultations

In developing its original strategic plan, the Board consulted with the Office of Management and Budget, the DOE, congressional staff, and members of the public and provided a copy of the plan to the NRC and to representatives of state and local governments. The Board solicited public comment and presented its strategic plan at a session held expressly for this purpose during a meeting in Amargosa Valley, Nevada, on January 20, 1998. Copies of the Board's strategic plan and annual performance plans are available on the Board's Web site: www.nwtrb.gov.

Appendix H
U.S. Nuclear Waste Technical Review Board Fiscal Year 2001 Performance Plan and Performance Evaluation

The NWTRB's General Goals and Strategic Objectives

The national goal for radioactive waste management established by Congress in the Nuclear Waste Policy Act of 1982 (NWPA) and the Nuclear Waste Policy Amendments Act of 1987 is safe disposal of civilian spent nuclear fuel and high-level radioactive waste in a permanent geologic repository at a suitable site or sites. In the acts, Congress directed the U.S. Department of Energy (DOE) to characterize a site at Yucca Mountain, Nevada, to determine its suitability as the potential location of a permanent repository for spent nuclear fuel and high-level radioactive waste. Congress charged the U.S. Nuclear Waste Technical Review Board with reviewing the technical and scientific validity of the Secretary of Energy's activities associated with implementing the NWPA, including characterizing the Yucca Mountain site and packaging and transporting the waste. The Board's general goals have been established in accordance with its congressional mandate.*

General Goals

To accomplish its congressional mandate, the Board has established four general goals.

1. Ensure that technical and scientific activities undertaken by the DOE related to characterizing and analyzing the natural components of a potential Yucca Mountain repository and predicting the performance of a potential repository establish a sound technical basis for a decision on whether to recommend the site for repository development.

2. Ensure that technical and scientific activities undertaken by the DOE related to evaluating and designing the repository and waste packages are well integrated and establish a sound technical basis for designing the repository system, including the engineered barrier system (EBS).

3. Ensure that technical and scientific activities undertaken by the DOE related to packaging, handling, and transporting spent nuclear fuel and high-level radioactive waste to a potential repository are well integrated and establish a sound technical basis for designing and operating a waste management system.

4. Ensure that technical and scientific performance-confirmation activities undertaken by the DOE establish a sound technical basis for operating a repository, reducing uncertainties related to repository performance, and revising repository

* In February 2002, the Secretary of Energy and the President recommended the Yucca Mountain site for repository development. If the State of Nevada disapproves the recommendation, Congress will debate a "Resolution of Approval" later this year. The Board's goals and objectives will be revised to reflect the outcome of these deliberations.

and waste package designs. (Will apply only if the site recommendation is approved.)

Strategic Objectives

To achieve its general goals, the Board has established the following long-term objectives.

1. Objectives Related to the Natural Components of the Repository System and Predicting Repository Performance

1.1. Evaluate the technical and scientific validity of DOE studies, testing, and analyses supporting a decision on whether to recommend the Yucca Mountain site.

1.2. Evaluate the analyses and investigations pertaining to hydrologic and other natural processes at the Yucca Mountain site and at related analogue sites that establish the foundation for predicting repository performance.

1.3. Review the technical and scientific validity of models used to predict repository performance.

1.4. Evaluate the DOE's progress in developing a safety strategy for the Yucca Mountain site.

1.5. Monitor progress in completing development of standards and regulatory guidelines for a potential Yucca Mountain repository.

1.6. Review the *Record of Decision* and maintain awareness of legal challenges to the final environmental impact statement (EIS) for a potential Yucca Mountain repository.

2. Objectives Related to the Engineered Components of the Repository System

2.1. Evaluate repository and waste package designs, including the technical bases for the designs.

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

2.3. Assess the integration of science and engineering in the DOE program, paying particular attention to the effects of site-characterization studies (e.g., modeling, testing, and analyses of thermal and mechanical effects) on repository and waste package designs.

3. Objectives Related to the Waste Management System

3.1. Evaluate the accuracy and reasonableness of analyses, methods, and major assumptions used by the DOE in estimating health and safety risks associated with transporting spent nuclear fuel and high-level radioactive waste.

3.2. Review the adequacy of DOE plans for developing the transportation infrastructure and determine the effort needed to develop a large-scale transportation capability.

3.3. Review the adequacy of the DOE's plans for safely handling and packaging spent nuclear fuel and high-level radioactive waste for transport to a permanent repository.

3.4. Evaluate the effectiveness of the DOE's efforts to integrate the various components of the waste management system (packaging, handling, transport, storage, and disposal of the waste).

3.5. Review the DOE's plans for addressing public safety concerns and for enhancing safety capabilities along transportation corridors. This includes activities related to development of plans (e.g., route selection), coordination, accident prevention (e.g., improved inspections and enforcement), and emergency response.

4. Objectives Related to Confirmatory Testing (Will apply only if the site recommendation is approved)

4.1. Monitor performance-confirmation activities, including performance-confirmation planning, undertaken by the DOE that are designed to reduce uncertainties related to repository performance.

4.2. Monitor performance-confirmation activities undertaken by the DOE, and evaluate the need to revise repository or waste package designs on the basis of the results of such activities.

Performance Goals for FY 2001

The Board's performance goals for FY 2001 have been developed to further the achievement of the Board's general goals and strategic objectives. Because some of the general goals and strategic objectives relate to work and activities that will be undertaken in the future, they may not have corresponding annual performance goals in any given year. For example, the following performance goals for FY 2001 relate primarily to DOE activities supporting a DOE decision on whether to recommend the Yucca Mountain site to the President, the design of a potential repository and waste package, and transportation planning.

1. Performance Goals Related to the Natural Components of the Repository System and Predicting Repository Performance

Performance Goals

1.1.1. Review for technical validity the technical and scientific components of the DOE site recommendation report.

1.1.2. Review for technical validity the technical and scientific components of the DOE site recommendation "notification document."

1.1.3. Review for technical validity the technical components of the DOE site recommendation "consideration document."

1.1.4. Evaluate the DOE's use of risk assessment and quantification of uncertainty, and determine whether they are being used appropriately.

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

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

1.2.3. Evaluate results of the fluid inclusion study.

1.3.1. Set priorities among and evaluate for technical validity the DOE process model reports that will be used to support a decision on site recommendation.

1.3.2. Determine the strengths and weaknesses of the total system performance assessment (TSPA) and recommend additional measures used to strengthen the DOE's repository safety case.

1.4.1. Determine the appropriateness of the "principal factors" identified by the DOE in its safety strategy.

1.4.2. On the basis of an evaluation of the natural processes at work at the Yucca Mountain site, recommend additional work needed to address uncertainties, paying particular attention to estimates of the rate and distribution of water seepage into the proposed repository.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Reviewing critical documents provided by the DOE and its contractors, including contractor reports, process model reports, TSPA, and the site recommendation.

- Meeting with contractor's principal investigators on technical issues, including those related to climate change, flow and transport in the unsaturated and saturated zones, seepage, and the biosphere.

- Holding public meetings with the DOE and contractor personnel at least three times a year involving the full Board and several meetings with individual Board panels.

- Visiting and observing ongoing laboratory investigations, including facilities at Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, Sandia National Laboratory, and the engineered barrier test facility; observing field investigations, including the niche, alcove, and sealed ECRB studies and Busted Butte.

- Meeting with other entities carrying out research on, or providing input to, scientific and technical issues related to waste disposal, including the Nuclear Regulatory Commission and its contractors, the Southwest Research Institute, The Nye County Early Warning Drilling Program, the University of Nevada at Las Vegas project on fluid inclusions, the Environmental Protection Agency, and the State of Nevada Nuclear Waste Projects Office.

2. Performance Goals Related to the Engineered Repository System and Strategy for Achieving Performance Goals

Performance Goals

2.1.1. Evaluate the accuracy and completeness of the technical bases for repository and waste package designs.

2.1.2 Evaluate the extent to which the DOE is using the technical bases for developing repository and waste package designs.

2.1.3. Monitor and evaluate the DOE's progress in developing a technical basis for modified or novel design features.

2.2.1. Evaluate the adequacy for a site recommendation decision of corrosion studies on materials being proposed for the EBS.

2.3.1. Assess the integration of scientific studies with engineering designs for the repository and the waste package. In particular, monitor the results of ongoing thermal tests and evaluate DOE plans for using the test results to support models of the thermally disturbed region near the repository and to decide on spacing between emplacement drifts, degree of preclosure ventilation, and closure date.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Evaluating the technical bases for the EBS design by reviewing technical documents and databases (e.g., the controlled design assumption document and the technical database), paying particular attention to the technical bases for making and inspecting final closure welds of the waste package and methods for making drip shield sections. Meetings will be held with project personnel as necessary to obtain clarification and confirmation.

- Evaluating the technical bases for repository design by reviewing federal documents and databases, paying particular attention to design features for promoting drainage, controlling ventilation, and protecting workers in the exhaust end of the ventilation system.

- Evaluating repository and waste package designs to identify which parts (if any) of the designs do not have a technical basis.

- Evaluating the DOE's technical program to fill in the gaps. In addition, where the DOE is working on alternative design features, the Board will evaluate the technical basis of these features.

- After identifying the corrosion mechanisms most important to performance of the overall repository system, reviewing the common database (literature, laboratory, and field data) and judging the adequacy of the database for a site recommendation decision.

3. Performance Goals Related to the Waste Management System and Strategy for Achieving Performance Goals

Performance Goals

3.1.1. Evaluate storage cask and container designs to ascertain whether there is a sufficient technical basis for predicting potential problems that could develop during storage and that could affect the performance of the spent fuel during subsequent repository disposal.

3.1.2. Evaluate storage cask and container designs to ascertain whether there is a sufficient technical basis for predicting potential problems that could develop during storage and that could affect the performance of the spent fuel during subsequent repository disposal.

3.2.1. Evaluate the effects of "off-normal" events at the surface facility and how the events could affect the ability of the facility to receive waste shipments.

3.2.2. Evaluate the effects of reduced receiving capacity at the repository surface facility on the nationwide transportation system.

3.3.1. Examine the ability of storage casks and containers, including multipurpose canisters, to serve as disposal casks and containers in a repository.

3.4.1. Monitor progress by the railroad industry in implementing new technologies that would enhance the safety of spent-fuel transportation (e.g., electronic braking, wheel-bearing monitoring). Evaluate how well the DOE works with the railroad industry to design an integrated cask-rail and car-train transportation system that would ensure maximum safety and efficiency.

3.4.2. Review criteria for waste acceptance for storage to ensure that accepted material has been suitably characterized for subsequent disposal.

3.4.3. 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.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Meeting with the American Association of Railroads (AAR), individual railroad companies, and railroad infrastructure manufacturers to determine the current state of rail infrastructure and noting the effects of a sustained transportation campaign on the railroad industry. The Board will monitor the construction of a short-line rail line currently under construction in Minnesota as an analogue to a possible rail line in Nevada from a main line to a repository at Yucca Mountain.

- Continuing to meet with the AAR to keep up to date on the work they are doing related to their performance specification for shipping radioactive waste, and meeting with AAR personnel at the AAR Technology Center in Pueblo, Colorado.

- Attending the semiannual DOE-sponsored Transportation External Coordination Working Group meetings to determine how well the DOE is working to implement Section 180 (c) of the Nuclear Waste Policy Act.

- Holding a meeting of the Board's Panel on the Waste Management System.

4. Performance Goal Related to Performance Confirmation and Strategy for Achieving the Goal

Performance Goal

4.1.1. Monitor the DOE's proposed performance-confirmation plans to help ensure that uncertainties identified as part of the site recommendation process are considered in the formulation of those plans.

Strategy for Achieving Goal

The Board will accomplish its goal by doing the following.

- Reviewing critical documents provided by the DOE and its contractors, including contractor reports, process model reports, TSPA, and the site recommendation.

- Reviewing performance-confirmation plans and meeting with DOE personnel to discuss aspects of the plans.

Board Operations

The Board is composed of 11 members appointed by the President who serve on a part-time basis; are eminent in a relevant field of science or engineering,

including environmental sciences; and are appointed solely on the basis of distinguished service. Because of the comprehensive nature of the program and the part-time availability of the members, Congress authorized the Board to maintain a small professional staff of 10 full-time employees to support the Board's comprehensive review of the DOE program. In addition to the members and professional staff, the Board maintains a small administrative staff that supports its activities.

The full Board meets three or four times each year. The Board has organized itself into panels that meet as needed. The Board also gathers information from field trips to the Yucca Mountain site, visits to contractor laboratories and facilities, and informal meetings with individuals working on the project. The Board has gained insights from visiting other countries to learn about their nuclear waste management programs. On the basis of the information gathered throughout the year, the Board issues its findings in letters and reports.

Evaluating the Board's Performance

The Board believes that measuring its effectiveness by directly correlating improvements in the DOE program with Board actions and recommendations would be ideal. However, the Board has no implementing authority, so it cannot compel the DOE to comply with its recommendations. Consequently, a judgment about whether a specific recommendation had a positive outcome for the DOE program is, in most cases, (1) subjective and (2) an imprecise indicator of Board performance because implementation of Board recommendations by the DOE is outside the Board's direct control. Therefore, to measure its performance in a given year, the Board has developed performance measures. For each annual performance goal, the Board considers the following.

1. Were the reviews, evaluations, and other activities undertaken under the auspices of the goal completed?

2. Were the results of the 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, the Board's performance in meeting the annual 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.

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 establish its annual performance objectives and develop its budget request for subsequent years. The results of the Board's performance evaluation are included in its annual summary report.

Performance Evaluation for 2001

On the basis of the following evaluation and consistent with the performance measures described in the previous section, the Board's performance for 2001 related to site investigations and other activities undertaken by the Secretary in preparation for a decision on site recommendation was found effective. However, the Secretary's activities related to transportation and packaging of spent fuel and high-level radioactive waste were extremely limited during 2001. Therefore, the Board's performance goals related to the waste management system are deferred until the Secretary of Energy undertakes technical and scientific work in this area.

1. Performance Goals Related to the Natural Components of the Repository System and Predicting Repository Performance

1.1.1. Review for technical validity the technical and scientific components of the DOE site recommendation report.

- Evaluation of 1.1.1: The Board met in November 2001 to begin a comprehensive review of work conducted by the DOE related to a site recommendation. The Board's

review included the results of the Board's ongoing review of the DOE's Yucca Mountain technical and scientific investigations since the Board's inception; an evaluation of the DOE's work on the natural and engineered components of the proposed repository system, using a list of technical questions identified by the Board; a comprehensive Board review of draft and final documents supplied by the DOE through mid-November 2001; and field observations by Board members at Yucca Mountain and related sites.

1.1.2. Review for technical validity the technical and scientific components of the DOE site recommendation "notification document."

- Evaluation of 1.1.2: All documents supplied to the Board by the DOE before the DOE's notification to the State of Nevada that the Secretary of Energy would recommend the site were reviewed by the Board (see evaluation of 1.1.1).

1.1.3. Review for technical validity the technical components of the DOE site recommendation "consideration document."

- Evaluation of 1.1.3: All documents supplied to the Board by the DOE before the DOE's notification to the State of Nevada that the Secretary of Energy would recommend the site were reviewed by the Board (see evaluation of 1.1.1).

1.1.4. Evaluate the DOE's use of risk assessment and quantification of uncertainty, and determine whether they are being used appropriately.

- Evaluation of 1.1.4: After conducting its comprehensive review, the Board concluded that when the DOE's technical and scientific work is taken as a whole, at this time the technical basis for the DOE's repository performance estimates is weak to moderate. The Board further found that gaps in data and basic understanding cause important uncertainties in the concepts and assumptions on which the DOE's performance estimates are now based. As part of its evaluation, the Board found that the DOE's efforts to quantify uncertainties had improved but are incomplete and recommended that the DOE implement suggestions proposed in a DOE contractor report titled *Uncertainty Analysis and Strategy*. The Board commented in letters dated March 30, 2001, and July 17, 2001, to the acting director of the Office of Civilian Radioactive Waste Management (OCRWM) on the DOE's progress in identifying and quantifying uncertainties associated with its estimates of repository performance.

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

- Evaluation of 1.2.1: The Board monitored the DOE's efforts and conducted an evaluation of the results of DOE studies included in *Supplemental Science and Performance Analysis* and *Technical Update Information Letter Report*.

1.2.2. Evaluate geologic, hydrologic, and geochemical information obtained from the ECRB at Yucca Mountain.

- Evaluation of 1.2.2: The Board heard several presentations on studies in the ECRB and commented to the DOE on specific concerns in letters to the acting director of OCRWM dated July 17, 2001, and October 17, 2001.

1.2.3. Evaluate results of the fluid inclusion study.

- Evaluation of 1.2.3: The results of a University of Nevada at Las Vegas fluid inclusion study, which was precipitated by a Board analysis of the hypothesis of hydrothermal upwelling, were presented and discussed at length at a meeting of the Board in Arlington, Virginia, in May 2001.

1.3.1. Set priorities among and evaluate for technical validity the DOE process model reports that will be used to support a decision on site recommendation.

- Evaluation of 1.3.1: The Board provided ongoing comments to the DOE on its process model reports and on its analysis model reports.

1.3.2. Determine the strengths and weaknesses of TSPA and recommend additional measures used to strengthen the DOE's repository safety case.

- Evaluation of 1.3.2: The Board commented extensively on TSPA, including the appropriateness and limits of the methodology, uncertainties related to lack of data and assumptions underlying performance estimates, and the need to supplement TSPA with additional lines of evidence and argument. In January 2001, Board Chairman Jared Cohon identified multiple lines of evidence to supplement TSPA in the DOE's repository safety case as one of the four essential elements of a site recommendation, from the Board's point of view. On April 13, 2001, the Board held a meeting devoted to discussing multiple lines of evidence and commented on the repository safety strategy in letters to the acting director of OCRWM dated March 30, 2001; June 11, 2001; and July 17, 2001. In May, two Board members and staff visited the Peña Blanca radionuclide transport analogue site in Chihuahua, Mexico.

1.4.1. Determine the appropriateness of the "principal factors" identified by the DOE in its safety strategy.

- Evaluation of 1.4.1: See evaluation of item 1.3.2.

1.4.2. On the basis of an evaluation of the natural processes at work at the Yucca Mountain site, recommend additional work needed to address uncertainties, paying particular attention to estimates of the rate and distribution of water seepage into the proposed repository.

- Evaluation of 1.4.2: The Board urged the DOE several times to reconcile results of different studies on fast water pathways and commented on infiltration studies in its July 17, 2001, letter to the acting director of OCRWM. The Board recommended to the DOE in an October 17, 2001, letter that the DOE obtain data supporting the DOE's contention that moisture discovered in the bulkheaded part of the cross drift is condensation.

2. Performance Goals Related to the Engineered Repository System and Strategy for Achieving Performance Goals

2.1.1. Evaluate the accuracy and completeness of the technical bases for repository and waste package designs.

- Evaluation of 2.1.1: In January 2001, the Board identified an evaluation and comparison of the base-case repository design with a low-temperature design as one of four essential elements of any site recommendation. During 2001, the Board evaluated DOE work related to high- and low-temperature operating modes for the DOE's flexible repository design. The Board commented to the DOE on this issue in letters to the acting director of OCRWM dated March 30, 2001; July 17, 2001; and October 17, 2001.

2.1.2. Evaluate the extent to which the DOE is using the technical bases for developing repository and waste package designs.

- Evaluation of 2.1.2: Uncertainties in the technical basis, particularly for higher-temperature designs, were identified. Because of a lack of data, the magnitude of these uncertainties cannot be determined. As stated in the Board's January 24, 2002, letter, because of the uncertainties, the Board has limited confidence in the DOE's performance estimates for high-temperature designs.

2.1.3. Monitor and evaluate the DOE's progress in developing a technical basis for modified or novel design features.

- Evaluation of 2.1.3: The novel design aspect of highest interest to the Board is development of one or more low-temperature designs for an evaluation and a comparison with higher- temperature designs. For example, if low-temperature designs require significantly larger repository footprints, whether the additional area has been adequately characterized and represented in performance estimates will need to be addressed.

2.2.1. Evaluate the adequacy for a site recommendation decision of corrosion studies on materials being proposed for the EBS.

- Evaluation of 2.2.1: In January 2001, the Board identified progress in understanding the underlying fundamental processes involved in predicting the rate of waste package corrosion as one of four essential elements of any site recommendation. The Board monitored DOE activities and commented on the issue in letters to OCRWM's acting director dated March 30, 2001, and July 17, 2001. On July 19 and 20, 2001, the Board hosted an international workshop on issues related to the stability of the passive layer on metals proposed for the waste package and the challenges of extrapolating data obtained from short-term experiments to performance of the waste packages over thousands of years. At the workshop, experts from programs in other countries gave their views on surprises that might be encountered over the very long time periods involved.

2.3.1. Assess the integration of scientific studies with engineering designs for the repository and the waste package. In particular, monitor the results of ongoing thermal tests and evaluate DOE plans for using the test results to support models of the thermally disturbed region near the repository and to decide on spacing between emplacement drifts, degree of preclosure ventilation, and closure date.

- Evaluation of 2.3.1: In a July 17, 2001, letter to the acting director of OCRWM, the Board commented on the need to complete investigations that connect the near-field natural environment with the engineered repository system. The letter also gave an example of lack of communication among program scientists, engineers, designers and modelers related to repository design and the large hydraulic gradient.

3. Performance Goals Related to the Waste Management System

As noted above, the DOE's efforts related to the waste management system were extremely limited. Therefore, the Board's review in this area was likewise constrained. The expectation is that if the site recommendation is approved, waste management activities, including transportation plans and studies, will become a major area of review for the Board. Therefore, waste management system performance goals have been deferred until FY 2003.

3.1.1. Evaluate storage cask and container designs to ascertain whether there is a sufficient technical basis for predicting potential problems that could develop during storage and that could affect the performance of the spent fuel during subsequent repository disposal.

- Evaluation of 3.1.1: Because of limited DOE activity in this area, Board work on this specific goal and related issues was deferred until fiscal year 2003.

3.2.1. Evaluate the effects of "off-normal" events at the surface facility and how the events could affect the ability of the facility to receive waste shipments.

- Evaluation of 3.2.1: Because of limited DOE activity in this area, Board work on this specific goal and related issues was deferred until fiscal year 2003.

3.2.2. Evaluate the effects of reduced receiving capacity at the repository surface facility on the nationwide transportation system.

- Evaluation of 3.2.2: Because of limited DOE activity in this area, Board work on this specific goal and related issues was deferred until fiscal year 2003.

3.3.1. Examine the ability of storage casks and containers, including multipurpose canisters, to serve as disposal casks and containers in a repository.

- Evaluation of 3.3.1: Because of limited DOE activity in this area, Board work on this specific goal and related issues was deferred until fiscal year 2003.

3.4.1. Monitor progress by the railroad industry in implementing new technologies that would enhance the safety of spent-fuel transportation (e.g., electronic braking, wheel-bearing monitoring). Evaluate how well the DOE works with the railroad industry to design an integrated cask-rail and car-train transportation system that would ensure maximum safety and efficiency.

- Evaluation of 3.4.1: Because of limited DOE activity in this area, Board work on this specific goal and related issues was deferred until fiscal year 2003.

3.4.2. Review criteria for waste acceptance for storage to ensure that accepted material has been suitably characterized for subsequent disposal.

- Evaluation of 3.4.2: Because of limited DOE activity in this area, Board work on this specific goal and related issues was deferred until fiscal year 2003.

3.4.3. 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 3.4.3: Because of limited DOE activity in this area, Board work on this specific goal and related issues was deferred until fiscal year 2003.

4. Performance Goal Related to Performance Confirmation

4.1.1. Monitor the DOE's proposed performance-confirmation plans to help ensure that uncertainties identified as part of the site recommendation process are considered in the formulation of those plans.

- Evaluation of 4.1.1: Several Board members and staff attended and contributed to a workshop sponsored by the Electric Power Research Institute at which representatives of the DOE, the NRC, the National Academy of Sciences, and Nye County, among others, began a preliminary discussion of the following questions: (1) What is the definition of performance confirmation? (2) How are the elements of a performance-confirmation plan selected? (3) What measurements will be used to confirm performance estimates? (4) How would the program or the repository system be modified according to the results of performance-confirmation studies? (5)How long would the performance-confirmation period continue?

Appendix I
U.S. Nuclear Waste Technical Review Board Fiscal Year 2002 Performance Plan

The NWTRB's General Goals and Strategic Objectives

The national goal for radioactive waste management established by Congress in the Nuclear Waste Policy Act of 1982 (NWPA) and the Nuclear Waste Policy Amendments Act of 1987 is safe disposal of civilian spent nuclear fuel and high-level radioactive waste in a permanent geologic repository at a suitable site or sites. In the acts, Congress directed the U.S. Department of Energy (DOE) to characterize a site at Yucca Mountain, Nevada, to determine its suitability as the potential location of a permanent repository for spent nuclear fuel and high-level radioactive waste. Congress charged the U.S. Nuclear Waste Technical Review Board with reviewing the technical and scientific validity of the Secretary of Energy's activities associated with implementing the NWPA, including characterizing the Yucca Mountain site and packaging and transporting the waste. The Board's general goals have been established in accordance with its congressional mandate.*

General Goals

To accomplish its congressional mandate, the Board has established four general goals.

1. Ensure that technical and scientific activities undertaken by the DOE related to characterizing and analyzing the natural components of a potential Yucca Mountain repository and predicting the performance of a potential repository establish a sound technical basis for a decision on whether to recommend the site for repository development.

2. Ensure that technical and scientific activities undertaken by the DOE related to evaluating and designing the repository and waste packages are well integrated and establish a sound technical basis for designing the repository system, including the engineered barrier system (EBS).

3. Ensure that technical and scientific activities undertaken by the DOE related to packaging, handling, and transporting spent nuclear fuel and high-level radioactive waste to a potential repository are well integrated and establish a sound technical basis for designing and operating a waste management system.

4. Ensure that technical and scientific performance-confirmation activities undertaken by the DOE establish a sound technical basis for operating a repository, reducing uncertainties related to repository performance, and revising repository

* In February 2002, the Secretary of Energy and the President recommended the Yucca Mountain site for repository development. If the State of Nevada disapproves the recommendation, Congress will debate a "Resolution of Approval" later this year. The Board's goals and objectives will be revised to reflect the outcome of these deliberations.

and waste package designs. (Will apply only if the site recommendation is approved.)

Strategic Objectives

To achieve its general goals, the Board has established the following long-term objectives.

1. Objectives Related to the Natural Components of the Repository System and Predicting Repository Performance

1.1. Evaluate the technical and scientific validity of DOE studies, testing, and analyses supporting a decision on whether to recommend the Yucca Mountain site.

1.2. Evaluate the analyses and investigations pertaining to hydrologic and other natural processes at the Yucca Mountain site and at related analogue sites that establish the foundation for predicting repository performance.

1.3. Review the technical and scientific validity of models used to predict repository performance.

1.4. Evaluate the DOE's progress in developing a safety strategy for the Yucca Mountain site.

1.5. Monitor progress in completing development of standards and regulatory guidelines for a potential Yucca Mountain repository.

1.6. Review the *Record of Decision* and maintain awareness of legal challenges to the final environmental impact statement (EIS) for a potential Yucca Mountain repository.

2. Objectives Related to the Engineered Components of the Repository System

2.1. Evaluate repository and waste package designs, including the technical bases for the designs.

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

2.3. Assess the integration of science and engineering in the DOE program, paying particular attention to the effects of site-characterization studies (e.g., modeling, testing, and analyses of thermal and mechanical effects) on repository and waste package designs.

3. Objectives Related to the Waste Management System

3.1. Evaluate the accuracy and reasonableness of analyses, methods, and major assumptions used by the DOE in estimating health and safety risks associated with transporting spent nuclear fuel and high-level radioactive waste.

3.2. Review the adequacy of DOE plans for developing the transportation infrastructure and determine the effort needed to develop a large-scale transportation capability.

3.3. Review the adequacy of the DOE's plans for safely handling and packaging spent nuclear fuel and high-level radioactive waste for transport to a permanent repository.

3.4. Evaluate the effectiveness of the DOE's efforts to integrate the various components of the waste management system (packaging, handling, transport, storage, and disposal of the waste).

3.5. Review the DOE's plans for addressing public safety concerns and for enhancing safety capabilities along transportation corridors. This includes activities related to development of plans (e.g., route selection), coordination, accident prevention (e.g., improved inspections and enforcement), and emergency response.

4. Objectives Related to Confirmatory Testing (Will apply only if the site recommendation is approved)

4.1. Monitor performance-confirmation activities, including performance-confirmation planning, undertaken by the DOE that are designed to reduce uncertainties related to repository performance.

4.2. Monitor performance-confirmation activities undertaken by the DOE, and evaluate the need

to revise repository or waste package designs on the basis of the results of such activities.

Performance Goals for FY 2002

The Board's performance goals for fiscal year (FY) 2002 have been developed to further the achievement of the Board's general goals and strategic objectives. Because some of the general goals and strategic objectives relate to work and activities that will be undertaken in the future, they may not have corresponding annual performance goals in any given year. For example, the following performance goals for FY 2002 relate primarily to DOE activities supporting a DOE decision on whether to recommend the Yucca Mountain site to the President, the design of a potential repository and waste package, and transportation planning.

1. Performance Goals Related to Site Suitability and Predicting Repository Performance and Strategy for Achieving Performance Goals

Performance Goals

1.1.1. Review for technical validity the technical and scientific components of a DOE site recommendation report (if applicable).

1.1.2. Monitor the DOE's efforts to quantify uncertainties related to estimates of repository performance.

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

1.2.2. Evaluate geologic, hydrologic, and geochemical information obtained from the enhanced characterization of the repository block at Yucca Mountain.

1.3.1. Determine the strengths and weaknesses of the total system performance assessment (TSPA).

1.3.2. On the basis of an evaluation of the natural processes at work at the Yucca Mountain site, recommend additional work needed to address uncertainties, paying particular attention to estimates of the rate and distribution of water seepage into the proposed repository under proposed repository design conditions.

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

1.3.4. Recommend additional measures for strengthening the DOE's repository safety case.

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

1.4.1. Review plans and work carried out on natural and engineered analogues.

Strategy for Achieving Goals

The strategy for achieving performance goals for fiscal year 2002 is similar to that used and proven successful in previous years. The Board will accomplish its goals by doing the following.

- Reviewing critical documents provided by the DOE and its contractors, including contractor reports, process model reports, TSPA for site recommendation, and the site recommendation.

- Meeting with contractor's principal investigators on technical issues, including those related to climate change, flow and transport in the unsaturated and saturated zones, seepage, and the biosphere.

- Holding public meetings with DOE and contractor personnel at least three times a year involving the full Board and holding several meetings with individual Board panels.

- Visiting and observing ongoing laboratory investigations, including the facilities at Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, Sandia National Laboratory, and the engineered-barrier test facility. Observing field investigations.

- Meeting with other entities carrying out research on, or providing input to, scientific and technical issues related to waste disposal, including the Nuclear Regulatory Commission and its contractors, the Southwest Research Institute, The Nye

County Early Warning Drilling Program, the Environmental Protection Agency, and the State of Nevada Nuclear Waste Projects Office.

2. Performance Goals Related to the Engineered Repository System and Strategy for Achieving Performance Goals

Performance Goals

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

2.1.2. Evaluate the accuracy and completeness of the technical bases for repository and waste package designs.

2.1.3. Evaluate the extent to which the DOE is using the technical bases for modifying repository and waste package designs.

2.1.4. Monitor and evaluate the DOE's progress in developing a technical basis for modified or novel design features.

2.2.1. Evaluate data from studies of corrosion and the waste package environment on the predicted performance of materials being proposed for the EBS.

2.3.1. Assess the integration of scientific studies with engineering designs for the repository and the waste package. In particular, monitor the results of ongoing thermal tests and evaluate DOE plans for using the test results to support models of the thermally disturbed region near the repository and for deciding on spacing between emplacement drifts, degree of preclosure ventilation, and closure date of the potential repository.

2.3.2. Evaluate the DOE's efforts in identifying natural and engineered analogues.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Evaluating the technical bases for the EBS design by reviewing technical documents and databases (e.g., the controlled design assumption document and the technical database), paying particular attention to the technical bases for making and inspecting final closure welds of the waste package and methods for making sections of the drip shields. Meetings will be held with project personnel as necessary to obtain clarification and confirmation.

- Evaluating the technical bases for repository design by reviewing DOE documents and databases, paying particular attention to design features developed to promote drainage, control ventilation, and protect workers in the exhaust end of the ventilation system.

- Evaluating repository and waste package designs to identify which parts (if any) of the designs do not have a technical basis.

- Evaluating the technical basis for the DOE's work on alternative design features.

- After identifying the corrosion mechanisms most important to performance of the overall repository system, reviewing the common database (literature, laboratory, and field data) and judging the adequacy of the database for a decision on site recommendation.

3. Performance Goals Related to the Waste Management System and Strategy for Achieving Performance Goals

Performance Goals

3.1.1. Monitor efforts by the NRC to update estimates of risk associated with transportation of spent nuclear fuel and high-level radioactive waste.

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

3.2.1. Evaluate the effects of "off-normal" events at the surface facility and how the events could

affect the ability of the facility to receive waste shipments.

3.2.2. Evaluate the effects of reduced receiving capacity at the repository surface facility on the nationwide transportation system.

3.3.1. Examine the ability of storage casks and containers, including multipurpose canisters, to serve as disposal casks and containers in a repository.

3.3.2. Evaluate effects of human errors on risks associated with packaging and transporting spent nuclear fuel.

3.4.1. Evaluate logistics capabilities of the transportation system.

3.4.2. Monitor progress in implementing new technologies for improving transportation safety for spent fuel (e.g., electronic braking, wheel-bearing monitoring).

3.4.3. Review criteria for waste acceptance for storage to ensure that accepted material has been suitably characterized for subsequent disposal.

3.4.4. 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.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Meeting with the American Association of Railroads, individual railroad companies, and railroad infrastructure manufacturers to determine the current state of rail infrastructure, and noting the effects of a sustained transportation campaign on the railroad industry.
- Attending meetings of the DOE-sponsored Transportation External Working Group to determine how well the DOE is working to implement Section 180(c) of the Nuclear Waste Policy Act.
- Holding meetings of the Board's Panel on the Waste Management System, as appropriate.

4. Performance Goals Related to Long-Term Activities and Strategy for Achieving Performance Goals (Will apply only if the site is found suitable and a site recommendation is ratified.)

Performance Goals

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

4.1.2. Monitor design modification activities undertaken by the DOE.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Reviewing critical documents provided by the DOE and its contractors, including contractor reports, process model reports, TSPA for site recommendation, and the site recommendation.
- Reviewing performance-confirmation plans and meeting with DOE personnel to discuss aspects of the plans.

Evaluating the Board's Performance

The Board believes that measuring its effectiveness by directly correlating improvements in the DOE program with Board actions and recommendations would be ideal. However, the Board has no implementing authority, so it cannot compel the DOE to comply with its recommendations. Consequently, a judgment about whether a specific recommendation had a positive outcome for the DOE program is, in

most cases, (1) subjective and (2) an imprecise indicator of Board performance because implementation of Board recommendations by the DOE is outside the Board's direct control. Therefore, to measure its performance in a given year, the Board has developed performance measures. For each annual performance goal, the Board considers the following.

1. Were the reviews, evaluations, and other activities undertaken under the auspices of the goal completed?

2. Were the results of the 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, the Board's performance in meeting the annual 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.

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 establish its annual performance objectives and develop its budget request for subsequent years. The results of the Board's performance evaluation are included in the Board's annual summary report to Congress and the Secretary.

Board Operations

The Board is composed of 11 members appointed by the President who serve on a part-time basis; are eminent in a relevant field of science or engineering, including environmental sciences; and are appointed solely on the basis of distinguished service. Because of the comprehensive nature of the program and the part-time availability of the members, Congress authorized the Board to maintain a small professional staff of 10 full-time employees to support the Board's comprehensive review of the DOE program. In addition to the members and professional staff, the Board maintains a small administrative staff that supports its activities.

The full Board meets three or four times each year. The Board has organized itself into panels that meet as needed. The Board also gathers information from field trips to the Yucca Mountain site, visits to contractor laboratories and facilities, and informal meetings with individuals working on the project. On the basis of the information gathered throughout the year, the Board issues its findings in letters and reports.

Appendix J
U.S. Nuclear Waste Technical Review Board Fiscal Year 2003 Performance Plan

The NWTRB's General Goals and Strategic Objectives

The national goal for radioactive waste management established by Congress in the Nuclear Waste Policy Act of 1982 (NWPA) and the Nuclear Waste Policy Amendments Act of 1987 is safe disposal of civilian spent nuclear fuel and high-level radioactive waste in a permanent geologic repository at a suitable site or sites. In the acts, Congress directed the U.S. Department of Energy (DOE) to characterize a site at Yucca Mountain, Nevada, to determine its suitability as the potential location of a permanent repository for spent nuclear fuel and high-level radioactive waste. Congress charged the U.S. Nuclear Waste Technical Review Board with reviewing the technical and scientific validity of the Secretary of Energy's activities associated with implementing the NWPA, including characterizing the Yucca Mountain site and packaging and transporting the waste. The Board's general goals have been established in accordance with its congressional mandate.*

General Goals

To accomplish its congressional mandate, the Board has established four general goals.

1. Ensure that technical and scientific activities undertaken by the DOE related to characterizing and analyzing the natural components of a potential Yucca Mountain repository and predicting the performance of a potential repository establish a sound technical basis for a decision on whether to recommend the site for repository development.

2. Ensure that technical and scientific activities undertaken by the DOE related to evaluating and designing the repository and waste packages are well integrated and establish a sound technical basis for designing the repository system, including the engineered barrier system (EBS).

3. Ensure that technical and scientific activities undertaken by the DOE related to packaging, handling, and transporting spent nuclear fuel and high-level radioactive waste to a potential repository are well integrated and establish a sound technical basis for designing and operating a waste management system.

4. Ensure that technical and scientific performance-confirmation activities undertaken by the DOE establish a sound technical basis for operating a repository, reducing uncertainties related to repository performance, and revising repository and waste package designs. (Will apply only if the site recommendation is approved.)

* In February 2002, the Secretary of Energy and the President recommended the Yucca Mountain site for repository development. If the State of Nevada disapproves the recommendation, Congress will debate a "Resolution of Approval" later this year. The Board's goals and objectives will be revised to reflect the outcome of these deliberations.

Strategic Objectives

To achieve its general goals, the Board has established the following long-term objectives.

1. Objectives Related to the Natural Components of the Repository System and Predicting Repository Performance

1.1. Evaluate the technical and scientific validity of DOE studies, testing, and analyses supporting a decision on whether to recommend the Yucca Mountain site.

1.2. Evaluate the analyses and investigations pertaining to hydrologic and other natural processes at the Yucca Mountain site and at related analogue sites that establish the foundation for predicting repository performance.

1.3. Review the technical and scientific validity of models used to predict repository performance.

1.4. Evaluate the DOE's progress in developing a safety strategy for the Yucca Mountain site.

1.5. Monitor progress in completing development of standards and regulatory guidelines for a potential Yucca Mountain repository.

1.6. Review the *Record of Decision* and maintain awareness of legal challenges to the final environmental impact statement (EIS) for a potential Yucca Mountain repository.

2. Objectives Related to the Engineered Components of the Repository System

2.1. Evaluate repository and waste package designs, including the technical bases for the designs.

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

2.3. Assess the integration of science and engineering in the DOE program, paying particular attention to the effects of site-characterization studies (e.g., modeling, testing, and analyses of thermal and mechanical effects) on repository and waste package designs.

3. Objectives Related to the Waste Management System

3.1. Evaluate the accuracy and reasonableness of analyses, methods, and major assumptions used by the DOE in estimating health and safety risks associated with transporting spent nuclear fuel and high-level radioactive waste.

3.2. Review the adequacy of DOE plans for developing the transportation infrastructure and determine the effort needed to develop a large-scale transportation capability.

3.3. Review the adequacy of the DOE's plans for safely handling and packaging spent nuclear fuel and high-level radioactive waste for transport to a permanent repository.

3.4. Evaluate the effectiveness of the DOE's efforts to integrate the various components of the waste management system (packaging, handling, transport, storage, and disposal of the waste).

3.5. Review the DOE's plans for addressing public safety concerns and for enhancing safety capabilities along transportation corridors. This includes activities related to development of plans (e.g., route selection), coordination, accident prevention (e.g., improved inspections and enforcement), and emergency response.

4. Objectives Related to Confirmatory Testing (Will apply only if the site recommendation is approved)

4.1. Monitor performance-confirmation activities, including performance-confirmation planning, undertaken by the DOE that are designed to reduce uncertainties related to repository performance.

4.2. Monitor performance-confirmation activities undertaken by the DOE, and evaluate the need to revise repository or waste package designs on the basis of the results of such activities.

Performance Goals for FY 2003

The Board's performance goals for fiscal year (FY) 2003 have been developed to further the achievement of the Board's general goals and strategic objectives. Because some of the general goals and strategic objectives relate to work and activities that will be undertaken in the future, they may not have corresponding annual performance goals in any given year.

1. Performance Goals Related to Site Suitability and Predicting Repository Performance and Strategy for Achieving Performance Goals

Performance Goals

1.1.1 Review for technical validity the technical and scientific components of the DOE's on-going site investigations (if applicable).

1.1.2. Monitor the DOE's efforts to quantify uncertainties related to estimates of repository performance.

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

1.2.2. Evaluate geologic, hydrologic, and geochemical information obtained from the enhanced characterization of the repository block at Yucca Mountain.

1.3.1. Determine the strengths and weaknesses of the total system performance assessment (TSPA).

1.3.2. On the basis of an evaluation of the natural processes at work at the Yucca Mountain site, recommend additional work needed to address uncertainties, paying particular attention to estimates of the rate and distribution of water seepage into the proposed repository under proposed repository design conditions.

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

1.3.4. Recommend additional measures for strengthening the DOE's repository safety case.

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

1.4.1. Review plans and work carried out on natural and engineered analogues to the repository system.

Strategy for Achieving Goals

The strategy for achieving performance goals for fiscal year 2003 is similar to that used and proven successful in previous years. The Board will accomplish its goals by doing the following.

- Reviewing critical documents provided by the DOE and its contractors, including contractor reports, process model reports, and TSPA.

- Meeting with contractor's principal investigators on technical issues, including those related to climate change, flow and transport in the unsaturated and saturated zones, seepage, and the biosphere.

- Holding public meetings with DOE and contractor personnel at least three times a year involving the full Board and holding several meetings with individual Board panels.

- Visiting and observing ongoing laboratory investigations, including the facilities at Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, Sandia National Laboratory, and the engineered-barrier test facility. Observing field investigations.

- Meeting with other entities carrying out research on, or providing input to, scientific and technical issues related to waste disposal, including the Nuclear Regulatory Commission and its contractors, the Southwest Research Institute, The Nye County Early Warning Drilling Program, the Environmental Protection Agency, and the State of Nevada Nuclear Waste Projects Office.

2. Performance Goals Related to the Engineered Repository System and Strategy for Achieving Performance Goals

Performance Goals

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

2.1.2. Evaluate the accuracy and completeness of the technical bases for repository and waste package designs.

2.1.3. Evaluate the extent to which the DOE is using the technical bases for modifying repository and waste package designs.

2.1.4. Monitor and evaluate the DOE's progress in developing a technical basis for modified or novel design features.

2.2.1. Evaluate data from studies of corrosion and the waste package environment on the predicted performance of materials being proposed for the engineered barrier system.

2.3.1. Assess the integration of scientific studies with engineering designs for the repository and the waste package. In particular, monitor the results of ongoing thermal tests and evaluate DOE plans for using the test results to support models of the thermally disturbed region near the repository and for deciding on spacing between emplacement drifts, degree of preclosure ventilation, and closure date of the potential repository.

2.3.2. Evaluate the DOE's efforts in identifying natural and engineered analogues (see also 1.4.1.).

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Evaluating the technical bases for the EBS design by reviewing technical documents and databases (e.g., the controlled design assumption document and the technical database), paying particular attention to the technical bases for making and inspecting final closure welds of the waste package and methods for making sections of the drip shields. Meetings will be held with project personnel as necessary to obtain clarification and confirmation.

- Evaluating the technical bases for repository design by reviewing DOE documents and databases, paying particular attention to design features developed to promote drainage, control ventilation, and protect workers in the exhaust end of the ventilation system.

- Evaluating repository and waste package designs to identify which parts (if any) of the designs do not have a technical basis.

- Evaluating the technical basis for the DOE's work on alternative design features.

- After identifying the corrosion mechanisms most important to performance of the overall repository system, reviewing the common database (literature, laboratory, and field data) and judging the adequacy of the database for a decision on repository development.

3. Performance Goals Related to the Waste Management System and Strategy for Achieving Performance Goals

Performance Goals

3.1.1. Monitor efforts by the NRC to update estimates of risk associated with transportation of spent nuclear fuel and high-level radioactive waste.

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

3.2.1. Evaluate the effects of "off-normal" events at the surface facility and how the events could affect the ability of the facility to receive waste shipments.

3.2.2. Evaluate the effects of reduced receiving capacity at the repository surface facility on the nationwide transportation system.

3.3.1. Examine the ability of storage casks and containers, including multipurpose canisters, to serve as disposal casks and containers in a repository.

3.3.2. Evaluate effects of human errors in risks associated with packaging and transporting spent nuclear fuel.

3.4.1. Evaluate logistics capabilities of the transportation system.

3.4.2. Monitor progress in implementing new technologies for improving transportation safety for spent fuel (e.g., electronic braking, wheel-bearing monitoring).

3.4.3 Review criteria for waste acceptance for storage to ensure that accepted material has been suitably characterized for subsequent disposal.

3.4.4. 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.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Meeting with the American Association of Railroads, individual railroad companies, and railroad infrastructure manufacturers to determine the current state of rail infrastructure, and noting the effects of a sustained transportation campaign on the railroad industry.

- Attending meetings of the DOE-sponsored Transportation External Coordination Working Group to determine how well the DOE is working to implement Section 180(c) of the Nuclear Waste Policy Act.

- Holding meetings of the Board's Panel on the Waste Management System, as appropriate.

4. Performance Goals Related to Long-Term Activities and Strategy for Achieving Performance Goals (Will apply only if the site is found suitable and a site recommendation is ratified.)

Performance Goals

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

4.1.2. Monitor design modification activities undertaken by the DOE.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Reviewing critical documents provided by the DOE and its contractors, including contractor reports, process model reports, and TSPA.

- Reviewing performance-confirmation plans and meeting with DOE personnel to discuss aspects of the plans.

Evaluating the Board's Performance

The Board believes that measuring its effectiveness by directly correlating improvements in the DOE program with Board actions and recommendations would be ideal. However, the Board has no implementing authority, so it cannot compel the DOE to comply with its recommendations. Consequently, a judgment about whether a specific recommendation had a positive outcome for the DOE program is, in most cases, (1) subjective and (2) an imprecise indicator of Board performance because implementation of Board recommendations by the DOE is outside the Board's direct control. Therefore, to measure its performance in a given year, the Board has developed performance measures. For each

annual performance goal, the Board considers the following:

1. Were the reviews, evaluations, and other activities undertaken under the auspices of the goal completed?

2. Were the results of the 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, the Board's performance in meeting the annual 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.

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 establish its annual performance objectives and develop its budget request for subsequent years. The results of the Board's performance evaluation are included in the Board's annual summary report to Congress and the Secretary.

Board Operations

The Board is composed of 11 members appointed by the President who serve on a part-time basis; are eminent in a relevant field of science or engineering, including environmental sciences; and are appointed solely on the basis of distinguished service. Because of the comprehensive nature of the program and the part-time availability of the members, Congress authorized the Board to maintain a small professional staff of 10 full-time employees to support the Board's comprehensive review of the DOE program. In addition to the members and professional staff, the Board maintains a small administrative staff that supports its activities.

The full Board meets three or four times each year. The Board has organized itself into panels that meet as needed. The Board also gathers information from field trips to the Yucca Mountain site, visits to contractor laboratories and facilities, and informal meetings with individuals working on the project. On the basis of the information gathered throughout the year, the Board issues its findings in letters and reports.