Nuclear Waste Technical Review Board

Performance Based Budget
Fiscal Year 2005

Summary and Highlights

The U.S. Nuclear Waste Technical Review Board's (Board) budget request for fiscal year (FY) 2005 has been developed to enable the Board to achieve its performance goals for the year. The goals have been established in accordance with the Board's congressional mandate, which is to conduct an independent evaluation of the technical and scientific validity of U.S. Department of Energy (DOE) activities related to implementing a nuclear waste management program, including the disposal, packaging, and transportation of commercial spent nuclear fuel and defense high-level radioactive waste. The Board's ongoing review is vital to the technical and scientific credibility of the DOE's activities.

In early 2002, Congress approved the President's recommendation of the Yucca Mountain site and authorized the DOE to proceed with an application to the Nuclear Regulatory Commission for a license to construct a repository at Yucca Mountain. Throughout this process, the Board evaluated the technical and scientific validity of DOE work supporting repository performance estimates and reported its findings to Congress and the Secretary. The Board expects to continue its review of the technical and scientific validity of DOE activities, including activities related to predicting the performance of the repository system and activities related to planning and implementing a waste management system. In conducting its review, the Board will provide a "systems" perspective of the repository and of waste management activities. In particular, the Board anticipates that its focus on the DOE's work related to the waste management system, including waste transportation, handling, and packaging and repository operations, will increase commensurate with additional DOE activity in these areas.

The Board is requesting **$3,177,000** for FY 2005, which is the same amount appropriated in FY 2004. This amount will allow the Board to conduct the review described above. It is anticipated that Board activities, especially those associated with reviewing transportation and other waste management activities, will require additional funding in future years.

NUCLEAR WASTE TECHNICAL REVIEW BOARD

Salaries and Expenses

(Including Transfer of Funds)

For necessary expenses of the Nuclear Waste Technical Review Board, as authorized by Public Las 100-203, section 5051, $3,177,000, to be transferred from the Nuclear Waste Fund and to remain available until expended.

(2005 Energy and Water Development Appropriations Act, P.L. 108-007)

Fiscal Year 2005 Budget Request

Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste

Currently, approximately 2,000 metric tons of spent nuclear fuel are produced each year by nuclear reactors at more than 70 sites nationwide. By the time the presently operating reactors reach the end of their scheduled 40-year lifetimes (sometime in the 2030's), approximately 87,000 metric tons of spent fuel will have been produced. (This estimate does not include spent nuclear fuel from plants that may be granted license renewals from the Nuclear Regulatory Commission.) Spent nuclear fuel currently is being stored at reactor sites across the country. Disposal of this waste in a deep geologic repository is the primary approach being pursued by the United States and other countries.

In early 2002, the Secretary of Energy recommended to the President development of a repository at Yucca Mountain. The President then recommended the site to Congress. Nevada later disapproved the recommendation. In subsequent weeks, both Houses of Congress approved the site recommendation. Throughout this process, the Nuclear Waste Technical Review Board provided its evaluation of the technical and scientific validity of DOE activities related to its repository performance estimates and communicated its views to Congress and the Secretary in the form of a letter report and congressional testimony.

The Board's Continuing Role

The Board was established by Congress in the Nuclear Waste Policy Amendments Act of 1987 (NWPAA). The Board is charged with evaluating the technical and scientific validity of activities undertaken by the Secretary of Energy, including site-characterization activities and activities related to the packaging and transportation of high-level radioactive waste and spent nuclear fuel.[1] The Board's technical and scientific findings and recommendations are included in reports that are submitted at least twice each year to the Secretary and Congress. In creating the Board, Congress realized that an ongoing, independent and expert evaluation of the technical and scientific credibility of the DOE's site-evaluation and other waste-management activities would be crucial to acceptance by the public and the scientific community of any approach for disposing of spent nuclear fuel and high-level radioactive waste.

[1] 42 U.S.C. 10263

The Board's Funding Requirement for Fiscal Year 2005: $3,177,000

As described below, the Board's budget request of $3,177,000 for fiscal year (FY) 2005 represents the funding needed to accomplish the Board's performance goals for the year. During FY 2005, the Board will review data and analyses developed by the DOE, including DOE data supporting predictions of repository performance; the basis for the DOE's proposed waste package and repository designs and revisions of the designs; and technical and scientific issues related to the DOE's plans for implementing a waste management system. Such a system includes waste packaging, transportation, handling, and repository operations.

The Board's request is the same as last year and allows for review of DOE activities related to the packaging and transportation of spent fuel to Yucca Mountain anticipated for FY 2005. It is expected that Board's activities, especially those associated with reviewing transportation and other waste management activities, will require additional funding in future years.

Goals and Strategic Objectives

The nation's goals related to the disposal of spent nuclear fuel and high-level radioactive wastes were set forth by Congress in the NWPA. The goals are to develop a repository or repositories for disposing of high-level radioactive waste and spent nuclear fuel at a suitable site or sites and to establish a program of research, development, and demonstration for the disposal of such waste.

The NWPAA limited repository-development activities to a single site at Yucca Mountain in Nevada. The NWPAA also established the Board and charged it with evaluating the technical and scientific validity of the Secretary of Energy's activities associated with implementing the NWPA. Such activities include characterizing the Yucca Mountain site and packaging and transporting spent nuclear fuel and high-level radioactive waste.

The Board's general goals and strategic objectives, which are set forward in the its strategic plan for fiscal years (FY) 2003-2008, have been established in accordance with its statutory mandate and with congressional action in 2002 authorizing the DOE to proceed with the development of an application to be submitted to the NRC for authorization to construct a repository at Yucca Mountain. The Board's goals reflect the continuity of the Board's ongoing technical and scientific evaluation and "systems" view of the repository and of waste management activities.

The Board's performance goals for FY 2005 are listed below. The performance goals have been numbered to correlate with appropriate strategic objectives and budget amounts have been preliminarily allocated to each set of performance goals.

Board Performance Goals for FY 2005

1. *Performance Goals Related to the Natural System and Strategy for Achieving the* Goals

(Dollars in Thousands)		
FY 03	**FY 04**	**FY 05**
757	**795**	**795**

Performance Goals

1.1.1. Review the technical activities and agenda of the DOE's science and technology program.

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.

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

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

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

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

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

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.

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

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

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Holding three public meetings of the full Board with the DOE and DOE contractor personnel involving the full Board and holding meetings of the Panel on the Natural System, as needed.

- Reviewing critical documents provided by the DOE and its contractors, including contractor reports, process model reports, and total system performance assessment (TSPA).

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

- Visiting and observing ongoing exploratory studies facility (ESF), ECRB, and laboratory investigations, including the facilities at Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, and Sandia National Laboratories. Observing other field investigations and visiting potential analogue sites.

- Visiting programs in other countries and attending national and international symposia and conferences.

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

(Dollars in Thousands)

FY 03	FY 04	FY 05
909	***953***	***953***

Performance Goals

2.1.1. Monitor the DOE's performance allocation studies.

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

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.

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

2.3.2. Evaluate the DOE's efforts in identifying natural and engineered analogs for corrosion processes.

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

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.

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

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

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Holding three public meetings of the full Board with DOE and contractor personnel involving the full Board and holding meetings of the Panel on the Engineered System, as needed.

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

- Meeting with contractor principal investigators on technical issues.

- 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.

- Reviewing the common database (literature, laboratory, and field data) and judging the adequacy of the database for a decision on repository development.

- Visiting and observing ongoing laboratory investigations, including the facilities at Lawrence Livermore National Laboratory and Lawrence Berkeley National Laboratory.

- Visiting programs in other countries and attending national and international symposia and conferences.

3. Performance Goals Related to Repository System Performance and Integration and Strategy for Achieving Performance Goals

	(Dollars in Thousands)		
	FY 03	**FY 04**	**FY 05**
	605	***635***	***635***

Performance Goals

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

3.1.2. Determine the strengths and weaknesses of TSPA.

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

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

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

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

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

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

3.4.1. Evaluate the DOE's efforts to analyze the contribution of the different engineered and natural barriers to waste isolation.

3.5.1. Evaluate technical aspects of value engineering and performance-related trade-off studies, including criteria, weighting factors and decision methodologies for such studies and how technical uncertainties are taken into account.

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

3.7.1. Evaluate the DOE's efforts to develop a feedback loop among performance-confirmation activities and TSPA models and data.

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

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Holding three public meetings of the full Board with DOE and contractor personnel involving the full Board and holding meetings of the Panel on the Repository System Performance and Integration, as needed.

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

- Meeting with contractor's principal investigators on technical issues.

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

- Visiting programs in other countries and attending national and international symposia and conferences.

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

(Dollars in Thousands)

FY 03	**FY 04**	**FY 05**
757	***794***	***794***

Performance Goals

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

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

4.1.3. Review the technical and scientific basis of the DOE's analyses of component interactions under various scenarios, including the degree of integration and redundancy across functional components over time.

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

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

4.2.1. Monitor the DOE's efforts to implement Section 180 (c) of the NWPA.

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.

4.3.2. Review the DOE's efforts to develop criteria for transportation mode and routing decisions.

4.3.3. Evaluate logistics capabilities of the transportation system.

4.3.4. Monitor progress in implementing new technologies for improving transportation safety for spent nuclear fuel.

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.

Strategy for Achieving Goals

The Board will accomplish its goals by doing the following.

- Holding three public meetings with DOE and contractor personnel involving the full Board and holding meetings of the Board's Panel on the Waste Management System in appropriate areas of the country.

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

- Meeting with groups involved in implementing transportation plans, including the NRC, the Department of Transportation, railroad and trucking companies, nonprofit groups, the utilities, and other stakeholders.

- Visiting programs in other countries and attending national and international conferences and symposia.

Budget Request by Object Class

Object Class 11.1, Full-Time Staff: $1,647,000

The amount requested for full-time permanent staff is based on the requirement to fund a total of 16 positions. Because the Board's technical and scientific evaluations are conducted by Board members supported by professional staff, the Board's enabling legislation authorizes the Chairman to appoint and fix the compensation of not more than 10 senior professional staff members. This request assumes the use of all 10 positions under this authority. In addition, the chairman is authorized to appoint such clerical and administrative staff as may be necessary to discharge the responsibilities of the Board. The other 6 positions funded under this object class are support staff engaged in clerical, secretarial, and administrative activities; development and dissemination of Board publications; information technology, including maintenance of the Board's Web site; public affairs; and meeting logistics for the Board. The small administrative staff supports the very active, part-time Board members and the 10 full-time professional staff.

The estimate assumes a 1.7 percent combined cost-of-living adjustment and locality raise in January 2005, in addition to a 2 percent step increase for support staff.

Object Class 11.3, Other than Full-Time Permanent Staff: $314,000

The amount requested for this category includes compensation for Board members. Each Board member will be compensated at the rate of pay for Level III of the Executive Schedule for each day the member is engaged in work for the Board. The 11 Board members serve on a part-time basis equaling 3 full-time equivalent positions. The budget assumes that each member will attend 3 full Board meetings, 4 panel meetings, and on average 3 additional meetings or field trips during the year. This estimate represents an average of 50 workdays per member in FY 2005. This estimate also assumes a 2.2 percent increase in Executive Schedule compensation for employees in this category for FY 2005 (effective January 2005).

Object Class 11.5, Other Personnel Compensation: $61,000

The amount requested for this category covers approximately 100 hours of staff overtime and performance awards under the Performance Management System approved by the Office of Personnel Management (OPM). Most Board and panel meetings require considerable overtime for handling preparations and on-site meeting logistics.

Object Class 12.1, Civilian Personnel Benefits: $322,000

The estimate for this category represents the government's contribution for employee benefits at the rate of 20 percent for staff and 7.65 percent for members and an expert consultant hired as special government employees.

Object Class 21.0, Travel: $245,000

The amount requested for this object class includes travel costs for Board members, staff, and consultants traveling to Board and panel meetings, to other meetings (including professional meetings and conferences) and sites for acquiring technical and scientific data, and to Yucca Mountain, Nevada, for reviewing site activities within the scope of the Board's mission. The request is based on Board members attending 3 Board and 4 panel meetings and making on average 3 other trips during the year at an average length of 4 days each, including travel time. In addition, the expectation is that each of the 10 professional staff members will travel on similar activities an average of 10 trips during the year at an average of 5 days per trip. The estimate is that consultants, whom the Board reimburses for travel expenses, will make a total of 15 trips, primarily to attend Board and panel meetings.

Object Class 23.1, Rental Payments to GSA: $189,000

The estimate for this object class represents the amount the Board will pay to the General Services Administration (GSA) for rental of office space totaling 6,288 sq. ft. at an annual rate of $30.06 per sq. ft.

Object Class 23.3, Communications, Utilities, Miscellaneous: $40,000

The requested amount represents estimates for telephone service, postage, local courier services, video teleconferencing, FTS long-distance telephone service, the Internet, and mailing services related to management and use of the Board's mailing list.

Object Class 24.0, Printing and Reproduction: $13,000

The major items in this object class are the publication of reports to the U.S. Congress and the Secretary of Energy, publication of meeting notices in the *Federal Register*, production of press releases announcing meetings and report publication, and production of other informational materials for Board members and the public.

Object Class 25.1, Consulting Services: $98,000

A consultant will be hired to support and supplement Board and staff analysis of technical and scientific issues related to the DOE's plans for packaging and transporting waste. In addition, the Board expects to contract with part-time technical consultants to supplement and support in-house operations in systems management, Web site management, report production, and editing.

Object Class 25.2, Other Services: $105,000

The major items in this category include court-reporting services for an estimated seven Board or panel meetings, meeting-room rental and related services, maintenance agreements for equipment, professional development, computer-network software maintenance, and miscellaneous supplies and services from commercial sources. In addition, funds are included to support the Federal Information Security Act, which requires Federal agencies to periodically test and evaluate the effectiveness of their information security policies, procedures and practices.

Object Class 25.3, Services from Other Government Agencies: $69,000

This category includes GSA administrative support services (payroll, accounting, personnel, etc.), legal advice from GSA, security clearances through the Office of Personnel Management, and other miscellaneous interagency agreements.

Object Class 26.0, Supplies and Materials: $49,000

Anticipated expenses include routine office supplies, subscriptions and library materials, off-the-shelf technical reports and studies, and computer software.

Object Class 31.0, Equipment: $25,000

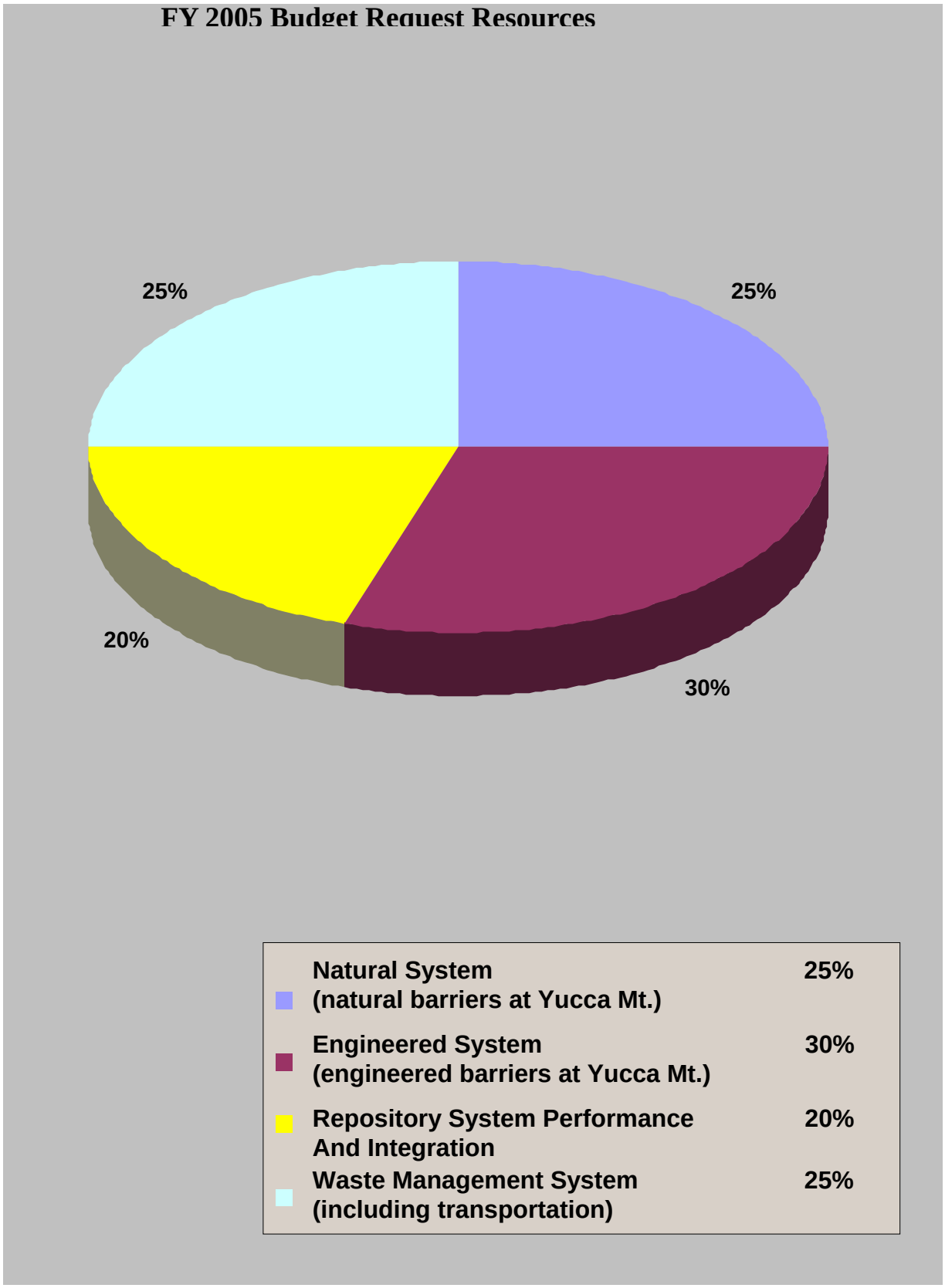
This estimate is for miscellaneous equipment costs, including audiovisual equipment and computer hardware.

NUCLEAR WASTE TECHNICAL REVIEW BOARD

SALARIES AND EXPENSES
OBJECT CLASSIFICATION (in thousands of dollars)

Identification code 48-0500-0-1-271		FY 03 ACT	FY 04 EST	FY 05 REQ
Personnel compensation				
11.1	Full-time permanent	$1,411	$1,443	$1,647
11.3	Other than Full-Time Permanent	327	366	314
11.5	Other Personnel Compensation	53	55	61
11.9	Total Personnel Compensation	1,791	1,864	2,022
12.1	Civilian Personnel Benefits	331	318	322
21.0	Travel and Transportation	260	385	245
23.1	Rental Payments to GSA	182	187	189
23.3	Communication, Utilities, Miscellaneous	19	46	40
24.0	Printing and Reproduction	11	13	13
25.1	Consulting Services	138	113	98
25.2	Other Services	161	103	105
25.3	Services from Government Accounts	42	76	69
26.0	Supplies and Materials	71	47	49
31.0	Equipment	22	25	25
99.9	***Total Obligations***	***$3,028***	***$3,177***	***$3,177***

Identification Code 48-0500-0-1-271	03 ACT	04 EST	05 REQ
Total Number of Full-Time Permanent Positions	14	16	16
Total Compensable Work-Years: Full-Time Equivalents	17	18	18


FY 2005 Budget Request Resources
25%
25%
20%
30%
Natural System
(natural barriers at Yucca Mt.)
25%
Engineered System
(engineered barriers at Yucca Mt.)
30%
Repository System Performance
And Integration
20%
Waste Management System
(including transportation)
25%

Evaluation of the Board's Performance in 2002

(Evaluation for 2003 will be provided by February 27)

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.

On the basis of the following evaluation and consistent with the performance measures described in the previous section, the Board's performance for 2002 was found to be effective. However, the Secretary's activities related to the waste management program were very limited in 2002. Therefore, most of the Board's 2002 goals in that area are deferred until 2003.

1. *Performance Goals and Evaluation Related to Site Suitability and Predicting Repository Performance*

Performance Goals

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

- Evaluation of 1.1.1: The Board submitted a letter to Congress and the Secretary on January 24, 2002 giving the Board's evaluation of the DOE's technical and scientific work. The Board found the DOE's technical basis for its performance estimates to be weak to moderate. On the same date, the Board sent answers to questions raised by Senators Harry Reid and John Ensign and by Representatives Joe Barton and John Shimkus on the DOE's technical and scientific activities related to site recommendation. On April 18, 2002, Chairman of the Board Jared Cohon testified before the House Subcommittee on Energy and Air Quality, Committee on Energy and Commerce, on issues related to the DOE's technical basis for its performance estimates. On May 23, 2002, Chairman Cohon testified before the Senate Committee on Energy and Natural Resources on the same subject. The Board received follow-up questions from the House Subcommittee and the Senate Committee. The Board sent its responses to the follow-up questions to Representative Joe Barton on May 22, 2002, and to the Committee on Natural Resources on May 31, 2002.

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

- Evaluation of 1.1.2: The Board reiterated its recommendation for the DOE to quantify uncertainties in the Board's January 24, 2002, letter report to Congress and the Secretary and in a June 20, 2002, letter to director of the DOE's Office of Civilian Radioactive Waste Management (OCRWM), Margaret Chu.

1.2.1. Monitor 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 received an update on the DOE's flow and transport models and on the site-scale saturated zone model at the Board's January 2002 meeting. The Board also commented on the DOE's efforts to determine whether the natural system makes a greater contribution to isolating and containing waste in its November 22, 2002 letter to OCRWM director Margaret Chu.

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

- Evaluation of 1.2.2: The Board was updated on the status of ECRB studies at its September 2002 meeting. In the Board's November 22, 2002, letter to Margaret Chu, the Board commented on the need to find an explanation for moisture discovered in the closed-off section of the tunnel.

1.3.1. Determine the strengths and weaknesses of the TSPA.

- Evaluation of 1.3.1: The Board discussed TSPA in its January 24, 2002, letter report to the Secretary of Energy and Congress. The Board held a session on TSPA at its January 2002 meeting and a session on barrier analysis at its September 2002 meeting. The

Board commented on TSPA in its November 22, 2002 letter to Margaret Chu.

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.

- Evaluation of 1.3.2: In its January 24, 2002, letter report the Board commented on ways to increase confidence and decrease uncertainties, including increasing fundamental understanding and, potentially, lowering repository temperatures. In its November 22, 2002, letter to Margaret Chu the Board encouraged the DOE to reconcile contradictory data about the presence of chlorine-36 at the repository horizon and urged the DOE to complete experiments such as the drift-scale thermal test before drawing conclusions about whether uncertainties have been properly estimated.

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

- Evaluation of 1.3.3: The Board evaluated the DOE's quantification of uncertainties in the Board's January 24, 2002, letter report to Congress and the Secretary. The Board was updated at its January meeting on the DOE's uncertainty analysis and strategy report. The Board commented on other aspects of the DOE's analyses of uncertainties in its November 22, 2002 letter to Margaret Chu.

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

- Evaluation of 1.3.4: The Board commented on the DOE's safety case in its January 24, 2002, letter to Congress and the Secretary. The Board held a session devoted to the DOE's safety case at its May 2002 meeting. The Board again commented to the DOE on the need for a defensible safety case that includes multiple lines of evidence supporting TSPA projections in a letter to Margaret Chu dated June 20, 2002.

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

- Evaluation of 1.3.5: The Board made the recommendation that the DOE complete and analyze the data from the drift-scale heater test in the Board's letter to Margaret Chu dated November 22, 2002.

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

- Evaluation of 1.4.1: The Board reiterated the importance of finding natural analogs in its November 24, 2002, letter to Congress and the Secretary in letters to Margaret Chu dated June 20, 2002, and November 22, 2002.

2. Performance Goals and Evaluation Related to the Engineered Repository System

Performance Goals

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

- Evaluation of 2.1.1: The Board discussed issues related to repository design at its May meeting and received on update on repository design at its November meeting. The Board commented on the DOE's analysis of the differences in performance associated with different repository designs in its November 22, 2002 letter to Margaret Chu.

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

- Evaluation of 2.1.2: The Board discussed issues related to repository design at its May meeting and received on update on repository design at its November meeting. The Board commented on the DOE's technical analysis of repository designs in its November 22, 2002 letter to Margaret Chu.

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

- Evaluation of 2.1.3: The Board discussed issues related to repository design at its May meeting and received on update on repository design at its November meeting. The Board commented on the DOE's technical analysis of repository designs in its November 22, 2002 letter to Margaret Chu.

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

- Evaluation of 2.1.4: The Board discussed issues related to repository design at its May 2002 meeting and received on update on repository design at its November 2002 meeting.

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.

- Evaluation of 2.2.1: The Board was updated on the DOE's corrosion studies at its January 2002 and September 2002 meetings. The Board commented specifically on tunnel environments and their influence on the performance of the waste package in its letter to Margaret Chu dated June 20, 2002.

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.

- Evaluation of 2.3.1: The Board was updated on the DOE's corrosion studies at its January 2002 and September 2002 meetings. The Board commented on waste package spacing and ventilation concepts in its letter to Margaret Chu dated June 20, 2002.

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

- Evaluation of 2.3.2: The Board commented on the importance of identifying natural and engineered analogs in its January 24, 2002, letter to the Secretary and Congress and in letters to Margaret Chu dated June 20, 2002 and November 22, 2002.

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

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.

- Evaluation of 3.1.1: The Board monitored the progress of the NRC's ongoing package performance study.

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

- Evaluation of 3.1.2: Because of limited DOE activity in this area, the Board's performance goal was deferred until 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, the Board's performance goal was deferred until 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, the Board's performance goal was deferred until 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, the Board's performance goal was deferred until 2003.

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

- Evaluation of 3.3.2: Because of limited DOE activity in this area, the Board's performance goal was deferred until 2003.

3.4.1. Evaluate logistics capabilities of the transportation system.

- Evaluation of 3.4.1: Because of limited DOE activity in this area, the Board's performance goal was deferred until 2003.

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

- Evaluation of 3.4.2: Because of limited DOE activity in this area, the Board's performance goal was deferred until 2003.

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

- Evaluation of 3.4.3: Because of limited DOE activity in this area, the Board's performance goal was deferred until 2003.

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.

- Evaluation of 3.4.4: Because of limited DOE activity in this area, the Board's performance goal was deferred until 2003.

4. Performance Goals and Evaluation Related to Long-Term Activities

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.

- Evaluation of 4.1.1: The Board referred to the need to develop performance confirmation activities as one of the confidence builders in its January 24, 2003 letter to Congress and the Secretary. The Board held a session on performance confirmation at its May 2002 meeting. In its June 20, 2002, letter to Margaret Chu, the Board questioned the DOE's goal for performance confirmation and its methods for validating its predictions. The Board said that performance confirmation should focus on evaluating the validity of estimates of long-term repository performance. The Board expressed similar sentiments in its November 22, 2002, letter to Margaret Chu.

4.1.2. Monitor design modification activities undertaken by the DOE.

- Evaluation of 4.1.2: The Board was updated at its January, May, and September meetings on the DOE's design modifications. It commented in its January 24, 2002, letter to Congress and the Secretary on the need to compare and evaluate repository designs and in its letters to Margaret Chu dated June 20, 2002, and November 22, 2002.

Supplementary Information on the Board

The Nuclear Waste Technical Review Board was established as an independent agency of the federal government on December 22, 1987, in the Nuclear Waste Policy Amendments Act (NWPAA). The Board is charged with evaluating the technical and scientific validity of activities undertaken by the Secretary of Energy, including

- site characterization; and
- activities related to packaging and transporting high-level radioactive waste and spent nuclear fuel.

The Board was given broad latitude to review activities undertaken by the Secretary of Energy in implementing the Nuclear Waste Policy Act. However, the Board was not given authority to require the DOE to implement Board recommendations.[2]

Board Members

The NWPAA authorized a Board of 11 members who serve on a part-time basis; are eminent in a field of science or engineering, including environmental sciences; and are selected solely on the basis of distinguished professional service. The law stipulates that the Board shall represent a broad range of scientific and engineering disciplines relevant to nuclear waste management. Board members are appointed by the President from a list of candidates recommended by the National Academy of Sciences. To prevent gaps in the Board's comprehensive technical review, Board members whose terms have expired continue serving until they are reappointed or their replacements assume office. The first members were appointed to the Board on January 18, 1989. On June 26, 2002, President George W. Bush appointed five new members. The names and affiliations of the current 8 Board members are listed below.[*]

- *Mark Abkowitz*, Ph. D., is a professor in the department of Civil & Environmental Engineering and director of the Vanderbilt Center for Environmental Management studies at Vanderbilt University. His areas of expertise include risk management, transportation of hazardous materials, emergency preparedness, and applications of advanced information technology.

- Daniel B. Bullen, Ph.D., P.E., is associate professor of mechanical engineering, Department of Mechanical Engineering, at Iowa State University. His areas of expertise include performance assessment modeling and materials science.

- *Thure Cerling*, Ph.D., is a professor in the department of Geology and Geophysics at the University of Utah. His areas of expertise include terrestrial geochemistry.

[2] Taken from *Legislative History of the Nuclear Waste Policy Amendments Act of 1987. February 26, 1998.*
[*] New Board member names are in italics.

- Norman L. Christensen, Jr., Ph.D., is professor of ecology and former dean of the Nicholas School of the Environment at Duke University in North Carolina. His areas of expertise include biology, ecology, and ecosystem management.

- *David Duquette*, Ph.D., is professor and head of the department of Materials Science and Engineering at the Rensselaer Polytechnic Institute in New York. His areas of expertise include the physical, chemical, and mechanical properties of metals and alloys.

- *Ron Latanision*, Ph.D., is professor at the Massachusetts Institute of Technology with joint appointments in the department of Materials Science and Engineering and the department of Nuclear Engineering. His areas of expertise include materials processing and the corrosion of metals and other materials in aqueous environments.

- Priscilla P. Nelson, Ph.D., is director, Division of Civil and Mechanical Systems, Directorate for Engineering, at the National Science Foundation. Her areas of expertise include rock engineering and underground construction.

- Richard R. Parizek, Ph.D., is professor of geology and geoenvironmental engineering at The Pennsylvania State University and president of Richard R. Parizek and Associates, consulting hydrogeologists and environmental geologists. His areas of expertise include hydrogeology and environmental geology.

Board Staff

The NWPAA limits the Board's professional staff to 10 positions. An additional 4 full-time and 2 part-time employees provide administrative support to Board members and the professional staff. Because of the comprehensive nature of the program, the diversity of Board member experience and expertise, and the part-time availability of Board members, the small, highly qualified staff is employed to its full capacity in supporting the Board's comprehensive review of the DOE program. The Board's offices are located in Arlington, Virginia.

Board Reporting Requirements

As required under the NWPAA, the Board reports to the U.S. Congress and the Secretary of Energy at least two times each year. The reports include Board recommendations to the DOE on improvements in the civilian radioactive waste management program. The DOE's written responses to Board recommendations are published in subsequent Board reports.

Board Activities

The Board and its panels sponsor meetings and technical exchanges with program participants and interested parties, including representatives of the DOE and its contractors, the U.S. Nuclear Regulatory Commission, the U.S. Environmental Protection Agency, the U.S. Geological Survey, the U.S. Department of Transportation, the State of Nevada, affected units of local governments, Native American tribes, nuclear utilities, environmental groups, state utility regulators, and members of the public. Board members and staff attend relevant technical conferences, meetings, symposia, and workshops. They participate in field trips to examine first-hand the DOE's characterization of the Yucca Mountain site and the geologic and ecological features in the surrounding area. Board and staff occasionally visit foreign programs to gain insights from the experience of other countries' repository development efforts.

Board and panel meetings are open to the public and usually are announced in the *Federal Register* 4 to 6 weeks before each meeting. Press releases also are issued on all public meetings. To facilitate access for program participants and the public, the Board holds most of its meetings in Nevada and sets aside time for public comment at each meeting. Transcripts of meetings and minutes of business sessions are available to the public through the Board's library. The Board's reports, meeting transcripts, the Board's letters to the DOE, congressional testimony, and all other published documents are available on the Board's Web site at www.nwtrb.gov.