



**Department of Energy**  
Washington, DC 20585

March 28, 1991

Dr. Don U. Deere  
Chairman, Nuclear Waste Technical  
Review Board  
1100 Wilson Boulevard  
Arlington, Virginia 22209

Dear Dr. Deere:

On behalf of the Department of Energy (DOE) and the Office of Civilian Radioactive Waste Management (OCRWM), I would like to thank the Nuclear Waste Technical Review Board (NWTRB) for its thoughtful and effective review of our site evaluation, waste packaging, environment, and transportation activities.

Enclosed are DOE's responses to the Board's recommendations in its Second Report to the U.S. Congress and the U.S. Secretary of Energy. The responses address the seven broad areas of the Board's recommendations. You will note that a number of the responses refer to past DOE/NWTRB technical interactions and ongoing evaluations that will provide a basis for significant program decisions. We will keep the Board informed of progress in these evaluations.

I would like to take this opportunity to call to the Board's attention the relationship between technical issues addressed by the Board and our strategic planning for the program. As you know, we have been conducting a series of predecisional workshops with representatives of interested and affected parties, in order to obtain their input to strategic principles and plans for the programs. These workshops are proving to be highly valuable in helping us select, focus, and prioritize the strategic issues and decisions we must address. The results of these workshops will be reflected in our Mission Plan Amendment to be issued later this year.

Among other contributions, the Strategic Principles workshops are demonstrating how technical issues, such as those addressed by the Board, are embedded in program strategy and in timing and sequencing of technical activities. It is evident that our ability and need to interact with the Board on technical issues will be strongly driven by program evolution, and we will keep the Board advised of our priorities and needs in order to aid the Board's planning for use of its resources.

Another factor which will affect the priorities and content of our interaction with the Board is our progress and plans for characterization of the Yucca Mountain site. As you know, we are currently trying to resolve the impasse with the State of Nevada which is preventing us from expanding our site evaluation activities. When new surface-based and underground evaluation activities do get started, they will be highly focused on determining if the Yucca Mountain site, and the geologic setting it provides, is a suitable location for a high-level waste repository.

With this strategic focus for Yucca Mountain activities, we expect emphasis on acquisition of site data and its use in evaluating site suitability. Acquisition and use of data for repository and engineered barrier system design will have a secondary priority, since effort on repository features will depend first on whether or not the site is suitable, and second on what the site properties that affect the engineered systems are.

I would, therefore, like to suggest that the agenda for the interactions between the Board and OCRWM be selected, to the extent practicable, to reflect the focus on issues of current strategic importance within each technical sector, as indicated above. I will direct our staff to work closely with the Board to achieve this objective.

I greatly appreciate the many contributions the Board has already made toward helping assure quality and effectiveness in the OCRWM program, and I look forward to a continuing productive relationship.

Sincerely

John W. Bartlett, Director

Office of Civilian Radioactive  
Waste Management

Enclosure

# DEPARTMENT OF ENERGY RESPONSES TO RECOMMENDATIONS IN THE NUCLEAR WASTE TECHNICAL REVIEW BOARD'S *SECOND REPORT* (November 1990)

## INTRODUCTION

The Nuclear Waste Policy Amendments Act of 1987 established the Nuclear Waste Technical Review Board to evaluate the technical and scientific validity of activities undertaken by the Department of Energy (DOE) in the Civilian Radioactive Waste Management Program.

The Board is required to report, not less than two times per year, to the Congress and the Secretary of Energy its findings, conclusions, and recommendations. The Board has issued two reports to date. The first report was released in March 1990. The second report was issued on November 27, 1990. The second reports contains 20 recommendations in 7 broad areas: (1) effects of seismicity and faulting on facility design and site suitability; (2) testing for site suitability; (3) performance assessment; (4) long-lived waste packages; (5) waste container materials, configurations, and disposal environments; (6) coordination and integration of environmental studies; and (7) human factors and system safety in transportation and handling of spent fuel.

These recommendations and DOE's responses are presented in this report. Each recommendation is quoted verbatim from the Board's report of November 27, 1990, and is followed by the response.

## EFFECTS OF SEISMICITY AND FAULTING ON FACILITY DESIGN AND SITE SUITABILITY

In these recommendations to DOE, the Board addresses how potential seismic and faulting risks should be considered in determining site suitability and developing criteria for facility design.

### Recommendation 1

*Increased emphasis should be placed on understanding the engineering, public safety, and environmental consequences of seismic events at Yucca Mountain, including earthquakes of magnitudes larger than those that are likely to occur during the lifetime of the facility.*

### Response

DOE will include engineering, public safety, and environmental consequences of seismic events and other natural hazards in the basis for determining the suitability of a site or a design. Earthquakes are potential events in the region during a repository's operational and postclosure periods; however, it is their potential consequences to workers and public health and safety that are of primary concern, not their potential for occurrence. The evaluation of these consequences should be based on the analysis of a range of potential seismic events, including those high-magni-

tude events that have a relatively low probability of occurring during the lifetime of the facility. DOE has completed a preliminary evaluation of this type, and the results are described in a report by Subramanian et al., (1989).

As discussed with the Board's Structural Geology and Geoengineering Panel during the April 12, 1990, meeting on seismic hazards, it is the current DOE policy that the seismic design basis for the repository facilities is to be an earthquake large enough to have a very low probability of occurring during the lifetime of the facility. Once a design basis is selected, further design analyses will be carried out to evaluate the consequences of hypothetical events that are both larger and smaller than the design basis. DOE is concerned with this approach in that the hypothetical very-low-probability, high-magnitude events that are used in conducting such evaluations may be taken to be the "expected" by the public and regulatory agencies. This may lead to pressure to adopt increasingly more conservative designs that maybe unwarranted when the probability of the event and its potential consequences are considered. DOE believes that analyses are important in evaluating the response of repository facilities to events that exceed facility design bases and for evaluating the potential health and safety consequences of any failures that may result from a seismic event or other natural hazard.

## Reference

C. V. Subramanian, N. Abrahamson, A. H. Hadjian, L. J. Jardine, J. B. Kemp, O. K. Kidman, C. W. Ma, J. King, W. Andrews, and R. P. Kennedy, *Preliminary Seismic Design Cost-Benefit Assessment of the Tuff Repository Waste-Handling Facilities*, SAND88-1600, Sandia National Laboratories, Albuquerque, New Mexico, 1989.

## Recommendation 2

*Discussions of site suitability should be based on the likelihood of adverse consequences and not on the occurrence of earthquake ground motion or fault displacement alone.*

## Response

DOE concurs that the ultimate determination of site suitability should be based on the potential consequences of seismic events or other hazards, in conjunction with their potential for occurrence. DOE is currently developing a methodology for an early determination of site suitability and will continue analyses of this type as additional information on natural hazards becomes available. In addition, the Test Prioritization Task will focus on identifying the parameters and activities needed to increase confidence in the assessments of site performance. This information will be used in developing the site-suitability methodology.

In licensing the repository, emphasis should be placed on evaluating the health and safety consequences of a wide range of potential events (e.g., the potential for releases of radionuclides to the accessible environment) rather than placing regulatory emphasis on the potential occurrence of a specific design event or natural phenomena related to a particular hazard. The evaluation of health and safety consequences should include the consideration of high-probability events that are equal to or smaller than a nominal design-basis event and very-low-probability events that may exceed a given design basis. The implementation of such an approach does not necessarily mean that additional information on the nature of potential natural hazards is not required.

Considerable additional information will be required to adequately define the range of potential events and the probability of occurrence of specific events within that range and to increase confidence that the results provide the appropriate degree of "reasonable assurance."

### **Recommendation 3**

*Formulation of a specific tectonic model, acceptable with a high degree of confidence, should not be viewed as a prerequisite to site suitability or to ensuring public safety and environmental protection.*

#### **Response**

DOE shares the Board's view that the formulation of a specific tectonic model, acceptable with a high degree of confidence, is not necessary for assessing site suitability. As explained in the Site Characterization Plan (SCP), section 8.3.1.17.4.12, and as discussed with the Board's Structural Geology and Geoengineering Panel on April 12, 1990, DOE is committed to the formulation and evaluation of tectonic models that include the range of credible descriptions of the candidate site. Since these alternative conceptual models are expected to differ significantly in their prediction of the potential effects of tectonics on waste isolation (e.g., through prediction of differing effects over time of crustal strain, faulting, and volcanism on gas and fluid travel paths and travel time or on water-table elevation), their use will assist DOE to assess the range of uncertainty in estimates of repository performance.

If performance estimates based on data-constrained models and subsequent numerical models vary widely with a resulting high degree of uncertainty regarding total-system radionuclide releases, DOE will seek to reduce uncertainty by designing tests, collecting additional data, and performing analyses to identify the more plausible alternative models.

The explicit formulation and evaluation of a full range of credible tectonic models will help increase public confidence that all plausible and significant tectonic events and scenarios that could occur during the preclosure and the postclosure periods have been considered.

### **Recommendation 4**

*Geologic licensing criteria and standards for the repository and its surface facilities should reflect the nature and relative vulnerability of the repository complex and the problems it poses. The criteria and standards should ensure public safety and environmental protection in light of current scientific knowledge and engineering practice, including the feasible mitigation of adverse consequences.*

#### **Response**

DOE concurs that licensing criteria and standards should reflect the nature and relative vulnerability of a repository complex as discussed in the Board's recommendation. As discussed with the Board's Structural Geology and Geoengineering Panel on April 12, 1990, DOE's comments on the NRC draft technical position "Methods of Evaluating the Seismic Hazard at a Geologic Repository" (June 1989) are consistent with the Board's position that suitability should be judged on the basis of the potential risk, and not just on the potential occurrence of a natural phenomena such as earthquake ground motion or fault displacement, independent of their consequences.

to health and safety. DOE has taken the position that Appendix A to 10 CFR Part 100 should not be used in siting and licensing a repository and its surface facilities because of the marked differences between the hazards posed by a nuclear reactor and the hazards posed by a geologic repository, and because Appendix A relies on outdated risk-assessment techniques. (See also the response to Recommendation 2.)

## TESTING FOR SITE SUITABILITY

The following Board recommendations on proposed geologic tests are made so that site suitability can be evaluated by DOE as early as possible.

### Recommendation 5

*Planned scientific testing of the Yucca Mountain geologic block should be re-evaluated to give highest priority to those tests and studies that provide the data essential to assess the suitability of the site. Each proposed study should be evaluated in terms of procedures, technologies, test locations, and appropriateness in meeting stated objectives.*

### Response

DOE is addressing the Board's recommendation that the highest priorities be given to tests and studies that will provide the data essential for assessing the suitability of the candidate site. As noted by the Board, DOE has initiated a management and technical analysis, known as the Test Prioritization Task (TPT), to identify and prioritize site-characterization tests that could influence early decisions about the suitability of the candidate site. Preliminary results were discussed at the October 11, 1990, meeting with the Board. The phase 1 report of the TPT was completed on March 1, 1991 (DOE, 1991a) and results were discussed at the Structural Geology & Geoengineering and Hydrogeology & Geochemistry joint panel meeting held on March 6, 1991.

TPT activities are now included as part of the Early Site Suitability Evaluation (ESSE) and will make use of the integrated results obtained from the Calico Hills Risk/Benefit Analysis (DOE, 1991b) and the Exploratory Shaft Facility Alternatives Study (Stevens and Costin, 1991) as part of this effort. If new concerns are identified by the ESSE, they will be factored into the test prioritization efforts.

Study Plans have been or are being developed for the tests identified in the Site Characterization Plan and considered as part of the TPT. These Study Plans describe the procedures, test locations, and the appropriateness of these tests for meeting their stated objectives, which will be evaluated as part of the Study Plan formal review process. Further management or technical review of individual studies or activities maybe necessary to implement the approved recommendations of the site suitability task dependent upon the issue under consideration. (See also the response to Recommendation 2).

## References

U.S. Department of Energy, *Testing Priorities at Yucca Mountain: Recommended Early Tests To Detect Potentially Unsuitable Conditions for a Nuclear Waste Repository*, YMP, Las Vegas, Nevada, 1991.

U.S. Department of Energy, *Risk/Benefit Analysis of Alternative Strategies for Characterizing the Calico Hills Unit at Yucca Mountain*, YMP-91-6, Las Vegas, Nevada, 1991.

Stevens, A.L. and L.S. Costin, *Findings of the ESF Alternatives Study, An Executive Report*, SAND90-3232, Albuquerque, New Mexico, 1991.

## Recommendation 6

*The DOE should consider expanding its development program for dry-drilling equipment to include the capability to drill inclined holes.*

## Response

DOE recognizes the potential benefits of inclined boreholes to maximize investigative capabilities relative to near-vertical joint and fault systems. As the Board has noted, DOE has developed new technology to recover core from vertical boreholes at depths of several thousand feet without introducing any fluids, as discussed at the October 11, 1990, meeting with the Board. Specifications for the dry-coring system include a borehole size of approximately 12-14 inches to allow for instrument installation and long-term monitoring. As a result of the required specification, the present system consists of a heavy dual-wall pipe with an open-center rotary type reaming bit which allows core recovery ahead of the reaming bit. However, because of the design of the present system (particularly because of estimated induced sideloads on the drill bit) inclined deep dry drilling and dry coring are not feasible with the present system.

DOE's current plans are to evaluate the need for additional data on near-vertical structures and will compare the costs and the benefits of drilling inclined boreholes with other means of obtaining similar information, such as in-situ testing along exploratory drifts in the Topopah Springs or the Calico Hills unit from the underground test facility. If a need is demonstrated, then DOE will evaluate options. Such an analysis would evaluate the need for dry drilling in boreholes and could also consider a broad range of possibilities within the existing drilling technology, including air-drilled inclined boreholes without core recovery and "wet-drilled" (including air foam) inclined boreholes with core recovery.

## PERFORMANCE ASSESSMENT

In these recommendations to DOE, the Board addresses methodologies and alternative approaches that can be used for assessing repository performance.

## Recommendation 7

*The DOE should continue using decision-aiding methodology to provide more explicit and formal means for relating program decisions to risk and performance issues. Such methods should be used in an iterative and ongoing fashion to explain the reasoning behind major programmatic decisions before these decisions are committed. The four existing DOE task force studies applying these methods should be closely coordinated.*

### Response

DOE will continue using decision-aiding methodology when appropriate for relating program decisions to risk and performance issues. In the past, DOE has used decision-aiding methodology for a comparative analysis of five potential repository sites (DOE, 1986). Two other studies that have used decision-aiding methodologies and have been closely coordinated are the Calico Hills Risk/Benefit Analysis (DOE, 1991) and the Exploratory Shaft Facility Alternatives Study (Stevens and Costin, 1991).

DOE will employ decision-aiding methodologies in an iterative manner to evaluate major programmatic decisions centered around test prioritization, design issues, and performance issues as appropriate. DOE will maintain a high degree of coordination between various groups applying decision-aiding methodologies (e.g., the Test Prioritization Task now included in the Early Site Suitability Evaluation).

### References

DOE (U.S. Department of Energy), 1986, *A Multiattribute Utility Analysis of Sites Nominated for Characterization for the First Radioactive Waste Repository-A Decision-Aiding Methodology*, Office of Civilian Radioactive Waste Management, RW-0074, Washington, D.C.

DOE (U.S. Department of Energy), *Risk/Benefit Analysis of Alternative Strategies for Characterizing the Calico Hills Unit at Yucca Mountain*, YMP-91-6, Las Vegas, Nevada, 1991.

Stevens, A.L. and L.S. Costin, *Findings of the ESF Alternatives Study, An Executive Report*, SAND90-3232, Albuquerque, New Mexico, 1991.

## Recommendation 8

*The DOE should continue to develop methods for assessing expert judgment in areas of significant uncertainty. Furthermore, the DOE should incorporate into the current task force studies the views of technical experts outside the DOE and its contractors. The basis for each expert judgment needs to be carefully documented.*

### Response

DOE will continue to use expert judgment effectively in making decisions that require its use. Emphasis is being placed on documenting the decision process, including the basis for the expert judgement used in the process. Other issues DOE is addressing include the question of bias and coordinating multiple expert-judgment panels so that they complement each other.

Efforts in the past where significant outside expertise has been used as part of, or in review of, programmatic initiatives include: 1) establishing the basis for the tectonics evaluation in the Environmental Assessment (DOE, 1986); 2) the cost/benefit analysis of seismic design for waste handling facilities; 3) the peer review to evaluate planned studies with respect to calcite-silica deposits; 4) the evaluation of the Szymanski hypothesis; 5) a peer review of the unsaturated zone hydrology program; and 6) a peer review for geophysical methods for site characterization.

In the past year DOE has employed several outside experts in decision analysis in the course of ongoing studies, to obtain the views of DOE and DOE contractor personnel who are considered to be experts in areas with high uncertainty. In the future, DOE will continue to seek opportunities to use a diverse group of experts and, where appropriate, increase the use of different outside experts on major issues where peer reviews are warranted.

## Reference

DOE (U.S. Department of Energy), 1986, *Final Environmental Assessment: Yucca Mountain Site, Nevada Research and Development Area, Nevada*, DOE/RW-0073, Washington, D.C.

## Recommendation 9

*The DOE should consider investigating more extensively the use of the natural analogues to support performance assessment for a potential repository at the Yucca Mountain Site.*

## Response

DOE continues to be interested in using data from analogue studies to support performance assessment. Several activities focused on analogue studies are underway or are being planned. For example, DOE recently completed field work on a multinational natural-analogue study in Brazil. Data from this study will be used as a test case in the next phase of the INTRAVAL project, an international effort focused on the techniques and limitations of validating performance-assessment models. The conclusions and consensus that develop from the INTRAVAL project on validation techniques and limitations may have a bearing on similar efforts in the OCRWM program.

DOE also monitors natural-analogue work in other countries and participates in the Natural Analogue Working Group under the Council of European Communities. (The objective of the Working Group is to promote understanding and consensus on the use of analogue studies in geologic disposal programs.) In addition, DOE is considering participation in a number of new international cooperative analogue studies.

In its plans for the characterization and performance assessment of the Yucca Mountain candidate site, DOE is considering the use of natural-analogue studies, including analogues for hydrothermal systems and other natural systems, as well as analogues for engineered systems and human activities. The needs of performance assessment will play a significant role in developing criteria for selecting new analogue studies and the technical review and evaluation involved in planning and managing the studies. As part of this effort, DOE is developing guidance for the selection of analogues and the conduct of studies. DOE also will consider the applicability of data associated with weapons testing at the Nevada Test Site, with the intent to cooperate with ongo-

ing and contemplated analogue studies. In addition, data from natural-analogue studies may provide methods for the validation of models used in performance assessment. Close coordination between DOE's work on natural analogues and performance-assessment activities was established during planning for fiscal year 1991, and it will continue during the planning of future activities.

## LONG-LIVED WASTE PACKAGES

These Board recommendations stress the importance of using long-lived waste packages as a means of ensuring repository performance.

### Recommendation 10

*At a future meeting, the DOE should respond to the Engineered Barrier System (EBS) Panel's four questions of January 6, 1990, relating to EBS performance. It should be emphasized that the Board's interest in a robust, extended-life EBS does not imply a diminished interest in the geologic barriers' contribution to overall repository performance; rather, the Board is suggesting engineered barriers may reduce the adverse consequences associated with difficult-to-predict geologic or climatological events occur.*

### Response

DOE is continuing to consider the implications of the questions raised in January 1990 by the Board's Engineered Barrier Systems Panel on the performance of the engineered-barrier system (EBS). To address these questions, we are using a structured systems-engineering approach, as reflected, for example, in the development of the Waste Package Plan (YMP/90-62).

A key consideration in responding to questions about the feasibility of developing waste packages designed for very long performance is a clear understanding of the challenges of demonstrating performance with reasonable assurance. Such a demonstration must address complex interactions among the components of the waste package and the repository environment, and it must rely on predictions that cannot be validated over long times.

As detailed in the Waste Package Plan, the first steps in systematically developing and evaluating waste-package concepts include determining requirements and defining the characteristics of the waste form and the near-field environment. Reports addressing these factors are being developed. These reports, together with the planned EBS workshop (discussed in the response to Recommendation 11), represent the initial steps in responding to this recommendation.

### Reference

U.S. Department of Energy, *Yucca Mountain Project Waste Package Plan*, YMP/90-62, Las Vegas, Nevada, 1990.

## **Recommendation 11**

*A workshop should be held to investigate the practicality, advantages, and disadvantages of developing a robust, extended-life EBS that would contribute to containment for periods of time well beyond 1,000 years. The Board would be pleased to assist in developing an agenda for such a workshop.*

### **Response**

DOE has initiated planning for a workshop with the objective of investigating the practicality of developing concepts for a robust, extended-life EBS, as recommended by the Board. This workshop is tentatively scheduled for June 1991. The format of the workshop will permit the structured presentation of a number of alternative EBS concepts by DOE and other interested parties. Such a workshop would involve convening qualified individuals in the appropriate disciplines to discuss the practicality, advantages, and disadvantages of pursuing the development of such concepts. Preliminary planning for this workshop has been informally discussed with the Board's staff, and DOE will continue to keep the Board apprised of the workshop plans as they are developed.

## **WASTE CONTAINER MATERIALS, CONFIGURATIONS, AND DISPOSAL ENVIRONMENTS**

These Board recommendations to DOE pertain to evaluating further a number of options on waste package design.

## **Recommendation 12**

*Studies of alternative materials should be restarted. These studies should include evaluation of container materials and designs, emplacement designs, and container configurations, including both internal adsorbing materials and external backfill materials.*

### **Response**

Since the release of the Board's second report, DOE has completed and issued the Waste Package Plan. This plan, which has been provided to the Board, describes a comprehensive process for developing alternative design concepts for the waste packages and other components of the engineered-barrier system, including the identification and evaluation of alternative materials, as recommended by the Board. In the meeting with the Board's Engineered Barrier System Panel on August 28-29, 1990, DOE described the approach and plans for implementing this process. The pace of implementation for this plan will be dictated by the priority assigned to development of the engineered systems and the availability of resources.

As stated in the Secretary's Report to the Congress in November 1989, major activities related to the design of a repository and the waste package are being deferred, pending availability of more information concerning the suitability of the candidate site. DOE does, however, intend to proceed with limited implementation of the plan, as resources permit.

## References

U.S. Department of Energy, *Yucca Mountain Project Waste Package Plan*, YMP/90-62, Las Vegas, Nevada, 1990.

U.S. Department of Energy, *Report to Congress on Reassessment of the Civilian Radioactive Waste Management Program*, DOE/RW-0247, Washington, D.C., 1989.

## Recommendation 13

*Heater tests should be re-initiated. These tests should examine the effects of alternative emplacement orientations and three-dimensional and multiple heat sources for a range of thermal loads.*

### Response

OCRWM does not currently have access to a suitable facility for performing in situ field tests in an unsaturated welded volcanic tuff. Therefore, it will not be possible to conduct field tests using electrically-heated simulators of waste packages prior to the development of the ESF.

## Recommendation 14

*The EBS development and testing program should be coordinated and funded at a level sufficient to produce a statistical basis for assessing its contribution to long-term predictions of repository behavior. Tests should be long-term preferably exceeding five years and include both laboratory and field testing.*

### Response

DOE will coordinate and fund long-term laboratory and field testing to provide a sound basis for predicting the contribution of the EBS components to the performance of the repository system. Limited laboratory tests, primarily involving the degradation of container materials and mechanisms for the release of radionuclides from spent fuel and vitrified high-level waste, have been underway for several years. These tests have focused on the identification and quantification of the phenomena that affect waste-package performance as opposed to statistically testing all of the EBS configurations that have been considered.

Long-term laboratory testing, especially when it involves tests of radioactive materials or tests in ionizing-radiation environments, are inherently costly in test facility preparation and operation. Therefore, DOE has been conservative in committing resources to these tests until the EBS concept development has advanced to a level of maturity where materials have been selected and the test environment parameters have been established. The process for establishing these selections and parameters is discussed in the responses to Recommendations 10 and 12.

In regard to producing a statistical basis, DOE believes that the Board's recommendation may not be practical, because of the diversity of characteristics, particularly for the waste forms, and the multiple interactions between materials that are possible. The intent of the testing strat-

egy is to address characteristic diversity by carefully selecting representative materials for testing and to identify the most significant degradation modes and interactions to establish the long-term test matrix.

It is DOE's strategy to initiate field tests when the exploratory shaft facility becomes available and, assuming that the candidate site is determined to be suitable, to continue them, as appropriate, as an integral part of a performance confirmation program as required under Subpart F of 10 CFR Part 60. This approach would allow the tests to continue during the licensing and repository construction period.

## COORDINATION AND INTEGRATION OF ENVIRONMENTAL STUDIES

These Board recommendations pertain to the need for the environmental study program at Yucca Mountain to be coordinated with respect to the various stakeholders involved and integrated with respect to the different subject areas of investigation.

### Recommendation 15

*The DOE should continue to include in its study plans the interests and concerns of Native Americans, the States of California and Nevada, the National Park Service, the Soil Conservation Service, and the Fish and Wildlife Service.*

### Response

DOE will continue to work with these parties and devote considerable effort to satisfy their concerns and interests. The following information summarizes the actions taken by DOE.

Sixteen Official Tribal Representatives (OTRs) from the various bands and Tribes in the area have been interacting with DOE on a regular basis regarding programmatic activities and events. These OTRs have been interacting with DOE for almost 2 years, and DOE intends to continue these interactions. Currently, DOE is discussing and developing methods whereby Native American concerns can be addressed in the course of Yucca Mountain Project environmental activities. Additional discussions with the OTRs are expected to be scheduled in the spring of 1991.

DOE has developed an environmental field program that it believes is technically appropriate to the site characterization phase. This program consists of ongoing monitoring programs in the areas of air quality, meteorology, terrestrial ecosystems, archaeology, reclamation, and background radiation. Water-resource monitoring and regional soil surveys will begin later this spring. All DOE management plans describing these field monitoring programs were shared with the State of Nevada.

DOE has not finalized environmental study programs in the State of California. DOE is conducting passive ongoing monitoring activities in California. In the near term, the DOE may need to commence water-sampling studies and other ecological surveys in and around the Ash Meadows area. These studies will be planned in consultation with the U.S. Fish and Wildlife Service

(USFWS) and the National Park Service (NPS), both of whom have an interest in the area. When activities are near commencement in the State of California, DOE plans to contact appropriate State agencies to ensure regulatory compliance and to keep the State of California apprised.

DOE has held several meetings with NPS regarding water monitoring. NPS had filed a protest to DOE's application, submitted to the State of Nevada, for water usage during site characterization. The effect of potential drawdowns are the primary issues of concern to NPS. As a result of several discussions, DOE accelerated the preparation of a monitoring plan specific to the concerns of NPS. This monitoring plan addresses the measurement of water levels in a monitoring network located south from Yucca Mountain to the Ash Meadows area. The plan was finalized and submitted to the NPS on March 12, 1991 (DOE, 1991). In the transmittal, Yucca Mountain Project requested that NPS lift their protests to the water appropriation permit application and let the State know that they are lifting their protests. NPS has indicated that it will lift its protest.

Both the "Environmental Field Activity Plan for Soils" and the "Reclamation Implementation Plan" were sent to the Soil Conservation Service (SCS) for review and comment, and the agency's comments were incorporated into the final documents. A regional soil survey is expected to commence in April 1991 and will be conducted in accordance with SCS guidelines.

DOE worked closely with USFWS to develop a desert tortoise research and protection program even before the designation of the desert tortoise as an endangered species. After the designation, DOE prepared a biological assessment that formalized this program. It was accepted with minor changes by USFWS, and which issued a "No Jeopardy Biological Opinion" in February 1990. Since then, DOE has kept USFWS apprised of site investigations, and such interactions are expected to continue. DOE also sent its "Yucca Mountain Site Characterization Project Environmental Training Program" to USFWS for review and comment, and this document was subsequently amended in response to their comments.

Consultation with the Bureau of Land Management (BLM) concerning compliance with applicable parts of the Federal Land Policy and Management Act has resulted in the issuance of two right-of-way reservations one for access to approximately 52,000 acres of BLM-administered land and one for access to 19,000 acres of the Nellis Air Force Range. In addition, a 12 year land withdrawal from mining and mineral leasing laws for 4,255.5 acres of BLM land immediately over the proposed repository block was granted to maintain the physical integrity of the subsurface environment. In achieving these milestones, several environmental issues were addressed that resulted in stipulations designed to protect the environment.

Finally, DOE plans to continue discussions with all of the above mentioned agencies to the maximum extent practicable. DOE will continue to keep the Board informed of how the interests and concerns of these parties are included in the study plans.

## References

U.S. Department of Energy, *Biological Assessment of the Effects of Site Characterization Activities on the Endangered Desert Tortoise*, Yucca Mountain Project Office, Las Vegas, Nevada, 1989.

U.S. Department of Energy, *Draft Reclamation Implementation Plan for the Yucca Mountain Project*, Yucca Mountain Project Office, Las Vegas, Nevada, 1990.

U.S. Department of Energy, *Draft Environmental Field Activity Plan for Soils*, Yucca Mountain Project Office, Las Vegas, Nevada, 1990.

U.S. Department of Energy, *Monitoring Program for Groundwater Levels and Springflows in the Yucca Mountain Region of Southern Nevada and California*, Yucca Mountain Project Office, Las Vegas, Nevada, 1991.

## **Recommendation 16**

*The DOE and the State of Nevada should explore the possibility of initiating a cooperative program to develop baseline environmental information.*

### **Response**

DOE has, in the past, extended several offers to the State to participate in DOE programs, but these offers have not been pursued by the State. DOE has also transmitted several requests to the State and its contractors to coordinate their environmental field activities with those of DOE in order to adequately protect the limited faunal populations at the site. This coordination is desirable to prevent oversampling of populations stressed by drought conditions, and to protect the desert tortoise, a species designated as threatened by the Federal Government. The State has not responded as of this date.

During the site characterization phase, DOE's objectives in the environmental arena are three-fold: (1) to monitor the effects of site characterization activities and to develop and implement mitigation strategies as appropriate; (2) to collect monitoring data as part of an overall field program that maybe used to fulfill potential permitting requirements; and (3) to conduct environmental activities to fulfill prerequisites established by DOE management for the initiation of site characterization activities. The environmental data gathered by these activities do not cover all the topics generally considered part of an "environmental baseline." However, all data gathered may be considered as "background" information to be used as corroborative data in support of the future baseline.

DOE believes that establishing an environmental baseline is an activity associated with the environmental impact statement (EIS) and will be initiated after the EIS scoping hearings and completion of the EIS Implementation Plan. The NWPA required that an environmental assessment (EA) be prepared on the basis of available data and that it provide an assessment of potential significant adverse environmental impacts due to site characterization activities. These analyses, as documented in the EA, determined that no significant adverse impacts were expected to result from site characterization. However, DOE has developed and implemented an extensive monitoring program in air quality, meteorology, background radiation, ecosystems, archaeology, and water resources to gather background data during site characterization so as to monitor site characterization activities. Establishing an environmental baseline prior to the conduct of the EIS scoping hearings may be interpreted as prejudging the results of the scoping process.

### **Reference**

U.S. Department of Energy, *Final Environmental Assessment: Yucca Mountain Site, Nevada Research and Development Area, Nevada*, DOE/RW-0073, Washington, D.C., 1986.

## **Recommendation 17**

*All environmental programs at the Yucca Mountain Site funded by the Nuclear Waste Fund should be developed and conducted in a manner that the data obtained are appropriate to and can be used during licensing.*

### **Response**

DOE will ensure that all environmental data needed for licensing will be developed such that it is usable for that purpose.

## **Recommendation 18**

*An integrated environmental program that takes cognizance of ecosystem processes should be developed for the Yucca Mountain Site. The results of this program should permit assessment of the effects of site characterization and repository construction and operation on the local ecosystem. The program also should provide a basis for understanding ecologic pathways for any radioactive materials that might escape containment during repository construction, operation, and decommissioning.*

### **Response**

DOE has developed an integrated environmental program that focuses on the needs of the different project phases.

DOE believes that its program will identify ecosystem processes at Yucca Mountain and will evaluate the effects of repository development (including site characterization), construction, and operation on the local ecosystem. Since the program is currently in the site characterization phase, the environmental program is directed at addressing ecological concerns associated with site characterization. The potential effects of repository construction, operation, closure, and decommissioning will be addressed when the process of developing the EIS is begun with the publication of a notice of intent and EIS scoping hearings.

The current DOE ecosystem program addresses five areas: (1) site characterization effects; (2) desert tortoise research and mitigation activities; (3) reclamation feasibility studies and reclamation actions as necessary; (4) support to the radiation-monitoring program in small-mammal sampling; and (5) preactivity surveys, required as prerequisites to the management approval of site-characterization activities.

# HUMAN FACTORS AND SYSTEM SAFETY IN TRANSPORTATION AND HANDLING OF SPENT FUEL

These Board recommendations pertain to enhancing the safety of spent fuel transportation when the scale of future transport activities becomes significantly large.

## **Recommendation 19**

*The NRC should develop policy statements, program guidelines, and, if feasible, criteria documents in human factors and system safety engineering that will help ensure that DOE's and utilities' system acquisition programs address future accident potentials. The goal should be for the system acquisition programs to be complete in all the technologies that can contribute to operations safety and efficiency, including emergency and mitigation planning.*

### **Response**

The Nuclear Regulatory Commission is the appropriate organization to respond to this recommendation. However, these activities are being addressed in the development of the OCRWM programmatic and physical system requirements documents.

## **Recommendation 20**

*Priority should be placed on developing a high-level waste management system that minimizes the handling of spent fuel.*

### **Response**

DOE recognizes that increased handling of spent fuel could lead to additional operational exposures and potential for mishandling incidents. DOE will limit the handling of spent fuel in the Federal waste-management system to the extent practicable and consistent with system operational requirements. DOE is also working with representatives of the utility industry to ensure compatibility between the Federal system and the spent-fuel storage options being pursued at the utility sites.