Department of Energy
Washington, DC 20585

November 9, 1990

John J. Linehan, Director
Repository Licensing and Quality
Assurance Project Directorate
Division of High-Level
Waste Management
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Linehan:

In response to comments from the State of Nevada and others, Dr. Bartlett is restructuring the activities of the Yucca Mountain Site Characterization Project Office in order to determine, as soon as possible, whether or not the Yucca Mountain site is a suitable location for a high-level waste repository.

One of our activities relative to this objective is to develop the means for evaluating the suitability of candidate high-level waste repository sites. We plan to develop suitability evaluation methods that are applicable to any candidate repository site, and to do so in a process involving external forums and participation by affected and interested parties.

As a first step in this process, we will, on November 14-16, 1990, convene a Department of Energy (DOE) workshop on site suitability evaluation in Albuquerque, New Mexico. This workshop will frame the issues, discuss ongoing relevant activities, and lay the foundation for future activities. For this initial action, workshop participants will be limited to DOE and contractor personnel. We are, however, inviting representatives of affected and interested parties to attend as observers.

I would like to take this opportunity to invite you to send a representative of the Nuclear Regulatory Commission to the workshop as an observer. Information on workshop arrangements and an agenda is provided in the enclosed copy of Dr. Bartlett's memo to staff on this event. I have also enclosed, as background information, a copy of the speech on this subject which Dr. Bartlett presented at Spectrum '90.

I would be very pleased to have your representative attend our workshop. I believe it is a highly important activity for our program, and that it is of high significance to your Office. Please call me at 202-586-6046 if you have questions or need further information.

Sincerely,

Dwight Shelor
Acting Associate Director for
Systems and Compliance
Office of Civilian Radioactive
Waste Management

2 Enclosures

cc:
R. Loux, State of Nevada
C. Gertz, DOE/YMPO/NV
M. Baughman, Lincoln County, NV
D. Bechtel, Clark County, NV
S. Bradhurst, Nye County, NV

DOE F 1325.8
(8-89)

United States Government | Department of Energy

memorandum

DATE: OCT 3 0 1990

REPLY TO ATTN OF: RW-1

SUBJECT: Participation in DOE Workshop on Developing Methodology for Early Site-Suitability Evaluations, November 14-16, 1990

TO: Distribution

Consistent with the Secretary's commitment to early site-suitability evaluations and the Department of Energy's (DOE) implementation of activities to meet that commitment, a workshop on this subject is being planned. The purpose of the workshop is to present the status of the different methodologies being developed by the Electric Power Research Institute (EPRI), Golder Associates, and DOE, and to hold open discussions on specific aspects of each methodology. Key aspects or topics for discussion will be the following:

- o Overview of activities;
- o site-suitability criteria and methodology;
- o data analysis and uncertainties; and
- o evolution of the testing program.

The attached agenda identifies the presentations and presenters. It is anticipated that all workshop attendees will contribute their experience and understanding of site-suitability evaluations through their active participation in the workshop. If you have any questions on the workshop or the presentations, please contact either S. Brocoum on (202) 586-4262 or M. Blanchard on (702) 794-7939, who are the technical coordinators for this meeting.

The workshop will be held in the Gran Quivira Conference room of the Amfac Hotel, located at 2910 Yale Blvd SE, Albuquerque, New Mexico ((505)843-7000). The meeting will convene at 1 p.m. on November 14, 1990, and will conclude on November 16, 1990, at 12 noon. Attendance is by invitation and is limited to those on the distribution list. Fifty rooms have been set aside at the Amfac Hotel in DOE's name. If you cannot attend the meeting, or if you plan to send a substitute, please contact the hotel directly, as they will only guarantee rooms for those on the attendance list.

All changes to the attendance list require the approval of C. Smith of my staff ((202) 586-6850).

John W. Bartlett

John W. Bartlett, Director
Office of Civilian Radioactive
Waste Management

2 Attachments

Distribution:
C. Smith, RW-2
Associate Director, Office of Systems and Compliance, RW-30
Associate Director, External Relations, RW-5
C. Gertz, RW-20/YMPO
S. Brocoum, RW-20/HQ
S. Van Camp, RW-20/HQ
S. Angelini, GC-11
M. Blanchard, YMPO
D. Gassman, YMPO
R. Dyer, YMPO
D. Dobson, YMPO
J. Boak, YMPO
R. Herbst, LANL
W. Wowak, WESTON
M. Cline, WESTON
L. Rickertsen, WESTON
M. Lugo, WESTON
R. Gamble, WESTON
L. Snow, WESTON
J. Younker, SAIC
S. Mattson, SAIC
M. Voegele, SAIC
C. Herrington, SAIC
R. Murray, SAIC
P. Gnirk, RE/SPEC
B. Shaw, EPRI
L. Hayes, USGS
R. Robertson, TRW
L. Jardine, LLNL
T. Blejwas, SNL
S. Sinnock, SNL
F. Bingham, SNL
A. Ducharme, SNL
L. Shepard, SNL
I. Miller, Golder Associates
R. McFarland, NWTRB
L. Reiter, NWTRB
R. Brown, DSC
B. Judd, DAC

25-Oct-1990 DRAFT

AGENDA FOR SITE-SUITABILITY WORKSHOP
ALBUQUERQUE, NEW MEXICO
NOVEMBER 14-16, 1990

Wednesday, November 14, 1990

1:00 pm	Welcome/Introductions Keynote Address - DOE's Intentions - Early Site-Suitability Evaluation	C. Gertz J. Bartlett
2:15 pm	Objectives of Meeting & Review of Agenda	M. Cline
2:30 pm	Role of DOE Siting Guidelines - Applicability of Siting Guidelines - Use in Early Site-Suitability Evaluation	S. Brocoum
3:15 pm	BREAK	
3:30 pm	EPRI Performance Assessment Methodology - Summmary of Activities - Early Site Suitability Criteria and Methodology - Data Analysis and Uncertainties - Evolution of the Testing Program	R. Shaw + staff
5:30 pm	ADJOURN	

Thursday, November 15, 1990

8:00 am	Golder Associates Approach to Evaluation of Site Suitability - Summary of Activities - Early Site Suitability Criteria and Methodology - Data Analysis and Uncertainties - Evolution of the Testing Program	I. Miller + staff
10:15 am	BREAK	
10:30 am	Management of the Site Characterization Program and Site Suitability Evaluation - The Test and Evaluation Plan - Overview of the Approach to Site Suitability Evaluation	M. Blanchard
11:30 am	Lunch	

Thursday, November 15, 1990

1:00 pm	DOE Approach to Development of Methodology and Criteria for Early Site Suitability Evaluation	
	- Description of Plan	L. Rickertsen
	- Status of Methodology/Criteria Development	J. Younker
	- Examples of Criteria	L. Rickertsen
3:00 pm	Break	
3:15 pm	Application of Method to Early Evaluation of Site Suitability: Data Analysis and Uncertainties	
	- Pilot Study	J. Younker
	- Example of Performance Assessment Support to the Early Suitability Evaluation	L. Shepard
5:15 pm	Discussion	

Friday, November 16, 1990

8:00am	Evolution of Data and Testing	R. Dyer
	- Test Prioritization Methodology - Status of Implementation and Future Plans	B. Judd
10:00am	BREAK	
10:30am	Open Discussion -- Where to Next?	Discussion Leads:
	- Summary of Presentations	Younker/
	- Review Open Items	Rickertsen
	- Agreements Reached	
	- Actions	
12:00	ADJOURN	

10/25/90

List of Attendees for Site Suitability Meeting
Albuquerque, NM
November 14-16, 1990

DOE/HQ
- J. Bartlett
- C. Smith
- OSCA (2)
- S. Angelini
- External Rel. (1)

DOE/OGD
- C. Gertz
- M. Blanchard
- D. Gassman
- S. Brocoum
- S. Van Camp
- R. Dyer
- D. Dobson
- J. Boak

LANL
- R. Herbst

Weston
- W. Wowak
- M. Cline
- L. Rickertsen
- M. Lugo
- R. Gamble
- L. Snow

SAIC
- J. Younker
- S. Mattson
- M. Voegele
- C. Herrington
- R. Murray

RE/SPEC
- P. Gnirk

EPRI
- B. Shaw +
  4 staff

USGS
- Larry Hayes

TRW
- R. Robertson +
  2 staff

LLNL
- L. Jardine

SNL
- T. Blejwas
- S. Sinnock
- F. Bingham
- A. Ducharme
- L. Shepard

Golder
- Ian Miller +
  4 staff

NWTRB
- R. McFarland
- L. Reiter

DSC
- R. Brown

DAC
- B. Judd

ISSUES IN EVALUATING SUITABILITY

OF THE CANDIDATE REPOSITORY SITE

John W. Bartlett, Director
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy

Presented to

SPECTRUM 90
Nuclear and Hazardous Waste Management
International Topical Meeting
October 1, 1990
Knoxville, Tennessee

October 1, 1990

ISSUES IN EVALUATING SUITABILITY OF THE CANDIDATE REPOSITORY SITE

INTRODUCTION

Those of you who have followed the U.S. high-level radioactive waste program are familiar with the difficulties of the past and the tough challenges of the future. With the total support of Admiral Watkins, I have taken several initiatives to streamline and strengthen program management. These include developing a strategy for carrying out the U.S. program for disposal of spent fuel and high-level radioactive waste as mandated by Congress in the Nuclear Waste Policy Act; establishing a national consensus on that strategy; developing effective working relationships with parties who have a stake in the program; ensuring that methods and criteria for demonstrating compliance with regulatory requirements are developed and ready when needed; focusing actions on goals and essential activities; and improving cost effectiveness and accountability.

To effectively implement these concepts which Secretary Watkins and I believe are fundamental to success, two significant changes are underway. First, we have put into place a new organization which focuses our resources on the mission assigned to us by Congress and provides all essential support functions.

Second, we have developed and are implementing a Management Systems Improvement Strategy (MSIS). This strategy recognizes that, just as the system and its elements are designed

to perform their functions, so can the program be designed to accommodate its unique characteristics and to accomplish the overall mission. We have begun a number of activities to implement that strategy, including a rigorous analysis of both physical-system and programmatic functions. And we are putting in place an appropriate quality-assurance program.

THE IMMEDIATE CHALLENGE

With these program improvement actions as our basis, we are beginning to address our challenges for the future. One important challenge in the near future is the suite of actions required to prepare for and to conduct evaluations of the suitability of the candidate site as a repository location. These actions will involve development of strategy, plans, and readiness for the conduct of the data acquisition program; acquisition and technical interpretation of the data; and use of the data in a system of analytical methods and criteria to make findings concerning site suitability. My talk today will focus on the issues associated with site suitability evaluation.

Progress in these actions depends in part, of course, on access to the Yucca Mountain site in order to expand our data acquisition capabilities. As I'm sure you know, we are in court with the State of Nevada in regard to our right to conduct the site evaluation. I'm sure you also know that the Ninth Circuit Court of Appeals recently ruled that Nevada's allegations that DOE has no right to proceed with evaluation of the Yucca Mountain site have no merit. While this victory for the Department is highly important, it is but a first step toward site access. The State apparently plans to appeal the decision, and we still have to have the permits needed to resume surface-disturbing activities. Meanwhile, we will be ready to resume activities in January of 1991, and will do so if everything falls into place.

Before proceeding further, I want to distinguish between "suitability" and "licensability", and how they relate to the issues surrounding the evaluation and selection of a site for development as a repository. The decision on the suitability of a site for recommendation to the President for development as a repository is the responsibility of the DOE under the provisions of the Nuclear Waste Policy Act, as amended. The decision on the licensability of a recommended site, once approved by the President and Congress, belongs to the Nuclear Regulatory Commission. The repository siting guidelines developed in 1984 in response to the Act reflect this distinction. The guidelines also reflect the fact that the decision on site suitability must take into account environmental standards promulgated by the Environmental Protection Agency and those safety criteria that will be used by the NRC in their licensing reviews. Thus, it is obvious that there is no benefit to declaring a site to be suitable if it cannot meet these independently developed Federal safety and environmental requirements for licensability. In other words, the evaluation of suitability must keep licensability in mind.

Since site-evaluation will be a major research and evaluation investment, we are developing an approach to using the data collected in this program in a manner consistent with the prudent management of resources. For example, near-term data acquisition activities will focus on disqualifying factors in the regulations, and thus avoid extended investment of time and resources if a valid reason is found to believe that a repository developed at the site would not be likely to meet licensing and regulatory requirements. These initial evaluations will draw on information already developed in the mandated site characterization plan (SCP) for defining the scope of the site-evaluation program.

In addition to evaluating current site conditions in terms of suitability, the site-evaluation program must also address the processes and events that might occur in the future and might affect those characteristics of the site that are important to waste isolation. The processes and events to be investigated are those that appear to be sufficiently credible, on the basis of available data, to warrant consideration. For example, we will investigate the possibilities for extreme climate changes or faulting to produce effects on the percolation of water, the local flux, and the elevation of the water table in relation to the repository horizon. The probability and the potential effects of volcanic and other igneous activity on the characteristics of the site will also be investigated.

We are developing an approach which will enable us to proceed iteratively with site evaluation. I am assigning a great deal of importance to the development of this approach. In general, the approach has two basic components: the collection and scientific interpretation of data, and evaluation of the data using regulatory and program decision criteria. The process might include, for example, specifications of probability distributions or ranges of parameters that define suitability measures for the site, sampling these distributions to produce distributions of the suitability measures, the use of experimental techniques to determine the probability that the tests being conducted will detect the features associated with these suitability measures, and then comparing the results of the tests to make comparisons against the criteria. Such techniques have been successfully applied to analyses of sites in Switzerland.

The necessary data will be collected through the activities planned for site evaluation. These activities consist of surface-based studies (which will be the initial focus of the DOE's site characterization program and include drilling, laboratory tests, and modeling), and

underground tests and studies to be conducted in an exploratory facility constructed at the depth of the proposed repository. The exploratory facility will be constructed to provide access to the proposed repository horizon in order to conduct in situ tests needed to evaluate the hydrologic, geochemical, geomechanical, and thermal conditions that would be expected in a repository if built at the candidate site, and to evaluate the host rock at the depth proposed for waste emplacement.

The evaluation program will focus first on features of the site that can be investigated through surface-based testing. The objective is to obtain early information about the site conditions or features that have the potential to so adversely affect performance that the site may not be able to meet the regulatory requirements and would therefore be disqualified.

The near-term focus on surface-based testing relative to evidence of unsuitability is not meant to suggest that underground testing is deemed less important. Although certain surface-based tests may yield information about conditions that are potentially adverse and indicators of unsuitability, they are unlikely to be sufficient by themselves to support the eventual evaluation of whether the site is suitable.

The iterative process will not produce definitive findings in the early stages of evaluation unless the site is found clearly to be disqualified. It will, however, allow us to take maximum advantage of information from early testing, including the ability to make early adjustments in our testing and design programs. If investigations uncover conditions that would make the site unsuitable or licensing extremely difficult, this option might lead to an earlier decision as to the prudence of investing more time and money in the site. In addition, iterative evaluation of

suitability will provide a mechanism for keeping affected and interested parties apprised of developments in the scientific investigations.

One of the major challenges of the site suitability evaluation will be the application of the siting guidelines identified in Title 10, Code of Federal Regulations, Part 960 (10 CFR 960). Possible approaches to application of the guidelines include:

- Focus on evaluating performance of the geologic and engineered components of the regulatory system. Criteria might be developed from consideration of regulatory safety performance requirements.

- Focus on the potential for future site dynamic behavior, such as earthquakes or saturation as a result of climate change, to perturb the repository. For example, limits on perturbation that will be permitted could be established.

- Focus on limits to our ability to reduce residual uncertainty in site characteristics. Because of the diversity of geologic characteristics of the site, the investments of time, money, and effort to investigate the site sufficiently to have low enough uncertainty about site characteristics may be excessive. Limits on investment of characterization effort may be necessary criteria.

The decision process to be utilized in determining whether or not the site is suitable also depends to a considerable degree on the stage of the evaluation process. In the early stages, disqualification criteria will be emphasized. If the site is found not to be disqualified,

criteria based on favorable and potentially adverse conditions, with focus on nuclide release, or dynamic behavior, or residual uncertainty will be used.

In interpreting and applying the siting guidelines it will be necessary to consider the interrelationships among the features and conditions that comprise the natural systems at the site. For example, the time it would take radionuclides to travel from a repository to the accessible environment, once they were released from a waste package, depends on (1) the length of the path traveled; (2) the retardation of the radionuclides, which depends, in a complex way, on the physical and chemical properties of the geologic environment; and (3) the velocity of ground-water flow, which in turn depends on the hydraulic conductivity, the hydraulic gradient, and porosity. In a host rock with a low retardation potential, a long path or a low velocity can provide the required long travel times; in a host rock with a more rapid flow, a long path or a high retardation potential can also provide the necessary confidence. No single numerical value for any of these site features is either necessary or sufficient to ensure that the system will perform satisfactorily; for such determinations, the three factors must be considered in combination. For the Yucca Mountain site, the potential for volcanism, seismicity, human intrusion, and climate change to alter site conditions in the future must also be considered.

Another issue in site suitability evaluation is development and use of what I call the "engine of evolution" of the iterative process. This engine will be basically performance assessment methodology adapted to the purposes of site suitability evaluation. Adaptation is necessary because performance assessment models include consideration of engineered barrier system performance, while site suitability evaluation must focus on geologic barrier performance. The methodology for site suitablilty evaluation must appropriately separate repository

performance and site performance, and must also include management criteria such as concern for our ability to reduce residual uncertainty sufficiently so that the determinations of whether or not the site is suitable can be made definitively.

Our programmatic strategy for site suitability evaluation has two basic elements. First, we are using multiple, independent approaches to development of the methodology. One approach is the DOE in-house effort. In parallel, two other independent efforts are being led by the Electric Power Research Institute and by Golder Associates. Each of these three efforts draws on the existing site data base as necessary, but the development of methodology is proceeding independently.

The second element of the strategy will be to compare and evaluate the approaches developed by the three independent efforts. This comparison will take place in an external technical forum such as might be provided by the Nuclear Waste Technical Review Board. Through use of such a forum we will make the candidate approaches available for external review and evaluation. The findings and recommendations stemming from these reviews will then be used by DOE in selecting and applying the site suitability evaluation approach to be used.

Through use of this strategy we expect to accomplish two things. First, we will assure that alternative approaches to site suitability evaluation are considered. Second, we will preserve the right and opportunity for other competent parties, such as the State of Nevada, to make independent contributions to development of the evaluation through participation in the technical forums. By this means we will assure that DOE does not unilaterally make up the

rules as it goes along. I would emphasize, however, that DOE has responsibility and authority for the site suitability decision. Our approach is designed to provide accountability for how we exercise that responsibility and authority.

CONCLUSIONS

Evaluation of site suitability poses both a scientific and a management challenge of the highest importance and priority. We must bring together data on site characteristics, methods for evaluation, and criteria for evaluation. In all of our work, we must be mindful of the close relationship between suitability and licensability. Because of the importance of the site suitability evaluation, the DOE program must and will be based on input from multiple independent efforts. Data collection and analysis will be performed with the appropriate participation of affected parties, and decision criteria and application methods will also be developed through a process in which input is sought from external parties.

I look forward to a stimulating exchange of scientific information as we integrate the entire effort. This collective effort, I am convinced, will result in findings that are scientifically, analytically, and systematically sound. The Department of Energy must retain its mandated responsibility for determining whether or not the Yucca Mountain site is a suitable location for a high-level waste repository, without in any way diminishing the regulatory authority of the NRC. While I am mindful that DOE must make the suitability determination, we will use an approach designed to involve others and to earn the trust and confidence of the public and scientific community.