



Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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WBS 1.2.5.2.6

MAY 03 1995

~~Joseph J. Holonich, Chief~~
High-Level Waste and Uranium
Recovery Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
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U.S. Nuclear Regulatory Commission
Washington, DC 20555

TRANSMITTAL OF U.S. DEPARTMENT OF ENERGY (DOE) "TECHNICAL BASIS
REPORT FOR SURFACE CHARACTERISTICS, PRECLOSURE HYDROLOGY, AND
EROSION" (SCPB: N/A)

References: (1) Ltr, Bernero to Dreyfus, dtd 10/4/94
(2) Ltr, Knapp to Summerson, dtd 11/29/94

Enclosed for your information is *Technical Basis Report For
Surface Characteristics, Preclosure Hydrology, and Erosion*
(YMP/TBR-001) (enclosure 1) and its companion public summary
(YMP/TBR-001A) (enclosure 2), the first in a series of Technical
Basis Reports (TBR) prepared by the Yucca Mountain Site
Characterization Office to support the DOE's evaluation of site
suitability.

In December 1994, after extensive interaction with stakeholders,
the DOE finalized and made available our process for evaluating
site suitability (enclosure 3). The U.S. Nuclear Regulatory
Commission (NRC) has commented on the draft process (Reference 1)
and on the proposed work scope for National Academy of Sciences
(NAS) Board on Radioactive Waste Management peer reviews of our
TBRs (Reference 2). Enclosure 4 is a response to the NRC's
comments on the site suitability evaluation process, and on the
scope of work for the NAS.

Under DOE's site suitability evaluation process, TBRs present the
scientific and engineering bases to support evaluations of the
site against the qualifying and disqualifying conditions of the
DOE's siting guidelines in 10 Code of Federal Regulations (CFR)
Part 960. TBRs summarize the available data and analyses and

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present a current understanding of related technical subject areas. The reports evaluate uncertainty, discuss alternative models and hypotheses permitted by the data, and establish bounding conditions for processes consistent with the current understanding. The schedule of availability and scope of TBRs are linked to testing and analysis milestones that support the technical site suitability evaluation.

TBRs will be subjected to independent peer review by the NAS/National Research Council Board on Radioactive Waste Management to help ensure their technical quality. Following peer review DOE will develop a guideline compliance assessment for each relevant guideline condition. Each assessment will receive public review and comment prior to any finding by the Director of the Office of Civilian Radioactive Waste Management (OCRWM) regarding compliance with the guideline conditions under evaluation.

This TBR is being sent to the NRC staff for their information, along with the public summary for this report (YMP/TBR-001A) (enclosures 1 and 2). The DOE is not requesting an NRC staff review of either document. The technical information presented or referenced in the TBR, and the information to be presented or discussed in future TBRs, is or will be incorporated in the DOE's License Application Annotated Outline for a repository, under the appropriate headings. New or revised sections of the annotated outline will be submitted to the NRC for review and comment with respect to the requirements of 10 CFR Part 60. Any technical comments on the TBR that the NRC staff wishes to provide should be sent to the NAS's manager for the TBR peer review, and they will be evaluated in addition to any other technical comments offered by external parties. All written technical comments submitted to DOE from oversight and stakeholder organizations will be forwarded to the NAS peer review manager and included in the documentation package for the OCRWM Director, but DOE does not intend to provide written responses to the comments.

All of these materials have been made available to program stakeholders.

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If you have any questions, please contact either Thomas W. Bjerstedt, Ph.D., of the Licensing Team, at (702) 794-7590, or Jane R. Summerson, Ph.D., Suitability Team Leader, at (702) 295-9610, or me, at (702) 794-7971.



Stephan J. Brocoum, Ph.D.
Assistant Manager for
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AMSL:TWB-2840

Enclosures:

1. *Technical Basis Report For
Surface Characteristics,
Preclosure Hydrology,
and Erosion (YMP/TBR-001)*
2. *Public Summary Technical Basis Report
For Surface Characteristics,
Preclosure Hydrology, and
Erosion (YMP/TBR-001A)*
3. *Site Suitability Evaluation
Process*
4. *Responses to NRC Comments*

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5-8-95

NOTE TO: Sue Fridley

FROM: Mark Delligatti *MD*

SUBJECT: TECHNICAL BASIS REPORT FOR SURFACE CHARACTERISTICS

Enclosures 1 and 2 to the attached letter are being kept in the Division of Waste Management for use by staff.

THE DEPARTMENT OF ENERGY
Office of Civilian Radioactive Waste Management

**THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT'S PROCESS FOR
EVALUATING THE SUITABILITY OF THE YUCCA MOUNTAIN SITE FOR
DEVELOPMENT AS A REPOSITORY FOR HIGH-LEVEL RADIOACTIVE WASTE AND
SPENT NUCLEAR FUEL**

SUMMARY

This paper describes a process (see Figures 1a-1d) that the Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM) will use for evaluating the suitability of Yucca Mountain, Nevada, as a site for a repository. This process is the result of several years of discussions between OCRWM and external parties about what this process should be and what role external parties should play in it.

Under the Nuclear Waste Policy Act of 1982 (P.L. 97-425) (the Act), as amended, the DOE is responsible, among other things, for siting, constructing, and operating a geologic repository for the disposal of high-level nuclear waste. The DOE must complete four major actions before a repository can be sited and built including: (1) determining a suitable site under 10 CFR Part 960; (2) complying with the provisions of the National Environmental Policy Act (NEPA) under 10 CFR Part 1021; (3) with the determination of a suitable site, submitting a Site Recommendation Report to the President; and (4) developing a License Application for submittal to the Nuclear Regulatory Commission (NRC) for a construction authorization under 10 CFR Part 60.

The Office of Civilian Radioactive Waste Management (OCRWM) has reevaluated its approach to achieving the objectives mandated under the Nuclear Waste Policy Act, as amended, to ensure that:

- efficient, measurable progress toward determining the suitability of the Yucca Mountain site for a permanent repository is made and, if the site is suitable, that the program is able to proceed with the environmental impact statement, site recommendation, and licensing and construction of a repository;
- the technical approach and schedule are realistic and consistent with established funding levels, and with expectations of stakeholders, including the Congress.

The new program approach is an attempt to bring the program back to the original intent of the legislative and regulatory framework. The approach provides a management tool to initially focus site characterization and engineering activities on that information deemed necessary and sufficient to support a technical site suitability determination of Yucca Mountain in 1998. The site suitability determination centers on a step-wise demonstration of compliance with each 10 CFR Part 960 siting guideline, or groups of guidelines. This step-

wise approach facilitates strategic planning at lower functional levels. Making conclusions on the individual higher-level findings, and a formal determination of technical site suitability, provide a logical means to reach convergence on the scientific program, to establish priorities and allocate appropriate resources, and demonstrate accountability and progress to external stakeholders.

If Yucca Mountain is found to be suitable, the Secretary's decision to recommend the site to the President for development as a repository will be supported by the information developed as a result of the OCRWM Site Suitability Evaluation Process described above, the final EIS, preliminary comments from the Nuclear Regulatory Commission on the sufficiency of site characterization analysis and waste form proposal for inclusion in a license application, comments by any state or affected Indian tribe together with a response, and any other such information as the Secretary considers appropriate.

Under the Program Approach, site characterization and engineering activities will assign early priority to the evaluation of the suitability of the Yucca Mountain site. Work will be in progress on the EIS and the license application concurrently and will continue after the suitability determination. Additional tests will be conducted wherever needed to support preparation of the EIS and License Application.

The NWPA, as amended, does not prescribe a decision on the suitability of the Yucca Mountain site that is distinct and separate from a decision by the Secretary of Energy to recommend the site. The program, however, believes that a formal determination of technical site suitability will provide a logical early target for the convergence of scientific studies and an important measure of progress to external stakeholders. Because the broad external credibility of the suitability evaluation is so critical to the success of the program, OCRWM has decided to make the evaluations of site suitability using an incremental and open process that features independent peer review and focused, effective public involvement. OCRWM has held extensive discussions with the Program's stakeholders about the suitability evaluation process over the past several years. The process for evaluating suitability has been revised, taking into consideration the views and ideas stakeholders have expressed during those discussions.

The process also provides for early public involvement at key points in the evaluation sequence. The development of this process itself has been subject to public review through written comments, meetings, and workshops, and to revision on the basis of that review. OCRWM is contracting with the National Academy of Sciences (NAS) to manage a process of external peer review of the technical basis for the OCRWM findings on individual guideline conditions. The external and stakeholder communities will be asked to nominate candidates for peer review, present technical issues to the peer review panel for consideration, and will be able to observe all public meetings of the peer review panels. OCRWM will seek public comments and hold public workshops on the guideline compliance assessments that follow the technical basis reports.

The process for evaluating suitability calls for the separate evaluation of individual guideline conditions, or groups of guideline conditions, of 10 CFR Part 960 (see Table 1). Evaluations will be conducted as site characterization data and analyses become available and will be based upon an assessment of the site and related design concepts to determine if guideline conditions are satisfied. The environmental aspects of the evaluation will use data and analyses developed to implement the NEPA process. For each guideline or group of guidelines, OCRWM would first develop a technical basis report and then, using the technical basis report, develop a guideline compliance assessment.

The process features three types of OCRWM evaluations. The first will be evaluations leading to higher-level findings on individual guideline conditions. The second is an evaluation of technical site suitability, and the third is an evaluation of overall site suitability. These OCRWM evaluations will be the basis for the Director's recommendation to the Secretary of Energy to submit the Site Recommendation Report (SRR) to the President of the United States of America. The SRR submittal is a final agency action and, as such, is the DOE's formal decision regarding the suitability of the site.

1.0 BACKGROUND

The Nuclear Waste Policy Act of 1982 (P.L. 97-425) (the Act) directs the Department of Energy (DOE) to site, construct, and operate geologic repositories for the disposal of high-level radioactive waste and spent nuclear fuel. It also and requires the DOE to complete a number of actions in carrying out these responsibilities.

As required by the Act, DOE issued final general guidelines for the recommendation of sites for repositories (10 CFR Part 960) on December 6, 1984. DOE used the guidelines to nominate five sites as suitable for characterization and to recommend to the President that three of the nominated sites be characterized as candidate sites for the first repository. For each of the five nominated sites, DOE issued a final Environmental Assessment (EA) in 1986 that included an evaluation of the suitability of that particular site under the guidelines. Each EA also contained a separate comparative evaluation of the subject site with the other nominated sites. On May 27, 1986, the President approved three sites recommended for characterization, including the Yucca Mountain site in Nevada. In December 1987, Congress amended the Act and directed DOE to evaluate only the site at Yucca Mountain.

DOE prepared a Site Characterization Plan (SCP) for the Yucca Mountain site which, in addition to other elements, described: (1) how DOE proposed to respond to the system and technical guidelines in 10 CFR Part 960 that fall within the scope of its planned site characterization program; (2) the postclosure guidelines concerning waste isolation; and (3) the preclosure guidelines concerning radiological safety and technical feasibility. The SCP did not deal with the guidelines that generally require non-earth science data gathering or the preclosure guidelines relating to environmental quality, socioeconomic impacts, and transportation. A Consultation Draft of the SCP was issued for comment in January 1988. In December 1988, the DOE submitted the final SCP for the Yucca Mountain site (DOE/RW-0199, December 1988) to the NRC and to the State of Nevada for their review and comment. Hearings on the SCP were held at three locations in Nevada during March 1989 to receive comments from the public on the DOE's plans for site characterization. Modifications in the site characterization program have occurred and will continue to occur as work progresses. These modifications are documented in the semi-annual reports prescribed in Section 113 (b) (3) of the NWPA.

The guidelines specify that, before DOE can find the Yucca Mountain site suitable for repository development, evidence should be developed on the adequacy to support positive "higher-level findings" for all the qualifying and disqualifying conditions in the guidelines (see Table 1). For qualifying conditions, a positive higher-level finding requires a conclusion that the condition exists and that new information is not likely to change that conclusion. For disqualifying conditions, a positive higher-level finding requires a conclusion that the condition is not present and that new information is not likely to change that conclusion. DOE made four such positive "higher-level findings" in the 1986 EA for the Yucca Mountain site.

Some of the qualifying conditions have associated favorable or potentially adverse conditions. These conditions can be used to evaluate the suitability of a site for site characterization as

was done in the EA for the Yucca Mountain site. There are no specific provisions in 10 CFR Part 960 for findings on either the favorable or potentially adverse conditions for the evaluation of the suitability of a site for a permanent repository. If these conditions exist, they will be considered in the evaluations of the qualifying conditions and disqualifying conditions of the guidelines.

In a November 1989 report to Congress on re-assessment of the Civilian Radioactive Waste Management program, the Secretary of Energy redirected the repository program to focus on the early evaluation of the suitability of the Yucca Mountain site. In December 1990, OCRWM directed a contractor to perform an early evaluation of the Yucca Mountain site under the general guidelines of 10 CFR Part 960. During 1991, a contractor-managed team of scientists and engineers participating in the Yucca Mountain site characterization program conducted these evaluations and, in January 1992, issued an Early Site Suitability Evaluation (ESSE) report presenting the results of their work. The ESSE was subjected to an external peer review managed by the contractor organization.

Both before and since the 1992 ESSE, DOE has held extensive discussions and interactions with the broad range of stakeholders about DOE's policy, plans, and process for determining the suitability of Yucca Mountain as a repository site. Those discussions and interactions have included:

- A series of Strategic Principles Workshops in December 1990, January 1991, April 1991, and October 1991
- A Director's Forum held in Chicago on May 8, 1992 that focused specifically on the policy, plans, and strategy for evaluations of site suitability
- Meetings with the Affected Units of Government (AUG) in October and December 1993 and February and March 1994, during which DOE discussed and solicited views on its plans for evaluating suitability
- An April 25, 1994 Federal Register Notice of Inquiry requesting the views of members of the general public on the process for evaluating suitability
- A public workshop on May 21, 1994 in Las Vegas, Nevada that sought stakeholder ideas and views on the suitability evaluation process
- An August 4, 1994 Federal Register Notice announcing the DOE decision to use the Siting Guidelines as they currently exist and requesting views of members of the general public on a draft description of the process for evaluating the suitability of the Yucca Mountain site
- Public Workshops on August 27, 1994 in Las Vegas, Nevada and August 30, 1994 in Washington, D.C. to discuss the draft process for evaluating site suitability.

On the basis of this external consultation, OCRWM has finalized a process for evaluating site suitability. This process is explained in the following section.

2.0 PROCESS FOR EVALUATING SITE SUITABILITY

2.1 Overview

OCRWM is implementing a restructured program consistent with the recent Administration Funding Proposal submitted to Congress for the 1995 fiscal year. The Program Approach was discussed with stakeholders at the morning session of the May 21, 1994 Las Vegas meeting. The new approach is designed to ensure that DOE makes efficient and measurable progress toward a decision about the suitability of Yucca Mountain as a repository site and, if the site is suitable, that the Program is able to proceed with the remaining steps toward development of a repository. The approach calls for evaluations of the Yucca Mountain site against the DOE's siting guidelines as the relevant data become available.

The DOE siting guidelines are categorized into four groups: (1) postclosure guidelines relating to long-term waste isolation; (2) preclosure guidelines relating to radiological safety; (3) preclosure guidelines relating to technical feasibility, and (4) preclosure guidelines relating to environmental quality (see Table 1). Three of these groups (those on postclosure waste isolation, preclosure radiological safety, and preclosure technical feasibility) require earth science data gathering and analysis. The plans for this data gathering and analysis were discussed in the SCP, as required by the NWPA. Evaluations of the site against the guidelines on postclosure waste isolation, preclosure radiological safety, and preclosure technical feasibility are expected to lead to OCRWM conclusions regarding technical site suitability.

The NWPA requires that an EIS, consistent with NEPA, accompany any site recommendation for development as a repository provided to the President. If the Yucca Mountain site is found suitable, the Secretary's decision to recommend the Yucca Mountain site to the President for development as a repository will be supported by an EIS. To support preparation of the EIS, certain types of data will be gathered and analyzed. This includes non-earth science data gathering and analysis that will be required to address the fourth group of guidelines, including socioeconomics, environmental quality, and transportation, which were not included in the SCP. OCRWM expects that data collected for the EIS will also be utilized to address the socioeconomic, environmental quality, and transportation guidelines contained in the DOE siting guidelines. The issuance, review, and revision of all suitability related documents for these three guidelines will be coordinated with the issuance and public review of the draft EIS. Evaluations of these guidelines, together with the determination of technical site suitability, constitute the OCRWM evaluation regarding overall site suitability which will form the basis for the recommendation of the site to the President.

As part of the restructured program, OCRWM has developed an open and sequential process for evaluating the suitability of the Yucca Mountain site that will document the evidence and the rationale for these evaluations. The process calls for the separate evaluation of individual guideline conditions, or groups of guideline conditions. These evaluations will be made as the relevant site characterization data, analyses, facility designs, and non-earth science data become available. The suitability process has three main elements:

1. **Development and review of the technical basis report**
2. **Development and review of assessments of compliance with the siting guidelines**
3. **OCRWM evaluations on higher-level findings, technical site suitability, and overall site suitability.**

Three types of OCRWM evaluations are specified in the third element of the process for evaluating site suitability. The first type of evaluation relates to making higher-level findings on individual guideline conditions based on the relevant technical basis documentation and guideline compliance assessment. The second is an evaluation of technical site suitability based on the findings and supporting information for guidelines relating to long-term waste isolation, to radiological safety, and to technical feasibility. The third evaluates overall site suitability based on information supporting the evaluation of technical site suitability and the additional technical basis documentation and guideline compliance assessments for preclosure guidelines relating to socioeconomics, environmental quality, and transportation. These OCRWM evaluations will be the basis for the Director's recommendation to the Secretary of Energy to submit the SRR to the President of the United States. The submittal of the SRR is the DOE's formal decision on the suitability of the site. If the site is found to be unsuitable, an alternative plan will be submitted to Congress within six months of the unsuitability declaration.

The process provides for an active predecisional role for interested parties, affected governments, and the public before any OCRWM findings on the guidelines. Development of this process itself has been subject to public review through written comments, meetings and workshops, and to revision on the basis of that review. External peer review of technical basis reports will be managed independently of OCRWM. The broad external and stakeholder communities will be requested to nominate candidates for peer review panels, will be requested to bring relevant technical issues to the attention of peer reviewers, and will be able to observe and comment on the work of the peer review panels. OCRWM will seek public comments and hold public workshops on the guideline compliance assessments that follow the technical reports.

2.2 Technical Basis Documentation

The first main element of the process for evaluating suitability is the development and review of technical basis documentation. This element consists of data acquisition and analysis, development of the technical basis reports, and external review of the technical basis reports.

2.2.1 Data Acquisition/Analysis

Under Section 113 of the NWPA, as amended, DOE must characterize the Yucca Mountain site to evaluate its suitability for recommendation for development as a repository. Site characterization is paralleled by non-earth science data collection to ensure compliance with

NEPA. The site characterization phase of the program includes the acquisition and analysis of site data and design information, and the iterative performance assessments or other analyses that are necessary to support the process for the evaluation of site suitability.

The data that are collected and analyzed, and the performance assessments that are conducted, will be used to develop the technical basis reports for evaluations of the site against the guidelines (qualifying and disqualifying conditions) of 10 CFR Part 960 (see Table 1). The timing and scope of these evaluations will be linked to testing and analysis milestones. OCRWM will review, and revise as needed, its data acquisition plans and its priorities for site studies and analyses. Through such an iterative process, OCRWM can continuously take advantage of new data, improve its understanding of site conditions and processes, and ensure that its testing remains firmly focused on those aspects of the site that are important to determining its suitability and safety.

2.2.2 Technical Basis Report

Technical basis reports will provide the primary scientific basis for development of assessments of compliance with each relevant guideline. These reports will summarize the available data and analyses and present a current understanding of the subject area, including an evaluation of uncertainty, alternative models/hypotheses permitted by the data, and conservative bounds on conditions and processes consistent with the current understanding. Each technical basis report will be accompanied by an executive summary that will be written for the public.

The data gathering required to support preparation of the repository EIS will also support preparation of technical basis reports relevant to the socioeconomic, environmental quality, and transportation guidelines. These technical basis reports will be peer reviewed in the same manner as other technical basis reports.

2.2.3 Peer Review

Each technical basis report will undergo external peer review. OCRWM will contract with the National Academy of Sciences (NAS) Board on Radioactive Waste Management (BRWM) to assist in the evaluation process by: selecting peer reviewers, setting up peer review committees, and managing the required peer reviews. The goal of a review selection process managed by a qualified independent organization and an external review that is not managed by OCRWM is to ensure that reviewers are independent of the work, that qualified reviewers have been selected, and that DOE's technical work is sound.

For a peer review of a given technical basis report, the BRWM will solicit nominations for qualified peer reviewers from the public and request that the public provide information on relevant technical issues for consideration by the peer review panel. All interactions between peer review panels and report authors will occur in open session and all documents submitted to the peer review panel will be publicly available.

Peer reviewers should evaluate the validity of the data and interpretations and the adequacy of the treatment of uncertainties in each technical basis report. The peer reviewers will be asked to answer the following questions, at a minimum.

- Have the data been collected and analyzed in a technically acceptable manner?
- Do the data, given analytical and conceptual uncertainties, support the technical interpretations and technical conclusions made in the report?
- Are there credible alternative interpretations that would significantly alter the conclusions reached?
- What testing, if any, would discriminate between alternative technical interpretations?
- If such testing is recommended, how effective would it be at reducing significant technical uncertainties?

Answers to these questions will help OCRWM decide whether the technical basis report is adequate to support a compliance assessment on one or more of the qualifying and disqualifying conditions, or whether additional testing and analyses are required before OCRWM develops a compliance assessment.

2.3 Guideline Compliance Assessment

The second element of the process is the development and review of assessments of compliance with the siting guidelines after consideration of the technical basis report and the results of the NAS peer review.

2.3.1 Development of the Guideline Compliance Assessment

If DOE decides that the technical basis report is sufficient and all the necessary information is available, OCRWM will develop a guideline compliance assessment to evaluate the available information, including both the technical basis report and the external review of the technical basis report, to determine whether the evidence appears to be sufficient to support a higher-level finding on a particular guideline condition. The guideline compliance assessments are OCRWM staff analyses of the available information relevant to a particular guideline condition. These draft guideline compliance assessments will be subject to external review and comment.

2.3.2 External Review of the Guideline Compliance Assessment

OCRWM will publish a Federal Register Notice of the availability of the draft guideline compliance assessment for public review and comment. The guideline compliance assessments will contain DOE's logic as to whether or not the available information, including the technical basis report, is adequate to support a conclusion with respect to the guideline conditions. It is important that wide public review take place. OCRWM also will hold

public workshops on the guideline compliance assessments during the public comment period. These workshops will provide an open forum to discuss the technical basis report and examine and discuss the logic arguments contained in the draft guideline compliance assessments. Such workshops provide for active predecisional public participation and the ability to probe the strength of the logic. A workshop summary will be developed as part of the documentation with discussion of issues raised. Any subsequent decision by the Director to make a higher-level finding will be based in part on the documentation developed during external review of the guideline compliance assessment. If, after all substantive issues are considered, the guideline compliance assessment logic is deemed satisfactory to OCRWM management, the draft guideline compliance assessment will be revised and issued in final form for consideration by the Director.

2.4 Evaluation Steps

The third element in the process for evaluating suitability is the sequence of OCRWM evaluations of higher-level findings, technical site suitability, and overall site suitability. At each step in the evaluation process, when the Director reaches a conclusion on the higher level finding, technical site suitability or overall site suitability, three options exist. The conclusion may be positive, negative, or that no action will be taken at present.

2.4.1 Higher-Level Findings

A higher-level finding is required for each of the qualifying and disqualifying conditions of the siting guidelines. These findings require a judgment by OCRWM that new information is not likely to change the conclusion. In making a positive higher-level finding, OCRWM will be deciding that available evidence supports a finding that either the site is not disqualified and not likely to be disqualified under a particular guideline condition, or that the site meets a particular qualifying condition and is likely to continue to do so. OCRWM fully recognizes the uncertainties inherent in the data and analyses that are likely to be reasonably available to support such judgements. For that reason, OCRWM will base its findings on technical basis reports that have undergone NAS peer review and on guideline compliance assessments that are appropriately conservative in interpreting the available information and that make use of robust bounding calculations to support compliance arguments where uncertainties are significant.

The Director of OCRWM may make a higher-level finding based primarily on the documentation developed in the suitability process. This documentation will include a final technical basis report, peer review comments on the technical basis report, the relevant final guideline compliance assessment, comments from the public, interested parties and affected governments, and any OCRWM response to these comments. Before making any finding, the Director will have the opportunity to examine the evolution of the technical basis report as a result of external review, and the evolution of the final guideline compliance assessment as a result of public comment, in determining the strength of the technical basis report and the soundness of the arguments in the guideline compliance assessment. The Director may also consider any other information he or she deems relevant in the process of making a finding. Notice of the Director's higher-level finding will be published in the Federal Register. A

rationale citing any additional information used and the rationale for the finding will be provided.

OCRWM recognizes that after making a higher-level finding, OCRWM or someone else could find new data that could require a reassessment of the technical basis report used to support that finding. Such data should be brought to the attention of the Director as soon as possible so that OCRWM can evaluate the information and the need to take appropriate steps.

If OCRWM makes a negative higher-level finding, the Director will use the documentation developed in the suitability process and any other information he or she deems relevant to make a recommendation to the Secretary for further action.

2.4.2 Technical Site Suitability

The Director of OCRWM will make an evaluation of technical site suitability after higher-level findings have been made on all relevant conditions within the guidelines relating to long-term waste isolation, radiological safety, and technical feasibility. The conclusion may be positive, negative or that no action will be taken at present. If the site is found to be unsuitable, an alternative plan will be submitted to Congress within six months of the unsuitability declaration.

2.4.3 Overall Site Suitability

The Director, OCRWM, will make an evaluation of overall site suitability after higher-level findings have been made on all relevant conditions within the guidelines, including those on environmental quality, socioeconomics, and transportation. The conclusion may be positive, negative, or that no action will be taken at present. If the conclusion is positive, the Director of OCRWM may recommend to the Secretary that the site is suitable for development as a repository. If the site is found to be unsuitable, an alternative plan will be submitted to Congress within six months of the unsuitability declaration.

3.0 SITE RECOMMENDATION REPORT

The Secretary of Energy may recommend the site for development of a repository based on the information required by Section 114 of the Act, as amended. This includes the information developed as a result of the OCRWM Site Suitability Evaluation Process described above, the final EIS, preliminary comments from the Nuclear Regulatory Commission on the sufficiency of site characterization analysis and waste form proposal for inclusion in a license application, comments by any state or affected Indian tribe together with a response, and any other such information as the Secretary considers appropriate.

The Secretary's recommendation to the President represents a final agency action and is the DOE's formal decision regarding the suitability of the site. If the site is found to be unsuitable, an alternative plan will be submitted to Congress within six months of the unsuitability decision.

Table 1

**Postclosure Guideline Excerpts from the Siting Guidelines
in 10 CFR Part 960, Subpart C**

Guideline	Condition	Description
System Guideline	Qualifying	Postclosure performance meets regulatory standards
Technical Guidelines		
Geohydrology	Qualifying	Geohydrologic setting is compatible with waste containment and isolation
	Disqualifying	Ground-water travel time is less than 1,000 years along paths of likely and significant radionuclide travel
Geochemistry	Qualifying	Geochemical characteristics are compatible with waste containment and isolation
Rock Characteristics	Qualifying	Rock characteristics will accommodate thermal, chemical, mechanical, and radiation stresses
Climatic Changes	Qualifying	Future climate is not likely to lead to releases greater than regulatory limits
Erosion	Qualifying	Erosion is not likely to lead to releases greater than regulatory limits
	Disqualifying	Site conditions preclude 200 m overburden above the repository
Dissolution	Qualifying *	Dissolution is not likely to lead to releases greater than regulatory limits
	Disqualifying *	Active dissolution could result in loss of waste isolation
Tectonics	Qualifying	Future tectonic processes and events are not likely to violate release limits
	Disqualifying	Fault movements are expected to cause loss of waste isolation

Postclosure Guideline Excerpts from the Siting Guidelines in 10 CFR Part 960, Subpart C
(Continued)

Guideline	Condition	Description
<p>Human Interference</p> <p>Natural Resources</p>	<p>Qualifying</p> <p>Disqualifying</p>	<p>Natural resources are not likely to cause interference activities that could lead to releases greater than regulatory limits</p> <p>1. Previous exploration has created significant pathways</p> <p>2. Activities outside the controlled area are expected to lead to loss of waste isolation</p>
<p>Site Ownership and Control</p>	<p>Qualifying</p>	<p>Department of Energy can obtain ownership, surface and subsurface rights, and control of access</p>

* Higher-Level Finding made in 1986 in Final Environmental Assessment

Source: Table 2-1 in October 12, 1994 Predecisional Draft Five-Year Plan, modified

**Preclosure Radiologic Safety Guideline Excerpts from the Siting Guidelines
in 10 CFR Part 960, Subpart D**

Guideline	Condition	Description
System Guideline	Qualifying	Preclosure exposures meet applicable safety standards
Technical Guidelines		
Population Density and Distribution	Qualifying	<ol style="list-style-type: none"> 1. Doses to highly populated areas are not likely to exceed small fraction of limits 2. Doses to any member of public in unrestricted area is not likely to exceed limits
	Disqualifying *	<ol style="list-style-type: none"> 1. *Site located in a highly populated area 2. *Site located adjacent to a one-square-mile area with population greater than 1,000 3. *Department of Energy cannot develop emergency preparedness program
Site Ownership and Control	Qualifying	Department of Energy can obtain ownership, surface and subsurface rights, and control of access
Meteorology	Qualifying	Meteorological conditions are not likely to lead to releases above limits
Offsite Installations and Operations	Qualifying	Effects from offsite facilities can be accommodated and will not lead to releases above limits
	Disqualifying	Irreconcilable conflicts with atomic energy defense activities are expected

* Higher-Level Finding made in 1986 in Final Environmental Assessment

Source: Table 2-2 in October 12, 1994 Predecisional Draft Five-Year Plan, modified

**Preclosure Ease and Cost of Siting, Construction, Operation, and Closure Guideline
Excerpts from the Siting Guidelines in 10 CFR Part 960, Subpart D**

Guideline	Condition	Description
System Guideline	Qualifying	Repository siting, construction, operation, and closure will be feasible using reasonably available technology
Technical Guidelines		
Surface Characteristics	Qualifying	Can be accommodated using reasonably available technology
Rock Characteristics	Qualifying	<ol style="list-style-type: none"> 1. Thickness and lateral extent are adequate 2. No undue hazards to personnel are expected 3. Reasonably available technology will be adequate
	Disqualifying	Presence of significant risk to health and safety of personnel taking into account possible mitigation using reasonably available technology
Hydrology	Qualifying	<ol style="list-style-type: none"> 1. Setting is compatible with repository development 2. Liners and seals will function as designed 3. Reasonably available technology will be adequate
	Disqualifying	Expected ground-water conditions require engineering measures beyond reasonably available technology
Tectonics	Qualifying	Expected tectonic activity can be accommodated with reasonably available technology
	Disqualifying	Expected fault movement will require engineering measures beyond reasonably available technology

Source: Table 2-3 in October 12, 1994 Predecisional Draft Five-Year Plan

**Preclosure Environmental Quality - Socioeconomic Impacts - Transportation Guideline
Excerpts from Siting Guidelines in 10 CFR Part 960, Subpart D**

Guideline	Condition	Description
System Guideline	Qualifying	Public and environment are adequately protected
Technical Guidelines		
Environmental Quality	Qualifying	Environmental quality is adequately protected
	Disqualifying	<ol style="list-style-type: none"> 1. Environment cannot be adequately protected or impacts acceptably mitigated 2. Site is located within protected area 3. Irreconcilable conflicts are expected with a protected area
Socioeconomic Impacts	Qualifying	Impacts can be offset by reasonable mitigation or compensation
	Disqualifying	Significant reduction in water quality / quantity at offsite sources is expected
Transportation	Qualifying	<ol style="list-style-type: none"> 1. Access routes will not cause irreconcilable conflicts with a protected area 2. Routes can be designed with reasonable available technology 3. No extreme performance standards are required 4. No unacceptable risks or environmental impacts are expected

Source: Table 2-4 in October 12, 1994 Predecisional Draft Five-Year Plan

Example of Favorable and Potentially Adverse Conditions

Preclosure Surface Characteristics

Favorable Conditions:

1. Generally flat terrain
2. Generally well-drained terrain

Potentially Adverse Conditions

1. Surface characteristics that could lead to the flooding of surface or underground facilities by the occupancy and modification of flood plains, the failure of existing or planned man-made surface water impoundments, or the failure of engineered components of the repository.

Source: Table 2-5 in October 12, 1994 Predecisional Draft Five-Year Plan, modified

Site Suitability Process

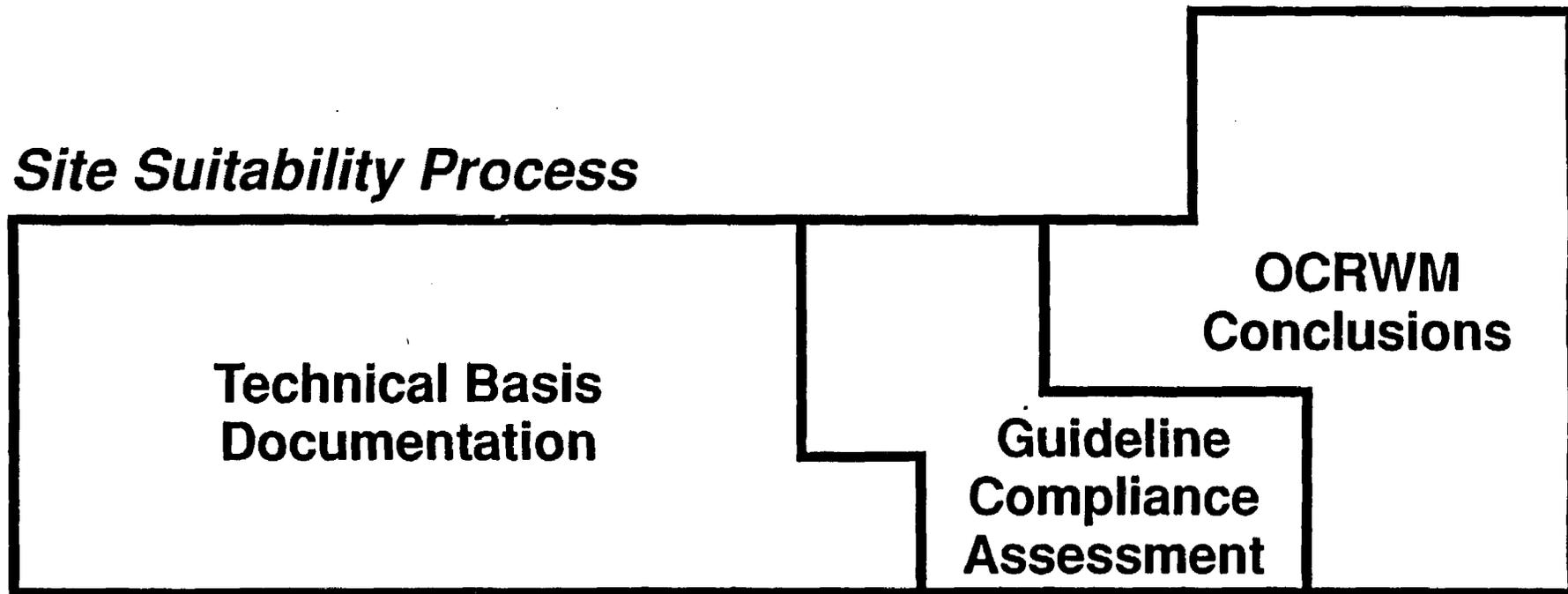


Figure 1a

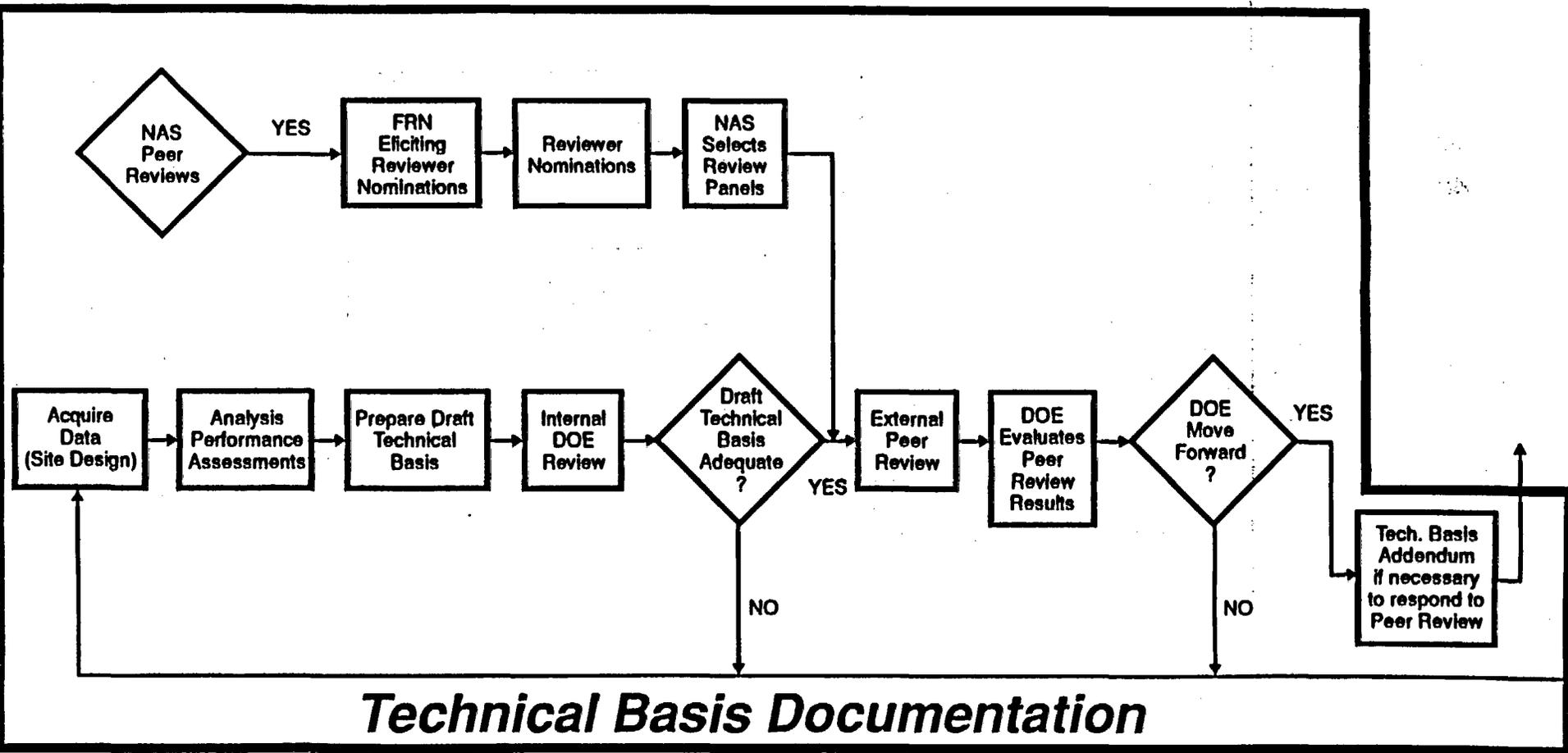


Figure 1b

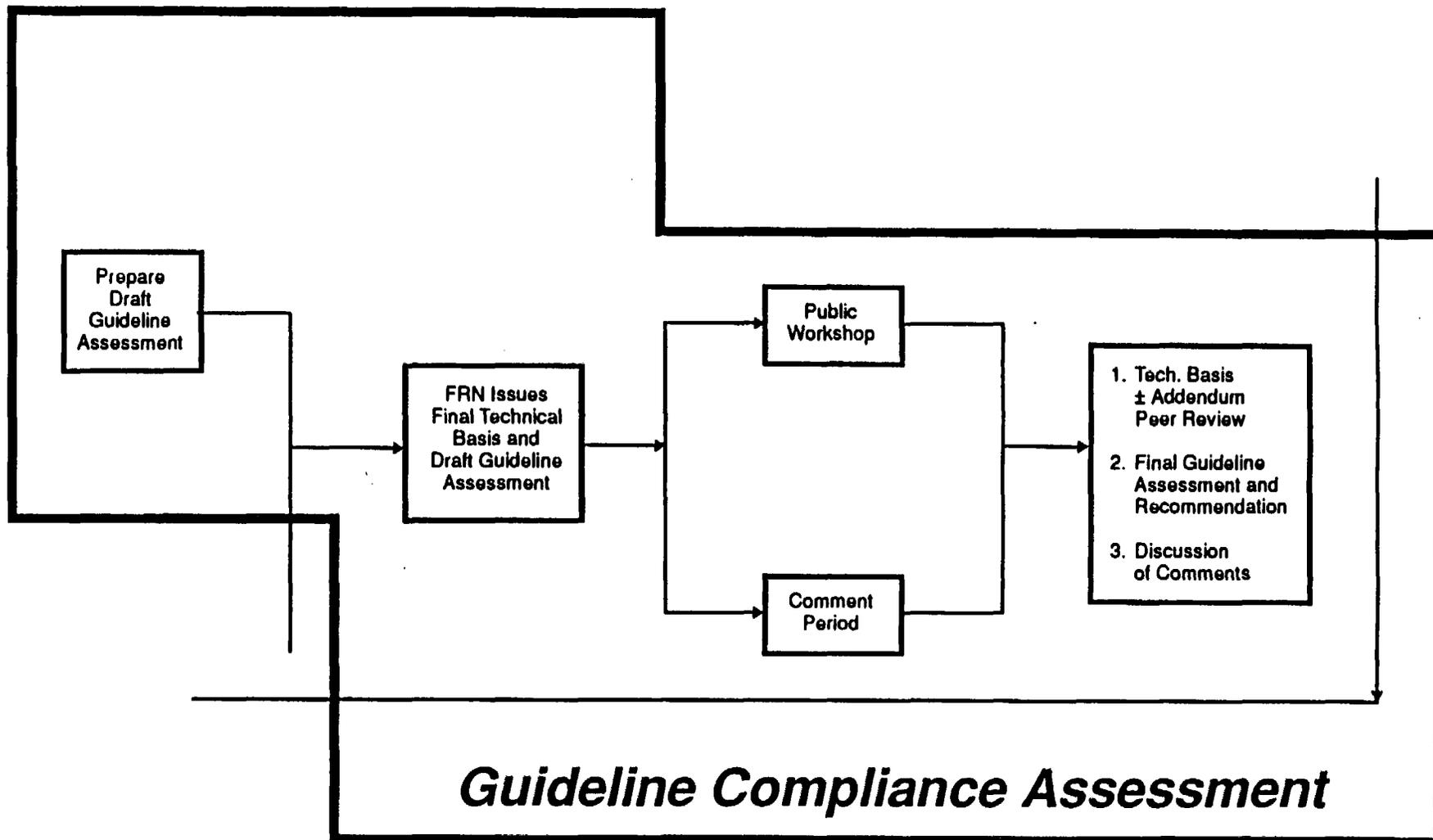


Figure 1c

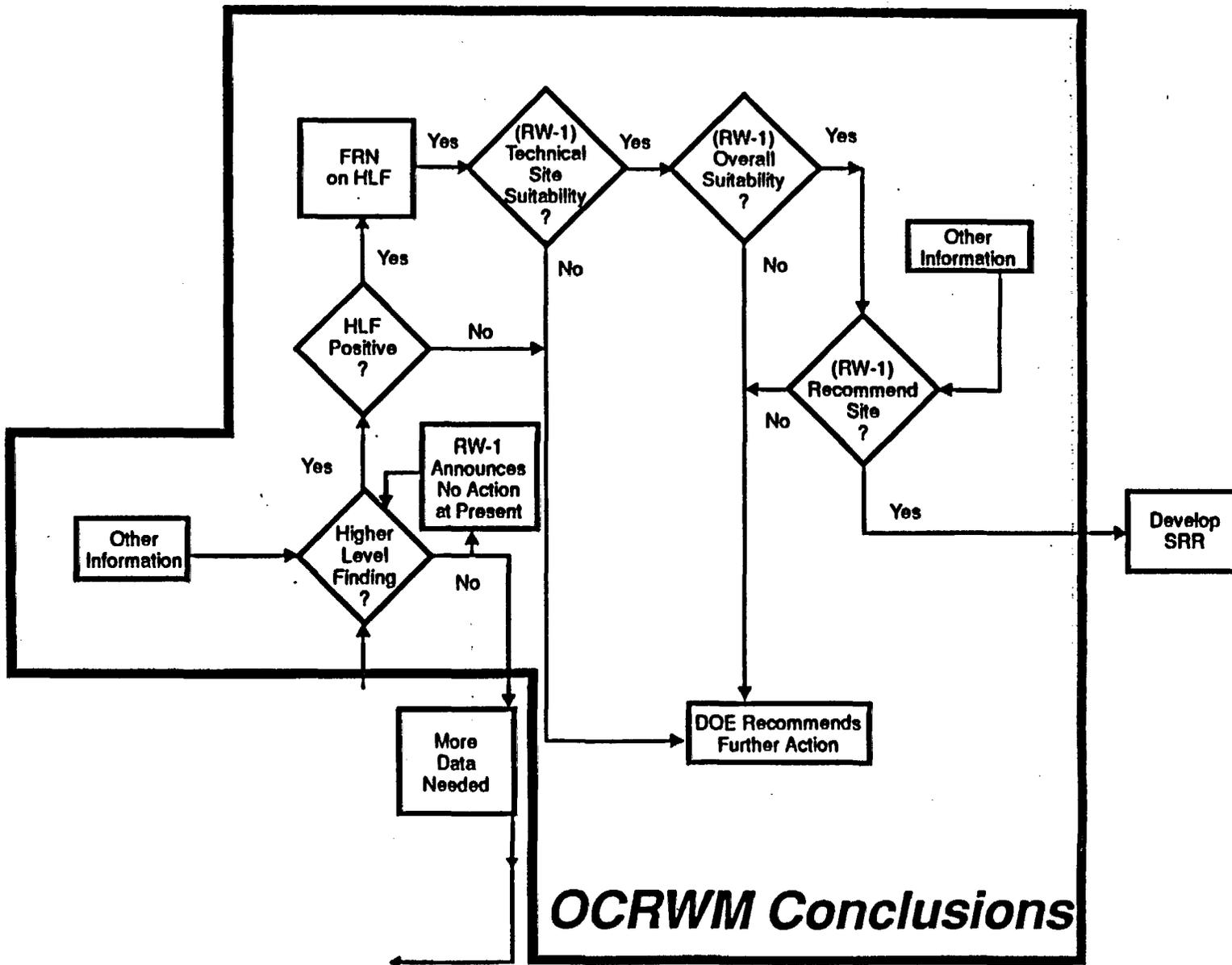


Figure 1d

U.S. DEPARTMENT OF ENERGY'S (DOE) RESPONSE
TO U.S. NUCLEAR REGULATORY COMMISSION (NRC) COMMENTS
ON AUGUST 5, 1994, AND OCTOBER 31, 1994
FEDERAL REGISTER NOTICES

SITE SUITABILITY EVALUATION PROCESS

On October 4, 1994, the NRC commented on DOE's August 4, 1994, Federal Register Notice that made available DOE's draft site suitability evaluation process. DOE used this input, and that received from a variety of other stakeholders, to finalize our process for making findings on 10 CFR Part 960 site guidelines.

NRC Comment:

"We have potential concerns about DOE's PPA particularly the statement in the Notice that DOE 'will not make specific evaluations of the favorable and potentially adverse conditions since these tests are primarily for use in comparing sites.' Specifically, if DOE intends the statement to guide its evaluation of Yucca Mountain in connection with any decision on site recommendation, as opposed to site suitability, then we must question DOE's position on regulatory and policy grounds."

DOE Response:

The NRC expressed concern that DOE, "will not make specific evaluations of the favorable and potentially adverse conditions since these tests are primarily used in comparing sites." DOE will consider favorable and potentially adverse conditions (FCs and PACs, respectively) because they are indicators, individually and collectively, for the presence or absence of qualifying and disqualifying conditions. PACs and FCs will be explicitly considered in the compliance assessments for each guideline. In accordance with 10 CFR Part 960, DOE will make formal findings on qualifying and disqualifying conditions. DOE will not make formal findings, however, on the presence or absence of PACs or FCs. Performance modeling may be performed to explicitly evaluate impacts on system performance to the extent that the presence or absence of FCs and PACs are indicators for the qualifiers and disqualifiers.

Inasmuch as DOE's FRN was not clear on the intended treatment for PACs and FCs, DOE clarifies that we will consider PACs and FCs explicitly in our guideline compliance assessments, but we will not be making findings on them.

Positive higher-level findings that are made during the site suitability evaluation process aggregate to the basis for technical site suitability. The technical basis for a Site Recommendation Report to the President and the Congress is completed when the environmental, socioeconomic, transportation, and land access guidelines have been addressed.

NRC Comment:

"We must question the focus in DOE's PPA on assessments to 'weigh whether a specific aspect of feature of the site is consistent with the ability of a repository to safely isolate waste.' Our experience leads us to view performance as being so highly dependent upon the interrelationship of various site and design parameters that one can rarely, if ever, conclude that a specific aspect or feature in and of itself is satisfactory."

DOE Response:

NRC is concerned that DOE will treat aspects of the natural and engineered setting in isolation, or that DOE may "weigh whether a specific aspect or feature of the site is consistent with the ability of a repository to safely isolate waste." This is completely consistent with 10 CFR Part 960.3-1-5 (cited in Reference 2) whereby DOE considers on balance the collection of PACs and FCs to reach findings. The term "on balance" is equivalent to the term "weigh."

DOE, of course, acknowledges that the total system deals with the entire natural and engineered system. As a practical matter, there are aspects of the natural system that can be treated together and, if they were not, some insights could be missed. This is especially true when bounding calculations and assumptions are used to bracket expected parameter ranges. Performance modeling can proceed under such bounded conditions.

To support higher-level findings for postclosure disqualifying conditions, DOE will either look back to the most recent total or subsystem performance modeling exercise to address the disqualifying conditions at hand, or undertake a special modeling exercise. A total system performance assessment will be completed in 1997 to support higher-level findings for postclosure qualifying conditions.

DOE agrees that site and design parameters are closely interrelated with performance. Grouping site parameters in a manner that considers less than the total system is possible, and the insights that can be gained by doing this are of value. The guidelines and higher-level findings grouped for treatment in Technical Basis Reports scheduled to be written in DOE's Program Plan (formerly, the 5-year plan), are sufficiently interrelated

to warrant being addressed as a group. For example, natural groupings include seismicity, tectonics, and volcanism or postclosure hydrology and geochemistry.

Another aspect of DOE's response to the concern expressed by NRC about the interrelationships of site and design parameters with performance pertains to the standard by which DOE demonstrates compliance with siting guidelines in 10 CFR Part 960, in contrast to that in NRC's regulation 10 CFR Part 60. The 10 CFR Part 960 siting guidelines are not inconsistent with 10 CFR Part 60, but the DOE's guidelines are not identical to the NRC's regulation. For DOE to make an affirmative higher-level finding against a qualifying condition, the extant data needs to indicate the following: (1) the evidence supports a finding that the site meets the qualifying condition, and (2) it is likely to continue to meet the qualifying condition.

Because 10 CFR Part 960 and 10 CFR Part 60 are similar, but different, and because each belongs to a different agency, the standard of proof and level of confidence for findings made by each agency are different. NRC's standard of proof is "reasonable assurance", and DOE's understanding at this time is that NRC's expected levels of confidence under the reasonable assurance standard are very high. For DOE, the standard of proof is the weight of evidence, and the level of confidence is the likelihood of the disqualifying condition being absent and the qualifying condition being present. To make findings against either standard does not require absolute certainty. To reach findings each agency will exercise judgement and decisions will be made that account for uncertainties due to incomplete and imperfect knowledge.

NRC Comment:

"We have questions about DOE's use of the [site suitability] assessments as a basis for making judgements to reduce the level or scope of investigations. When the details of such plans are presented, NRC should expect that NRC may take exception to modifications that would reduce, without adequate justification, the investigations and evaluations that are called for under the site characterization plan."

DOE Response:

The NRC expressed concern about the DOE's site suitability evaluation process being used as the basis for judgements to reduce the level or scope of investigations. DOE understands NRC's concern that the site characterization program could be molded to the needs for sequential higher-level findings in pursuit of a technical site suitability finding in 1998, under 10 CFR Part 960, without cognizance or priority for what data and

analyses NRC needs to make licensing findings under 10 CFR Part 60. Data gathering and evaluation does not end after higher-level findings are made, or in 1998 when a decision of technical site suitability is scheduled, or between 1998 and 2001 if a license application is being prepared for submittal to the NRC. DOE expects the site characterization program to supply the data needs for each agency's decision path, but DOE's decision on site suitability is required before a license application is submitted to the NRC. The Nuclear Waste Policy Act (NWPA) requires that an affirmative site suitability finding precede the submission of a license application.

Understanding the differences between NRC's data needs for licensing (defined in NUREG-1323; the License Application Review Plan) and DOE's data needs for the site suitability evaluation process (defined initially in the 1988 Site Characterization Plan) is valuable information. DOE expects that our Technical Basis Reports are likely to elicit comments from NRC that will greatly assist us in identifying differences.

The differences between the NRC's 10 CFR Part 60 and DOE siting guidelines in 10 CFR Part 960, generally speaking, are less a matter of breadth or depth of investigation needed, than a matter of the standard of proof and the level of confidence needed by each agency to make findings. For DOE's decision path, we have developed an independent peer review process for our Technical Basis Reports, and a public comment process on our Guideline Compliance Assessments to help us judge when data gathering and analyses are adequate and sufficient to make findings. The DOE will be aided in deciding when our data-gathering programs and analyses are adequate and sufficient for licensing by NRC's comments on our draft License Application Annotated Outline (LAAO), comments on our Topical Reports, and by comments on a Site Recommendation Report.

There are differences in the process used by DOE and NRC in reaching the suitability and licensing decisions required by law. These differences include the type of documents prepared and submitted to support the case, the standard of proof that is applied, the level of confidence that is expected, the mechanics of how each decision is made, and who is involved in making it.

BOARD OF RADIOACTIVE WASTE MANAGEMENT WORK SCOPE

On November 29, 1994, the NRC commented on DOE's October 31, 1994 Federal Register Notice making available a draft work scope for National Academy of Sciences (NAS) management of peer reviews on the Technical Basis Reports (TBR). DOE will use TBRs as the primary input for evaluation of the guideline conditions in 10 CFR Part 960.

NRC Comment:

"It is the intent of the NRC staff to comment formally in parallel with the reviews of the NAS peer review committees throughout this process on those issues and findings which have bearing on NRC's licensing responsibilities."

DOE Response:

The DOE will not request an NRC staff review of our Technical Basis Reports (TBR). Any technical comments on TBRs that the NRC staff wish to provide should be sent to the NAS's peer review manager where they can be evaluated and become part of the review record. If the NRC or any other oversight or stakeholder organization forwards technical comments to DOE, we will send them to the NAS peer review manager to be evaluated during the review. NRC may also make technical presentations to the peer review panel during the panel's public deliberations, as is the prerogative of other stakeholders. All written technical comments to DOE will be included in the documentation package for the OCRWM Director. DOE does not intend to provide written responses to technical comments on TBRs beyond those needed to address NAS's recommendations that arise from their peer review.

For draft Guideline Compliance Assessments (GCA), wherein findings are proposed, NRC may comment formally or provide verbal input at workshops on the potential findings facing DOE. For GCAs we intend to prepare a summary discussion of the issues and concerns expressed during the workshops and public comment period. These will become part of the documentation package to the OCRWM Director.

The technical information presented or referenced in TBRs will be incorporated into DOE's draft License Application Annotated Outline (LAAO) for a repository, which is based on the headings defined in NRC's License Application Review Plan (NUREG-1323). DOE's documentation to fulfill the requirements of 10 CFR Part 60 is our LAAO. New or revised sections of the annotated outline will be submitted to the NRC for review and comment as they are completed during the pre-licensing period.

NRC Comment:

"The proposed peer review process limits peer reviews solely to the technical basis for compliance and does not include reviews of compliance assessments and decisions. While we understand the reason for not having a peer review of the compliance assessment, it is not clear how the technical adequacy of data and analyses can be evaluated meaningfully without taking into consideration their ultimate use. DOE should consider making available to the peer review committees relevant information regarding regulatory

compliance methods so that the committees' review may address the technical adequacy of data and analyses for their intended application to regulatory compliance with both Part 960 and Part 60."

DOE Response:

The NRC expressed concern with the separation of the National Academy of Sciences's (NAS) technical peer review and DOE's compliance assessments. Technical Basis Reports will provide the primary scientific basis for development of compliance assessments with each relevant guideline. For each TBR, the NAS will manage a peer review designed to address the technical adequacy of the data, analyses, interpretations, and conclusions that are presented. The goal is to acquire an independent judgement on DOE's technical work from a qualified and eminent source that is completely external to the DOE's site characterization program.

The NRC stated that TBR peer review panels should have access to the regulatory criteria and compliance methods so that panels may address the technical adequacy of data and analyses for their intended application to regulatory compliance (emphasis NRC's) with both 10 CFR Part 960 and 10 CFR Part 60. Two comments are expressed which need to be addressed separately. The first comment pertains to the separation of reviews conducted on the technical adequacy of TBRs, and the compliance assessment which uses this review as input for DOE's decision(s). The second comment pertains to DOE involvement, in this case via the NAS's peer review, in an evaluation based on 10 CFR Part 60 criteria.

First, we address the separation of technical review and compliance assessment. In the 1994 workshops preceding finalization of DOE's site suitability evaluation process, the Yucca Mountain Site Characterization Office's Site Suitability Team explained why such a separation was of benefit. Much of the impetus for this decision resulted from experience with the 1991 Early Site Suitability Evaluation, which used an independent and qualified peer review where this separation was not made. The peer review members had great difficulty in evaluating the adequacy and sufficiency of the technical conclusions in ESSE as the basis for making a suitability finding(s). The peer reviewers found themselves as de facto surrogates of the agency responsible for making a public health and safety determination. For this reason primarily, DOE chose not to introduce that complication into the technical evaluation and designed the process so that the responsible agency remains responsible and that the peer review results are input to that decision.

DOE will include excerpted text in each Technical Basis Report (TBR) pertaining to the 10 CFR Part 960 guideline findings being addressed. Inclusion of this information is not implied or explicit review criteria for the NAS peer review, but is meant simply to inform the reader why the document was prepared.

Second, we address the potential for a review based on 10 CFR Part 960 and 10 CFR Part 60 criteria. Not only would a technical review commingled with a compliance assessment on 10 CFR Part 960 be counter to our experience, but to have 10 CFR Part 60 criteria included as part of that review would compromise the independence of NRC's review of a license application submitted by DOE, at which time compliance determinations are made to 10 CFR Part 60. The NRC's findings are to be made pursuant to their licensing authority under the Atomic Energy Act, and NRC evaluation of DOE's technical data and analyses is carried out after submission of a license application.

DOE does not endorse, or see the need for, an evaluation by the NAS against 10 CFR Part 60 criteria before the submission of a license application. Further, it would complicate our suitability evaluation process by introducing additional explicit or implied review criteria on our TBRs that DOE does not want. We have established a decision path through a full and open public process to discharge our statutory responsibilities under the Nuclear Waste Policy Act, as amended. It would therefore not be prudent to do as NRC suggests.

NRC Comment:

"In the NRC staff's view, individual aspects of repository performance should be assessed in relation to their effects on overall system performance. The subject notice does not clarify how DOE intends to provide for such integration in the annual peer review of long-term systems performance. At a minimum, for the results of this process to be included as a part of a license application, peer-reviewed calculations and assessments should be evaluated by the standing committee in terms of the overall system performance objectives of Part 60."

DOE Response:

The NRC is concerned with the potential loss of a total system performance context when groupings of technical guidelines are considered sequentially. DOE's Program Plan identifies a Total System Performance Assessment TBR in 1997 wherein the data and analyses are provided to support the evaluation of the qualifying conditions in several of the system guidelines. The qualifying and disqualifying conditions for the technical guidelines in 10 CFR Part 960 are considered in a sequential manner, in appropriate groupings. In providing the basis for evaluating

the technical guidelines, some physical system or mechanistic subsystem models are likely to be documented in TBRs. The system guideline is considered in the total system roll-up in 1997. DOE believes, therefore, that we are not evaluating the technical guidelines in a context that is independent of the total system.

With respect to integration in annual peer reviews of long-term system performance, the FRN passage in question is no longer applicable and was removed from the NAS's peer review work scope. The issue of NAS peer review of the performance assessment technical basis report (SII, B., Establish a standing review committee for OCRWM's assessments of postclosure performance at the repository) did not take adequate note of applicable statute (Federal Advisory Committee Act) in the concept that was explained in our October 31, 1994 FRN. OCRWM's final Proposed Scope of Task for the NAS's Board on Radioactive Waste Management for peer review of the technical bases for the suitability evaluation process has been revised to delete SII, B. in its entirety.

NRC Comment:

"We note that NRC has provided guidance for peer reviews that DOE would use in support of a HLW license application. This guidance appears in NUREG-1297 'Peer Review for High-Level Waste Repositories.' To the extent that DOE plans to use the results of any peer review process to support a license application, it should ensure that the peer reviews are conducted consistent with this guidance. If DOE does not follow the guidance, it will need to show that the process used is acceptable for demonstrating compliance with Part 60. However, use of an alternative to the guidance given in NUREG-1297 could impact the staff's ability to review a future license application in a timely manner. For these reasons, consideration should be given to establishing a peer review process consistent with NRC guidance on peer reviews provided in NUREG-1297."

DOE Response:

DOE made a specific inquiry to NAS about their willingness to provide peer review documentation in a format and content that would meet NUREG-1297 expectations. The NAS informed DOE that it would not alter its peer review documentation to be in conformance to a NUREG-1297 peer review.

DOE agrees that any peer review used to support a license application would need to fully consider NUREG-1297. The peer reviews managed by the NAS address technical information and interpretations of data in TBRs that are used ultimately as inputs for DOE's decisions on compliance with its own siting guidelines in 10 CFR Part 960. It should be stressed that

management of the TBR peer review process is independent of the DOE by design, as explained above, and so there is limited opportunity to direct the NAS to conduct the peer reviews in specific ways or to pattern the resulting documentation.

DOE may include data discussed in TBRs by reference, or we may include the TBR itself by reference, in the draft License Application Annotated Outline (LAAO) submitted to the NRC. DOE does not, however, envision including any component of an NAS peer review, or its results, in the LAAO.