Encl to 12-17-82 memo to McDougall

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 15 1982

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WM-10

MEMORANDUM FOR: BWIP Group Coordinators

FROM: R.J. Wright, BWIP PM, WMHT, WM

SUBJECT: STANDARD OUTLINE FOR CHAPTERS OF THE DRAFT SITE CHARACTERIZATION ANALYSIS

Through experience with the DSCA chapter mock-ups and after a preliminary look at Draft 1, a standard outline for most of the DSCA technical chapters has been evolved. It is basically similar to the suggested outlines that I discussed with most of you last week, during the review of the mock-ups.

The standard outline is attached. It is expected to be used for all chapters with the exceptions of: Chapter 1 (Introduction), 2 (Description of Facility), 3 (Site Selection Process), 9 (Environmental Factors), 10 (Quality Assurance) and 12 (Summary of NRC Concerns). Understandably, the fit will be more comfortable for some subjects than for others. It is essential, nevertheless, to have a uniformity of treatment so the DSCA is a unified document, not a collection of mini-essays of various forms.

In DSCA Draft 1, some chapters are more in line with the standard outline than are others. Many of my review comments focus on the organization of chapter contents. In particular, some drafts contain evaluations and recommendations that are scattered throughout the text rather than being centered in sections (4) and (5).

It is essential that each chapter in Draft 2 accord with the standard outline, excepting Chapters 1, 2, 3, 9, 10, 12. If anyone has a problem in meeting this requirement, please see me.

Robert J. Wright
BWIP Project Manager
High-Level Waste Technical
Development Branch
Division of Waste Management

cc: M. Bell
J. Bunting
H. Miller

Attachment

STANDARD OUTLINE FOR DSCA CHAPTERS

1. Introduction

   1.1 Type of material presented in the SCR

   1.2 Relevant sections of 10 CFR 60

   1.3 Relation of SCR and NRC issues (making use of Appendix C)

2. Summary of SCR conclusions and assertions

3. Analysis and discussion of issues, conclusions and assertions in the SCR

4. Evaluation of site characterization plans and program

5. Recommendations for site characterization plans and program

To Chris
From: Phil

3 SITE CHARACTERIZATION ANALYSIS: THE SITE SELECTION PROCESS

3.1 Introduction

In this chapter of the Site Characterization Analysis, the staff will analyze the process by which DOE selected a reference repository location at the Hanford Reservation. Beginning in section 3.3, the staff will briefly describe specific aspects of the site-selection process. These descriptions either restate or paraphrase the Site Characterization Report and its references. The staff's analysis will follow each description.

3.2 The National Waste Terminal Storage Program

The DOE has given the National Waste Terminal Storage (NWTS) Program the task of finding and characterizing sites for a geologic repository. The NWTS geologic field offices are investigating basalt (the Basalt Waste Isolation Project (BWIP)), volcanic tuff (Nevada Nuclear Waste Storage Investigations (NNWSI)) and salt and crystalline rocks (Office of Nuclear Waste Isolation (ONWI)) as potential geologic media for a high level waste (HLW) repository. Figure ____ in Appendix A shows where these investigations are taking place.

Basalt, volcanic tuff, and salt are the primary media under consideration. A schedule for the activities planned for each of these media appears in Figure___, Appendix A. The BWIP site characterization report (SCR) is the first of three SCR's DOE will submit to NRC. The SCR for tuff is scheduled for June 1983, and for salt, July 1983.

The NWTS Program is following a three phase siting process consisting of (1) site screening (2) detailed site studies, and (3) site selection (see Figure___ in Appendix A). This siting process is described in the DOE Public Draft, National Plan for Siting High-Level Radiactive Waste Repositories and Environmental Assessment, DOE/NWTS-4 (Ref. 7). (The staff will refer to this

document as the National Siting Plan). A brief description of each phase of the siting process follows.

3.2.1 Site Screening

The first phase of the siting process, termed site screening, covers the activities planned to find sites favorable for waste isolation. DOE uses several approaches to begin site screening. The approaches differ in their geographic starting points. The host-rock approach begins by identifying large, multi-state regions of the country, overlying geologic formations of potential interest. Early in the NWTS program, DOE used the host rock approach to delineated regions containing salt domes and bedded salt formations which may be suitable for a geologic repository. More recently, DOE has screened the U.S. for regions containing crystalline rocks such as granite.

Another approach, termed the land-use approach, investigates land already owned by the federal government and committed to nuclear activities. In particular, DOE has initiated siting studies in Nevada (Nevada Test Site) and Washington (Hanford Site) using the land-use approach. Although DOE is pursuing two additional approaches to site screening (province screening and simultaneous screening), DOE expects that the nation's first repository will be selected by either the land-use or host-rock approach.

3.2.2 Detailed Site Studies

After completing site screening, DOE will begin detailed site studies. Here, DOE assesses the safety, environmental, regulatory, and societal concerns associated with constructing and operating a geologic repository at a particular site. The BWIP Site Characterization Report (SCR) details how DOE plans to make the above assessments at Hanford.

3.2.3 Site Selection

Site selection is the process by which one or more sites are selected by DOE with the intent to apply for a construction authorization from the NRC.

(licensing process). As part of the licensing process, DOE will prepare a Safety Analysis Report and an Environmental Report for the repository site it has chosen. The NRC, in turn, will prepare an Environmental Impact Statement for its decision to authorize the construction of the repository.

3.3 Selection of the Hanford Reservation

3.3.1 DOE Rational For Its Selection of the Hanford Reservation

The DOE is considering the thick basalt sequence of the Columbia Plateau for siting a repository for radioactive wastes. The Columbia Plateau covers 78,000 mi^2, extending across southeast Washington and parts of Idaho and Oregon. In 1976, DOE began site feasibility studies in the Columbia Plateau to assess the hydrologic and geologic properties of basalt. The purpose of these investigations was: "...to provide geologic and hydrologic information necessary to identify areas beneath the Hanford Site that have a high probability of containing basaltic rock suitable for a nuclear waste repository" (Refs. 1,2). Later, in 1978, the National Academy of Science (NAS) recommended that DOE consider the Rattlesnake Hills at Hanford, as a possible storage site for nuclear wastes (Ref. 15). The NAS surmised that a nuclear waste repository could be excavated between the perched water table, high in the hills, and the main water table.

DOE selected Hanford as a potential repository site primarily because of its land-use. Hanford is owned by the Federal government and has been committed to nuclear activities since 1943. After many years of commitment to nuclear activities, extensive portions of the Hanford Reservation would never be returned to unrestricted land-use; thus, Hanford is considered to be highly appropriate for continued equivalent use (BWIP-SCR). In addition, DOE had some technical reasons for selecting Hanford. Considerable geologic and hydrologic data has been gathered on the Pasco Basin. Much of this data is closely aligned with the objectives of finding a site for a nuclear waste repository (Refs. 2,3). Also, DOE maintains that the Pasco Basin's nearly uniform physical characteristics and thick basalt flows make it an attractive site for a repository (Ref. 5).

3.3.2 Staff's Analysis of DOE's Rationale For Selecting the Hanford Reservation

The NWTS National Siting Plan states that the first repository will be selected through either a land-use approach or a host rock approach. The Hanford Reservation was selected by the land-use approach. By using the land-use approach, DOE has by-passed two screening steps that occur when the host-rock approach to siting is used. When the host-rock approach is used, the screening program would pass through national and regional surveys before area surveys could begin. When a land-use approach is used, the site investigation begins with an area survey (see Figure ____, Appendix A).

National and regional surveys have led to several study areas. For example, investigations at the Paradox Basin alone have delineated four study areas: Salt Valley, Gibson Dome, Elk Ridge and Lisbon Valley. Since the land-use approach omits national and regional surveys in its screening process, there is only one study area. For the BWIP, this study area is the Pasco Basin .

If the BWIP-SCR is [illegible] to provide some basis for future National Environmental Policy Act (NEPA) decisions, DOE should have shown, in the SCR, how the Pasco Basin compares to other study areas, particularly those which are also dedicated to nuclear activities (e.g., land in South Carolina, Idaho, New Mexico and Nevada). The staff recommends that DOE makes this comparison in the BWIP-semiannual reports. As an alternative, DOE could compare the Pasco Basin area to study areas selected by the host-rock approach.

Could we use this type of approach constantly?

By comparing the Pasco Basin area to other study areas, DOE could confirm that Hanford is a reasonable repository site alternative for NEPA purposes. The NRC will be required to prepare an environmental impact statement (EIS) to support its decision to authorize the construction of a geologic repository. Under the provisions of the National Environmental Policy Act (NEPA) and the NRC procedural rule (46 FR 13973), the alternative repository sites, presented in the EIS, must be among the best that can reasonably be found. The staff feels that DOE should confirm that the Hanford Reservation is a reasonable alternative for a repository site before NRC begins its formal NEPA process.

That is — you side stepped the question but must give an answer immediately

3.4 The BWIP Site Screening Process

The BWIP site screening process begins at the Pasco Basin (1600 mi^2) and ends at the reference repository location (18 mi^2). Three objectives guide DOE's progression from large to smaller land areas:

- maximize public health and safety
- minimize adverse environmental and socioeconomic impacts
- minimize system costs

Before these objectives could be realized, some assumptions had to be made on how a repository would be constructed, how it would operate, and what impacts it may have. These assumptions are listed in reference 5.

Having established their objectives and made their assumptions, DOE prepared screening guidelines. (see p.p. 2.2-9 through 2.2-13 of the SCR) The guidelines where depicted on map overlays and applied in five steps to areas under study. Starting at the Pasco Basin, each step successively reduced the land area that would be considered in the following step. At the end of each step the following areas were defined:

Step 1 - Pasco Basin or study area (1,600 mi^2)
Step 2 - candidate area (several hundred mi^2)
Step 3 - subarea (approximately 100 mi^2)
Step 4 - site locality (up to 50 mi^2)
Step 5 - candidate site (approximately 10 mi^2)

The overlay process ended with nine candidate sites, all on the Hanford Reservation.* At this point in the screening program DOE discontinued using overlays and began a comparative evaluation of the candidate sites. Five attributes were used to provide a means of comparing and eventually differentiating among the sites. The attributes include:

- Distance to discharge areas
- Structural geologic considerations

- Site biologic impact
- Distance to potentially hazardous facilities
- Potential for repository expansion

These attributes were used to quantitatively measure a condition or charactristic of the candidate site by means of actual unit scale, such as distance or a constructed scale that quantified the conditions. For example, under the site attribute, "potential for repository expansion," a site condition which would allow expansion for say 6 miles would be given a higher value than one which allow expansion for 2 miles. In a similar fashion, all the conditions or characteristics for a particular candidate site were assigned a value, the values were totalled and the sites with the highest score were considered the most attractive. The results of the comparative evaluation of the candidate sites showed that the central portion of the Cold Creek syncline area (Figure ___, Appendix A) should be evaluated in the final screening phase.

The final phase of site-selection deliniated a reference repository location (18 mi^2) within the Cold Creek syncline area. Ranking criteria, analagous to the attributes used in the previous screening phase, were applied to each candidate site in the Cold Creek syncline area. The ranking criteria include:

- Structural geology
- Seismucity
- Geohydrology
- Man's activities
- Host rock characteristics
- Environment

*At one point in the site screening process, DOE evaluated 4 subareas (each approximately 100 mi^2) located outside the Hanford boundry but within the Pasco Basin. Three subareas were eliminated from consideration because of land use and hydrological conflicts. The remaining subarea was dropped because of conflicts in land use, hydrology, bedrock dip and tectonic stability. DOE concluded from this evaluation: "Because no area of the Pasco Basin outside of the Hanford Site was found to be obviously superior to areas within the Hanford Site, further study to identify (repository) site localities was concentrated on the subareas of the Hanford site." (Ref. 4)

Then the sites were ranked using an ordinal dominance analysis (see ref. 5 for details). The outer boundaries of the sites ranked highest incribed the reference repository location (Figure__, Appendix A).

3.5 Staff Analysis of the BWIP Site-Selection Process

As discussed in Section 3.4, DOE applied screening guidelines to the Pasco Basin to find nine candidate sites for a geologic repository. The SCR references a document that compares the BWIP screening guidelines to those recommended by the National Waste Terminal Storage Program (NWTS) (Ref. 13). This document, entitled Comparison of NWTS-33(2) Criteria and Basalt Waste Isolation Project Screening Considerations, RHO-BW-EV-IP, compares BWIP criteria with a draft version of the NWTS criteria (Ref. 12). The final NWTS document (Ref. 12) recommends several screening criteria which were not applied at BWIP. Specifically, the staff finds that the following NWTS criteria were omitted from the BWIP site-selection process:

- A site's geohydrology should:
  1. be compatable with retrival.
  2. minimize contact time between groundwater and waste.
  3. ~~permit~~ modeling.
- A site's geochemistry should have characteristics compatible with retrival.
- A site's resources, ~~such as~~ particularly water, should be evaluated to assess the likelihood of human intrusion
- A site should be located such that risk to the population from transportation of radioactive waste can be reduced below acceptable levels to the extent reasonably achievable.

In selecting the reference repository location, DOE considered mineral deposits and transportation impacts, but not in sufficient depth. DOE should have evaluated water resources as well as mineral resources. Given the arid environment of the Pasco Basin and the expected agricultural growth, water resources may be a limiting factor when repository construction begins. DOE did not

consider transportation guidelines until the locality phase of site screening. Transportation impacts, however, will not be limited to the locality of the proposed site, alone. High level waste must be transported across the nation to reach a repository at Hanford, Washington. The staff recommends that DOE evaluate transportation and water-use impacts during their detailed investigations at Hanford.

Even though BWIP did not use all of the NWTS screening criteria, the staff believes that the reference repository location is at least as good as any location within the Pasco Basin. Some of the NWTS criteria may be more appropriate for national and regional surveys and could not distinguish one site from another within Hanford's 620 mi^2 area. Nevertheless, BWIP should not omit any of the NWTS screening criteria without some explanation. Selective implementation of the NWTS criteria can create inconsistencies among repository investigations in different geologic media. For example, the Office of Nuclear Waste Isolation (ONWI), which is investigating domal salt for a potential repository site, is using different terminology than BWIP. In reference 14, an ONWI document, each of seven salt domes is called a "candidate site" while the same term does not appear in the BWIP program until DOE was fairly certain where the repository would be located. Likewise, reference 14 refers to a "repository location" but does not define its size. At BWIP a repository location can cover an area of up to 50 mi^2 (except for the reference repository location which covers 18 mi^2).

3.5 Staff Conclusion

Based on our review of the BWIP SCR and its supporting documents, the staff offers the following comments and conclusions regarding the DOE site selection process.

- The DOE did not adequately compare the Pasco Basin study area to other study areas selected by either the land-use or the host-rock approach (as described in the NWTS National Siting Plan). The staff feels that DOE should make this comparison, perhaps in the BWIP semiannual reports, before the NRC NEPA process begins. The study areas should be compared at the

same level of detail as the area survey phase of characterization in the National Siting Plan. An early comparison of study areas will ensure that only reaonable alternatives will be considered during the licensing process.

- None of the other sites within the Pasco Basin that were evaluated by DOE in the SCR are preferrable to the reference repository location.

- Differences between the BWIP and NWTS siting criteria can be attributed to the different geographic starting point for the host-rock and land-use siting concepts. The differences do not indicate that the NWTS and BWIP site-screening guidelines are inconsistant or that the BWIP guidelines were ineffective. The differences will, however, complicate a comparison between BWIP and repository projects which have followed the NWTS guidelines more closely.

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3 SITE CHARACTERIZATION ANALYSIS: THE SITE SCREENING PROCESS USED AT THE BASALT WASTE ISOLATION PROJECT (BWIP)

3.1 Introduction

The Basalt Waste Isolation Project (BWIP) is considering the thick basalt sequence of the Columbia Plateau for siting a repository for radioactive wastes. The Columbia Plateau covers 78,000 mi^2, extending across southeast Washington and portions of Idaho and Oregon. In 1976, DOE began site feasibility studies in the Columbia Plateau to assess the hydrologic and geologic properties of basalt. The purpose of these investigations was: "...to provide geologic and hydrologic information necessary to identify areas beneath the Hanford Site that have a high probability of containing basaltic rock suitable for a nuclear waste repository." (Refs. 1,2)

From its beginning, BWIP had planned to locate the candidate repository site on the Hanford Reservation. DOE gives three reasons for this decision: First, Hanford is on Federal land presently dedicated to nuclear waste management activities (Ref. 3). Secondly, considerable geologic and hydrologic data has been gathered on the Pasco Basin. Much of this data is closely aligned with the objectives of finding a site for a nuclear waste repository (Refs. 2,3). And thirdly, the Pasco Basin's nearly uniform physical characteristics and thick basalt flows make it an attractive site for a repository (Ref. 5).

At one point in the site screening process, DOE evaluated 4 subareas (each approximately 100 mi^2) located outside the Hanford boundry but within the Pasco Basin. Three subareas were dropped because of land use and hydrological conflicts. The remaining subarea was dropped because of conflicts in land use, hydrology, bedrock dip and tectonic stability. DOE concluded from this evaluation: "Because no area of the Pasco Basin outside of the Hanford Site was found to be obviously superior to areas within the Hanford Site, further study to identify (repository) site localities was concentrated on the subareas of the Hanford site." (Ref. 4)

This review will focus on the site screening process which took DOE from the Hanford Reservation (620 mi^2) to the reference repository location (RRL) (18 mi^2). Before examining or criticizing what DOE has done, this review will first restate, very briefly, how the BWIP site-screening process works. The reader is referred to the Site Characterization Report (SCR) and the references for this chapter for more detailed information.

3.2 The BWIP Site Screening Process

The entire site screening process at Hanford was developed from three objectives:

- maximize public health and safety
- minimize adverse environmental and socioeconomic impacts
- minimize system costs

Before these objectives could be realized, some assumptions had to be made on how a repository would be constructed, how it would operate and what impacts it may have. These assumptions are listed in reference 5.

Having established their objectives and made their assumptions, DOE prepared 27 screening guidelines. These guidelines where depicted on map overlays and applied in four steps to areas under study. Each step successively reduced the land area that would be considered in the following step. At the end of each step the following areas were defined:

Step 1 - candidate area (several hundred mi^2)
Step 2 - subarea (approximately 100 mi^2)
Step 3 - site locality (up to 50 mi^2)
Step 4 - candidate site (approximately 10 mi^2)

The overlay process ended with nine candidate sites. At this time the screening process discontinued using overlays and began to rank the candidate sites using a dominance analysis technique. This technique found that the candidate sites overlying the Cold Creek syncline were the most suitable for a repository.

The final phase of site screening identified a reference repository location (RRL) within the Cold Creek syncline. Again, a ranking process compared and evaluated the candidate sites, but with the benefit of more detailed and recently acquired technical data. This enlarged data base is referred to as a Criteria Matrix (Ref. 5). Data collection for this final phase of site screening ended on May 16, 1980, although updates of specific information continues.

3.3 NRC Review of the BWIP Site Screening Process

The BWIP screening process can be divided into three phases: each distinguished by its screening criteria. In the first phase, 27 guidelines - applied through map overlays - reduced the screening area from the Pasco Basin (1,600 mi^2) to nine candidate sites (each approximately 10 mi^2). In the second phase, ranking factors selected the Cold Creek syncline area through a comparitive evaluation of the nine candidate sites. In the final phase a Criteria Matrix delineated the reference repository location. Each phase has its own set of screening criteria: phase 1; 27 guidelines, phase 2; ranking factors, and phase 3; a Criteria Matrix. The staff's review of these screening criteria follows.

3.3.1 Screening Guidelines

were derived

Twenty-seven screening guidelines from assumptions on a repository's construction, operation and environmental impacts. The guidelines were graphically represented on map overlays, which, in turn, were applied to maps of the Pasco Basin, and later, the Hanford Reservation. The overlays were applied in four successive stages, which ended with nine candidate repository sites.

DOE did not consider transportation guidelines until the locality phase (step 3, page 3.2) of site screening. The transportation guideline would exclude repository sites within 0.6 miles of highways, interstate highways, railroads and navigable waterways (Ref. 6). The NRC concurs that for safety reasons a repository should not be built along a transportation corridor. At the same time, however, a repository should be accessible to the sources of high-level radioactive waste (HLW).

At some point in the site screening process, DOE should have evaluated the impact of transporting HLW, across the nation, to Hanford, Washington. National transportation guidelines are or will be established for repository programs investigating non-DOE land (Ref. 7). Unless BWIP does the same, NRC has an incomplete basis for comparing Hanford to other repository sites.

The National Plan For Siting High-Level Radiological Waste Repositories (Ref. 7) has also developed screening guidelines which are generally consistent with those used at Hanford. However the following National Plan guidelines do not appear to ~~have a counterpart~~ in the Hanford program:

1. geohydrological regime
2. hydrological regime/shaft construction
3. subsurface rock dissolution
4. geochemical interactions with the waste package
5. engineering feasibility
6. uplift or subsidence rates
7. exploration history
8. subsurface hydrological system
9. meteorological concerns
10. human proximity
11. normal and extreme environmental conditions

DOE acknowledges that there will be variations in the screening process, depending upon where it is applied. The BWIP screening process begins at a greater level of detail than the National Plan since two screening steps, National surveys and Regional surveys, were omitted in the BWIP program. Consequently, a particular condition, such as meteorology, would be an appropriate guideline at the National level, but would be irrelevant if the entire screening area had the same climate (as in the Pasco Basin).

3.3.2 Ranking Factors

In phase II of the screening process, five ranking factors evaluated the nine candidate sites. The ranking factors are:

- distance to discharge
- structural geologic conditions
- site biological impacts
- distance to potentially hazardous facilities
- potential for repository expansion

Site attributes were listed under each ranking factor. The attributes correspond to conditions at the candidate sites. Each attribute was given a numerical value designating its importance. For example, under the ranking factor, "potential for repository expansion," a site attribute which would allow expansion for say 6 miles would be given a higher value than one which would allow expansion for 2 miles. The attribute values for each site were totalled and the sites with the highest score were considered the most suitable.

Numerical ranking was useful at Hanford because of the surface and subsurface variability among the candidate sites. However, assigning numerical values to qualitative attributes, for example, wildlife habitat, can be subjective. Researchers in other repository programs may assign a different value to the same attribute creating inconsistencies in their respective screening programs.

3.3.3 Criteria Matrix

The final phase of the BWIP screening program continues the ranking process only more detailed and recent data were used. A Criteria Matrix assigned a numerical value to an expanded list of attributes for each candidate site. The Criteria Matrix was developed from assumptions on baseline repository conditions.

One of the ~~Criteria Matrix~~ baseline assumptions states that liquid defense waste may be placed in the repository. This is inconsistent not only with draft 10 CFR 60.135(c)(1) (wastes shall be in solid form) but also with the HLW programs at Savannah River and West Valley. Both programs have prepared environmental impact statement for solidifying their liquid high-level waste

(Refs. 8,9). Savannah River has already selected borosilicate glass to be the waste form (Ref. 10) and we expect West Valley to do the same. Unless the liquid defense waste is something other than HLW, the DOE should not assume that it will be placed in a repository licensed by the NRC.

3.4 Conclusion

The BWIP site screening program has demonstrated that the reference repository location is as good or better than any other site within the Pasco Basin. But DOE has not shown how the Hanford site compares to those outside of the Pasco Basin. Before the NRC can prepare an environmental impact statement for its decision to license a repository, the NRC must affirm that the Hanford site is a reasonable alternative, i.e., Hanford must compare favorably to other candidate sites.

One way of comparing candidate repository sites is to compare their respective screening processes. The Hanford Reservation was essentially the geographic starting point for the BWIP site screening process. The DOE has given some good reasons for concentrating their efforts at Hanford. However, none of these reasons appear in the National Siting Plan. Conversely, the National Siting Plan used screening guidelines which were not used at BWIP. Consequently, the NRC will find it difficult to compare the Hanford site to those which have benefited from National and Regional Surveys and were selected by a different set of screening guidelines (e.g., Paradox Basin and Permian Basin).

The NRC does not expect that each repository site will be selected by the same screening plan. However, we do expect individual screening plans to use consistent terminology, and, during their early phases, use similar screening guidelines. With a common basis of comparing sites, the NRC would be in a better position to judge Hanford or any other site as being a reasonable alternative.

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November 12, 1982

WMPI: 101.1

MEMORANDUM FOR: Regis G. Boyle, Group Coordinator
Institutional and Environmental Concerns
Review Group

THRU: John J. Surmeier, Section Leader
Policy Analysis Section

FROM: Rob MacDougall
Policy Analyst

SUBJECT: COMMENTS ON DRAFT SITE CHARACTERIZATION ANALYSIS OF BWIP SITE SELECTION PROCESS

At your request, I've reviewed the draft site characterization analysis prepared prior to our receipt of the Department of Energy's (DOE's) Site Characterization Report (SCR) for the Basalt Waste Isolation Project (BWIP). Here are my comments:

1. The draft inadvertently promotes an impression at the outset that NRC is accepting DOE's site screening process uncritically. Half of it is devoted simply to describing DOE's process. More important, it is structured to track the steps in DOE's site screening process, rather than the issues we have to address arising from the elements required to be included in the SCR. Under Section 60.11(a) of the rule, these elements are:

    1. "(2) the criteria used to arrive at the candidate area;"

    2. "(3) the method by which the site was selected for site characterization;"

    3. "(4) identification and location of alternative media and sites at which DOE intends to conduct site characterization and for which DOE anticipates submitting subsequent Site Characterization Reports;" and

    4. "(5) a description of the decision process by which the site was selected for characterization, including the means used to obtain public, Indian tribal and State views during selection"

OFC	:WMPI	:WMPI	:	:	:	:	:
NAME	:RMacDougall	:JJSurmeier	:	:	:	:	:
DATE	:82/11/12	:82/11/12	:	:	:	:	:

It would promote the perception that we have made a good faith attempt at rigorous, systematic analysis if our review were structured according to the issues arising under these elements of the SCR.

2. Considering the likelihood that our analysis will be skeptically received by a suspicious public, the first paragraph of page 3-2 is especially troublesome. It says that our review will focus on the screening process that took DOE from the Hanford Reservation to the reference repository location. This conveys a false impression that we intend to avoid the critical issue of how DOE arrived at Hanford in the first place. The conclusion does point out that DOE has not shown how the Hanford site compares to those outside the Pasco Basin, but I doubt that the public would judge our review as complete if we devoted no more than a few sentences to address this fundamental part of the site selection process. I haven't seen the SCR, but if I can safely assume that its discussion of the siting process justifies what follows below, I would suggest we point out that:

a. Under current NEPA law, NRC will have to examine reasonable alternatives to authorizing construction at the site proposed by DOE, and in making that examination in the course of a licensing proceeding, NRC will have to determine that the alternative sites investigated by DOE are reasonable.

b. The process by which DOE selects the slate of alternative sites for characterization becomes especially critical in light of the possibility that Congress may enact pending legislation allowing NRC to consider only the sites characterized by DOE as alternatives under NEPA.

c. We see nothing in the prior nuclear-related federal land use approach to site screening that would disqualify a site selected under this approach as a reasonable alternative for location of a repository. (Note: DOE's National Siting Plan calls these concepts "approaches" rather than "guidelines.") However, we also see no evidence in the SCR that DOE comparatively examined all the federal nuclear reservations that fall into this category before choosing the Hanford site as a reasonable alternative for characterization.

OFC	WMPI	WMPI					
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d. We also see no evidence in the SCR that DOE has undertaken a comparative evaluation of screening approaches other than prior nuclear-related federal land use in arriving at the selection of Hanford as the first site to be characterized. Since NRC will have to consider DOE's comparative evaluation at the licensing stage, we believe DOE should complete this evaluation soon before too much is invested in a site that may turn out to compare unfavorably with sites selected under other screening approaches.

3. Another thing likely to enhance a false impression about our critical intent is the format of our analysis. Since the first three pages are devoted almost completely just to describing DOE's process, it is easy for the reader to miss the beginning of our critical analysis at the bottom of page 3-3. Perhaps it would be useful to break out our comments with an underlined notation (e.g., NRC Comment:) preceding our remarks, which should be delivered in a separate paragraph where possible. Also, since the Federal Register notice of our receipt of the BWIP SCR points out that our Site Characterization Analysis (SCA) will have to be read in conjunction with the SCR, I don't think we need to devote so much valuable space to describing DOE's process and its rationale.

4. If DOE has failed to describe in the SCR "the means used to obtain public, Indian tribal and State views during selection" under Section 60.11(a)(5) above, we should be prepared to say so.

5. The conclusion section (3.4) should expand on the point made in the discussion of screening guidelines (3.3.1.). I believe we should recommend that in the future, transportation factors be given thorough consideration before the locality stage of the site screening process, since transportation impacts from construction and operation of a repository will not be limited to the locality of the proposed site alone.

6. The conclusion contains important points, but some of them (eg., in the first paragraph) are new and don't appear to be integrally related to the analysis preceding it. The conclusion should be presented as our judgments on the most important issues arising from DOE's description of its criteria, methods, alternatives, and and site screening decision process under Section 60.11(a). It would

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thus track our previous discussions of each of the elements of the SCR (see comment 2.), reinforcing the thoroughness of our review.

7. Several good points in the conclusion itself could be strengthened for emphasis. For example, instead of saying in the second full paragraph that "NRC will find it difficult" to compare Hanford with sites selected from national and regional surveys under other screening guidelines, we should say that without a comparative analysis of the screening approaches by which DOE selected all the candidate sites on its current slate, DOE cannot expect NRC to be able to make timely NEPA determinations at the construction authorization stage.

Similarly, instead of saying in the last sentence of 3.4 that "NRC would be in a better position" to judge Hanford as a reasonable alternative, we could say that without consistent use of screening guidelines under the several approaches to site selection, DOE will not provide NRC sufficient basis to judge Hanford or any other site as a reasonable alternative.

In the last sentence of the first paragraph of this section, I'm not sure that we have to find that Hanford "compares favorably" to other sites in order to find it a "reasonable alternative." The phrase "compares favorably" suggests that the site has to be found superior to others to be considered a reasonable alternative. Perhaps it would be better to say that to find a site a "reasonable alternative," we have to find that alternatives to the site in question are "not obviously superior." As I understand it, this is the test used in NEPA analyses for reactor licensing, so it may have the advantage of familiarity.

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 24 1982

MEMORANDUM FOR: Regis G. Boyle, Group Coordinator
Institutional and Environmental
Concerns Review Group

THRU: John J. Surmeier, Section Leader
Policy Analysis Section

FROM: Rob MacDougall
Policy Analyst

SUBJECT: COMMENTS ON 18 NOVEMBER DRAFT SITE CHARACTERIZATION ANALYSIS OF BWIP SITE SCREENING PROCESS

I have reviewed the latest available draft of the attached document, and as requested have attached it with marginal notes, comments, and suggestions. In general, it appears a good deal stronger, but I believe the conclusions do not reflect the intent of 10 CFR 60. Overall, I recommend that we:

1. State at the outset that the purpose of this chapter of the SCA is to evaluate the extent to which the information in DOE's SCR fulfills the requirements of Section 60.11(a), subparagraphs (2) through (5), and cite these provisions in full to show their applicability to DOE's site selection process.

2. Conclude that since subparagraph (a)(2) requires a description of "the criteria used to arrive at the candidate area," and (a)(3) and (a)(5) require, respectively, a description of the "method" and the "decision process" by which the site was selected for characterization, much of the discussion of the site screening process within the Pasco basin is irrelevant to the criteria, method, and decision process by which the Pasco basin was selected as a candidate area in the first place. Indeed, the SCR itself says on page 2.0-2 that the "overall goal [of the site screening process carried out by BWIP] was to identify a reference repository location (i.e. preferred site) and an alternate repository location within the Hanford Site."

3. As the bottom line for this SCA chapter, tell DOE that without following the provisions of 10 CFR 60.11(a) for a comprehensive description of the site screening process, DOE is proceeding with BWIP site characterization at its own risk. It is therefore

incumbent on DOE to provide at the earliest possible time all the required information on how it came to select the Hanford site, so that the States, tribes, and interested members of the public may comment.

Rob MacDougall
Policy Analyst

Enclosure: Markup of Draft SCA
Chapter 3.

Document Name:
BWIP DSCA/CH 3/PFLUM

Requestor's ID:
DENISE

Author's Name:
PFLUM C

Document Comments:
You MUST return this sheet when submitting corrections!!!!

Comments of Rob MacDougall, WMPI

I still think our analysis should more explicitly track compliance with 60.11(a), especially ¶'s (1) thru (5). An introductory paragraph stating this as the purpose of our analysis would be helpful.

3 SITE CHARACTERIZATION ANALYSIS: THE SITE SCREENING PROCESS USED AT THE BASALT WASTE ISOLATION PROJECT (BWIP)

3.1 Introduction

The Basalt Waste Isolation Project (BWIP) is considering the thick basalt sequence of the Columbia Plateau for siting a repository for radioactive wastes. The Columbia Plateau covers 78,000 mi², extending across southeast Washington and parts of Idaho and Oregon. In 1976, DOE began site feasibility studies in the Columbia Plateau to assess the hydrologic and geologic properties of basalt. The purpose of these investigations was: "...to provide geologic and hydrologic information necessary to identify areas beneath the Hanford Site that have a high probability of containing basaltic rock suitable for a nuclear waste repository." (Refs. 1,2)

From its beginning, BWIP had decided to locate the candidate repository site on the Hanford Reservation. This decision was consistent with a recommendation by the National Academy of ~~Services~~ Sciences? (NAS) to consider the Rattlesnake Hills, at Hanford, as a possible storage site for nuclear wastes (Ref. 15). The NAS surmised that a nuclear waste repository could be excavated between the perched water table, high in the hills, and the main water table.

Do we need to say this? Sounds like we're flacking for DOE.

This rationale doesn't seem to track DOE's, at least on p. 2.0-? of SCR.

In addition, DOE had its own reasons for selecting Hanford for a potential repository site. First, Hanford is owned by the federal government and has been committed to nuclear activities since 1943. Second, considerable geologic and hydrologic data has been gathered on the Pasco Basin. Much of this data is closely aligned with the objectives of finding a site for a nuclear waste repository (Refs. 2,3). And third, the Pasco Basin's nearly uniform physical characteristics and thick basalt flows make it an attractive site for a repository (Ref. 5).

In the view of DOE's contractors; we can't (& shouldn't) judge at this point.

That's because finding a repository site was the purpose of these studies. Sounds like we're saying DOE has good reasons for selecting Hanford because it's "studied" so much, not because studies' conclusions are warranted.

At one point in the site screening process, DOE evaluated 4 subareas (each approximately 100 mi²) located outside the Hanford boundry but within the Pasco Basin. Three subareas were dropped because of "land use* and hydrological conflicts." The remaining subarea was dropped because of "conflicts in land use, hydrology, bedrock dip and tectonic stability. DOE concluded from this evaluation: "Because no area of the Pasco Basin outside of the Hanford Site was found to be obviously superior to areas within the Hanford Site, further study to identify (repository) site localities was concentrated on the subareas of the Hanford site." (Ref. 4)

The DOE has given some good reasons for selecting Hanford as the geographic starting point for the BWIP site screening program. However, the SCR nor the National Plan for Siting High-Level Radioactive Waste Repositories (National Siting Plan, Ref. 7) does not elaborate on these reasons. Using the National Siting Plan, a screening program would pass through national and regional survey before reaching a candidate area stage; the point where the BWIP site-screening program begins. Because of its wider scope, the National Screening Plan uses different screening guidelines than BWIP. Consequently, the NRC will find it difficult to compare the Hanford Site to those which have benefited from National and Regional Surveys and were selected by a different set of screening guidelines (e.g. Paradox Basin and Permian Basin).

3.2 The BWIP Site Screening Process

The site screening process at Hanford was developed from three objectives:

- maximize public health and safety
- minimize adverse environmental and socioeconomic impacts
- minimize system costs

Before these objectives could be realized, some assumptions had to be made on how a repository would be constructed, how it would operate and what impacts it may have. These assumptions are listed in reference 5.

Having established their objectives and made their assumptions, DOE prepared screening guidelines. The guidelines where depicted on map overlays and applied in four steps to areas under study. Each step successively reduced the land area that would be considered in the following step. At the end of each step the following areas were defined:

Step 1 - candidate area (several hundred mi^2)
Step 2 - subarea (approximately 100 mi^2)
Step 3 - site locality (up to 50 mi^2)
Step 4 - candidate site (approximately 10 mi^2)

The overlay process ended with nine candidate sites. At this time the screening process discontinued using overlays and began to rank the candidate sites using a dominance analysis technique. This technique found that the candidate sites overlying the Cold Creek syncline were the most suitable for a repository.

The final phase of site-screening identified a reference repository location (RRL) within the Cold Creek syncline. Again, a ranking process compared and evaluated the candidate sites, but with the benefit of more detailed and recently acquired technical data. This enlarged data base is referred to as a Criteria Matrix (Ref. 5). Data collection for this final phase of site screening ended on May 16, 1980, although updates of specific information continues.

3.3 NRC Review of the BWIP Site Screening Process

The BWIP screening process can be divided into three phases: each distinguished by its screening criteria. In the first phase, screening guidelines - applied through map overlays - reduced the screening area from the Pasco Basin (1,600 mi^2) to nine candidate sites (each approximately 10 mi^2). In the second phase, ranking factors selected the Cold Creek syncline area through a comparative evaluation of the nine candidate sites. In the final phase a Criteria Matrix delineated the reference repository location. Each phase has its own set of screening criteria: phase 1; screening guidelines, phase 2; ranking factors, and phase 3; a Criteria Matrix. The staff's review of these screening criteria follows.

3.3.1 Screening Guidelines

Like repository programs in other media, BWIP follows the programs and objectives of the National Waste Terminal Storage Program (NWTS). NWTS has prepared site performance criteria which..."delineate characteristics a site must have to ensure that the disposal system will perform as required" (Ref. 12). The NWTS performance criteria are general, but, nevertheless, important. Unless each repository program builds their site-screening guidelines from the NWTS criteria, there can be no common basis for comparing alternative repository sites in different geologic media. Without a comparative analysis of alternative repository sites, NRC may be unable to prepare an Environmental Impact Statement (EIS) for its decision to authorize the construction of a geologic repository.

The SCR states: "Siting criteria being applied to selecting a repository site within the Hanford site are comparable, however, to those resulting from the national screening process as discussed in Chapter 2." In chapter 2, the SCR states that reference 13, Comparison of NWTS-33(2) Criteria and Basalt Waste Isolation Project Screening Considerations, shows that the screening process used to identify the site of a proposed exploratory shaft (at Hanford) is compatible with the NWTS site qualification criteria for geologic repositories.

In reference 13, DOE compares the BWIP site screening guidelines with a draft version of the NWTS performance criteria (ONWI-33(2)) which differs from the final version (NWTS-33(2)). The staff finds that the BWIP site screening criteria differ from the final NWTS criteria in the following ways:

1. NWTS criteria for geohydrology states that the site will have characteristics:

   a. compatable with retrieval
   b. that will minize contact time between groundwater and wastes
   c. that will permit modeling to show that present and probable future conditions have no unacceptable impact on repository performance

BWIP has no site-screening criteria for the above concerns.

2. NWTS criteria for geochemistry states that the site:

   a. will have characteristics compatible with retrieval
   b. will be located so that chemical interactions between radionuclides, rocks, groundwater, or engineered components will not unacceptably affect system performance

BWIP has no site-screening criteria for the above concerns.

3. NWTS criteria for geologic characteristics states that the site will have characteristics compatible with retrieval.

The BWIP criteria do not.

4. NWTS criteria for human intrusion states that the site's resources, such as water, should be evaluated to assess the likelihood of human intrusion.

BWIP has similiar criteria for mineral resources but does not include water.

5. NWTS criteria for demography states that the site shall be located such that risk to the population from transportation of radioactive waste can be reduced below acceptable levels to the extent reasonably achievable.

BWIP did not consider transportation guidelines until the locality phase of site screening. The transportation guideline would exclude repository sites within 0.6 miles of highways, interstate highways, railroads and navigable waterways (Ref. 6). The NRC concurs that for safety reasons a repository should not be built along a transportation corridor. At the same time, however, a repository should be accessible to the sources of high-level radioactive waste (HLW).

At some point in the site screening process, DOE should have evaluated the impact of transporting HLW, across the nation, to Hanford, Washington. National transportation guidelines are or will be established for repository

programs investigating non-DOE land (Ref. 7). If BWIP does the same, perhaps in one of their semi-annual reports, NRC could compare Hanford's transportation impacts to those at other repository sites. The staff recommends that in the future, transportation impacts from construction and operation of a repository be given thorough consideration before the locality phase of the site-screening process, since transportation impacts will not be limited to the locality of the proposed site alone.

The NWTS National Siting Plan lists site-performance criteria ~~guidelines~~ which are ~~consistent with but~~ more comprehensive than the screening guidelines used at Hanford. The NRC staff found that the National Siting Plan has developed criteria in the following areas that were not included in the BWIP screening guidelines:

1. geohydrological regime
2. hydrological regime/shaft construction
3. subsurface rock dissolution
4. geochemical interactions with the waste package
5. engineering feasibility
6. uplift or subsidence rates
7. exploration history
8. subsurface hydrological system
9. meteorological concerns
10. human proximity
11. normal and extreme environmental conditions.

The differences between BWIP and NWTS does not mean the two are inconsistent. ~~The differences, however, will complicate the NRC's~~ comparison of repository site-selection process in different geologic media. Already, the Office of Nuclear Waste Isolation (ONWI), which is investigating domal salt for a potential repository site, is using different terminology than BWIP. For example reference 14, an ONWI document, calls each of seven salt domes a "candidate site" while the same term does not appear in the BWIP program until DOE was fairly certain where the repository would be located. Likewise, reference 14 refers to a "repository location" but does not define its size.

At BWIP a repository location can cover up to 50 mi (except for the reference repository location which covers 18 mi^2).

DOE acknowledges that there will be variations in the screening process, depending upon where it is applied. The BWIP screening process begins at a greater level of detail than the National Siting Plan since two screening steps, National surveys and Regional surveys, were omitted in the BWIP program. Consequently a particular screening guideline which would be useful at a National or Regional level may not distinguish one site from another within Hanford's 620 mi^2. For example, the National Siting Plan has screening criteria for meteorological concerns but BWIP does not because the entire Pasco Basin has the same climate.

3.3.2 Ranking Factors

In phase II of the screening process, five ranking factors evaluated the nine candidate sites. The ranking factors are:

- distance to discharge
- structural geologic conditions
- site biological impacts
- distance to potentially hazardous facilities
- potential for repository expansion

Site attributes were listed under each ranking factor. The attributes correspond to conditions at the candidate sites. Each attribute was given a numerical value designating its importance. For example, under the ranking factor, "potential for repository expansion," a site attribute which would allow expansion for say 6 miles would be given a higher value than one which would allow expansion for 2 miles. The attribute values for each site were totalled and the sites with the highest score were considered the most suitable.

Numerical ranking was useful at Hanford because of the surface and subsurface variability among the candidate sites. However, assigning numerical values to

qualitative attributes, for example, wildlife habitat, can be subjective. Researchers in other repository programs may assign a different value to the same attribute creating inconsistencies in their respective screening programs.

3.3.3 Criteria Matrix

The final phase of the BWIP screening program continues the ranking process with more detailed and recent data. A Criteria Matrix assigned a numerical value to an expanded list of attributes for each candidate site. The Criteria Matrix was developed from assumptions on baseline repository conditions.

One of the baseline assumption states that liquid defense waste may be placed in the repository. This is inconsistent not only with draft 10 CFR 60.135(c)(1) (wastes shall be in solid form) but also with the HLW programs at Savannah River and West Valley. Both programs have prepared environmental impact statement for solidifying their liquid high-level waste (Refs. 8,9), and Savannah River has already selected borosilicate glass to be its waste form. (Ref. 10) The DOE should not assume that liquid HLW will be placed in a repository licensed by the NRC.

3.4 Conclusion

The staff concludes, from its analysis of the BWIP site-screening program, that the reference repository location is as good as any other site within the Pasco Basin. The staff found some differences between the BWIP and NWTS siting criteria. These differences can be attributed to the different geographic starting point for each screening process. The differences do not indicate that the NWTS and BWIP site-screening guidelines are inconsistent or that the BWIP guidelines were ineffective. The differences, however, will complicate a comparison between the BWIP site-screening process to those which have followed the NWTS guidelines more closely (eg. the Paradox and Permian Basin).

The NRC will be required to prepare an environmental impact statement (EIS) to support its decision to authorize the construction of a geologic repository.

Under the provisions of the National Environmental Policy Act (NEPA) and the NRC procedural rule (46 FR 13973), the alternative repository sites, presented in the EIS, must be among the best that can reasonably be found. Before the staff can affirm that the Hanford reference repository location is a reasonable alternative, the staff must find that alternative candidate areas throughout the U.S. are not obviously superior to Hanford.

The NRC procedural rule defines a candidate area as a "...geologic and hydrologic system within which a geologic repository may be located" (10 CFR 60.2(a)). Under this definition, the Pasco Basin would be a candidate area. The procedural rule further states that a site characterization report should include "...the criteria used to arrive at the candidate area" (10 CFR 60.11(a)(3)). The BWIP-SCR, however, does not adequately show why the Pasco Basin was selected for characterization over other candidate areas. Without knowing how the Pasco Basin compares with other candidate areas, the staff cannot state, at this time, that the Pasco Basin (i.e., the Hanford candidate area) is a reasonable alternative for a repository site.

The staff recommends that the ~~BWIP semiannual reports~~ DOE explain why the Pasco Basin was selected for ~~characterization over other~~ candidate areas. The staff recognizes that Hanford's dedication to nuclear activities gives it some institutional and land use advantages over sites that are not. But DOE owns land in South Carolina, Idaho, and New Mexico that is also dedicated to nuclear activities. The semiannual report should explain why these areas were not considered, with Hanford, as potential repository sites.

The staff also recommends that the National Siting Plan compare the advantages of building a repository on a nuclear reservation to the advantages realized through National, Regional, and Area surveys. Arguments can be made, for and against, concentrating nuclear activities at the same site. In a draft report (Ref. 16), DOE states: "Multiple regional repositories will distribute the risk and the environmental, socioeconomic, and potential burdens across the country rather than concentrating them in one region." The National Siting Plan should explain why colocating repositories would be a burden while siting a repository with some other nuclear facility would be an advantage.

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
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NOV 18 1982

WMPI: 101.1

MEMORANDUM FOR: Regis G. Boyle, Group Coordinator
Institutional and Environmental Concerns
Review Group

THRU: John J. Surmeier, Section Leader
Policy Analysis Section

FROM: Rob MacDougall
Policy Analyst

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b. The process by which DOE selects the slate of alternative sites for characterization becomes especially critical in light of the possibility that Congress may enact pending legislation allowing NRC to consider only the sites characterized by DOE as alternatives under NEPA.

c. We see nothing in the prior nuclear-related federal land use approach to site screening that would disqualify a site selected under this approach as a reasonable alternative for location of a repository. (Note: DOE's National Siting Plan calls these concepts "approaches" rather than "guidelines.") However, we also see no evidence in the SCR that DOE comparatively examined all the federal nuclear reservations that fall into this category before choosing the Hanford site as a reasonable alternative for characterization.

d. We also see no evidence in the SCR that DOE has undertaken a comparative evaluation of screening approaches other than prior nuclear-related federal land use in arriving at the selection of Hanford as the first site to be characterized. Since NRC will have to consider DOE's comparative evaluation at the licensing stage, we believe DOE should complete this evaluation soon before too much is invested in a site that may turn out to compare unfavorably with sites selected under other screening approaches.

3. Another thing likely to enhance a false impression about our critical intent is the format of our analysis. Since the first three pages are devoted almost completely just to describing DOE's process, it is easy for the reader to miss the beginning of our critical analysis at the bottom of page 3-3. Perhaps it would be useful to break out our comments with an underlined notation (e.g., NRC Comment:) preceding our remarks, which should be delivered in a separate paragraph where possible. Also, since the Federal Register notice of our receipt of the BWIP SCR points out that our Site Characterization Analysis (SCA) will have to be read in conjunction with the SCR, I don't think we need to devote so much valuable space to describing DOE's process and its rationale.

4. If DOE has failed to describe in the SCR "the means used to obtain public, Indian tribal and State views during selection" under Section 60.11(a)(5) above, we should be prepared to say so.

5. The conclusion section (3.4) should expand on the point made in the discussion of screening guidelines (3.3.1.). I believe we should recommend that in the future, transportation factors be given thorough consideration before the locality stage of the site screening process, since transportation impacts from construction and operation of a repository will not be limited to the locality of the proposed site alone.

6. The conclusion contains important points, but some of them (eg., in the first paragraph) are new and don't appear to be integrally related to the analysis preceding it. The conclusion should be presented as our judgments on the most important issues arising from DOE's description of its criteria, methods, alternatives, and and site screening decision process under Section 60.11(a). It would

thus track our previous discussions of each of the elements of the SCR (see comment 2.), reinforcing the thoroughness of our review.

7. Several good points in the conclusion itself could be strengthened for emphasis. For example, instead of saying in the second full paragraph that "NRC will find it difficult" to compare Hanford with sites selected from national and regional surveys under other screening guidelines, we should say that without a comparative analysis of the screening approaches by which DOE selected all the candidate sites on its current slate, DOE cannot expect NRC to be able to make timely NEPA determinations at the construction authorization stage.

Similarly, instead of saying in the last sentence of 3.4 that "NRC would be in a better position" to judge Hanford as a reasonable alternative, we could say that without consistent use of screening guidelines under the several approaches to site selection, DOE will not provide NRC sufficient basis to judge Hanford or any other site as a reasonable alternative.

In the last sentence of the first paragraph of this section, I'm not sure that we have to find that Hanford "compares favorably" to other sites in order to find it a "reasonable alternative." The phrase "compares favorably" suggests that the site has to be found superior to others to be considered a reasonable alternative. Perhaps it would be better to say that to find a site a "reasonable alternative," we have to find that alternatives to the site in question are "not obviously superior." As I understand it, this is the test used in NEPA analyses for reactor licensing, so it may have the advantage of familiarity.

Rob MacDougall
Policy Analyst

Ch. 3

[illegible]
12/19/82

General Comments:

1. If we're going to describe the NRC & BWIP screening processes in the SCA, those descriptions must be very clear & not misleading at all. Some SCA readers will not read the SCR — their entire knowledge about site screening will be obtained through reading the SCA. As now written, I feel the SCA is not being clear in this regard. Also, if we specifically describe the DOE process, & process maybe minor misleading statements, we could [illegible] letters from DOE & others. Agree

2. Be clear & consistent in use of geographic terms — area, site ... Agree

3. For all sections which are presentations of DOE's program or the SCR & the documents, we need clear, initial intro statements saying this — & also saying what the section is not (if appropriate) Agree

4. Separate chapter in 2 main sections:

① Description of DOE program

② NRC analysis of DOE program.

Don't agree

As now written, it is confusing to go ①, ②, ①, ② ...

All NRC critique, I think, should be in one place.

3 SITE CHARACTERIZATION ANALYSIS: THE SITE SELECTION PROCESS

3.1 Introduction

In this chapter of the Site Characterization Analysis, the staff will analyze the process by which DOE selected a reference repository location at the Hanford Reservation. Beginning in section 3.3, the staff will briefly describe specific aspects of the site-selection process. These descriptions either restate or paraphrase the Site Characterization Report and its references. The staff's analysis will follow each description.

3.2 The National Waste Terminal Storage Program

The DOE has given the National Waste Terminal Storage (NWTS) Program the task of finding and characterizing sites for a geologic repository. The NWTS geologic field offices are investigating basalt (the Basalt Waste Isolation Project (BWIP)), volcanic tuff (Nevada Nuclear Waste Storage Investigations (NNWSI)) and salt and crystalline rocks (Office of Nuclear Waste Isolation (ONWI)) as potential geologic media for a high level waste (HLW) repository. Figure ____ in Appendix A shows where these investigations are taking place.

Basalt, volcanic tuff, and salt are the primary media under consideration. A schedule for the activities planned for each of these media appears in Figure___, Appendix A. The BWIP site characterization report (SCR) is the first of three SCR's DOE will submit to NRC. The SCR for tuff is scheduled for June 1983, and for salt, July 1983.

The NWTS Program is following a three phase siting process consisting of (1) site screening (2) detailed site studies, and (3) site selection (see Figure___ in Appendix A). This siting process is described in the DOE Public Draft, National Plan for Siting High-Level Radiactive Waste Repositories and Environmental Assessment, DOE/NWTS-4 (Ref. 7). (The staff will refer to this

document as the National Siting Plan). A brief description of each phase of the siting process follows.

3.2.1 Site Screening

The first phase of the siting process, termed site screening, covers the activities planned to find sites favorable for waste isolation. DOE uses several approaches to begin site screening. The approaches differ in their geographic starting points. The host-rock approach begins by identifying large, multi-state regions of the country, overlying geologic formations of potential interest. Early in the NWTS program, DOE used the host rock approach to delineated regions containing salt domes and bedded salt formations which may be suitable for a geologic repository. More recently, DOE has screened the U.S. for regions containing crystalline rocks such as granite.

Another approach, termed the land-use approach, investigates land already owned by the federal government and committed to nuclear activities. In particular, DOE has initiated siting studies in Nevada (Nevada Test Site) and Washington (Hanford Site) using the land-use approach. Although DOE is pursuing two additional approaches to site screening (province screening and simultaneous screening), DOE expects that the nation's first repository will be selected by either the land-use or host-rock approach.

3.2.2 Detailed Site Studies

After completing site screening, DOE will begin detailed site studies. Here, DOE assesses the safety, environmental, regulatory, and societal concerns associated with constructing and operating a geologic repository at a particular site. The BWIP Site Characterization Report (SCR) details how DOE plans to make the above assessments at Hanford.

3.2.3 Site Selection

Site selection is the process by which one or more sites are selected by DOE with the intent to apply for a construction authorization from the NRC.

(licensing process). As part of the licensing process, DOE will prepare a Safety Analysis Report and an Environmental Report for the repository site it has chosen. The NRC, in turn, will prepare an Environmental Impact Statement for its decision to authorize the construction of the repository.

3.3 Selection of the Hanford Reservation

3.3.1 DOE Rational For Its Selection of the Hanford Reservation

The DOE is considering the thick basalt sequence of the Columbia Plateau for siting a repository for radioactive wastes. The Columbia Plateau covers 78,000 mi^2, extending across southeast Washington and parts of Idaho and Oregon. In 1976, DOE began site feasibility studies in the Columbia Plateau to assess the hydrologic and geologic properties of basalt. The purpose of these investigations was: "...to provide geologic and hydrologic information necessary to identify areas beneath the Hanford Site that have a high probability of containing basaltic rock suitable for a nuclear waste repository" (Refs. 1,2). Later, in 1978, the National Academy of Science (NAS) recommended that DOE consider the Rattlesnake Hills at Hanford, as a possible storage site for nuclear wastes (Ref. 15). The NAS surmised that a nuclear waste repository could be excavated between the perched water table, high in the hills, and the main water table.

DOE selected Hanford as a potential repository site primarily because of its existing land-use. Hanford is owned by the Federal government and has been committed to nuclear activities since 1943. After many years of commitment to nuclear activities, extensive portions of the Hanford Reservation would never be returned to unrestricted land-use; thus, Hanford is considered to be highly appropriate for continued equivalent use (BWIP-SCR). In addition, DOE had some technical reasons for selecting Hanford. Considerable geologic and hydrologic data has been gathered on the Pasco Basin. Much of this data is closely aligned with the objectives of finding a site for a nuclear waste repository (Refs. 2,3). Also, DOE maintains that the Pasco Basin's nearly uniform physical characteristics and thick basalt flows make it an attractive site for a repository (Ref. 5).

3.3.2 Staff's Analysis of DOE's Rationale For Selecting the Hanford Reservation

The NWTS National Siting Plan states that the first repository will be selected through either a land-use approach or a host rock approach. The Hanford Reservation was selected by the land-use approach. By using the land-use approach, DOE has by-passed two screening steps that occur when the host-rock approach to siting is used. When the host-rock approach is used, the screening program would pass through national and regional surveys before area surveys could begin. When a land-use approach is used, the site investigation begins with an area survey (see Figure ____, Appendix A).

National and regional surveys have led to several study areas. For example, investigations at the Paradox Basin alone have delineated four study areas: Salt Valley, Gibson Dome, Elk Ridge and Lisbon Valley. Since the land-use approach omits national and regional surveys in its screening process, there is only one study area. For the BWIP, this study area is the Pasco Basin .

If the BWIP-SCR is going to provide some basis for future National Environmental Policy Act (NEPA) decisions, DOE should have shown, in the SCR, how the Pasco Basin compares to other study areas, particularly those which are also dedicated to nuclear activities (e.g., land in South Carolina, Idaho, New Mexico and Nevada). The staff recommends that DOE makes this comparison in the BWIP-semiannual reports. As an alternative, DOE could compare the Pasco Basin area to study areas selected by the host-rock approach.

By comparing the Pasco Basin area to other study areas, DOE could confirm that Hanford is a reasonable repository site alternative for NEPA purposes. The NRC will be required to prepare an environmental impact statement (EIS) to support its decision to authorize the construction of a geologic repository. Under the provisions of the National Environmental Policy Act (NEPA) and the NRC procedural rule (46 FR 13973), the alternative repository sites, presented in the EIS, must be among the best that can reasonably be found. The staff feels that DOE should confirm that the Hanford Reservation is a reasonable alternative for a repository site before NRC begins its formal NEPA process.

3.4 The BWIP Site Screening Process

The BWIP site screening process begins at the Pasco Basin (1600 mi^2) and ends at the reference repository location (18 mi^2). Three objectives guide DOE's progression from large to smaller land areas:

- maximize public health as safety
- minimize adverse environmental and socioeconomic impacts
- minimize system costs

Before these objectives could be realized, some assumptions had to be made on how a repository would be constructed, how it would operate, and what impacts it may have. These assumptions are listed in reference 5.

Having established their objectives and made their assumptions, DOE prepared screening guidelines. (see p.p. 2.2-9 through 2.2-13 of the SCR) The guidelines where depicted on map overlays and applied in five steps to areas under study. Starting at the Pasco Basin, each step successively reduced the land area that would be considered in the following step. At the end of each step the following areas were defined:

Step 1 - Pasco Basin or study area (1,600 mi^2)
Step 2 - candidate area (several hundred mi^2)
Step 3 - subarea (approximately 100 mi^2)
Step 4 - site locality (up to 50 mi^2)
Step 5 - candidate site (approximately 10 mi^2)

The overlay process ended with nine candidate sites, all on the Hanford Reservation.* At this point in the screening program DOE discontinued using overlays and began a comparative evaluation of the candidate sites. Five attributes were used to provide a means of comparing and eventually differentiating among the sites. The attributes include:

- Distance to discharge areas
- Structural geologic considerations

- Site biologic impact
- Distance to potentially hazardous facilities
- Potential for repository expansion

These attributes were used to quantitatively measure a condition or charactristic of the candidate site by means of actual unit scale, such as distance or a constructed scale that quantified the conditions. For example, under the site attribute, "potential for repository expansion," a site condition which would allow expansion for say 6 miles would be given a higher value than one which allow expansion for 2 miles. In a similar fashion, all the conditions or characteristics for a particular candidate site were assigned a value, the values were totalled and the sites with the highest score were considered the most attractive. The results of the comparative evaluation of the candidate sites showed that the central portion of the Cold Creek syncline area (Figure ___, Appendix A) should be evaluated in the final screening phase.

The final phase of site-selection deliniated a reference repository location (18 mi^2) within the Cold Creek syncline area. Ranking criteria, analagous to the attributes used in the previous screening phase, were applied to each candidate site in the Cold Creek syncline area. The ranking criteria include:

- Structural geology
- Seismucity
- Geohydrology
- Man's activities
- Host rock characteristics
- Environment

*At one point in the site screening process, DOE evaluated 4 subareas (each approximately 100 mi^2) located outside the Hanford boundry but within the Pasco Basin. Three subareas were eliminated from consideration because of land use and hydrological conflicts. The remaining subarea was dropped because of conflicts in land use, hydrology, bedrock dip and tectonic stability. DOE concluded from this evaluation: "Because no area of the Pasco Basin outside of the Hanford Site was found to be obviously superior to areas within the Hanford Site, further study to identify (repository) site localities was concentrated on the subareas of the Hanford site." (Ref. 4)

Then the sites were ranked using an ordinal dominance analysis (see ref. 5 for details). The outer boundaries of the sites ranked highest incribed the reference repository location (Figure__, Appendix A).

3.5 Staff Analysis of the BWIP Site-Selection Process

As discussed in Section 3.4, DOE applied screening guidelines to the Pasco Basin to find nine candidate sites for a geologic repository. The SCR references a document that compares the BWIP screening guidelines to those recommended by the National Waste Terminal Storage Program (NWTS) (Ref. 13). This document, entitled Comparison of NWTS-33(2) Criteria and Basalt Waste Isolation Project Screening Considerations, RHO-BW-EV-IP, compares BWIP criteria with a draft version of the NWTS criteria (Ref. 12). The final NWTS document (Ref. 12) recommends several screening criteria which were not applied at BWIP. Specifically, the staff finds that the following NWTS criteria were omitted from the BWIP site-selection process:

- A site's geohydrology should:
  1. be compatable with retrival.
  2. minimize contact time between groundwater and waste.
  3. permit modeling.

- A site's geochemistry should have characteristics compatible with retrival.

- A site's resources, such as water, should be evaluated to assess the likelihood of human intrusion

- A site should be located such that risk to the population from transportation of radioactive waste can be reduced below acceptable levels to the extent reasonably achievable.

In selecting the reference repository location, DOE considered mineral deposits and transportation impacts, but not in sufficient depth. DOE should have evaluated water resources as well as mineral resources. Given the arid environment of the Pasco Basin and the expected agricultural growth, water resources may be a limiting factor when repository construction begins. DOE did not

consider transportation guidelines until the locality phase of site screening. Transportation impacts, however, will not be limited to the locality of the proposed site, alone. High level waste must be transported across the nation to reach a repository at Hanford, Washington. The staff recommends that DOE evaluate transportation and water-use impacts during their detailed investigations at Hanford.

Even though BWIP did not use all of the NWTS screening criteria, the staff believes that the reference repository location is at least as good as any location within the Pasco Basin. Some of the NWTS criteria may be more appropriate for national and regional surveys and could not distinguish one site from another within Hanford's 620 mi^2 area. Nevertheless, BWIP should not omit any of the NWTS screening criteria without some explanation. Selective implementation of the NWTS criteria can create inconsistencies among repository investigations in different geologic media. For example, the Office of Nuclear Waste Isolation (ONWI), which is investigating domal salt for a potential repository site, is using different terminology than BWIP. In reference 14, an ONWI document, each of seven salt domes is called a "candidate site" while the same term does not appear in the BWIP program until DOE was fairly certain where the repository would be located. Likewise, reference 14 refers to a "repository location" but does not define its size. At BWIP a repository location can cover an area of up to 50 mi^2 (except for the reference repository location which covers 18 mi^2).

3.5 Staff Conclusion

Based on our review of the BWIP SCR and its supporting documents, the staff offers the following comments and conclusions regarding the DOE site selection process.

- The DOE did not adequately compare the Pasco Basin study area to other study areas selected by either the land-use or the host-rock approach (as described in the NWTS National Siting Plan). The staff feels that DOE should make this comparison, perhaps in the BWIP semiannual reports, before the NRC NEPA process begins. The study areas should be compared at the

same level of detail as the area survey phase of characterization in the National Siting Plan. An early comparison of study areas will ensure that only reaonable alternatives will be considered during the licensing process.

- None of the other sites within the Pasco Basin that were evaluated by DOE in the SCR are preferrable to the reference repository location.

- Differences between the BWIP and NWTS siting criteria can be attributed to the different geographic starting point for the host-rock and land-use siting concepts. The differences do not indicate that the NWTS and BWIP site-screening guidelines are inconsistant or that the BWIP guidelines were ineffective. the differences will, however, complicate a comparison between BWIP and repository projects which have followed the NWTS guidelines more closely.

3 SITE CHARACTERIZATION ANALYSIS: THE SITE SELECTION PROCESS

3.1 Introduction

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After completing site screening, DOE will begin detailed site studies. Here, DOE assesses the safety, environmental, regulatory, and societal concerns associated with constructing and operating a geologic repository at a particular site. The BWIP Site Characterization Report (SCR) details how DOE plans to make the above assessments at Hanford.

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(licensing process). As part of the licensing process, DOE will prepare a Safety Analysis Report and an Environmental Report for the repository site it has chosen. The NRC, in turn, will prepare an Environmental Impact Statement for its decision to authorize the construction of the repository.

3.3 Selection of the Hanford Reservation

3.3.1 DOE Rational For Its Selection of the Hanford Reservation

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- A site's geochemistry should have characteristics compatible with retrival.

- A site's resources, such as water, should be evaluated to assess the likelihood of human intrusion

- A site should be located such that risk to the population from transportation of radioactive waste can be reduced below acceptable levels to the extent reasonably achievable.

In selecting the reference repository location, DOE considered mineral deposits and transportation impacts, but not in sufficient depth. DOE should have evaluated water resources as well as mineral resources. Given the arid environment of the Pasco Basin and the expected agricultural growth, water resources may be a limiting factor when repository construction begins. DOE did not

consider transportation guidelines until the locality phase of site screening. Transportation impacts, however, will not be limited to the locality of the proposed site, alone. High level waste must be transported across the nation to reach a repository at Hanford, Washington. The staff recommends that DOE evaluate transportation and water-use impacts during their detailed investigations at Hanford.

Even though BWIP did not use all of the NWTS screening criteria, the staff believes that the reference repository location is at least as good as any location within the Pasco Basin. Some of the NWTS criteria may be more appropriate for national and regional surveys and could not distinguish one site from another within Hanford's 620 mi^2 area. Nevertheless, BWIP should not omit any of the NWTS screening criteria without some explanation. Selective implementation of the NWTS criteria can create inconsistencies among repository investigations in different geologic media. For example, the Office of Nuclear Waste Isolation (ONWI), which is investigating domal salt for a potential repository site, is using different terminology than BWIP. In reference 14, an ONWI document, each of seven salt domes is called a "candidate site" while the same term does not appear in the BWIP program until DOE was fairly certain where the repository would be located. Likewise, reference 14 refers to a "repository location" but does not define its size. At BWIP a repository location can cover an area of up to 50 mi^2 (except for the reference repository location which covers 18 mi^2).

3.5 Staff Conclusion

Based on our review of the BWIP SCR and its supporting documents, the staff offers the following comments and conclusions regarding the DOE site selection process.

- The DOE did not adequately compare the Pasco Basin study area to other study areas selected by either the land-use or the host-rock approach (as described in the NWTS National Siting Plan). The staff feels that DOE should make this comparison, perhaps in the BWIP semiannual reports, before the NRC NEPA process begins. The study areas should be compared at the

IN FOR ER? are we trying to fuzz this?

same level of detail as the area survey phase of characterization in the National Siting Plan. An early comparison of study areas will ensure that only reaonable alternatives will be considered during the licensing process.

- None of the other sites within the Pasco Basin that were evaluated by DOE in the SCR are preferrable to the reference repository location.

- Differences between the BWIP and NWTS siting criteria can be attributed to the different geographic starting point for the host-rock and land-use siting concepts. The differences do not indicate that the NWTS and BWIP site-screening guidelines are inconsistant or that the BWIP guidelines were ineffective. The differences will, however, complicate a comparison between BWIP and repository projects which have followed the NWTS guidelines more closely.

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9 SITE CHARACTERIZATION ANALYSIS: INSTITUTIONAL AND ENVIRONMENTAL FACTORS

9.1 Introduction

In this chapter of the Site Characterization Analysis, the staff will point out the environmental factors at Hanford that could be particularly sensitive to the operation and construction of a geologic repository. Environmental factors will be used as a collective term for institutional, ecological, and radiological factors and air and water quality.

NRC regulation 10 CFR 51 requires DOE to prepare an environmental report as part of a license application for constructing a geologic repository. The NRC, in turn, will prepare an environmental impact statement (EIS) for its decision to authorize the construction of a repository. In preparing the EIS, the staff will depend to a large degree, upon the DOE environmental report for pertinent and reliable data.

The BWIP Site Characterization Report (SCR) describes, in general, the type of environmental data that will be presented in the environmental report. The staff feels that the DOE has overlooked a few environmental issues that, if left unresolved, could protract the NEPA process and delay licensing. In this review, the staff will identify these environmental issues and recommend how they should be resolved.

9.2 Institutional Factors

For the purposes of this review, the staff defines an institutional factor as an objective of an organized segment of society (e.g., state and local laws, Indian tribal views). Institutional factors are not discussed, in detail, in the SCR. DOE has held some public workshops and hearings. The staff expects that these public meetings will become more frequent as licensing approaches.

DOE has not adequately shown, however, the means used to obtain public, Indian tribal and State views during the selection of the reference repository location (see 10 CFR 60.11).

The staff recognizes that Hanford's prior long-standing use and commitment to nuclear activities and existing government ownership may preclude some institutional concerns during the site-selection process. Thus, institutional factors may not occur to the same degree at Hanford as they might at non-DOE land.

9.3 Ecology

The SCR identified three wildlife preserves within the Hanford Reservation: the Saddle Mountain National Wildlife Refuge, the McNary Wildlife Refuge, and the Arid Lands Ecology Reserve (managed by DOE). It appears, from Figure 9-1 in the SCR, that the reference repository location would not extend into any of the wildlife preserves. The SCR does not mention, however, that both the reference repository location and its alternate lie completely within the Rattlesnake Hills Critical Wildlife Habitat (CWH) and 25% of each lies within the Cold Creek Critical Wildlife Habitat (Ref. 1).

Although DOE may be able to construct a repository at the reference repository location without diminishing its ecological value, the DOE should recognize the location's ecological significance. Provisions of the Endangered Species Act regarding critical habitats and endangered species should be considered before DOE commits itself to the reference repository location (RRL). The SCR states: "Two threatened and endangered bird species, the bald eagle, Haliaeetus leucocephalus, and the peregrine falcon, Falco peregrinis are known to occur as winter migrants on the Hanford Site." The SCR does not recognize the status of some other important bird species which nest at the Hanford Site. The prairie falcon (Falco mexicanus) nests in several regions on the Hanford Site, with the number of nesting pairs being approximately six. This species is listed as threatened by the U. S. Department of Interior (Ref. 2). The western burrowing owl and the long-billed curlew (both possibly in danger) nest on or near the reference repository location in significant numbers, particularly

around the 200 area (Ref. 2). DOE should keep abreast of the status of all rare, endangered, threatened or special species that could be affected by the construction and operation of a geologic repository.

9.4 Water Use

Given the arid environment of the Pasco Basin, a repository could compete with irrigated agriculture for water. During a repository's construction, large quantities of water will be needed for drilling and dust control. Coupled with continued agriculatural growth, a repository could have an impact on the area's water resources.

The SCR does not estimate the quantity of water needed to construct, operate and decommission a repository. Nor does the SCR identify the source of water or have any programs in place (i.e., work elements) that would obtain water-use information. This apparant oversight of possible water-use conflicts is inconsistent with a previous DOE position which states:

> "The source and quantity of water required for use in repository processes will be established during conceptual design. Water consumption should then be evaluated with respect to the results of an economic geology study (water resources assessment) by the Basalt Waste Isolation Project, which will provide an analysis of historical trends in regional water use. Together, these studies should indicate whether or not a potential conflict on water use exists in the Hanford Site" (Ref. 3).

The staff recommends that DOE complete the water-use studies described above.

9.5 Radiological Background

A shallow depression within the RRL, called "U Pond," has received radioactive effluents since the beginning of the Manhattan Project in World War II (Ref. 2). Additionally, five ditches or ponds, all within the RRL, are used for the disposal of low-level radioactive wastes, certain industrial wastes, laboratory and sanitary wastes and discharge of water used for plant cooling (SCR p.

7.1-11). As a result of these discharges, soil and vegetation within the RRL have a higher concentration of radionuclides than the median concentration for the Hanford area. Of 21 soil samples taken within the RRL, 10 show radionuclide concentrations higher than the Hanford median. ^{90}Sr concentration in the RRL soil (Control Plot No. 2) is more than 1000 times that of the Hanford median. Bioaccumulation of ^{137}Cs and ^{90}Sr into RRL vegetation (Control Plot No.2) is up to 100 times the median concentration for the Hanford area (see Tables 9-6, 9-7, 9-8, 9-9 in SCR), and groundwater beneath the RRL shows H^3 levels from 30 to more than 3000 pCi/ml (Ref. 1).

Knowing that a repository may be constructed in a contaminated area raises some questions on how DOE plans to monitor the repository's performance. Background radiation levels will fluctuate with the continued use of the RRL as a low-level waste disposal site. Likewise, radioactivity in the surface water (including the Columbia River) can change from day to day; depending upon what is being discharged and sampling conditions.

Reference 1 (p. iv-27) has indicated that repository development will be supported by additional monitoring. Yet the SCR contains little information on the repository monitoring program. Although it may be premature to discuss in depth how DOE plans to monitor radiation releases from a repository, the staff feels that DOE should affirm, as soon as possible, that Hanford's background radiation will not interfere with repository monitoring. Thus, the staff believes that DOE should consider how it intends to monitor the radiological performance of a geologic repository at Hanford.

9.6 Staff Conclusion

After reviewing the environmental and institutional sections of the BWIP SCR, the staff comes to the following conclusions:

- Institutional factors played a minor role in the BWIP site-selection process. DOE should explain if Hanford's prior commitment to nuclear activities and federal ownership precluded the need for considering institutional factors.

- DOE should examine, in detail, the ecological significance of the reference repository location. A mitigation plan may be needed for possible adverse impacts on two critical wildlife habitats and several bird species.

- DOE should ensure that a repository's water requirement will not limit agricultural growth.

- DOE should begin to consider how it intends to monitor the radiological performance of a repository at Hanford.

REFERENCES

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(licensing process). As part of the licensing process, DOE will prepare a Safety Analysis Report and an Environmental Report for the repository site it has chosen. The NRC, in turn, will prepare an Environmental Impact Statement for its decision to authorize the construction of the repository.

3.3 Selection of the Hanford Reservation

3.3.1 DOE Rational For Its Selection of the Hanford Reservation

The DOE is considering the thick basalt sequence of the Columbia Plateau for siting a repository for radioactive wastes. The Columbia Plateau covers 78,000 mi^2, extending across southeast Washington and parts of Idaho and Oregon. In 1976, DOE began site feasibility studies in the Columbia Plateau to assess the hydrologic and geologic properties of basalt. The purpose of these investigations was: "...to provide geologic and hydrologic information necessary to identify areas beneath the Hanford Site that have a high probability of containing basaltic rock suitable for a nuclear waste repository" (Refs. 1,2). Later, in 1978, the National Academy of Science (NAS) recommended that DOE consider the Rattlesnake Hills at Hanford, as a possible storage site for nuclear wastes (Ref. 15). The NAS surmised that a nuclear waste repository could be excavated between the perched water table, high in the hills, and the main water table.

There seems to be a gap here!

DOE selected Hanford as a potential repository site primarily because of its land-use. Hanford is owned by the Federal government and has been committed to nuclear activities since 1943. After many years of commitment to nuclear activities, extensive portions of the Hanford Reservation would never be returned to unrestricted land-use; thus, Hanford is considered to be highly appropriate for continued equivalent use (BWIP-SCR). In addition, DOE had some technical reasons for selecting Hanford. Considerable geologic and hydrologic data has been gathered on the Pasco Basin. Much of this data is closely aligned with the objectives of finding a site for a nuclear waste repository (Refs. 2,3). Also, DOE maintains that the Pasco Basin's nearly uniform physical characteristics and thick basalt flows make it an attractive site for a repository (Ref. 5).

Use these terms consistently in Chapter 2 of SCA

1. Site Selection - the process of choosing a specific site with the intent of applying for a license to construct a repository

2. Site Screening - the process of finding a site for Characterization

3. Detailed Site Studies - DOE term for Site Characterization (NRC)

4. candidate site -

NRC: one of at least three sites which will be evaluated for a license application

BWIP: one of nine sites, all within the Cold Creek syncline area. Two candidate sites were combined to form the reference repository location

5. reference repository location: BWIP term for the candidate site (NRC)

~~6. candidate area~~

~~NRC: defined in procedural rule~~

~~NWTS: a tract of land which is~~

~~delineated by National and Regional Screens~~

~~BWIP:~~

6. ~~Study area:~~

BWIP: the geographic starting point for the site screening process at Hanford

NWTS: the land that remains after National and Regional screens have been completed

7. Candidate area

BWIP: a single tract of land extending beyond Hanford's boundary but within the Pasco Basin. The candidate area was the first land area that was delineated by the site screening process at Hanford

NRC: defined in procedural rule

NWTS: candidate area and study area appear to mean the same

8. Hanford Site - term used loosely throughout SCR. Refer Hanford Site consists the reference repository locations

or to the entire excavation

9 SITE CHARACTERIZATION ANALYSIS: INSTITUTIONAL AND ENVIRONMENTAL FACTORS

9.1 Introduction

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mtg w/ Bob Wright
12/13/82

3 SITE CHARACTERIZATION ANALYSIS: THE SITE SELECTION PROCESS

3.1 Introduction

change section title

In this chapter of the Site Characterization Analysis, the staff will analyze the process by which DOE selected a reference repository location at the Hanford Reservation. Beginning in section 3.3, the staff will briefly describe specific aspects of the site-selection process. These descriptions either restate or paraphrase the Site Characterization Report and its references. The staff's analysis will follow each description.

3.2 The National Waste Terminal Storage Program

The DOE has given the National Waste Terminal Storage (NWTS) Program the task of finding and characterizing sites for a geologic repository. The NWTS geologic field offices are investigating basalt (the Basalt Waste Isolation Project (BWIP)), volcanic tuff (Nevada Nuclear Waste Storage Investigations (NNWSI)) and salt and crystalline rocks (Office of Nuclear Waste Isolation (ONWI)) as potential geologic media for a high level waste (HLW) repository. Figure ____ in Appendix A shows where these investigations are taking place.

Basalt, volcanic tuff, and salt are the primary media under consideration. A schedule for the activities planned for each of these media appears in Figure___, Appendix A. The BWIP site characterization report (SCR) is the first of three SCR's DOE will submit to NRC. The SCR for tuff is scheduled for June 1983, and for salt, July 1983.

The NWTS Program is following a three phase siting process consisting of (1) site screening (2) detailed site studies, and (3) site selection (see Figure___ in Appendix A). This siting process is described in the DOE Public Draft, National Plan for Siting High-Level Radiactive Waste Repositories and Environmental Assessment, DOE/NWTS-4 (Ref. 7). (The staff will refer to this

document as the National Siting Plan). A brief description of each phase of the siting process follows.

3.2.1 Site Screening

The first phase of the siting process, termed site screening, covers the activities planned to find sites favorable for waste isolation. DOE uses several approaches to begin site screening. The approaches differ in their geographic starting points. The host-rock approach begins by identifying large, multi-state regions of the country, overlying geologic formations of potential interest. Early in the NWTS program, DOE used the host rock approach to delineated regions containing salt domes and bedded salt formations which may be suitable for a geologic repository. More recently, DOE has screened the U.S. for regions containing crystalline rocks such as granite.

Another approach, termed the land-use approach, investigates land already owned by the federal government and committed to nuclear activities. In particular, DOE has initiated siting studies in Nevada (Nevada Test Site) and Washington (Hanford Site) using the land-use approach. Although DOE is pursuing two additional approaches to site screening (province screening and simultaneous screening), DOE expects that the nation's first repository will be selected by either the land-use or host-rock approach.

3.2.2 Detailed Site Studies

The NRC refers to this phase as the Site Characterization Phase because DOE must prepare a Site Characterization Report before it begins.

After completing site screening, DOE will begin detailed site studies. Here, DOE assesses the safety, environmental, regulatory, and societal concerns associated with constructing and operating a geologic repository at a particular site. The BWIP Site Characterization Report (SCR) details how DOE plans to make the above assessments at Hanford.

3.2.3 Site Selection

Site selection is the process by which one or more sites are selected by DOE with the intent to apply for a construction authorization from the NRC.

(licensing process). As part of the licensing process, DOE will prepare a Safety Analysis Report and an Environmental Report for the repository site it has chosen. The NRC, in turn, will prepare an Environmental Impact Statement for its decision to authorize the construction of the repository.

3.3 Selection of the Hanford Reservation for Site Characterization

3.3.1 DOE Rational For Its Selection of the Hanford Reservation for Site Characterization

The DOE is considering the thick basalt sequence of the Columbia Plateau for siting a repository for radioactive wastes. The Columbia Plateau covers 78,000 mi^2, extending across southeast Washington and parts of Idaho and Oregon. In 1976, DOE began site feasibility studies in the Columbia Plateau to assess the hydrologic and geologic properties of basalt. The purpose of these investigations was: "...to provide geologic and hydrologic information necessary to identify areas beneath the Hanford Site that have a high probability of containing basaltic rock suitable for a nuclear waste repository" (Refs. 1,2). Later, in 1978, the National Academy of Science (NAS) recommended that DOE consider the Rattlesnake Hills at Hanford, as a possible storage site for nuclear wastes (Ref. 15). The NAS surmised that a nuclear waste repository could be excavated between the perched water table, high in the hills, and the main water table.

DOE selected Hanford as a potential repository site primarily because of its land-use. Hanford is owned by the Federal government and has been committed to nuclear activities since 1943. After many years of commitment to nuclear activities, extensive portions of the Hanford Reservation would never be returned to unrestricted land-use; thus, Hanford is considered to be highly appropriate for continued equivalent use (BWIP-SCR). In addition, DOE had some technical reasons for selecting Hanford. Considerable geologic and hydrologic data has been gathered on the Pasco Basin. Much of this data is closely aligned with the objectives of finding a site for a nuclear waste repository (Refs. 2,3). Also, DOE maintains that the Pasco Basin's nearly uniform physical characteristics and thick basalt flows make it an attractive site for a repository (Ref. 5).

3.3.2 Staff's Analysis of DOE's Rationale For Selecting the Hanford Reservation for Site Characterization

The NWTS National Siting Plan states that the first repository will be selected through either a land-use approach or a host rock approach. The Hanford Reservation was selected by the land-use approach. By using the land-use approach, DOE has by-passed two screening steps that occur when the host-rock approach to siting is used. When the host-rock approach is used, the screening program would pass through national and regional surveys before area surveys could begin. When a land-use approach is used, the site investigation begins with an area survey (see Figure ____, Appendix A).

National and regional surveys have led to several study areas. For example, investigations at the Paradox Basin alone have delineated four study areas: Salt Valley, Gibson Dome, Elk Ridge and Lisbon Valley. Since the land-use approach omits national and regional surveys in its screening process, there is only one study area. For the BWIP, this study area is the Pasco Basin .

If the BWIP-SCR is going to provide some basis for future National Environmental Policy Act (NEPA) decisions, DOE should have shown, in the SCR, how the Pasco Basin compares to other study areas, particularly those which are also dedicated to nuclear activities (e.g., land in South Carolina, Idaho, New Mexico and Nevada). The staff recommends that DOE makes this comparison in the BWIP-semiannual reports. As an alternative, DOE could compare the Pasco Basin area to study areas selected by the host-rock approach.

By comparing the Pasco Basin area to other study areas, DOE could confirm that Hanford is a reasonable repository site alternative for NEPA purposes. The NRC will be required to prepare an environmental impact statement (EIS) to support its decision to authorize the construction of a geologic repository. Under the provisions of the National Environmental Policy Act (NEPA) and the NRC procedural rule (46 FR 13973), the alternative repository sites, presented in the EIS, must be among the best that can reasonably be found. The staff feels that DOE should confirm that the Hanford Reservation is a reasonable alternative for a repository site before NRC begins its formal NEPA process.

3.4 The ~~BWIP~~ Site-~~Screening~~ Screening Process Used at the Hanford Reservation

The BWIP site screening process begins at the Pasco Basin (1600 mi^2) and ends at the reference repository location (18 mi^2). Three objectives guide DOE's progression from large to smaller land areas:

- maximize public health as safety
- minimize adverse environmental and socioeconomic impacts
- minimize system costs

Before these objectives could be realized, some assumptions had to be made on how a repository would be constructed, how it would operate, and what impacts it may have. These assumptions are listed in reference 5.

Having established their objectives and made their assumptions, DOE prepared screening guidelines. (see p.p. 2.2-9 through 2.2-13 of the SCR) The guidelines where depicted on map overlays and applied in five steps to areas under study. Starting at the Pasco Basin, each step successively reduced the land area that would be considered in the following step. At the end of each step the following areas were defined:

Step 1 - Pasco Basin or study area (1,600 mi^2)
Step 2 - candidate area (several hundred mi^2)
Step 3 - subarea (approximately 100 mi^2)
Step 4 - site locality (up to 50 mi^2)
Step 5 - candidate site (approximately 10 mi^2)

The overlay process ended with nine candidate sites, all on the Hanford Reservation.* At this point in the screening program DOE discontinued using overlays and began a comparative evaluation of the candidate sites. Five attributes were used to provide a means of comparing and eventually differentiating among the sites. The attributes include:

- Distance to discharge areas
- Structural geologic considerations

- Site biologic impact
- Distance to potentially hazardous facilities
- Potential for repository expansion

These attributes were used to quantitatively measure a condition or charactristic of the candidate site by means of actual unit scale, such as distance or a constructed scale that quantified the conditions. For example, under the site attribute, "potential for repository expansion," a site condition which would allow expansion for say 6 miles would be given a higher value than one which allow expansion for 2 miles. In a similar fashion, all the conditions or characteristics for a particular candidate site were assigned a value, the values were totalled and the sites with the highest score were considered the most attractive. The results of the comparative evaluation of the candidate sites showed that the central portion of the Cold Creek syncline area (Figure ___, Appendix A) should be evaluated in the final screening phase.

The final phase of site-selection deliniated a reference repository location (18 mi^2) within the Cold Creek syncline area. Ranking criteria, analagous to the attributes used in the previous screening phase, were applied to each candidate site in the Cold Creek syncline area. The ranking criteria include:

- Structural geology
- Seismucity
- Geohydrology
- Man's activities
- Host rock characteristics
- Environment

*At one point in the site screening process, DOE evaluated 4 subareas (each approximately 100 mi^2) located outside the Hanford boundry but within the Pasco Basin. Three subareas were eliminated from consideration because of land use and hydrological conflicts. The remaining subarea was dropped because of conflicts in land use, hydrology, bedrock dip and tectonic stability. DOE concluded from this evaluation: "Because no area of the Pasco Basin outside of the Hanford Site was found to be obviously superior to areas within the Hanford Site, further study to identify (repository) site localities was concentrated on the subareas of the Hanford site." (Ref. 4)

Then the sites were ranked using an ordinal dominance analysis (see ref. 5 for details). The outer boundaries of the sites ranked highest incribed the reference repository location (Figure__, Appendix A).

3.5 Staff Analysis of the BWIP Site ~~Selection~~ Screening Process

As discussed in Section 3.4, DOE applied screening guidelines to the Pasco Basin to find nine candidate sites for a geologic repository. The SCR references a document that compares the BWIP screening guidelines to those recommended by the National Waste Terminal Storage Program (NWTS) (Ref. 13). This document, entitled Comparison of NWTS-33(2) Criteria and Basalt Waste Isolation Project Screening Considerations, RHO-BW-EV-IP, compares BWIP criteria with a draft version of the NWTS criteria (Ref. 12). The final NWTS document (Ref. 12) recommends several screening criteria which were not applied at BWIP. Specifically, the staff finds that the following NWTS criteria were omitted from the BWIP site-selection process:

- A site's geohydrology should:
  1. be compatable with retrival.
  2. minimize contact time between groundwater and waste.
  3. permit modeling.

- A site's geochemistry should have characteristics compatible with retrival.

- A site's resources, such as water, should be evaluated to assess the likelihood of human intrusion

- A site should be located such that risk to the population from transportation of radioactive waste can be reduced below acceptable levels to the extent reasonably achievable.

In selecting the reference repository location, DOE considered mineral deposits and transportation impacts, but not in sufficient depth. DOE should have evaluated water resources as well as mineral resources. Given the arid environment of the Pasco Basin and the expected agricultural growth, water resources may be a limiting factor when repository construction begins. DOE did not

consider transportation guidelines until the locality phase of site screening. Transportation impacts, however, will not be limited to the locality of the proposed site, alone. High level waste must be transported across the nation to reach a repository at Hanford, Washington. The staff recommends that DOE evaluate transportation and water-use impacts during their detailed investigations at Hanford.

Even though BWIP did not use all of the NWTS screening criteria, the staff believes that the reference repository location is at least as good as any location within the Pasco Basin. Some of the NWTS criteria may be more appropriate for national and regional surveys and could not distinguish one site from another within Hanford's 620 mi^2 area. Nevertheless, BWIP should not omit any of the NWTS screening criteria without some explanation. Selective implementation of the NWTS criteria can create inconsistencies among repository investigations in different geologic media. For example, the Office of Nuclear Waste Isolation (ONWI), which is investigating domal salt for a potential repository site, is using different terminology than BWIP. In reference 14, an ONWI document, each of seven salt domes is called a "candidate site" while the same term does not appear in the BWIP program until DOE was fairly certain where the repository would be located. Likewise, reference 14 refers to a "repository location" but does not define its size. At BWIP a repository location can cover an area of up to 50 mi^2 (except for the reference repository location which covers 18 mi^2).

3.5 Staff Conclusion

Based on our review of the BWIP SCR and its supporting documents, the staff offers the following comments and conclusions regarding the DOE site selection process.

- The DOE did not adequately compare the Pasco Basin study area to other study areas selected by either the land-use or the host-rock approach (as described in the NWTS National Siting Plan). The staff feels that DOE should make this comparison, perhaps in the BWIP semiannual reports, before the NRC NEPA process begins. The study areas should be compared at the

same level of detail as the area survey phase of characterization in the National Siting Plan. An early comparison of study areas will ensure that only reaonable alternatives will be considered during the licensing process.

- None of the other sites within the Pasco Basin that were evaluated by DOE in the SCR are preferrable to the reference repository location.

- Differences between the BWIP and NWTS siting criteria can be attributed to the different geographic starting point for the host-rock and land-use siting concepts. The differences do not indicate that the NWTS and BWIP site-screening guidelines are inconsistant or that the BWIP guidelines were ineffective. The differences will, however, complicate a comparison between BWIP and repository projects which have followed the NWTS guidelines more closely.

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9 SITE CHARACTERIZATION ANALYSIS: INSTITUTIONAL AND ENVIRONMENTAL FACTORS

9.1 Introduction

In this chapter of the Site Characterization Analysis, the staff will point out the environmental factors at Hanford that could be particularly sensitive to the operation and construction of a geologic repository. Environmental factors will be used as a collective term for institutional, ecological, and radiological factors and air and water quality.

NRC regulation 10 CFR 51 requires DOE to prepare an environmental report as part of a license application for constructing a geologic repository. The NRC, in turn, will prepare an environmental impact statement (EIS) for its decision to authorize the construction of a repository. In preparing the EIS, the staff will depend to a large degree, upon the DOE environmental report for pertinent and reliable data.

The BWIP Site Characterization Report (SCR) describes, in general, the type of environmental data that will be presented in the environmental report. The staff feels that the DOE has overlooked a few environmental issues that, if left unresolved, could protract the NEPA process and delay licensing. In this review, the staff will identify these environmental issues and recommend how they should be resolved.

9.2 Institutional Factors

For the purposes of this review, the staff defines an institutional factor as an objective of an organized segment of society (e.g., state and local laws, Indian tribal views). Institutional factors are not discussed, in detail, in the SCR. DOE has held some public workshops and hearings. The staff expects that these public meetings will become more frequent as licensing approaches.

DOE has not adequately shown, however, the means used to obtain public, Indian tribal and State views during the selection of the reference repository location (see 10 CFR 60.11).

The staff recognizes that Hanford's prior long-standing use and commitment to nuclear activities and existing government ownership may preclude some institutional concerns during the site-selection process. Thus, institutional factors may not occur to the same degree at Hanford as they might at non-DOE land.

9.3 Ecology

The SCR identified three wildlife preserves within the Hanford Reservation: the Saddle Mountain National Wildlife Refuge, the McNary Wildlife Refuge, and the Arid Lands Ecology Reserve (managed by DOE). It appears, from Figure 9-1 in the SCR, that the reference repository location would not extend into any of the wildlife preserves. The SCR does not mention, however, that both the reference repository location and its alternate lie completely within the Rattlesnake Hills Critical Wildlife Habitat (CWH) and 25% of each lies within the Cold Creek Critical Wildlife Habitat (Ref. 1).

Although DOE may be able to construct a repository at the reference repository location without diminishing its ecological value, the DOE should recognize the location's ecological significance. Provisions of the Endangered Species Act regarding critical habitats and endangered species should be considered before DOE commits itself to the reference repository location (RRL). The SCR states: "Two threatened and endangered bird species, the bald eagle, Haliaeetus leucocephalus, and the peregrine falcon, Falco peregrinis are known to occur as winter migrants on the Hanford Site." The SCR does not recognize the status of some other important bird species which nest at the Hanford Site. The prairie falcon (Falco mexicanus) nests in several regions on the Hanford Site, with the number of nesting pairs being approximately six. This species is listed as threatened by the U. S. Department of Interior (Ref. 2). The western burrowing owl and the long-billed curlew (both possibly in danger) nest on or near the reference repository location in significant numbers, particularly

around the 200 area (Ref. 2). DOE should keep abreast of the status of all rare, endangered, threatened or special species that could be affected by the construction and operation of a geologic repository.

9.4 Water Use

Given the arid environment of the Pasco Basin, a repository could compete with irrigated agriculture for water. During a repository's construction, large quantities of water will be needed for drilling and dust control. Coupled with continued agriculatural growth, a repository could have an impact on the area's water resources.

The SCR does not estimate the quantity of water needed to construct, operate and decommission a repository. Nor does the SCR identify the source of water or have any programs in place (i.e., work elements) that would obtain water-use information. This apparant oversight of possible water-use conflicts is inconsistent with a previous DOE position which states:

> "The source and quantity of water required for use in repository processes will be established during conceptual design. Water consumption should then be evaluated with respect to the results of an economic geology study (water resources assessment) by the Basalt Waste Isolation Project, which will provide an analysis of historical trends in regional water use. Together, these studies should indicate whether or not a potential conflict on water use exists in the Hanford Site" (Ref. 3).

The staff recommends that DOE complete the water-use studies described above.

9.5 Radiological Background

A shallow depression within the RRL, called "U Pond," has received radioactive effluents since the beginning of the Manhattan Project in World War II (Ref. 2). Additionally, five ditches or ponds, all within the RRL, are used for the disposal of low-level radioactive wastes, certain industrial wastes, laboratory and sanitary wastes and discharge of water used for plant cooling (SCR p.

7.1-11). As a result of these discharges, soil and vegetation within the RRL have a higher concentration of radionuclides than the median concentration for the Hanford area. Of 21 soil samples taken within the RRL, 10 show radionuclide concentrations higher than the Hanford median. ^{90}Sr concentration in the RRL soil (Control Plot No. 2) is more than 1000 times that of the Hanford median. Bioaccumulation of ^{137}Cs and ^{90}Sr into RRL vegetation (Control Plot No.2) is up to 100 times the median concentration for the Hanford area (see Tables 9-6, 9-7, 9-8, 9-9 in SCR), and groundwater beneath the RRL shows H^3 levels from 30 to more than 3000 pCi/ml (Ref. 1).

Knowing that a repository may be constructed in a contaminated area raises some questions on how DOE plans to monitor the repository's performance. Background radiation levels will fluctuate with the continued use of the RRL as a low-level waste disposal site. Likewise, radioactivity in the surface water (including the Columbia River) can change from day to day; depending upon what is being discharged and sampling conditions.

Reference 1 (p. iv-27) has indicated that repository development will be supported by additional monitoring. Yet the SCR contains little information on the repository monitoring program. Although it may be premature to discuss in depth how DOE plans to monitor radiation releases from a repository, the staff feels that DOE should affirm, as soon as possible, that Hanford's background radiation will not interfere with repository monitoring. Thus, the staff believes that DOE should consider how it intends to monitor the radiological performance of a geologic repository at Hanford.

9.6 Staff Conclusion

After reviewing the environmental and institutional sections of the BWIP SCR, the staff comes to the following conclusions:

- Institutional factors played a minor role in the BWIP site-selection process. DOE should explain if Hanford's prior commitment to nuclear activities and federal ownership precluded the need for considering institutional factors.

- DOE should examine, in detail, the ecological significance of the reference repository location. A mitigation plan may be needed for possible adverse impacts on two critical wildlife habitats and several bird species.

- DOE should ensure that a repository's water requirement will not limit agricultural growth.

- DOE should begin to consider how it intends to monitor the radiological performance of a repository at Hanford.

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