WM Record File

WM Project WM-10
Docket No.
PDR ✓
LPDR ✓

Distribution:

NOV 30 1982

(Return to WM, 623-SS)

Distribution: w/o encl.
WM file
WMHL r/f
NMSS r/f
JBMartin
REBrowning
MJBell
RRBoyle
CGPflum & r/f
JOBunting
PDR

WMHL: 3101.1

MEMORANDUM FOR: Paul T. Prestholt
High-Level Waste Technical
Development Branch
Division of Waste Management

FROM: Regis R. Boyle
High-Level Waste Licensing
Management Branch
Division of Waste Management

SUBJECT: CHAPTER 3 OF THE BWIP SITE CHARACTERIZATION ANALYSIS: THE SITE SELECTION PROCESS

Would you please review the subject document for its geotechnical accuracy. Our review relied heavily upon references 5 and 7 (indicated on p. 3-11).

We intend to have a re-draft of this on Monday, December 6.

Original Signed by
Regis R. Boyle

Regis R. Boyle
High-Level Waste Licensing
Management Branch
Division of Waste Management

Enclosure:
As stated

cc: R. Uleck
R. MacDougall
H. Miller

8307260078 821130
PDR WASTE
WM-10 PDR

OFFICE	WMHL	WMHL					
SURNAME	CGPflum:lmc	RRBoyle					
DATE	11/30/82	11/30/82					

NRC FORM 318 (10-80) NRCM 0240 OFFICIAL RECORD COPY 00123 USGPO: 1981—335-960

Document Name:
BWIP DSCA/CH 3/PFLUM

Requestor's ID:
IRENE

Author's Name:
PFLUM C

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

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 Basalt Waste Isolation Project (BWIP). Beginning in section 3.3, the staff will briefly describe specific aspects of the BWIP 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

All of DOE's repository projects (the Office of Nuclear Waste Isolation (ONWI), the Basalt Waste Isolation Project (BWIP) and the Nevada Nuclear Waste Storage Investigations (NNWSI)) follow the programs and objectives of the National Waste Terminal STorage Program (NWTS). NWTS has published site-selection criteria (Ref. 7 and Ref. 12) which provides a basis for the process each project office will use to find a repository site.

The National Siting Plan (Ref. 7) describes a three phase siting process consisting of site screening, detailed site studies and site selection (see Figure ___, Appendix A). A brief description of each phase 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 ~~sup~~ crys talline 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 sutdies in Nevada (Nevada Test Site) and Washington (Hanford Site) using the land-use approach. Although DO~~e~~E is pursuing two additional approaches to site screening, province screening and simultaneous screening, DOE experts that the nation's first repository will be selected by either the land-use or host-rock approach.

3.2.2 ~~d~~Detailed Site Studies

After completing site screening, DOE will begin detailed site studies. The NRC refers to this phase as the Site Characterization Phase since DOE must prepare a Site Characterization Re~~p~~port before it begins. Here, DOE thoroughly assess the safety, environmental, regulatory and societal concerns associated wth constructing and operating a geologic repository at a particular site. The BWIP Site Characterization Reprot (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 suitable sites are selected for licensing. As part of the licensing process, DOE will prepare a Safety Analysis Report and an Environmental Report for the repsoitory site it has chosen. The NRC, in turn, will prepare an Environmental Impact S~~t~~atement for its decision to authorize the construction of the repository. A~~f~~ter the public has reviewed and commented on these documents, the NRC may issue a license allowing repository construction to begin.

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 surmized 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, 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. Using the host

rock approach, a screening program would pass through national and regional surveys before reaching the candidate area stage: the point where the land use approach begins. (see Figure ____, Appendix A)

National and regional surveys have lead to several candidate areas. For example, investigations at the Paradox Basin have delineated four candidate areas: Salt Valley, Gibson Dome, Elk Ridge and Lishon Valley. The land-use approach, however, omits national and regional surveys in its screening process. Consequently, there is only one candidate area. Since the Hanford Reservation was selected by the land-use approach, it is the only candidate area discussed in the BWIP-SCR.

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 Hanford compares to other candidate 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 HAnford to candidate areas selected by the host-rock approach.

The provisions of NEPA clearly state that a proposed action or its alternative must be evaluated by a comparative analysis. This will ensure that only reasonable alternatives are presented in an environmental impact statement. The staff feels that DOE should affirm that the Hanford Reservation is a reasonable choice for a repository site before the NEPA process begins by showing how HAnford compares to other candidate areas.

3.4 The BWIP Site Screening Process

3.4.1 An Overview of 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 five 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 - 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 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 (see Figure ___, Appendix A).

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).

*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)

The BWIP screening process can be divided into three phases: each distinguished by its screening criteria. The first phase encompases steps 1 through 5. Here 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.

3.4.2 A Description of the BWIP Screening Guidelines

Like repository programs in other geologic 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 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.

3.4.3 Staff Analysis of the BWIP Screening Guidelines

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 minimize 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 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.

4. 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. 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 candidate areas. 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 which are 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

DOE acknowledges that there will be variations in the screening process, depending upon where it is applied. Since the BWIP screening process begins at a greater level of detail than the National Siting Plan, a particular screening guideline that would be useful at a National or Regional level may not distinguish one site from another within Hanford's 620 mi^2. 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 up to 50 mi (except for the reference repository location which covers 18 mi^2).

3.4.4 A Description of the BWIP Ranking Factors

In phase II of the screening process, several ranking factors were used to evaluate nine candidate sites. 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.

3.4.5 Staff Analysis of the BWIP Ranking Factors

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.

3.4.6 A description of the BWIP Criteria Matrix

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

3.4.7 Staff Analysis of the BWIP Criteria Matrix

One of the baseline assumptions which were used to develop the Criteria Matrix, 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.

3.5 Staff Conclusion

The staff concludes, from its analysis of the BWIP site-screening program, that the reference repository location is ~~a~~ 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~~ and those which have followed the NWTS guidelines more closely (eg. the Paradox and Permian Basins).

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 provision 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. Consequently, the staff must affirm that the Hanford candidate area is a reasonable choice for a repository site.

The DOE did not adequately compare the Hanford candidate area with candidate 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 before the NEPA process begins; perhaps in the BWIP semi-annual reports. The candidate areas should be compared at the same level of detail as the candidate area screening step described in the National Siting Plan. An early comparison of candidate areas will ensure that only reaonable alternatives will be considered during the NEPA and licensing processes.

REFERENCES

1. Myers, C.W. et al., 1979, Geologic Studies of the Columbia Plateau: A Status Report, RHO-BWI-ST-4, Rockwell Hanford Operations, Richland, Washington.

2. Gephart, R.E. et al., 1979, Hydrologic Studies within the Columbia Plateau, Washington: An Integration of Current Knowledge, RHO-BWI-ST-5, Rockwell Hanford Operations, Richland, Washington.

3. BWIP, 1980, Identification of Canadate Sites Suitable for a Geologic Repository in Basalt Within Hanford, RHO-BWI-LD-24, Rockwell Hanford Operations, Richland, Washington.

4. W.C.C., 1980, Site Locality Identification Study: Handford Site, RHO-BWI-C-62, Woodward-Clyde Consultants for Rockwell Hanford Operatios, Richland, Washington.

5. W.C.C., 1981, Study to Identify a Reference Repository Location for a Nuclear Waste Repository on the Hanford Site, RHO-BWI-C-107 volume I, Woodward-Clyde Consultants for Rockwell Hanford Operations, Richland, Washington.

6. Ibid, volume II.

7. DOE, 1982, Public Draft; National Plan for Siting High-Level Waste Repositories and Environmental Assessment, DOE/NWTS-4, DOE/EA-151, National Waste Terminal Storage Progdram, U.S. Department of Energy, Washington, D.C.

8. DOE, 1982, Final Environmental Impact Statement; Long-Term Management of Liquid High-Level Radioactive Wastes Stored At The Western New York Nuclear Service Center, West Valley, DOE/EIS-0081, U.S. Department of Energy, Washington, D.C.

9. DOE, 1982, Final Environmental Impact Statement; Defense Waste Processing Facility Savannah River Plant Aiken, S.C., DOE/EIS-0082, U.S. Department of Energy, Washington, D.C.

10. DOE, 1982, Environmental Assessment; Waste Form Selection For SRP High-Level Waste, DOE/EA-0179, U.S. Department of Energy, Washington, D.C.

11. DOE, 1982, Environmental Assessment For The Basalt Waste Isolation Project Exploratory Shaft Construction; Hanford Site Richland, Benton County, Washington, DOE/EA-0188, U.S. Department of Energy, Washington, D.C.

12. Staff, NWTS Program Criteria for Mined Geologic Disposal of Nuclear Waste, Site Performance Criteria, NWTS-33(2), Office of Nuclear Waste Isolation, Battelle Project Management Division, Columbus, Ohio, February, 1981. Previously issued in draft form as ONWI-33(2), Site Qualification Criteria, Draft, Office of Nuclear Waste Isolation, Columbus, Ohio, November 21, 1979.

13. Staff, Comparison of NWTS-33(2) Criteria and Basalt Waste Isolation Project Screening Consideratios, RHO-BW-EV-IP, Rockwell Hanford Operatios, Richland, Washington, August 1981.

14. S.R.S. Inc, 1981, Engineering Feasibility Studies for Candidate Salt Domes: National Waste Storage Repository No. 1, Special Study No. 5, ONWI-283, Steams-Roger Services Inc for Office of Nuclear Waste Isolation, Battlelle Project Management Division. Columbus, Ohio.

15. Panel on Hanford Wastes, 1978, Committee on Radioactive Waste Management, Commission on Natural Resources, National Research Council, Radioactive Wastes at the Hanford Reservation, A Technical Review, National Academy of Sciences.

16. DOE, 1982, Site Recommendation Guidelines, draft, U.S. Department of Energy, Washington, D.C.