



United States Department of the Interior

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Denver Research Center
Ground Control Division

May 7, 1986

Mr. Banad Jagannath, Project Manager
Engineering Branch
Division of Waste Management
Nuclear Regulatory Commission
1920 Norfolk Avenue
Bethesda, MD 20814

Dear Mr. Jagannath:

The enclosed comments pertain to the Conceptual Geologic Repository Design and the Exploratory Shaft Test Plan for the NNWSI project site discussed during the meeting at NRC, February 26-27, 1986. The comments describe information needs to evaluate the Site Characterization Program, which are not adequately discussed in the Conceptual Design and Test Plan.

If we can provide further assistance for this review, please phone me at FTS 776-0741 or Dave Conover at 776-0755.

Sincerely,

for R. L. Mundell
Supervisory Mining Engineer

Enclosure

- cc: D. R. Forshey, WO
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- R. L. Mundell, DRC
- D. P. Conover, DRC
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NRC - NNWSI Meeting Review (February 1986)

Title: Evaluation of Conceptual Design and Exploratory Shaft Test Plan
Reviewer: Dave Conover

1. Fault Behavior

Relevant sections of 10 CFR 60

- 60.122 (c) (3 and 4) Siting criteria: Potentially adverse conditions - Potential for natural phenomena to adversely affect groundwater flow.
- 60.133 Additional design criteria for the underground facility:
 - (c) Retrieval of waste
 - (d) Control of water and gas
 - (e) Stability of underground openings
- 60.140 (c and d) Performance confirmation: General requirements - In situ testing

Because of the importance of fault behavior on repository performance, it appears the planned site characterization activities to investigate fault parameters are insufficient. The key parameters to be evaluated are: 1) water content and hydraulic conductivity of faults, 2) stability of faults around mined openings, 3) evidence of, or potential for, movement along faults, 4) fault behavior under expected thermal loads, and 5) the frequency and spatial distribution of faults throughout the planned repository area.

If fault areas are found to be unsuitable for emplacement operations and if a large number of faults intersect the repository horizon (both conditions are reasonably probable), then a significant portion of the repository area would be unsuitable for waste emplacement, possibly reducing the capacity below an acceptable level. This condition would further aggravate the failure to meet the lateral flexibility guideline (10 CFR 960. 5-2-9).

Investigation of the stability of openings intersected by faults will be difficult due to the limited excavation planned for the exploratory shaft test facility. ~~Stability problems may increase in areas where faults intersect multiple openings, intersections between openings, and junctions between differently-sized openings.~~ In addition, the stability of openings may be adversely affected by faults oriented parallel to the openings and by the effects of filling materials, water, and thermal loads. The uncertainty regarding the effect of faults on opening stability should be reduced once the underground test facilities have intersected faults and if the proposed lateral core drilling can adequately show the intersected faults are representative of faults throughout the repository.

Significant problems may arise if movement occurs along faults that intersect emplacement boreholes. These problems are reduced for the vertical emplacement scheme because the faults are approximately vertical and the frequency of faults intersecting boreholes would be less. For the horizontal emplacement scheme, significant storage area may be lost unless

the fault areas are used for emplacement. Fault movement may cause bending, pinching, or other disruption of the hole liner, making retrieval operations more difficult. Fault movement could also rupture canisters making retrieval more hazardous and potentially compromising containment performance.

2. Ventilation System Performance

Relevant sections of 10 CFR 60

- 60.131 General design criteria for the geologic repository operations area
 - (a) Radiological protection
 - (b) Structures, systems, and components important to safety
 - (3) (i) structures to withstand fires/explosions
 - (4) emergency capability
 - (9) compliance with mining regulations
- 60.133 Additional design criteria
 - (a) (2) Prevent spread of disruptive events
 - (g) Underground facility ventilation

The Conceptual Design indicates that during repository operation, waste emplacement and emplacement-room construction will occur concurrently. To control the potential release of contaminants from the emplacement areas, two separate ventilation systems are proposed, one for the emplacement areas and another for the construction areas. Both systems will use exhausting-type main fans, and the emplacement system will operate at a lower (more negative) pressure than the construction system to prevent leakage to the construction areas. The main fans for both systems will be non-reversible.

Although a non-reversible fan is advantageous in directing airflow in the emplacement system away from active working areas, it may compromise safety in the event of fire. The proposed repository operation excavation system uses minimal combustible material with the exception of fuel and lubricating oil for mining and emplacement equipment. However, combustible material will likely be stored in the shop areas to maintain and repair equipment. Since the shop areas are in the same general area as the shafts and ramps, a major fire could block all available exits. The capability to maintain a negative pressure in the emplacement system could be assured by installing exhaust fans, both at the waste exhaust shaft and the waste ramp. A similar installation could be applied to the construction system; however, operating the construction fan at positive pressure during reversal would still maintain the intended pressure differential between the two systems. Although the ability to reverse the fans may be beneficial, the relatively small size of the underground facility may allow extensive dispersion of smoke and fumes before the airflow could be reversed. An alternative solution is to provide an additional shaft at the southern repository boundary to serve as an escapeway and a supplemental ventilation source during an emergency.

To properly evaluate the performance of the structures (bulkhead, doors, etc.) that separate the two ventilation systems, it would be helpful to

have a description of the pressure distributions in both ventilation systems during various stages of development. Actual pressures after construction may be significantly different than those predicted due to mining inconsistencies, variable flow geometries during different development stages, and localized influences such as thermal loads. Identification of areas having low pressure differentials would be useful to evaluate the adequacy of isolation barriers.

3. Seismic Loading of Underground Structures

Relevant sections of 10 CFR 60

- 60.131 (b) Structure, systems, and components important to safety
- 60.133 (e) (1) Stability of underground openings
(h) Engineered barriers
- 60.134 Design of seals for shafts and boreholes

The proposed design of surface facilities is based on recognized standards and guidelines and includes design features to mitigate the effects of seismic loading. Although underground structures are normally less susceptible to damage from seismic loads, a detailed explanation of the design basis would be useful in evaluating the design of the shaft structures (collar, lining, stations), ventilation isolation barriers (bulkheads, doors), and other extensive structures.

4. Monitoring Plan

Relevant sections of 10 CFR 60

- 60.131 (b) (8) Instrumentation and control systems
- 60.140 (b) Begin performance confirmation monitoring during site characterization
(c and d) Types of tests and testing requirements
- 60.141 Confirmation of geotechnical and design parameters
- 60.142 Design testing

The SCP should describe the monitoring plans to be included in the repository and how suitability and performance characteristics of various instrument types will be evaluated.

5. Shaft and Borehole Sealing

Relevant sections of 10 CFR 60

- 60.134 (a) General design criterion
(b) Selection of materials and placement method (amended)

Site characterization should provide evidence that suitable sealing methods are available to adequately meet performance requirements. Regardless of the selected method (impervious vs. pervious), the SCP should describe testing to be conducted to evaluate sealing methods. In addition to hydrologic implications, the design and testing program should consider the seal behavior under seismic loading and fault displacement.