United States Department of the Interior

BUREAU OF MINES
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Mr. John Greeves
Chief Engineering Branch
Nuclear Regulatory Commission
Willste Building, 6th floor
Silver Springs, Maryland 20555

Dear Mr. Greeves:

In accordance with NRC/BOM Interagency Agreement No. NRC-02-80-075, "Technical Assistance for Assessment of Repository Siting and Design," we are forwarding a review conducted for NRC by BOM's Pittsburgh Center. The document reviewed was Engineers International's contract report No. 3489 for NRC entitled, "Assessment of Retrieval Alternatives for the Geologic Disposal of Nuclear Waste."

Sincerely,

for Harry R. Nicholls
Assistant Director--Mining Research

Enclosure

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BOM Review of Nuclear Regulatory Commission Report No. 3489

Assessment of Retrieval Alternatives for the Geologic Disposal of Nuclear Waste

1. The canister placement method which uses a carbon steel sleeve that is grouted into place with cementitious absorptive material is not familiar to the reviewers. This method is referred to in Sections 4.1.4, 5.1.4, 6.1.4, 11.1.4, 12.1.4, 12.1.4, and 13.1.4 of the Appendices. In these sections a common statement used for canister arrangement is "within standard tunneling technology." No mention is made how the sleeve or grout are placed. Most recent conceptual designs are for long horizontal boreholes backfilled using pneumatically emplaced material. Evaluation of backfill techniques by the Bureau of Mines indicates there may be significant problems in pneumatically placing backfill in long horizontal boreholes. This report does not adequately address the problems of backfilling with respect to the impact the backfilling technique may have on how the canisters are retrieved. Specifically, the retrieval of canisters that have been surrounded with pneumatically emplaced backfill should be examined.
2. This report gives little information about how canisters can be retrieved from long horizontal boreholes even though this is the most recently developed concept. Overcoring to remove a single canister is the main technique discussed. Primary emphasis for retrieval is given to the cooling of backfill in rooms and removal of the backfill from those emplacement rooms.
3. The methods of canister retrieval from vertical and horizontal holes would be much different. To avoid confusion, separate discussions of retrieval from horizontal and vertical holes should be given in Sections 3, 4, and 5 of this report.

4. The degree of compaction of backfill material (in borehole or emplacement rooms) will probably have an effect on retrieval of canisters. The influence of compaction on retrieval should be examined.

5. In basalt and tuff repositories it is assumed that the backfill material will consist of 75% crushed rock and 25% bentonite (cf. p.41). Many other mixtures including those containing cement and magnesium oxide have been proposed. The effect of backfill composition on retrievability should be discussed. In addition, this report assumes that backfill composition in the borehole and in placement rooms will be the same. This is unlikely if long horizontal boreholes are used.

6. In this report, the repository designs that assumed backfilling of placement rooms assumed backfilling of the boreholes at the same time. Immediate backfilling of the boreholes would add structural integrity to the holes, provide heat transfer to the host rock and prevent migration of water to the canister. Leaving placement rooms open would provide cooling until the integrity of the canister and backfill was assured and rooms could be backfilled. A retrieval technique for this scenario should be provided.

7. On page 37, 106°F at 100% humidity is excessive. Airflow volume calculations are on basis of ventilating all 130 rooms in parallel and reducing temperature to 106°F. Is this practical? What air velocities are there in the intakes and returns? What is the basis for calculating the volume of air to cool down to 106°F; is it just air velocity?

8. On page 56, Stress Control Method relies upon creating a pressure arch through developing a zone of fractured rock within the bounds of the arch. This increases the permeability, and decreases the effectiveness of the geological barrier.

9. On page 58, for a homogeneous rock, an oval opening is theoretically the most stable, but when the effects of joints are considered, it is probably more unstable than a circular tunnel.

10. On page 59, drill and blast does more damage to the rock than a tunnel boring machine. If stresses are high enough to cause spalling, then it would just create a loosened zone similar to that formed by blasting.

11. On page 61, a safety factor derived from strength/stress, does not mean rock will not fracture. South African work has shown that fractures start around excavations for stress = 0.2x strength.

12. On page 69, will the use of rockbolts lead to larger thermal stresses in the rock upon cooling the rooms for retrieval operations?

13. If overcoring is not feasible, how can a canister be removed if borehole squeezing occurs. It seems that an overcoring technique must be developed in the event a canister needs to be removed from a collapsed or squeezed emplacement hole.

14. The many references to "standard" tunneling techniques are misleading since 24 to 48 inch diameter boring projects are not routinely performed.

15. Concerning borehole deviation parameters: there are indications that bit type, in situ stress fields, rotational speeds, and penetration rates also have an impact on deviation.

16. Is the reaming room to be intersected at a specific point by the horizontal emplacement holes?