February 16, 1983

Memorandum

To: David Tiktinsky, U.S. Nuclear Regulatory Commission, High-Level Waste Technical Development Branch, Division of Waste Management

From: Ernest L. Corp, U.S. Bureau of Mines, Spokane Research Center

Subject: NRC/DOE/SNL Engineering Review Meeting and Nevada Test Site Trip, January 24-26, 1983

The two-day review meeting at Sandia National Laboratories in Albuquerque, New Mexico addressed site characterization and conceptual design work on the proposed nuclear waste repository in tuff at the Nevada Test Site.

In general, I was very pleased with the progress to date on the Nevada Nuclear Waste Storage Investigations (NNWSI) Project. The reasons for this favorable impression are: (1) The site on Yucca Mt. appears more favorable than the Hanford basalts in terms of unresolved critical issues (hydrology, opening stability, etc.) that will affect repository safety; (2) the cost of constructing a repository will be far less than in basalt because of the shallower depth, the lack of overlying acquifers, and softer rock formations; (3) NNWSI personnel have taken a more candid approach to addressing critical issues than personnel at BWIP; (4) site characterization and design work conducted for NNWSI is more thorough and defendable than that at BWIP; and (5) the NNWSI team appears better qualified.

The conceptual design studies use a multi-faceted approach that includes analytical analysis, finite element, joint behavior, rock mass quality, and case histories. Rock strengths are reduced 50 to 60% over laboratory values, a factor of safety is employed, and sensitivity analyses have been made to determine the most critical parameters affecting design. BWIP designs incorporated only a simple linear elastic analysis with no consideration to strength reduction, factor of safety, or parameter sensitivity.

Site characterization information for Yucca Mt. is more detailed than for Hanford, and a more thorough program of sampling and in situ testing has been completed. Also, exploratory work planned for the experimental shaft on Yucca Mt. is more extensive. For example, seven 2,000-foot holes are planned at the repository horizon. BWIP personnel seem unconcerned about exploring their potential horizons.

Specific items of criticism on the NNWSI Project are:

1) Finite-element studies on opening stresses should include an elastic-plastic code in addition to Adina and Spectrum which are elastic. Elastic codes give unconservative results in terms of failure-zone propagation (presentation by Keith Johnstone).

2) The horizontal placement concept using blind boreholes, 24 inches in diameter and 700 feet long appears to be beyond current technology. The ability to drill a horizontal straight hole of this length is doubtful, and the ability to retrieve waste at a later time is even more doubtful.

3) There is a variation in the assumed parameters used for various design calculations. For example, a vertical to horizontal stress ratio of 1/3 was used in the structural studies of opening stability. A ratio of 1/6 was used in the thermal stress analyses. It is understandable that the different analyses are done at different periods in time and the accuracy of the assumptions may improve. However, older calculations should be updated to reflect new information.

4) The problem of waste retrieval has not been seriously addressed. Removal of canisters from 700-foot long horizontal holes by over-coring may present some insurmountable problems in terms of hole alignment and possible damage to the canisters. A pre-licensing demonstration of emplacement and retrieval feasibility would seem appropriate.

5) More information is needed on the long-term performance of the repository in terms of safety and its ability to meet the requirements of EPA and NRC. This should include studies on canister life in a partially saturated environment where acids formed by radiolysis may accelerate corrosion. More work on a far-field fluid flow model (gas & liquid) is needed to better understand the interactions of infiltration, repository temperature, unsaturated flow through intact rock, water table fluctuations, and fracture control of flow. Also the effects of fault movement on canister breaching should be considered. If a canister is breached, where will the waste go, how long will it take to get there, and what intervening natural or man-made features may intercept this flow? Air as well as water contamination should be considered. Incorporated in these studies should be the need for sealing and what contamination is being controlled by sealing, if any.

On January 26, a tour was made of the Nevada Test Site. This included observations of the geology and topography of Yucca Mt., the spent fuel tests at the Climax Mine, and the underground in situ test work in the G-Tunnel.

The in situ experiments conducted in the G-Tunnel (in situ stress, heater tests, and ground support and stability monitoring) appeared to be well designed, simply executed, and relatively successful. Compared to BWIP's New Surface Test Facility (NSTF), the rock conditions in G-Tunnel (tuffs) are more representative of those at the repository horizon. Test results, therefore, should be much more applicable. The G-Tunnel looks and is operated the way a test mine should look and be operated. Contrasted to the movie-set appearance of the NSTF, G-Tunnel should produce reliable data, more quickly, and at considerably less cost.

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