March 20, 1984

Mr. David Dahlem, Team Leader
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RRL Seismicity; Microearthquakes

Dear Dave:

The purpose of this letter is to expand on the point I raised at the NRC-USDOE workshop on March 14th. This topic will be entered in our "issues file", a formal data base maintained in this office to record unresolved problem areas.

Seismic Data at Hanford: Both U of W and BWIP data show shallow activity at and around the RRL, in contrast to, for example, the lack of recorded data on some "suspect" structural alignments. I am concerned that the tectonic modeling will concentrate on large, unlikely events such as the "floating" magnitude 8 earthquake and not pay due attention to what current data tells us: That microearthquakes and slightly larger events are not only probable, they are a geologic certainty at and near the RRL.

Possible Effects on Mined Openings: At the proposed depths there are high, anisotropic stresses in brittle, highly jointed rock. The inevitable stress concentrations at corners and junctions in drifts and crosscuts, shaft entries and drilled embayments create, in our view, considerable risk of rockbursts or uncontrolled spalling, even before the thermal pulse from the waste canisters. The combination of the thermal pulse and close-in microearthquakes, in our view, provides a good trigger mechanism.

Failure Scenarios: Rockbursts or other uncontrolled types of stress relief are hazardous to people and equipment during mining, but the real risks to public health and safety arise after the beginning of repository operation and before the final backfill and sealing, say for a period of 30 years. The thermal pulse will have begun and microearthquakes are certain to occur.

While most conceivable rockbursts would not broach a waste container, the container might well become wedged in an unwanted,

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uncontrolled way, and a continuation of rock failure might well make it either inaccessible or extremely costly and difficult to recover.

The failure of even small parts of the underground structure would create zones of vastly increased permeability precisely where they can do the most harm over geologic time, and while good mine design will obviate block-caving, fractures can be expected to propagate upward and outward into lubricated rock. These effects might well make idealized calculations of groundwater movement and velocity moot.

Proposed Action: We believe a major part of the tectonic model effort should address microearthquake activity, to explain their causes and nature in sufficient detail and with reasonable certainty of being right. Then we believe this information should be cycled through mine design, rock mechanics and thermal stress analyses and into performance evaluation.

Conclusion: Frankly, I am not nearly as concerned with magnitude 8 events, for which there is not a shred of evidence supporting a probable occurrence in the 30 to 50 year period the mine is open, as I am with magnitude 2 events which are certain to occur in that period.

Once backfilled and sealed, the repository should withstand any conceivable earthquake, and in your file of "natural analogs" you may want to include pre-Inca water tunnels in Peru, in layered volcanics, that have withstood very large, very frequent earthquakes for 800 years without failure.

But RRL conditions are vastly different, and as things are now, the adequacy of tectonic modeling is an unresolved issue.

Sincerely,

Bill

William A. Brewer
Engineering Geologist

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cc: Robert Wright, NRC