

STANFORD



UNIVERSITY

DEPARTMENT OF GEOLOGY
School of Earth Sciences
Stanford, California 94305-2115

TELEPHONE: (415) 723-2537
TELEX: 348402 STANFRD STNU

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ACRS CONSULTANT'S REPORT

Mr. Owen Merrill
Senior Staff Engineer
ACRS
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Owen:

Here are some random thoughts about the presentations we heard during the past three days in Tucson and Las Vegas. If you think they would be of any interest to Dade, I hope you will send them along to him.

University of Arizona. Seems to me some good research is being done, and just for the sake of scientific knowledge I'm glad to see such work supported, but I wonder if all of it is relevant to NRC's problem of judging the licensability of DOE's disposal efforts. For example, Jaak Daemen gave a good presentation of his work on seals, in repositories in granite and basalt, but a major worry seemed to be the effect of wetting and drying. Such repositories, as far as I know, will be well below the water table, so I wonder if this worry is relevant? Once a repository is closed, only in extraordinary circumstances would it ever dry out. Also I doubt that finding an exact relation between flow rate and pressure is important for an actual repository situation. Shlomo Neuman's talk was an impressive analysis of the difficulties of predicting flow thru fractured rocks and of his efforts to surmount the difficulties, but I was left with the feeling (as I have been after many other discussions of this forbidding subject) that I still didn't understand how his equations and experimental results would help much in judging a real-life repository. Much the same criticism can be leveled at the work of Dan Evans and his colleagues: they have developed methods for obtaining much useful scientific information, but are they asking the right questions to get information quickly and efficiently that will apply directly to licensing problems? One other objection I had to the presentations in Tucson was the repetition in the talks of materials that we had already seen in the pre-meeting handouts.

Talk by Carl Johnson of the Nevada Agency for Nuclear Projects. It is hard to comment objectively about this talk, because the speaker took a negative attitude toward every question regarding the Yucca Mountain site.-- which I expect he was required to do by his political position. At least it is encouraging that the State and DOE are looking at the same set of questions, and I expect it is salutary for DOE to be continually reminded of the possible negative answers.

DOE - USGS presentations in Las Vegas. These talks were well organized and well presented. Seems to me the right questions are being asked, the methods of attack are reasonable, and appropriate attention is being paid to estimates of uncertainty. There is some overkill in the planned research, but much less than at Tucson. The only talk that disappointed me was the one on radionuclide retardation by K. Eggert. We were shown tables of retardation factors, and told about plans for getting additional numbers, but we heard very little about how the numbers were obtained. Retardation factors have no meaning unless the conditions of the experiments are specified very precisely -- the nature of the solid material used, the pH and Eh and chemical composition of the solution, the assurance that steady-state conditions were reached, and so on. To me, one of the major unknowns about the unsaturated zone is the oxidation potential and acidity of solutions that move thru it, and I wish more had been said about how these will be

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PDR WASTE
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PDR



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determined. They are essential not only in limiting retardation, but also in limiting solubility of radionuclides and in influencing the formation of colloids. Very probably the people doing the research are aware of all this, but I wish Mr. Eggert had made it clear in his talk.

John Stuckless in his talk on hydrothermal activity made it pretty clear that there is little evidence for warm solutions or mineralization at the site. Much of his talk concerned the exposures in trenches across a fault that we saw at the end of our field trip, and from the very superficial examination we could make I would certainly agree with him that the calcite-opal mixtures look like the work of pretty cold water. As I remember it, the only evidence he cited for elevated temperatures was from work on fluid inclusions in quartz from the matrix of the Tiva breccia. Just to be on the safe side, I suggest that samples of this matrix be assayed for gold and silver; if the solutions from which the matrix formed were warm, traces of the metals might be present. If the metals are completely absent (as I expect they will be), this would help to confirm that the site lacks mineral resources of any consequence. Assaying is a simple and inexpensive procedure, so it might be well to include also samples of the calcite-opal material from the fault zone and any similar material from fault- or vein-fillings elsewhere at the site.

G-tunnel. seems to me that Roger Zimmerman is getting valuable information about the behavior of welded tuff from his in-situ experiments. The heating experiments, however, give somewhat ambiguous results because they are done with short holes drilled into a rock face that is exposed to a well-ventilated tunnel. I would like to see an experiment on a larger scale, of this general sort: seal a section of the tunnel a few tens of meters long, or drive a branch tunnel that can be sealed; put heaters in the tunnel so that its temperature can be raised to the point expected in a repository; and equip the tunnel with instruments to see what happens to water in the adjacent rock. My guess is that water moving down thru the unsaturated zone toward a heated repository would never reach the repository, but would be deflected around it by multiple vaporization-and-condensation. G-tunnel would be a fine place to see if the guess is correct.

I hope this will be of some use. You arranged a fine trip for us to Tucson and Las Vegas, and I do thank you for taking care of all the details.

Sincerely,

Konrad B. Krauskopf