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LETTER REPORT

TITLE: Review of: "Hydrothermal Interaction of Topopah Spring Tuff with J-13 Water as a Function of Temperature," in Scientific Basis for Nuclear Waste Management VIII, Mat. Res. Soc. Symp. Vol. 44, 539-546, 1985, by K.G. Knauss, J.M. Delany, W.J. Beiriger, and D.W. Peifer.

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PROJECT TITLE: Technical Assistance in Geochemistry

PROJECT MANAGER: G. K. Jacobs

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The subject report documents a study of the interaction between Topopah Spring Tuff and J-13 well water at temperatures of 150° and 250°C. Wafers of crushed tuff were reacted with J-13 well water for 66 days in a Dickson gold-bag apparatus, allowing fluid samples to be removed during the course of the experiments. The main objectives of the study were:

1. To assess the ability to use "accelerated" tests based on the SA/V parameter and temperature.
2. To measure the changes in chemical composition and phases in the solids resulting from the hydrothermal interaction.
3. To test the validity of the EQ3/6 code.

Results are reported for the solution concentrations of Si, Na, Ca, K, Al and Mg. Silica appears to be controlled by cristobalite solubility in both sets of experiments, while most of the other species appear to be controlled by clay or zeolite equilibria. Although the solution compositions from these experiments should be directly comparable to those reported by Oversby (UCRL-53552, 1984) for the reaction of Topopah Spring Tuff with J-13 water at 150°C in Parr bombs, no mention is made of these experiments. Oversby's data is reported based on water/rock mass ratios used in the experiments versus the SA/V units reported in this document, making the comparison less than straightforward. The agreement is good, except for potassium, when this data is compared to the intermediate water/rock ratio (30:1, 60:1) experiments of Oversby. When the brief subject report is expanded into a full length document, a comparison between the data sets should be included.

The major importance of these experiments comes from examination of both the solutions and the solids, which not only helps to predict both

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the mineralogy and solution composition under repository conditions but also allows the validation of geochemical models, in this case EQ3/6.

For the 150°C experiment the agreement between the observed alteration mineralogy and solution composition and that predicted by the model is excellent. In this case the alteration assemblage is cristobalite, calcite, gibbsite and various clays.

A major problem is encountered in the 250°C experiment which prohibits any worthwhile attempts at geochemical modeling and model validation. The most abundant alteration product is a zeolite, daschardite. No thermodynamic data exist for this phase, a Ca, Na, K alumino-silicate, hence the model can not be applied. This points out one of the deficiencies in the thermodynamic data base; the lack of data on the zeolites. Since the zeolites form in the temperature and pressure range of interest, and are also potentially very important in retarding radionuclide transport, this is a major problem. In order for the experiments reported in this document to be of maximum utility in predicting repository conditions and in model validation requires additional work to be done on the thermodynamic properties of zeolites.