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Study Plan Title MECHANICAL ATTRIBUTES OF THE WASTE PACKAGE ENVIRONMENT

Revision Number 1

Prepared by: LAWRENCE LIVERMORE NATIONAL LABORATORY

Date: MARCH 12, 1993

Approved:

3/30/93

Director, Regulatory and Site Evaluation Division / Date

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1-2 Relation of activities described in this study plan to characterization of the WP environment 1-10

1-3 In the reference configuration, the waste container is emplaced in a vertical borehole with an air gap between the waste

Table 2-2. Rationale for temperature ranges to be used in experiments.

Range no.	Temperature range	Rationale
1	23–90°	This temperature range will allow us to provide background data; assess whether or not lower temperatures will aid in the isolation of the WP; and assess the effect of geochemical changes on mechanical properties that are associated with increasing temperature in this range.
2	90–150°	This temperature range will allow us to determine the effect of boiling pore water on rock properties; and assess the effect of geochemical changes on mechanical properties that are associated with increasing temperature in this range.
3	150–250°	This temperature range will allow us to determine the effect of cristobalite and other mineral phase transformations on geomechanical properties; and assess the effect of geochemical changes on mechanical properties that are associated with increasing temperature in this range.
4	250–300°	Elevated temperatures, when possible, will allow us to drive mechanisms at higher rates.

Table 2-3. Values of α and γ corresponding to confidence levels defined by issues.

Specified confidence level	α	γ = (1 – a)
High	0.05	0.95
Medium	0.10	0.90
Low	0.25	0.75

Table 8.3 of Bowker and Lieberman (1972) can be used to obtain an estimate of the number of samples (n) necessary to provide the required statistical confidence in the parameter. However, for a heterogeneous and poorly characterized material, such as rock from the potential repository horizon, there is not enough information available regarding the variability of some properties with which to reliably estimate a preliminary number of required samples. Moreover, for other properties, the initial estimate of the standard deviation is too high and/or the initial tolerance limit is too tight for this approach to be applied directly. In both cases, an alternate approach has been employed which, although arbitrary, will allow a preliminary sampling strategy to be formulated. In the alternate approach, the required number of initial experiments is estimated by determining the number of experiments needed to attain a consistent but arbitrary tolerance limit (i.e., the k value). Based upon engineering judgement, a value of k equal to 2.5 was selected for determining the initial number of samples. For the three confidence levels, the corresponding numbers of samples are 3[$\gamma = (1 - \alpha) = 0.75$], 11[$\gamma = (1 - \alpha) = 0.90$], and 34[$\gamma = (1 - \alpha) = 0.95$]. These three values have been rounded to 5, 10, and 35 for the convenience of this study. These numbers of samples are consistent with previous testing experience with similar rocks and with the number of samples required for adequate estimates of the mean and standard deviation for the properties.

Table 1-1 shows that the needed confidence for thermal and mechanical properties of the postemplacement WP environment is high, which implies that for irradiation and drying/rewetting experiments $n = 35$ as shown in Table 2-1. This is consistent with the results of Durham et al. (1986) who

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