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REVISED DESCRIPTION OF PROPOSED NEW ACTIVITIES FOR FIN A-1755 DURING FY85

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Introduction

At the review meeting for FIN A-1755 at Sandia (SNLA) on October 15 and 16, 1984, several activities for this project during FY85 were proposed. These activities, some of which were suggested by J. Peshel (NRC), are expected to be carried out in addition to the review of documents and attendance at workshops and meetings. Below, a short description of each of the proposed activities is provided, including estimates of costs and personnel efforts required, as well as deliverables. After review by NRC staff, priorities can be assigned to the suggested tasks by mutual agreement with SNLA personnel. Any questions regarding these activities can be directed to K. Wahi (FTS 844-6268) or E. J. Bonano (FTS 844-5303).

Proposed Activities

A. Shaft-seal Failure Analysis

It is proposed that analyses similar to the ones performed during FY84 to investigate the performance of shaft seals be carried out using more realistic parameter values. The new analyses will include effects of seal geometry and a more detailed description of the stratigraphy along the shaft length. Jaak Daemen's input and expertise will be used in the design of these calculations. From these analyses, the effects that the performance of shaft seals has on the ground-water flow and, consequently, the radionuclide transport around the repository can be studied.

A generalized version of the DNET Code that allows for set up of a general (i.e., not a fixed number of legs) network will be used for the calculations. The code is capable of treating creep deformation, salt dissolution and heat conduction

simultaneously. The DNET code could be modified to include radionuclide transport by incorporating the Distributed Velocity Method (DVM) of the NWFT/DVM Code in DNET. The transport calculations can assist in evaluating the consequences associated with different scenarios by providing estimates of releases at the accessible environment. The scope of the analysis will be limited to bedded and domed salt.

The estimated effort is 3.5 man-months at a cost of $45K, including computer charges. Upon completion of the analyses, a letter report will be prepared and forwarded to NRC. This letter report shall include description of the problems, description of the network used, and discussion of results.

B. Thermohydrologic Analysis of BWIP Site

Results of a recent two-dimensional analysis of ground-water flow and heat transport around a repository using SWIFT II, and the reported variations in the field data for basalt indicate a need to perform a three-dimensional coupled thermal-hydrologic analysis. It is expected that the latter will elucidate the flow-reversal effects obtained with the two-dimensional model and will provide a more realistic estimate of the extent of the disturbed zone. In addition, it will provide a better description of the ground-water flow path and the path length.

It is noted that in the draft EA for basalt, results of different models give widely different flow directions. Thus, this is a subject that deserves further investigation.

For this analysis, we propose to use the SWIFT II Code which has two- and three-dimensional modeling capabilities. A direct comparison with the two-dimensional model results

mentioned earlier will quantify the effects of model dimensionality on flow direction and flow rates. Once the effects of model dimensionality have been elucidated, the DNET code with DVM can be used to carry out performance calculations. It is emphasized that the DVM capability does not exist in DNET at this time. The DNET network, design, and boundary conditions would be based on SWIFT II results.

Upon completion of these analyses, a letter report will be prepared and forwarded to NRC. The report will discuss the relative merits of three-dimensional models of the BWIP Site. It will provide estimates of the effects of repository heat on flow, and comment on the significance of coupling between thermal and hydrologic effects.

C. Near-field Thermomechanical Response

The conceptual design for BWIP has undergone many revisions. The most recent design calls for horizontal emplacement of waste canisters in the pillar walls with one canister per hole. When thermomechanical stresses are superimposed on the in-situ stress field, the stress concentrations near the pillar walls may cause structural instabilities. An elastic-plastic analysis is proposed that would simulate the thermomechanical response of a typical emplacement room. The predicted stress and strain fields could be used to identify potential "failure" zones where artificial support may be required. It could also serve as an independent verification of DOE analyses and help assess the adequacy of their design.

Two-dimensional simulations using STEALTH and/or SANCHO are proposed to predict the stress and strain fields. The estimated effort is 1.5 man-months and the cost is $20K,

including computer charges. A letter report describing the problem, modeling approach, and discussion of results will be prepared and forwarded to NRC.

D. Structural Integrity of Waste Package

Depending on the design, an initial gap between the host rock (hole surface) and the waste package may exist; this gap is expected to close with time. Once the host rock and the package surface come in contact, radial stresses will be transmitted to the package liner (overpack). The stresses can

lead to structural failure (elastic buckling, plastic deformation etc.) of the canister. The magnitude of the radial stress will be a function of factors such as elastic properties of the host rock, thermal load, temperature gradient, etc. In order to evaluate the structural integrity of the waste package, appropriate analyses that take into account these factors need to be carried out.

A combination of analytical and numerical techniques is proposed for these calculations. Conditions under which a canister may fail shall be identified. The radiological consequences of canister failure can be evaluated with a simplified NWFT/DVM analysis. The estimated effort is 3.5 man-months at a cost of $40K, including computer charges. A letter report will be prepared and forwarded to NRC detailing the analyses and results obtained.

E. Coupled Thermomechanical-Permeability Effects

There is a need to assess the state-of-the-art for the treatment of coupled stress-permeability effects. There are

circumstances when thermomechanical effects, such as glaciation, can possibly alter the ground-water flow. One such case is the possibility that continental ice sheets re-advance with the concurrent lowering of the sea level so that the ice sheets cover the Pasco Basin or enter the Columbia River Drainage at the Handford Site. In either of these two scenarios, the fracture apertures can be altered due to loading or unloading and, consequently, alter permeability resulting in changes in ground-water flow.

Empirical stress-fracture aperture relationships, and expressions relating permeability to fracture aperture that allow treatment of the effect of stress variations on flow have been proposed in the literature. Also, there are several studies reported in the literature that examine the effects of temperature variations on permeability. A literature search is proposed to assess the state-of-the-art for the treatment of these coupled effects. The effort for this task is estimated at 2 man-months at a cost of $20K. A letter report will be forwarded to NRC incorporating the findings of the literature search and recommendations with respect to the incorporation of appropriate relationships into existing or future models and/or analyses.