

SEP 14 1983

DISTRIBUTION

MEMORANDUM FOR: Philip S. Justus, Section Leader
 Siting Section
 High-Level Waste Technical
 Development Branch
 Division of Waste Management

FROM: Jeffrey A. Pohle, Project Manager
 Siting Section
 High-Level Waste Technical
 Development Branch
 Division of Waste Management

SUBJECT: LBL TRIP REPORT

WM s/f(3109.9) ✓
 WMHT r/f
 NMSS r/f
 CF
 REBROWNING
 MBELL
 PALTOMARE
 JBUNTING
 HJMILLER
 JPOHLE & r/f
 JTGREEVES
 DMILTON
 SGROOMS
 PDR
 LOGSPEN

On August 17-19, 1983, I accompanied P. Ornstein, M. Weber, and M. Gordon to a workshop arranged by WMHL on the variably-saturated, non-isothermal computer code TOUGH at the Lawrence Berkeley Laboratory in Berkeley, California. The purpose of the workshop was for NRC staff to acquire a working knowledge of TOUGH prior to LBL's transfer of the code to NRC in mid-September.

A detailed description of the code as well as the workshop agenda were included in P. Ornstein's Trip Report of August 26, 1983 which was distributed previously.

This code is primarily a research tool which has been used by LBL in their Geothermal Program. The code exists as a package of subroutines (twenty or so) which in various configurations, including additions and deletions in the past was called Shaft 79, Mulkom and now TOUGH. In general, LBL prefers to call the package a simulator and avoid specific names because, as I understand it, it is often modified to answer specific research questions as they arise.

For certain types of problems this code, in the form to be transferred to the NRC, is applicable where other codes available in-house are not. For example, problems involving the very-near field surrounding a canister where heat (and water evaporation and condensation) is important can be simulated. By use of a subroutine called GMINC, flow in a fractured medium can be simulated although this is not an easy task. In such a simulation flow is considered to be only in the fractures and not the rock matrix. This is similar to the dual-porosity version of SWIFT (except SWIFT cannot consider heat).

WM Record File 109.9 WM Project 1
 Docket No. _____
 PDR
 LPDR _____

Distribution: _____

 (Return to WM, 623-SS) CZ

8309270662 830914
 PDR WASTE
 WM-1 PDR

AUG 14 1983

109.9/JP/83/09/02/0

- 2 -

The one area where use of this code might not be applicable is under low saturations when fractures have been drained and flow is predominately in the rock matrix. In effect, the fractures act as barriers to flow because the negative pressure potential in the matrix (suction) will not allow water to drain freely into fractures. Of course this situation would probably result in such low groundwater fluxes that it would represent the most "favorable" case and a more simplistic solution would be sought.

Another subroutine used in the simulator is called MA28. This subroutine solves the simultaneous linear equations. It does so efficiently because the matrices do not have to be symmetric (saves only non-zero elements). As it is, the TOUGH simulator uses a lot of computer memory. The MA28 package aids considerably in making use of the simulator feasible in terms of storage requirements. However, the MA28 subroutine is proprietary material of a British company. LBL has permission to use the package for research purposes but not for commercial applications.

In summary, my comments on the simulator TOUGH are as follows:

1. The simulator can handle specific problems which cannot be assessed by any other code available in-house.
2. Depending on how the results of the in-house use of TOUGH are to be used (i.e. in public hearing?) additional QA documentation may be necessary.
3. Also depending on how this simulator will be used in-house, questions arising from the proprietary subroutine MA28 require resolution.

It is my understanding that the Performance Assessment Team will continue with the lead in making the TOUGH code available to NRC staff.

Handwritten signature

Jeffrey A. Pohle, Project Manager
Siting Section
High-Level Waste Technical
Development Branch
Division of Waste Management

cc: P. Ornstein

OFC :	WMHT <i>[Signature]</i>	WMHT <i>[Signature]</i>	WMHT <i>[Signature]</i>	:	:	:	:
NAME :	JPohle:dm	PJuskus	WJMiller	:	:	:	:
DATE :	9/13/83	9/13/83	9/13/83	:	:	:	: