MEMORANDUM TO: Barbara D. Meehan, August 17, 1999
Contracting Officer
Contract Management Branch No. 2
Division of Contracts and Property
Management, ADM

THRU: Deborah A. DeMarco
NRC CNWRA Deputy Program Manager
Program Management, Policy Development
and Analysis Staff, NMSS

FROM: Mysore Nataraja, Program Element Manager
Projects and Engineering Section
High Level Waste and Performance
Assessment Branch
Division of Waste Management, NMSS

SUBJECT: RDTME ISSUE RESOLUTION STATUS REPORT, REVISION 2, LETTER REPORT (MM 1402-671-930)

The Center for Nuclear Waste Regulatory Analyses (CNWRA) submitted its input to staff's Issue Resolution Status Report (IRSR) for the Repository Design Thermal-Mechanical Key Technical Issue (RDTME KTI) in its letter report (CNWRA MM 1402-671-930) dated July 29, 1999. I have reviewed this report and received input from appropriate KTI leads and the staff has no major comments. The subject major milestone deliverable is acceptable to the staff subject to the attached minor comments and recommendations for changes. The staff will consider further changes and additions to the CNWRA input before making the IRSR available to the Department of Energy and the general public.

The attached minor comments may be passed on to the CNWRA for its consideration. If you have any questions regarding the contents of this memorandum, please contact me at 415-6695 or e-mail me at msn1.

Attachment: As stated

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COMMENTS ON CNWRA MAJOR MILESTONE (MM 1402-671-930)
INPUT TO REV. 2 OF ISSUE RESOLUTION STATUS REPORT ON
REPOSITORY DESIGN THERMAL-MECHANICAL EFFECTS KEY TECHNICAL ISSUE

General:

Comments/observations are made only on major changes made to the text (relative to Rev. 1) as indicated by the side bars of the draft submitted by the Center. Page numbers and section numbers are provided for each comment/observation.

Major Comments:

None

Minor Comments/Observations:

(1) Throughout the text, many sections, whenever a reference is made to TMHC interactions, examine whether a reference to all four processes is warranted. In most cases, the discussions pertain to TM couplings/interactions.

(2) All sections dealing with acceptance criteria (particularly, pages 27-28, section 4.3.3.1 and page 68, section 4.3.5.1), examine if sufficient flexibility is given to DOE to meet the overall requirements.

(3) Page iii, change history table, the date for Rev. 2 will be changed to correspond to the date of final production date.

(4) Page xiii, Acknowledgments For Revision 2, names of NRC reviewers will be provided for addition after the technical/management review at NRC.

(5) Page 8, Figure 1, use the latest version of (see TSPA IRSR Rev. 2 p.103). Also, examine whether the highlighting of boxes is consistent with discussions in the text.

(6) Page 10, section 3.3.4, eliminate reference to Part 60 and remove the statement that links seals to human intrusion. (Note: Seals in Part 60 were meant to prevent water inflow from an aquifer above the repository into the repository and outflow from the repository to the aquifer below. Filling up of shafts and ramps with backfill material was not considered part of "seals.")

(7) Pages 28 and 29, section 4.3.3.2, there is a need to clear the ambiguities/inconsistencies in the use of terms such as "thermal" and "mechanical" properties, for example:

> (a) Three items are listed as "thermal" properties required for conducting TM analyses, namely, (1) thermal conductivity; (2) specific heat capacity; and (3) density. It does not seem appropriate to classify density as a thermal property.
>
> (b) Four properties are listed as mechanical properties required for TM analyses, namely, (1) Poisson's ratio; (2) thermal expansivity; (3) Young's modulus; and (4)

Strength parameters, such as friction angle and cohesion. It does not seem appropriate to classify specific heat capacity as a mechanical property.

(8) Page 33, same section, the discussion leads to the conclusion (rightly) that the RMR - Rock-Mass modulus relationship (the lower curve of Figure 3, page 32, titled as "YMP-unpublished) is an inappropriate extrapolation based on insufficient data. However in Figure 4, a relationship between Young's modulus and Rock-Mass Quality, Q has been derived (curve Y2, titled "YMP-unpublished") using this very same (inappropriate) relationship and used as a basis for discussion. This line of argument needs some clarification.

(9) Yet another observation related to Figure 4 is the coincidence between curves Y2 and Y3 that might mislead (unintentionally) the reader to (erroneously) conclude that the YMP in situ stiffness data might correspond to one tenth the stiffness characteristics of the generic rocks on which Serafin and Perira 1983 relationship was based.

(10) Page 34 (Figure 5) and page 35, same section, consider the following observation related to long-term THM/THC interaction effects:

(a) First, the results of the Near Field Expert Elicitation and the results of Hardin, 1998 need to be used in the sections on "Degradation of Mechanical Properties with Time and "THM effects on flow."

(b) Second, the results of these studies are pertinent to the conclusions reached on the importance of dissolution and precipitation (primarily of clay minerals) on rock mechanical properties. Using the site as a self analog the amount of clay formed from extensive hydrothermal circulation associated with the Timber Mountain caldera formation was limited. More importantly the minerals most likely to form at the repository horizon are carbonate and silica rich phases such as opal. Both reports indicate that the dominant coupled THC process will be changes in flow properties, not changes in rock strength. Without using a reference from the peer-review literature, it will be hard to justify the arbitrary assertion of a factor of 10 in strength reduction exhibited in Figure 4.