

**CNWRA SUGGESTED RESOLUTION OF CNWRA COMMENTS
ON THE NRC PUBLIC COMMENT DRAFT OF THE
TECHNICAL POSITION ON REPOSITORY
DESIGN-THERMAL LOADS: AUGUST, 1990**

**Prepared for the U. S. Nuclear Regulatory Commission
Contract No. NRC-02-088-005
Account No. 20-3702-022**

RDCO Intermediate Milestone No. 20-3702-022-085-002

Prepared by:

Asadul H. Chowdhury

**Center For Nuclear Waste Regulatory Analyses
San Antonio, Texas**

March 7, 1991

CNWRA SUGGESTED RESOLUTION OF CNWRA COMMENTS
ON THE NRC PUBLIC COMMENT DRAFT OF THE TECHNICAL
POSITION ON REPOSITORY DESIGN - THERMAL LOADS: AUGUST, 1990

Comment 1

This draft TP stated in Section 4.2 as following: ".....A reasonable assurance, on the basis of the record before the Commission, that the objectives and criteria will be met is the general standard that is required. The Commission must, therefore, make a finding that issuance of a license will not constitute an unreasonable risk to the health and safety of the public. Further, this finding must be made on the basis of the information presented in the license application....."

".....However, when following this approach, conservative data and assumptions must be used to compensate for the uncertainties, since otherwise such uncertainties may preclude the staff from finding, with reasonable assurance, that the performance objectives will be met."

It is our understanding that above statements clearly require DOE to provide such data and analyses at the time of construction authorization, through conservative data and assumptions, that the issuance of a license will not constitute an unreasonable risk to the health and safety of the public. Our comment #1 is built on the understanding that before construction authorization DOE has already demonstrated through conservative data and assumptions that the issuance of a license will not constitute an unreasonable risk to the health and safety of the public. The concerns we expressed were two-fold. First, we expressed a sensitivity to a possible misperception that a licensing decision might be based on inadequate models. NRC Staff has expressed in their response that they do not believe such a misperception will arise. Second, the Center was concerned as to the regulatory basis the NRC would have for requiring further more sophisticated modeling after NRC has issued to DOE the construction authorization. During our verbal discussions, the technical staff and management of NRC Engineering Branch involved with this TP stated that according to NRC including Office of General Counsel (OGC), the NRC has the regulatory grounds for requiring the DOE further more sophisticated modeling after NRC has issued to DOE construction authorization based on DOE's demonstration of reasonable assurance through conservative data and assumptions that the issuance of a license will not constitute an unreasonable risk to the health and safety of the public.

CNWRA acknowledges NRC's positions (Reference 1) on these two matters and consider this comment has been resolved. No revision of this technical position is necessary.

Comment 2

This draft TP in Para 2 of Page 2 states: ".....that a total system performance assessment model will exist, which incorporates the predicted T-M-H-C responses.....when evaluating the total system performance" (emphasis added). The use of the word "incorporates" conveys the notion correctly that the output from the detailed thermal analysis would be available for use in the total system

performance assessment model in some fashion. However the statements in section 3.0 of page 3 and section 4.1.4 of page 9 give the notion that the detailed thermal analysis code must necessarily be constructed in such a manner that its calculated responses "feed" directly into the total system performance assessment code. This could be resolved by revising the relevant sentences as following:

Section 3.0 of Page 3 - "The adequacy of the, and then by testing the performance of the geologic repository system by incorporating the predicted thermally induced responses to the performance assessment model."

Section 4.1.5 of Page 9 - "It is expected that models....., and will incorporate the predicted heat transfer, responses, including uncertainties, for analyses."

Comment 3

As correctly identified in this draft TP (Section 1.0, Page 1; Section 2.0, Page 3; Section 3.0, Page 3, Section 3.1.5, Page 3; and Section 4.1.5, Page 9), thermal loads affect both the pre-closure safety aspects (stability of excavations, ventilation, etc.) of the underground facility as well as the post-closure performance aspects (near- and far-field flow and transport in liquid and gaseous form, effect on waste packages). Obviously, the design criteria for the repository, of which thermal loads are a part, should be based on the pre- and post-closure functional requirements expected to be fulfilled by the repository. Our views here are wholly consistent with those expressed by the NRC Staff in SP 60-003 "Performance Objectives as used in 10 CFR 60.133(i)." The pre-closure requirements are stated in 10 CFR 60.111 and the post-closure requirements are stated in 10 CFR 60.112 and 60.113. Each one of these may (and likely will) produce a different design criteria. According to the regulation, each must be considered. In practice, the most strict one may be adopted as the "controlling" requirement. Further, the underground facility must also comply with the design criteria of 10 CFR 60.130, 60.131, and 60.133.

The idea of the performance based top-down approach suggested in our comment to the draft TP was that the importance of the thermal load should first be ascertained for each of these requirements. This would require that an analysis (which may be simple initially) be performed to determine adverse effects of the thermal loads on the expected performance of the repository. From such an analysis, if it is found that post-closure performance is not sensitive to thermal load, then it may be possible to not include 10 CFR 60.112 and/or 10 CFR 60.113 in further analysis. On the other hand, as it is likely at the Yucca Mountain where thermal pulses are the real driving forces for both water and radionuclides, it may be found that 10 CFR 60.112 and/or 10 CFR 60.113 govern the design as far as thermal load is concerned. Our suggestion was that such an analysis, taking site data into account, be performed as a first step for thermal analysis. This approach makes the relation between the performance requirements and thermal load explicit but, does not in any way detract from the importance of meeting the individual design criteria independent of and in addition to meeting the performance objectives.

It is our understanding that the draft TP commences with detailed low-level calculations without identifying what thermally induced phenomena are important to meet the individual design criteria and the performance objectives for which detailed lower-level calculations are necessary. This will impose on DOE the

6

requirement of development of detailed predictive model and detailed thermal analysis involving all the thermally induced phenomena but leave the possibility for DOE to find very late in the process (Step 7 in Figure 1) that performance objectives are sensitive only to some of the thermally induced phenomena. This will also put undue burden on NRC in the development of its compliance determination methods for 10 CFR 60.133(i). The revised Figure 1 (Reference 1) addresses our concern and our comment is considered to be resolved.

Comment 4

Since this comment is applicable in the context of Comment 1, and the resolution of Comment 1 does not need the revision of the draft technical position, the resolution of Comment 4 also does not need any revision of the draft technical position.

Comment 5

The process described in Figure 2 requires DOE to consider one-way coupling for all the thermally induced phenomena without identifying the one-way coupling of what thermally induced phenomena are important to meet the performance objectives and individual design criteria. This could be resolved by revising the relevant section as follows:

Section 3.3 of Page 4 - ".....Analyses which cannot be can then utilize a model of an interactive analytical process...and ground water system. This model could be developed in Step 3.1.3 above. A detailed flow diagram of this process model is presented in Figure 2."

Comment 6

The performance measures of temperature, stress, strain, etc. discussed in paragraph 4 of Page 7 of this technical position are associated with the predicted outcome of each of the individual thermal, mechanical, hydrologic, and chemical models, and are therefore response measures instead of performance measures. This could be resolved by revising para 4 of Page 7 as follows:

Since the purpose of the predictive models....., the models must provide the performance measures that enable such evaluation. Relationships should be established between the response measures and the performance measures. For the heat transfer model this response measure would be the transient temperatures in the rock and.....

Comment 7

This comment could be resolved as follows:

Para 3 of Page 7 - eliminate the sentence "The ultimate test of a model is that....., inadequate (see Van Fraasen, 1980)" and Section 5.0 of Page 12 - eliminate the reference of Van Fraasen.

Comment 8

CNWRA acknowledges NRC's position (Reference 2) that if the DOE does use the method presented in the TP then data and information must be presented to allow the NRC to make an independent check of the DOE results. If DOE does not use this methodology then DOE may be required to present data and information related to this TP methodology to allow NRC to make an Independent Analysis. In both cases DOE is expected to allow NRC evaluation of compliance.

Comment 9

CNWRA acknowledges NRC's resolution (Reference 1) of this comment. This comment is considered to have been resolved.

Reference

1. Letter of February 28, 1991 from Jerome R. Pearring to Asadul H. Chowdhury on RDCO Intermediate Milestone No. 20-3702-022-085-001.
2. NRC/CNWRA RDCO staff telecon and meeting, 3/6/91.