

December 19, 1996

Dr. Paul W. Pomeroy, Chairman
Advisory Committee on Nuclear Waste
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: STAFF RESPONSE TO ACNW COMMENTS ON COUPLED PROCESSES IN THE
NUCLEAR REGULATORY COMMISSION'S HIGH-LEVEL WASTE PRELICENSING
PROGRAM

Dear Dr. Pomeroy:

The staff appreciates the Advisory Committee on Nuclear Waste's (ACNW's) thoughtful, detailed comments on coupled processes in the Nuclear Regulatory Commission's high-level waste (HLW) prelicensing program. We generally agree with ACNW's observations, suggestions, and recommendations. As you know, the current funding of NRC's HLW program has reduced the resources available to staff and to our contractor, the Center for Nuclear Waste Regulatory Analyses (CNWRA). Consequently, we are unable, at this time, to respond positively to all ACNW's recommendations, but instead must pursue those activities that we consider to be of higher priority. The comments, provided in the enclosure, follow the structure of the ACNW's letter to Chairman Jackson and respond to the ACNW's five emphasized recommendations, as well as each category of "TECHNICAL OBSERVATIONS AND SUGGESTIONS." We look forward to a continuing dialogue with ACNW on this important topic.

Sincerely,

Original signed by
James M. Taylor

James M. Taylor
Executive Director
for Operations

Enclosure: As stated

cc: Chairman Jackson
Commissioner Rogers
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
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NAME	CPaperiello		HThompson		JTaylor					
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Advisory Committee on Nuclear Waste
U.S. Nuclear Regulatory Commission
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HIGH-LEVEL WASTE PRELICENSING PROGRAM

The staff appreciates the Advisory Committee on Nuclear Waste's (ACNW's) thoughtful, detailed comments on coupled processes in the U.S. Nuclear Regulatory Commission high-level waste (HLW) prelicensing program. We generally agree with ACNW's observations, suggestions, and recommendations. As you know, the current funding of NRC's HLW program has reduced the resources available to staff and to our contractor, the Center for Nuclear Waste Regulatory Analyses (CNWRA). Consequently, we are unable, at this time, to respond positively to all ACNW's recommendations, but instead must pursue those activities that we consider to be of higher priority. The comments, provided in the enclosure, follow the structure of the ACNW's letter to Chairman Jackson and respond to the ACNW's five emphasized recommendations, as well as each category of "TECHNICAL OBSERVATIONS AND SUGGESTIONS." We look forward to a continuing dialogue with ACNW on this important topic.

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FROM FZFR-KRAUS, INC. 202 537 5133
TEL. 303-5391

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P. Pomeroy

important feedback, which has already led to improvements in the HLM program.

(2) As stated in item 4 under General, although some aspects of the treatment of coupled processes may appear to be "data-starved," the staff continues to use whatever data sources might be available, given the current limitations on resources. A greater effort to obtain data is anticipated.

we anticipate
(3) Sensitivity analyses are planned for this fiscal year to address various components of repository performance as a function of changing conditions, such as temperature. Should these sensitivity studies indicate that thermal loading has a significant impact on performance, the staff will continue to address this issue with DOE. As in other aspects of NRC licensing decisions, the use of bounding analyses, or conservative assumptions will be necessary in the absence of definitive data (e.g., from the thermal testing at Yucca Mountain) and robust analyses.

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LSS : YES ☐ NO ☒
ACNM: YES ☒ NO ☐
IG : YES ☐ NO ☒
PDR : YES ☒ NO ☐

(6) We agree that mechanical aspects of T-H-M-C coupled processes are less problematic, so CNWRA support for this KTI has been suspended for FY97.

III. Related Issues

(1) We agree that effective integration will require the staff and management to maintain an on-going effort regarding this area. A decision on whether the Integration Task Force will continue has not been finalized yet. However, the work of the Integration Task Force has provided the staff and management with important feedback, which has already led to improvements in the HLW program.

(2) As stated in item 4 under General, although some aspects of the treatment of coupled processes may appear to be "data-starved," the staff continues to use whatever data sources might be available, given the current limitations on resources. We anticipate a greater effort to obtain data.

(3) Sensitivity analyses are planned, for this fiscal year, to address various components of repository performance as a function of changing conditions, such as temperature. Should these sensitivity studies indicate that details regarding the thermal loading strategy has a significant impact on performance, the staff will continue to address this issue with DOE. As in other aspects of NRC licensing decisions, the use of bounding analyses, or conservative assumptions, will be necessary in the absence of definitive data (e.g., from the thermal testing at Yucca Mountain) and robust analyses.

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ACNW's Priority Recommendations and Staff Responses

- (1) Performance assessment should be given a more prominent role in guiding the prioritization of coupled processes studies;
- (2) NRC should participate in the DECOVALEX study, reversing a previous decision;
- (3) The NRC program should acquire information to relieve the "data-starved" nature of current activities;
- (4) Modeling studies in thermal-hydrological (T-H) processes need to be expanded; and
- (5) Greater attention is needed on near-field chemistry, with particular emphasis on thermal-hydrological-chemical (T-H-C) processes that affect contaminant release and transport.

The staff agrees with, and intends to continue to implement, Recommendation (1). The staff largely agrees with and will implement, as resources allow, and as importance to performance indicates, Recommendations (3), (4), and (5). The staff cannot reinstitute participation in the DECOVALEX study, Recommendation (2) because of resource constraints and higher-priority work. However, staff from the Office of Nuclear Regulatory Research (RES) participated in a recent DECOVALEX meeting as an observer. The staff expands on these responses to the ACNW's priority recommendations by discussing the corresponding detailed points the Committee made in its letter.

Staff Responses to ACNW Technical Observations and Suggestions

I. General

(1) We thank the ACNW for concluding that the staff and CNWRA have "...developed a strong program for studying the impact of selected coupled processes on the performance of the potential repository at Yucca Mountain." We hope this largely alleviates the Committee's concern regarding the treatment of coupled processes under the program reorganized into Key Technical Issues (KTIs). We believe that, with the ACNW's input, we will assure that important interdisciplinary issues (e.g., coupled processes), will not fall between the cracks of the KTI structure. We also believe that the important coupled processes are being adequately addressed.

(2) We agree with the ACNW judgment that performance assessment (PA) is a key element in evaluating the importance to repository performance of various physical processes, including coupled processes. The staff intends, in the coming year, to increase the involvement of PA in determining importance and to make such evaluations more quantitative.

Enclosure

(3) We agree that the DECOVALEX study could enhance our understanding of certain coupled processes and our evaluation of alternative models. However, continuing budget cuts have reduced both financial and human resources to such a degree that continued participation in the DECOVALEX study is no longer feasible. Nevertheless, staff from the Office of RES participated in a recent meeting of the DECOVALEX study as an observer. Although not as good as direct participation, we do expect to obtain benefits from the documentation of the study.

(4) Because the primary emphasis of recent NRC/CNWRA work has been on developing models and related codes, the staff acknowledges that the coupled processes studies may appear to be "data-starved." We agree on the need to obtain all relevant data from the Department of Energy (DOE) and its contractors, as well as information from other experiments or studies of ancient thermal anomalies where data are available. Having obtained the G-tunnel thermal test data from DOE during FY96, plans for this fiscal year emphasize evaluating models and related codes rather than developing them. The NRC staff continues to ask DOE and contractors for relevant data that can be used either to evaluate conceptual models of T-H processes or to provide bounds for the models. Note further that participating in international meetings, reading peer-reviewed literature, and reviewing "literature-review" documents are part of the routine activities conducted by NRC and CNWRA. However, such activities are limited to a degree by current fiscal constraints and by the proprietary nature of some information on active geothermal areas. Evaluation of existing Nevada Test Site data will continue to play a role in the staff evaluation of coupled thermal-hydrological-mechanical-chemical (T-H-M-C) processes. In summary, the staff intends to pursue available alternatives to provide needed data for thermally-driven phenomena.

As noted in your letter, data from the drift scale heater test will not be available at the time of the DOE Viability Assessment (VA). Evaluation of DOE VA decisions will have to rely on data obtained from the single heater test currently ongoing in the Exploratory Studies Facility and the Fran Ridge heater test, currently planned by DOE. It is anticipated that NRC analyses and responses to DOE's VA will need to be based on bounding and conservative assumptions. More DOE data will be available later at the time of site recommendation and license application.

II. Specific

(1) Although the CNWRA's assessment of the importance of post-closure processes indicated that the combination of T-H processes on chemical processes is most important, quantitative evaluation of this significance will be done through the total system performance assessment sensitivity studies conducted by the Near Field Environment and Total System Performance Assessment and Integration KTIs. Effort will focus on those aspects of the chemical portion of the coupled processes that the sensitivity studies indicate are important to performance. The staff has been working with the DOE to assure that the Organization for Economic Cooperation and Development, Nuclear Energy Agency efforts to compile a thermodynamic data base include species of interest at elevated temperature.

(2) We agree that the efficacy of Equivalent Continuum Models (ECMs) is an important issue. Although time and resources do not permit initiating new independent studies of current or ancient geothermal regions as a basis for testing the validity of ECMs, we expect staff to be cognizant of the literature. We also continue to encourage the CNWRA to make use of any specific information existing in the literature that is suitable for evaluating ECMs. Furthermore, staff continues to provide comments to DOE regarding the adequacy of their field tests to evaluate the ECMs.

(3) Current modeling studies evaluate coupled T-H-C processes between the repository and the location of the critical group, but have primarily focused on the unsaturated zone in the vicinity of the emplaced waste where the T-H-C coupling is expected to have a significant influence on the source term. The CNWRA has initiated a limited evaluation of hydrological chemical effects in the Calico Hills formation as part of an analysis of the capability of modeling methodologies to represent present and paleohydrothermal conditions at Yucca Mountain. The impact of nonreversible processes in the near field, such as certain thermal effects on permeability, will be evaluated as part of the Evolution of the Near-Field Environment KTI PA sensitivity studies.

(4) Coupled processes related to disruptive events and processes, such as igneous activity, will be studied by the staff and CNWRA on a schedule that reflects: (1) their prioritization by importance analysis; and (2) the resources available.

(5) Given that the literature indicates that the "Onsager" processes are less important to waste isolation and that resources are scarce, we do not intend to perform scoping studies to demonstrate more definitively that these processes are unimportant to waste isolation and containment.

(6) We agree that mechanical aspects of T-H-M-C coupled processes are less problematic, so CNWRA support for this KTI has been suspended for FY97.

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