February 2, 1989

LETTER TO: John L. Russell
Manager, Geologic Setting
Center for Nuclear Waste Regulatory Analyses
6220 Culebra Road, Drawer 28510
San Antonio, TX 78284

FROM: Philip Justus for David Brooks
Geologic Setting Program Element Manager
Geosciences and Systems Performance Branch
Division of High-Level Waste Management

SUBJECT: TECHNICAL DIRECTION #8. TECHNICAL ASSISTANCE TO NRC STAFF IN ITS PREPARATION OF THE SCA FOR YUCCA MT PROJECT IN THE AREAS OF GEOLOGY EXCLUSIVE OF NATURAL RESOURCES AND GEOPHYSICS

This letter summarizes discussions that were held at the Center during the week of January 9th regarding work to be done in Year 2, but not yet written into the Operations Plan for the Geologic Setting Program Element for Year 2. The work- to support NRC in its preparation of the Yucca Mt. Site Characterization Analysis- is an extension of Task 4: Support Geologic Setting Investigations and Compliance Determination and Subtask 4.2, "Center staff are committed in Year 1 to prepare for reviewing site characterization plans." This letter also specifies sections of the SCP and responses to CDSCP comments and questions that the staff wish to have reviewed, provides technical direction, estimates of level of effort and schedules and also describes expertise and experience required of consultants who would be reviewers.

Task Summary. Task title: Support SCA in Areas of Geology. The Center will support staff's preparation on the SCA of the Yucca Mt site to include review and comment on the SCP, on responses to the CDSCP comments and questions, on selected Study Plans and by performing analyses and evaluations of data, methods, models and computer codes, as directed. However, Technical Direction #8 concerns only review and comment of SCP and responses to CDSCP comments and questions. Thus, technical directions will be forthcoming to effect reviews of additional materials or to followup action items that may emanate from this task and subtasks. The scope of this task includes geology, geomorphology, volcanism, tectonics, engineering geology, mining geology, stratigraphy and structural geology. Generally excluded from this task as long as resources are available through NRC offices, Bureau of Mines or Weston Geophysical Corporation are: natural resources, geophysics, seismology and geostatistics/probabilistic analyses. Subtasks 4 and 5 have exceptions.

Subtask Detailed Directions.

1) Center shall adhere to the SCP Review Plan and Schedule

2) Use attached "CDSCP Point Paper Evaluation Form" for review of DOE's responses to CDSCP Point Papers specified below

3) Use attached Comment 28 as an example of format for modified or new point papers

4) Estimated individual reviewer time on task is 2-3 weeks

5) Reviewer is to review and comment in writing on sections of SCP and responses to CDSCP Point Papers specified in the subtasks below; references and additional sections/responses in the SCP will be reviewed commensurate with the extent that the references and additional materials are relevant to the assignment (telephone NRC contact for details)

6) Assigned SCP sections enumerated below are meant to include all relevant subsections

7) Written preliminary point papers and concerns are to be provided Ms. Charlotte Abrams or Philip Justus two days prior (2/27/89) to a meeting in Rockville, MD, currently scheduled for March 1 and 2 (reviewer and PI travel to NRC HQ to discuss reviewer's input is expected; such a meeting is not likely to occur less than two weeks after receipt of the materials to be reviewed)

8) C. Abrams is the NRC coordinator for these tasks and subtasks and those assigned to other contractors; reviewers may call upon her or P. Justus for assistance

9) Instructions for finalizing Point Papers and other assignments will be given within 5 days of receipt and discussion of the drafts (it is expected that such technical direction will be given soon after the March meeting).

Subtasks and Reviewer Qualifications

Subtask 1. Geomorphology, including erosion

[expertise- B&R surface processes, denudation-rate studies, Quaternary age determinations; experience- grounded in DOE and NRC regs, FEA and NRC's comments, CDSCP and NRC's concerns]

Chapter 1, parts relevant to geomorphology
8.3.1.5.1.4 Analysis of paleoenvironmental history of Yucca
8.3.1.6 Erosion
8.3.1.14 Surface characteristics
CDSCP Comments 34, 35
CDSCP Questions 18, 19, 29

Subtask 2. Volcanism, including volcanic stratigraphy, hydrogenic deposits, representativeness

[expertise- B&R volcanic stratigraphy; Yucca hydrogenic deposits; Yucca Mt site-specific geology; experience-grounded in DOE and NRC regs, hands-on Topopah Springs strata, hands-on hydrogenic deposits in Yucca Mt vicinity, FEA and NRC's comments, CDSCP and NRC's concerns]

SAND 87-1685 "Preliminary Evaluation of the Exploratory Shaft Representativeness for the Yucca Mountain Project"; telephone NRC contact for detailed instructions for reviewing and commenting on this document

Chapter 1. parts relevant to volcanism and hydrogenic deposits and representativeness

8.3.1.5.2.1.5 Calcite and opaline silica deposits
8.3.1.8.1 Direct releases from volcanic activity
8.3.1.8.5 Characterization of volcanic features
8.3.1.8.5.2 Characterization of igneous intrusive features
8.3.1.17.1 Required Information on volcanic activity that could affect repository design or performance
8.4.2.1 Rationale for planned testing
8.4.2.2 Surface-based activities
8.4.2.3 Subsurface-based activities
CDSCP Comment 36
CDSCP Question 20

Subtask 3. Engineering Geology, including use and interpretation of borehole and underground mapping methods and data

[expertise- engineering geology, rock-mass characterization techniques for input to foundation/tunnel/mine design; experience- 20-years hands-on rock-mass characterization planning/execution/interpretation in layered volcanics using borehole data, core testing data, underground mapping methods; grounded in DOE and NRC regs, FEA and NRC's comments, CDSCP and NRC's concerns]

Chapter 1. parts relevant to engineering geology

8.3.1.4 Rock characteristics
8.3.1.15 Thermal and mechanical rock properties
8.3.2.2 Configuration of underground facilities
8.3.2.3 Repository Design Criteria for radiological safety
8.3.3.2 Shaft and borehole seals issue resolution
8.3.5.2 Waste retrievability
8.4.2 Description and location of characterization operations
8.4.3 Impacts of site characterization activities on post-closure performance objectives

Additional instructions for Subtask 3: a) provide comments

pertaining to boring, boreholes, cores, core testing and underground geologic mapping; b) review Close-Range Photogrammetric Underground Geologic Mapping Method, and equipment and software used in the above mapping method.

Subtask 4. Support Geology-Geophysics Section Leader with IQA

[expertise- hard-rock geology, surface and subsurface geologic/geophysical exploration methods, sampling statistics and mineral resources assessment, engineering and/or mining geology, working knowledge of limitations of site characterization methods and needs of hydrologic and geomechanical computer modelers; experience- senior geologist, 20-years hands-on surface and subsurface site characterization, hands-on Yucca Mt site characterization, QA/QC of detailed geology/geophysics reports; grounded in DOE and NRC regs, FEA and NRC's comments, CDSCP and NRC's concerns]

Geology-Geophysics Section Leader (SL) is responsible for complete Internal Quality Assurance (IQA) review of section work.

In addition to possessing expertise and experience as indicated above, the IQA designate:

a) shall read applicable sections of the SCP, including applicable responses to CDSCP comments and questions,
b) shall read the SCP Review Plan;
c) shall comply with Section 6.1 of the SCRP, "IQA Requirements for SCP Review"
d) shall read, selectively audit and comment on the draft SCP Point Papers provided for such review
e) can outline point papers or analyses on his/her own initiative, but will not develop them unless approved
f) will discuss NRC staffs' point papers directly with staff at NRC HQ after having reviewed the written drafts, as in activity 'd' above (suggested meeting date - end of March, early April)

Subtask 5. Technical Integration of Geology-Geophysics Parts of SCP and Related Documents with Program Architecture and Development of Center's Capability in Areas of Geologic Setting Program Element (GS PE)

[expertise- working knowledge of geology, geomorphology, volcanism, tectonics, stratigraphy, structural geology, natural resources assessment, geophysics, seismology, geostatistics/probability, engineering/mining geology, field methods/instrumental/numerical techniques of surface/subsurface exploration/testing/mapping, conceptual/numerical 3D geologic modeling; experience- senior geologist, 5 to 10-years each field-lab/theoretical-applied/modeling of geologic

systems characterization and evaluation; grounded in DOE and NRC regs, FEA and NRC's comments, CDSCP and NRC's concerns, PASS, NRC-DHLWM 5-year plans; known expert- John L. Russell]

a) Serve as PI for this task and subsequent related tasks and perform all duties incumbent upon such PI
b) Develop plans to assure that SCP methods, models, codes, data, references, issues, activities and information needs in scope of GS PE are incorporated into PASS, and are evaluated for purposes of critiquing SCP, SCP updates and open items
c) Develop plans to review final set of NRC Point Papers and SCA for purpose of recommending whether to modify NRC compliance determination methods, uncertainty reduction methods (e.g., rulemakings, technical positions), and research within scope of GS PE and in PASS.

Detailed instructions for completing activities 'b' and 'c' in this subtask will be discussed and issued in March, 1989.

FEB 1 1989

REQUEST TO CNWRA FOR TECHNICAL ASSISTANCE IN REVIEWING THE YUCCA MOUNTAIN SCP IN AREAS RELATED TO HYDROLOGY, GEOHYDROLOGY AND GEOCHEMISTRY

1. Potential Impacts Of Site Characterization Activities On Postclosure Performance Objectives

You are directed to provide a technical review and evaluation of DOE technical report SAND85-0805 by J.A. Fernandez and others entitled: "Selected Analysis to Evaluate the Effect of the Exploratory Shafts on Repository Performance at Yucca Mountain." This report is a significant reference to SCP Section 8.4.3 (Potential Impacts of Site Characterization on Postclosure Performance Objectives) containing technical evaluations of the effects of water infiltration at the exploratory shaft facility (ESF) on repository performance. The report's evaluation of shaft performance is critical to resolving NRC CDSCP Objection 4. The technical scope of the review should focus on the adequacy of the technical basis for the report's findings on flooding related performance of the ESF. The review should determine if the methodology for calculating the PMF (flood peak, volume, and elevation) and modeling water inflow and drainage in the ESF is valid and conclusions on shaft performance conservative. The review should consider aspects of ESF flooding and its possible effects on performance that may have been overlooked or underestimated. Attention should be paid to Chapters 3,6, and 8 and supporting appendices C and D. This report is a final version of a report previously reviewed by the Center (April 29, 1988 letter to Dr. Philip Justus from Dr. John Russell) and it contains significant technical revisions based on the relocation of ES-1. Your review should concentrate on the revised analyses and related conclusions. Because a more detailed and precise evaluation of the PMF elevation appears to be important to assessing the adequacy of the revised flood analysis for the new ESF location (out of the valley fill wash and above the PMF elevation), we will be asking DOE for additional topographic data (cross sections of Coyote Wash) that form the basis for the water surface elevations in the vicinity of the relocated shafts. Your assistance in defining those data will be required. The individual responsible to work with your staff on this review and evaluation is Mr. Fred Ross (492-0527). The format used in the initial review of SAND85-0805 is acceptable for this review. The NRC staff must be able to cite your review as needed to close any related issues. Please submit the completed review and evaluation by March 8, 1989.

2. Geochemistry

There is one chapter in the "Site Program" portion of the SCP that deals with geochemistry (Chapter 8.3.1.3; Geochemistry). The primary objective of this chapter is to define the geochemistry site characterization program used to obtain information needed to evaluate postclosure repository performance. with respect to performance objectives of 10 CFR 60. Included in this chapter is a table (Table 8.3.1.3-2) outlining the current representation and alternative

hypotheses for geochemical model(s) for the site geochemistry program. We request technical comments on the completeness of this table with respect to: 1) identification of the assumptions in DOE's current representation of geochemical models of the Yucca Mountain site; 2) identification of the uncertainty in those assumptions; and 3) identification of contradictory information or alternative hypotheses (interpretations) consistent with existing site data and evidence from field or laboratory tests. In addition, we request any comments your staff may have on the adequacy of the studies/activities outlined in this chapter that are to be used to gain information to defend identified assumptions and/or distinguish between alternatives. Existing site data on geochemistry is presented in Chapter 4 (Geochemistry) of the SCP.

General review guidance for Chapter 8.3.1.3 (in terms of the information provided in Table 8.3.1.3-2) is provided in Sections 3.2.4.4 (Review Guide for Modeling), 3.2.4.5 (Review Guide for Model Uncertainty) and 3.2.3 (Review Guide for Site Investigations and Design Activities) of the NRC SCP Review Plan. The general review criterion is that DOE should provide justification for neglecting any contradicting information or alternative interpretations or else multiple conceptual models should be considered in assessing model uncertainty (for any models, not only geochemistry). In the NRC review of the CDSCP it was noted that the plan was inadequate in identifying basic assumptions as well as alternative assumptions, hypotheses or models. Table 8.3.1.3-2 was included in the SCP (as well as other tables for other technical areas such as geohydrology) to respond to that inadequacy. Thus, review of this table is important in assessing the adequacy of DOE's response to our CDSCP comment (NRC CDSCP Objection No. 1).

Various chapters of the SCP contain discussions of the use of EQ3/6 in geochemical modeling, and the plans to increase and improve this codes capabilities. The chapters where EQ3/6 is mentioned are 8.3.4.2 (Waste Package Characteristics), 8.3.5.9 (Containment by Waste Package), 8.3.5.10 (Engineered Barrier System Release Rates), and 8.3.5.19 (Completed Analytical Techniques). Background information on EQ3/6 utilization is presented in Chapter 7 (Waste Package). We request technical comments on the adequacy of EQ3/6 to modeling the geochemistry of the proposed repository. General review guidance for these chapters is provided in Section 3.2.4.4 (Review Guide for Modeling), 3.2.4.5 (Review Guide for Model Uncertainty), and 3.3.9 (Review Guide for Geochemical Concerns for Modeling).

Mr. John Bradbury (492-0535) of the Hydrologic Transport Section is the individual responsible to work with your staff in direct preparation of any comments related to all aspects of geochemistry.

3. Geohydrology

There is one chapter in the "Site Program" portion of the SCP that deals with geohydrology (Chapter 8.3.1.2; Geohydrology). The primary objective of this chapter is to define the geohydrology site characterization program used to obtain information needed to evaluate postclosure repository performance with respect to performance objectives of 10 CFR 60. Included in this chapter are two tables (Table 8.3.1.2-2a and Table 8.3.1.2-2b) outlining the current representation and alternative hypotheses for unsaturated and saturated zone hydrologic system conceptual models for the geohydrology program. We request technical comments on the completeness of these tables with respect to: 1) identification of the assumptions in DOE's current representation of geohydrologic models of the Yucca Mountain site; 2) identification of the uncertainty in those assumptions; and 3) identification of contradictory information or alternative hypotheses (interpretations) consistent with existing site data and evidence from field or laboratory tests. In addition, we request any comments your staff may have on the adequacy of the studies/ activities outlined in this chapter that are to be used to gain information to defend identified assumptions and/or distinguish between alternatives. Existing site data on geohydrology are presented in Chapter 3 (Geohydrology) of the SCP.

General review guidance for Chapter 8.3.1.2 (in terms of the information provided in Tables 8.3.1.2-2a and 8.3.1.2-2b) is provided in Sections 3.2.4.4 (Review Guide for Modeling), 3.2.4.5 (Review Guide for Model Uncertainty) and 3.2.3 (Review Guide for Site Investigations and Design Activities) of the NRC SCP Review Plan. The general review criterion is that DOE should provide justification for neglecting any contradicting information or alternative interpretations or else multiple conceptual models should be considered in assessing model uncertainty. The rationale for this review is identical to that described for the geochemistry site program in item number 2 above. The individuals responsible to work with your staff in direct preparation of any comments related to geohydrology are Mr. William Ford (unsaturated zone) and Mr. Neil Coleman (saturated zone). Their phone numbers are 492-0506 and 492-0530, respectively.

Comments generated from Items 2 and 3 above should be provided in "point paper" format. The overall schedule for the Hydrologic Transport Sections review of the SCP calls for completing final drafts of point papers by March 31, 1989. To meet that schedule we request that initial drafts of point papers developed by your staff be provided to the responsible individuals identified above by March 8, 1989 and final drafts by March 24, 1989. This will allow the NRC staff to complete final point papers by the end of March. These responsible individuals will coordinate all review activities with Mr. Jeffrey Pohle (492-0545), the lead reviewer responsible for integrating the overall Hydrologic Transport Section review of the SCP.

RDCO SCP REVIEW MINUTES

JAN 17 1989

NOTE TO: Jerome Pearring

FROM: Dinesh Gupta

SUBJECT: MINUTES OF RDCO SCP REVIEW KICK-OFF MEETING WITH CENTER

The subject review meeting was held at OWFN on January 12 and 13, 1988, in room 4-B-13.

The purpose of the meeting was to define the scope of SCP review to be performed by the Center for Nuclear Waste Regulatory Analyses in the Rock Mechanics and Design area. Meeting agenda is enclosed as Attachment 1.

The following are meeting attendees:

NRC	Center
D. Gupta	John Hageman
J. Peshel	Simon Hsiung
J. Pearring	Jaak Daemen (ITASCA)
	Loren Lorig (ITASCA)

The following items were discussed and agreed to by the attendees

1. The Center will review those sections of SCP for which Engineering-Geotechnical (EG) has been identified as lead or support section in Table 4 of the SCP Review Plan.

2. The Center will review previous NRC concerns on CDSCP in Rock Mechanics and Design area along with the DOE's responses and provide evaluation for the adequacy of DOE's responses. New concerns may be identified also in the review.

3. The Center will provide input to D. Gupta who will be responsible to integrate the input to the appropriate SCA sections.

4. Total time of review is eight weeks and limited to existing funding already budgeted by NRC to the Center.

Attachment 2 summarizes the scope of review and plans for deliverable for this effort.

SCOPE OF SCP TECHNICAL REVIEW UNDER TASK 5 OF THE CNWRA RDCO PROGRAM ELEMENT

1. Total time for the CNWRA technical review of the SCP in the rock mechanics/design area is 8 weeks (starting on Jan 3 and ending on February 27, 1989).

2. The following SCP Sections are to receive a technical review in accordance with Section 3.1 of the SCP Review Plan in the given order:

   Section 8.4
   Section 8.3.1.4
   Section 8.3.1.15
   Section 8.3.2
   Section 8.3.3
   Section 8.5

   Other Sections for which EG has been identified as Lead or Support Section in Table 4 of the SCP Review Plan will be reviewed as time permits.

3. All CDSCP comments are to be addressed. If any of these comments are to be closed, they will be addressed in Appendix A of the SCA. If any of the CDSCP concerns are not resolved, they will be addressed as new comments in Section 4 of the SCA. In addition, comments on new material in the SCP will also go in Section 4.

4. No CNWRA effort is required to be applied to the direct preparation of the SCA.

5. Milestones for this Task are to be developed consistent with the 8 week review period and with the integration responsibilities of the CNWRA for other Program Element SCP review activities.

NOTE TO: Shirley Fortuna

FROM: Kien Chang 1/17/89

SUBJECT: MINUTES OF EBS SCP REVIEW KICK-OFF MEETING WITH CENTER AND NIST

The subject review meeting was held at OWFN on January 12, 1988, in room 4-B-7.

The purpose of the meeting was to define the scope of SCP review to be performed by the Center for Nuclear Waste Regulatory Analyses and the National Institute of Standards and Technologies. Meeting agendas is enclosed as Attachment 1.

The following are meeting attendees:

NRC	Center	NIST
R. Weller	P. Nair	C. Interrante
K. Chang		E. Escalante
J. Pearring		
C. Peterson		

The following items were discussed and agreed to by the attendees

1. Both the Center and NIST will review those sections of SCP for which Engineering-Material (EM) has been identified as lead or support section in Table 4 of the SCP Review Plan.

2. NIST and the Center will review previous NRC concerns on CDSCP on waste package and DOE's responses and provide evaluation for the adequacy of DOE's responses. New concerns may be identified also in the review.

3. NIST and the Center will provide input to K. Chang who will be responsible to integrate the input to the SCA waste package sections.

4. Total time of review is eight weeks and limited to existing funding already budgeted by NRC to NIST and the Center.

Attachment 2 summarizes the scope of review and plans for deliverable for this effort.

SCOPE OF SCP TECHNICAL REVIEW UNDER TASK 5 OF THE CNWRA EBS PROGRAM ELEMENT

1. Total time for the CNWRA technical review of the SCP in the Engineered Barrier System area is 8 weeks (starting on January 3 and ending on February 27, 1989).

2. The following SCP Sections are to receive a technical review in accordance with Section 3.1 of the SCP Review Plan in the given order:

   Section 8.3.4
   Section 8.3.5
   Section 8.4.2.1
   Section 8.4.2.3
   Section 8.4.3

   Other Sections for which Engineering-Material (EM) has been identified as Lead or Support Section in Table 4 of the SCP Review Plan will be reviewed as time permits.

3. All CDSCP comments are to be addressed. If any of these comments are to be closed, they will be addressed in Appendix A of the SCA. If any of the CDSCP concerns are not resolved, they will be addressed as new comments in Section 4 of the SCA. In addition, comments on new material in the SCP will also go in Section 4.

4. No CNWRA effort is required to be applied to the direct preparation of the SCA.

5. Milestones for this Task are to be developed consistent with the 8 week review period and with the integration responsibilities of the CNWRA for other Program Element SCP review activities.