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November 8, 1984

Dr. D. J. Brooks
Geotechnical Branch
Office of Nuclear Materials
Safety and Safeguards
U.S. Nuclear Regulatory Commission
623-SS
Washington, D.C. 20555

'84 NOV 14 A10:44

WM-RES
WM Record File
~~B-0287~~
B-0290
ORNL
Distribution:
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WM Project 10, 11, 16
Docket No. _____
PDR _____
LPDR B, N, S

Jean Tarkenton

Dear Dave:

Enclosed is the progress report for the month of October 1984 for B0287, "Technical Assistance in Geochemistry," the proposed agenda for the project review of B0287 and B0290 meeting on November 14 and 15, 1984, and a draft of the Work Plan for B0287. As noted in the agenda for the meeting next week, I would like to discuss the draft of the work plan. If you have changes and/or additions to the agenda, please call me.

Also enclosed are some mailing address labels. When addressing mail, please use my entire address so as to reduce the possibility of loss and the receipt of information much faster.

Sincerely,

Susan K. Whatley, Manager
Engineering Analysis and Planning
Chemical Technology Division

SKW:kk

Enclosures

cc: Office of the Director, NMSS (Attn: Program Support Branch)
Division Director, NMSS Division of Waste Management (2)
M. R. Knapp, Chief, Geotechnical Branch
R. J. Starmer, Geochemistry Section, Geotechnical Branch
Branch Chief, Waste Management Branch, RES
W. D. Arnold
J. T. Bell
J. G. Blencoe
N. H. Cutshall
L. M. Ferris
J. R. Hightower
G. K. Jacobs
A. D. Kelmers
D. C. Kocher
S. Y. Lee
A. P. Malinauskas
R. E. Meyer
F. G. Seeley
F. J. Smith
R. G. Wymer
SKW File

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B-0287 PDR

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Agenda

B0287 and B0290 Project Review

November 14, 1984 - morning

Room 246, Building 4500N

Discussion of B0290 Project

- | | |
|---|---------------|
| ● Introduction and summary of progress | A. D. Kelmers |
| ● Technetium/Neptunium Reactions (MRS talk) | R. E. Meyer |
| ● Sample characterization | S. Y. Lee |
| ● Modeling activities | G. K. Jacobs |

Discussion of B0290 Work Plan

- Prioritize activities
- Review future directions

November 14, 1984 - afternoon

Laboratory Tours

November 15, 1984 - morning

Room 246, Building 4500N

Discussion of B0287 Project

- Topical review content
- Topical review schedule
- Data Base
- Future DOE/NRC workshops
- EA and SCP schedules
- Review draft Work Plan

November 15, 1984 - afternoon

Room 246, Building 4500N

Wrapup

MONTHLY PROGRESS REPORT FOR OCTOBER 1984

PROJECT TITLE: Technical Assistance in Geochemistry

PROJECT MANAGER: S. K. Whatley

ACTIVITY NUMBER: ORNL #41 37 54 92 4 (FIN No. B0287)/NRC #50 19 03 01

TECHNICAL HIGHLIGHTS:

Task 1 - BWIP Geochemical Technical Assistance

Scoping reviews of the draft EAs for the Hanford Site, Yucca Mountain site, and the seven salt sites were completed. The areas of major concern and the basis for the concern were identified. The reviews also included a list of the references that we will need in order to adequately address the concerns.

Many of the sections of the draft EAs were obviously in rough draft form and can reasonably be expected to be changed or eliminated in the final EAs. In addition, many sections of the draft EAs contained only superficial statements about various geochemical aspects.

Some of the areas of concern in the Hanford Site EA were:

1. The overall treatment of data uncertainties in the draft EA may be inadequate.
2. Only two radionuclides (^{14}C and ^{129}I) were identified as nonsorbing. We have previously expressed concern as to the adequacy and accuracy of the sited sorption data used in the draft EA to support the BWIP assessment [KELMERS 1984].
3. The site evaluation process discussed in the draft EA includes a brief summary of recent reports from the BWIP and others to support the stated conclusion that radionuclide solubility and sorption will be favorable site aspects. The applicability of some of the sited material to the Hanford Site, in particular, the question of system Eh measurements and the thermodynamic arguments supporting the reducing nature of basalt/groundwater systems, should be evaluated by the NRC.
4. The BWIP concluded that the basalt rock and interbeds are unlikely to contain substantial concentrations of organic complexes. The effects of the presence of large amounts of methane in groundwaters from the RRL-2 borehole and the possible radiolytic formation of organics capable of forming radionuclide complexes from this methane needs to be assessed before this conclusion can be accepted.
5. The EA does not seem to give definite plans for addressing the issue of colloidal/particulate transport.

6. The analysis of the EA should address the question of groundwater and host rock redox condition and capacity.

The final draft of the topical report, "Review and Assessment of Radionuclide Solubility Information for the Hanford, Washington, Candidate HLW Repository Site," was forwarded to the NRC project manager for review and comment.

Task 2 - NNWSI Geochemical Technical Assistance

The draft EA for the Yucca Mountain repository site was reviewed and scoping comments were provided to the NRC project manager (see Task 1 for general comments). Some specific concerns are:

1. The draft EA does not adequately discuss the potential role of kinetics of the rock/water reactions in the tuff/groundwater systems.
2. Only liquid-borne radionuclide transport is considered in the draft EA; the role of vapor or aerosol transport needs to be examined.
3. Since the glass-to-zeolite reactions may result in significant changes in the physical and chemical integrity of NTS tuffs (e.g., zeolitization could produce important changes in the porosities, permeabilities, and sorptive properties of the tuffs), the effects of temperature on the kinetics of zeolitization in NTS tuffs needs to be better understood.
4. The statements on sorption in the draft EA are not consistent with other reported analyses [KELMERS, 1984 draft].
5. The lack of information on how particulates and colloids influence radionuclide transport in tuff/groundwater systems needs to be addressed since there is a distinct possibility that particulates and (especially) colloids may be very important vehicles of radionuclide transport in tuff/groundwater systems.
6. The draft EA does not adequately address whether NNWSI plans to use only calculated solubilities for radionuclides in tuff/groundwater systems or if they plan to experimentally determine solubilities under geochemical conditions which simulate those that are expected for the Yucca Mountain site.
7. There is concern about the groundwater conditions in the host rock and the assumptions that are being made about the groundwater chemistry, i.e., that the chemical character of the reference repository groundwater should be similar to vadose water in the saturated zone and that the effects of any differences between the vadose water and J-13 well water can be [easily] assessed.

Task 3 - Salt Geochemical Technical Assistance

A scoping review was done on the draft EAs for the seven potential salt sites. General comments are shown under Task 1; some particular concerns are:

1. In some cases, the information presented is clearly a word-for-word reproduction from one EA to another for the seven sites. If the information and supporting analysis is identical, it does not seem possible that DOE can use the EAs as a basis for choice among the sites.
2. The basis for evaluation is weak since site-specific data are not available.
3. The basis for assumptions and parameter being reasonably conservative is not established. In order to have reasonable assurance that extrapolations and predictions of repository performance are not nonconservative, the so-called bounding assumptions and parameter values must be based on a sound fundamental understanding.
4. Insufficient information is presented to take credit for precipitation of radionuclides since not all important processes (e.g., radiation, presence of corroded metal rather than fresh metal, etc.) have been investigated.
5. Considerably more information is needed before reducing redox conditions and its favorable effect on radionuclide limiting concentrations can be assumed for these sites.
6. There is insufficient information to invoke the favorable condition that mineral assemblages will not alter as a result of the repository.

Task 4 - Short-Term Geochemical Technical Assistance

Letter report LR 4.1-19 entitled, "Review of the document entitled 'An Application of the Population Balance to the Assessment of the Importance of Radioactive Colloids in High-Level Waste Management' by H. E. Nuttall, M. D. Siegel, and E. J. Bonano," was submitted to the NRC project manager.

Task 5 - Project Management

The workshop on "Application of Geochemical Models to High-Level Nuclear Waste Repository Assessment" was held in Oak Ridge on October 2-5, 1984, to discuss the current status of geochemical code development, thermodynamic data bases, reaction kinetics, and coupled process models as applied to site characterization and performance assessment activities. There were 72 participants in the workshop including representation from the DOE facilities, numerous universities, a number of consulting firms, the EPA, many of the DOE National Laboratories, USGS, NRC, and several foreign countries. The presentations were well received and the discussion sessions resulted in a number of consensuses on the capabilities and limitations of geochemical modeling. In addition, some specific technical recommendations related to geochemical modeling resulted from the workshop. A summary of the discussion sessions and the recommendations are being drafted and will be published in the conference proceedings along with the extended abstracts of the talks.

MEETINGS AND TRIPS: None

REPORTS AND PUBLICATIONS:

LR 4.1-19, "Review of the document entitled, 'An Application of the Population Balance to the Assessment of the Importance of Radioactive Colloids in High-Level Waste Management' by H. E. Nuttall, M. D. Siegel, and E. J. Bonano," written by S. Y. Lee.

PROBLEM AREAS: None

COST/BUDGET REPORT:

Expenditures were \$29.4K for October 1984. A detailed cost/budget report will be sent under separate cover.

Draft

WORK PLAN
TECHNICAL ASSISTANCE IN GEOCHEMISTRY (B-0287)

The purpose of this plan is to complement the NRC Form 189 by briefly describing the approach that will be used to accomplish the milestones. This description will necessarily be somewhat generic since the exact nature of a technical assistance project generally evolves over time; this is especially true in this project, which is a first-of-a-kind.

1. PROJECT DEFINITION AND SCOPE

The objective of this project is to provide the NRC/NMSS/WMHT staff with geochemical technical assistance and information in support of the NRC effort to license geologic repositories for nuclear waste disposal purposes. The technical staff will assist the NRC in establishing what geochemical information about a candidate area will be required in order to assess and determine how much credit a particular candidate area can receive for radionuclide retardation in performance assessments conducted in licensing.

Technical assistance will be provided to support the NRC's analysis of the DOE (pre) site characterization activities, the geochemistry portions of the draft Environmental Assessments (EAs), and the Site Characterization Plans (SCPs), as available, on each of the three DOE candidate sites. The analysis of the DOE (pre) site characterization activities will focus on identifying:

1. What are the specific geochemical issues at sites under investigation,
2. What specific information is available and will be needed, and what kind of information and what level of detail is required to arrive at

Draft

reasonable, quantitative estimates that can be used to provide reasonable assurance that the site will function as characterized, and

3. The adequacy of past, current, and planned test methods, procedures and strategies for gathering and interpreting data, in the context of NRC/DOE time schedules for licensing and construction of underground facilities.

This analysis will be utilized in the review of the DOE repository site characterization plans (SCP), which are site-specific documents written by DOE telling (a) the current status of knowledge concerning the site and (b) how they plan to complete the characterization of the site during the next several years. The preparation of the SCP is required by 10 CFR 60 and its contents are specified in an NRC regulatory guide (Reg. Guide 4.17). The SCP will cover all aspects of the repository (geology, hydrology, geochemistry, waste package, etc.). In response to the SCP, the NRC is required to prepare a site characterization (report) analysis (SCA), which evaluates the SCP with respect to information completeness and accuracy, and identifies the information needed to characterize the site in a manner anticipated to be acceptable to the NRC.

The overall approach to the SCP evaluation is to prepare topical reviews (NUREG/CR reports) on site specific geochemical topics (e.g., solubility) on the validity of the technical approach as well as the validity of geochemical data, algorithms and interpretations reported in DOE documents and available through information exchange at DOE/NRC geochemical workshops. These reports, published prior to the receipt of the SCP, will be the basis for preparation of site technical positions issued by NRC.

Upon receipt, the SCP will be reviewed and evaluated by the NRC and ORNL staffs and the SCA will be written. The draft SCA will be circulated and reviewed within the NRC, revised, circulated for public comment, again revised, and issued as a finalized document. It is anticipated that the topical reviews on site specific areas will be updated as the DOE sites publish new data and that the NRC will issue updated site technical positions as appropriate. The SCP is expected to be updated every 6 months, but the approach to handling these updates has not yet been established.

2. TECHNICAL APPROACH

To meet the overall objective of providing NRC/NMSS/WMHTR with geochemical technical assistance while meeting the SCP evaluation schedule and needs, a two-phase mode of operation is required: (1) data acquisition and understanding and (2) generation, review, and evaluation of documents supporting the SCA. Also included are reviews of selected DOE documents, presentations and origination of documents not directly related to the SCP/SCA process, and participation in and/or holding of meetings and workshops to discuss the current status of the DOE geochemistry program.

2.1 Data Acquisition

Providing the NRC with technical assistance (TA) in geochemical areas requires that the TA staff have a quasi-independent, comprehensive understanding of the geochemical aspects of the relevant waste repository projects. This background can only be quasi-independent because it is almost totally dependent on DOE to acquire and accessibly document the geochemical information.

While the TA project staff will be qualified in areas related to repository geochemistry by virtue of their prior training and/or experience, it is necessary to make a deliberate, substantial, and methodical effort to obtain and comprehend the site-specific information available. Toward this end, the project will

1. identify the documentation of interest to repository geochemistry based on searches of document data bases using RECON, prior knowledge of the activities at the site, and the results of DOE program review meetings;
2. acquire such documents insofar as possible and assemble them in a single location;
3. organize the searching of these documents by storing relevant summary information in a computerized data base.

As a result of the relatively short amount of time anticipated between the receipt of the SCP and the generation of documents based on the SCP and the attendant DOE data base, it is necessary that the collection and organization of these documents be essentially complete before the SCP is received.

The collection and organization of DOE geochemical data base documentation will manifest itself in three ways.

1. The acquired documents will be housed in a central Waste Management Document Library (WMDL), a joint undertaking of this project and the DOE Integrated [waste management] Data Base project.

2. The essence of the documents in the WMDL will be abstracted and stored in a computerized data base accessible and searchable by the ORNL ORLOOK system. These searches are performed on a time-sharing basis and can be conducted by local or off-site users. A user's manual describing the scope and implementation of this capability will be issued.

3. The data base will be used by the staff in the preparation of the topical reviews on site specific geochemical topics and other documents as requested by the NRC. The reviews will include a listing of the acquired documents for the geochemical subject area.

The information collected, organized, and evaluated as described above will form a substantial part of the basis for preparing the SCA support documents. Additionally, the identification of key geochemical data/methods and possible deficiencies therein will provide valuable guidance to the B0290 ORNL project under NRC/NMSS/WMHT sponsorship involving experimental evaluation of selected repository-geochemistry-related parameters.

The following documents will be prepared by the technical staff in support of the NRC's analysis of the DOE (pre) site characterization activities, the geochemistry portions of the draft EAs, and the SCPs. As is evident, the preparation of these documents requires detailed knowledge of the geochemical activities of the repository projects and the plans of the projects. These are obtained from the DOE geochemical data base collected and organized by this project (Sect. 2.1) and from participation in the DOE/NRC geochemistry workshops.

2.2 Document Production

2.2.1 Topical Reviews

Prior to the receipt of the SCP, selected topical reviews on specific geochemical topics (e.g., solubility) will be published as NUREG/CR reports. The reports will include a list of the documents comprising the DOE geochemical information base relevant to the geochemical topic at the specific repository site. The review reports will focus on an evaluation of the site data as to completeness of information, data quality, and appropriateness of experimental techniques and procedures employed.

2.2.2 Generic and Site Technical Positions

Both generic and site technical positions (TP and STP) will be written by NRC staff on the aspects of waste repository geochemistry that are thought to be important to the licensing of the repository. The technical positions are very short and specific documents which

1. define the geochemical issue,
2. tell why it is important to licensing,
3. summarize the current state of knowledge concerning the issue (reference will be made to the topical reviews discussed in Sect. 2.2.1), and
4. summarize the information needed to close out the issue for licensing purposes.

These TPs and STPs are written by the NRC staff with input and review by the ORNL project.

2.2.3 SCA Geochemistry Chapter

The SCA chapter on geochemistry will be generated by the NRC staff. The ORNL project will assist in this effort by (1) technically reviewing the draft SCA chapter and (2) providing technical comments concerning the SCP to the NRC geochemistry team for using in preparing item (1). The technical comments will be provided in a two-phase letter report. The first phase will include specific and general comments organized according to the SCP. The second phase will provide similar comments, but reorganized according to the subheadings of the headings of the geochemistry chapter of the SCA. The first phase report is due 2 weeks after SCP receipt. The second phase report is due 2 weeks after receipt of the chapter headings or the SCP, whichever is later. If experience permits early specification of the SCA geochemistry chapter headings, the first phase report will be eliminated.

2.3 Other Geochemical Technical Assistance Activities

The activities considered under this are the short-term assistance task of the project and project management activities.

2.3.1 Short-Term Technical Assistance

The short-term assistance task of this project involves

1. review and evaluation of selected DOE documents and presentations,
2. review and evaluation of selected draft NRC documents (other than those alluded to previously), and
3. origination of draft documents not directly related to the SCP analysis process.

Item 1 can represent a work activity, by requiring review/evaluation, as well as an opportunity to acquire additional information on the DOE program and data base (e.g., attending geochemical workshops by DOE repository projects). This latter aspect directly relates to and compliments activities described in Sects. 2.1 and 2.2 of this document. However, to provide a short-term, high-quality response some activities under item 1 (e.g., review a specific report) and items 2 and 3 require prior knowledge and understanding of (a) other related data, (b) past work in the areas, and (c) earlier NRC decisions, pronouncements, and approaches. This knowledge and understanding results from the involvement of the ORNL project staff in the tasks described in Sects. 2.1 and 2.2.

The results of the short-term technical assistance task will be manifested as letter reports. However, since the exact nature and timing of these activities cannot be predicted beforehand, their number and schedule are based on agreement between the ORNL and NRC project managers subject to an overall limit on the time committed to the task.

2.3.2 Project Management

The most evident project management outputs are administrative documents, such as (a) this plan, (b) the NRC Form 189, (c) monthly progress reports, and (d) quarterly review meetings. However, for projects in general, and especially the project described herein, the most important function of project management is to serve as a focus and facilitator for communication and scheduling. This is particularly important in this project which is a first-of-a-kind waste repository licensing effort whose scope is evolving as activities progress. Project management must organize the

work demands into individual tasks, communicate to the individual the desired product, and ensure at an early date that schedules can be met with the available staff.

The overall ORNL management approach is to assemble a project team comprised of an appropriate mix of technical backgrounds (geochemists, physical chemists, waste generalists) and educate them via the collection, organization, and evaluation of the DOE geochemical data base. At this point, the ORNL project staff is in a position to address the evolving needs of the NRC staff.

Since prior knowledge of the number, type, and scope of future deliverables is impossible in a project such as this, the NRC and ORNL project staffs must define these during the project based on mutual agreement. It was initially recognized by all concerned that such an approach can only work by building a track record of trust in which the NRC recognizes that the resources available can produce only a certain amount of output within a specified time and ORNL recognizes that the changing nature of the NRC licensing effort or unexpected problems may require rapid changes in direction and schedule. It is this approach that has been adopted by the ORNL project management.

3. SCHEDULES

As noted in previous sections, relatively little concerning schedules can be defined beforehand due to the uncertainty in the dates of key exogenous events (e.g., SCP receipt dates). At present there are seven site geochemical topics being reviewed which will be published as NUREG/CR reports

[NUREG/CR-3763, "Review and Assessment of Radionuclide Sorption Information for the Basalt Waste Isolation Project Site (1979 through May 1983) was published in FY 1984]. The current status and projected schedule is shown below. [NOTE: No allowance has been made for review of EAs and SCPs due to the uncertainty in the date of receipt.]

<u>Report</u>	<u>Draft to NRC^a</u>	<u>Technical Comments Received From</u>		<u>Mats to NRC</u>
		<u>Reviewers</u>	<u>NRC</u>	
<u>BWIP</u>				
Geochemical Conditions	12/31/84			c
Sorption (Revision)	TBD			
Solubility	10/24/84			c
<u>NNWSI</u>				
Geochemical Conditions	1/31/85			c
Sorption ^b		5/22/84		c
Solubility ^b		8/13/84		c
Matrix Diffusion ^b	2/28/84	8/13/84		c
<u>Salt</u>				
Geochemical Conditions	5/20/84			c

^aDraft report will be peer reviewed at ORNL and edited before transmittal to NRC.

^bDrafts were not edited prior to transmittal to NRC; final copy will be edited.

^cMats will be sent to NRC ~30 days after technical comments received from external reviewers and NRC.

Since this document is intended as a working document, it is anticipated that the NRC project manager will supply anticipated dates for comments to be received from external reviewers and/or NRC staff members. Again, it must be emphasized that both the preparation and review of the these reports are extremely dependent upon the dates of key exogenous events and are subject to change upon mutual agreement between the NRC and ORNL project managers.

4. FUTURE PLANS

Defining future plans for a project whose near-term is still evolving can only be done in general terms. The baseline for the future plans is dependent upon the schedule maintained by the DOE. Anticipated future activities, all in the geochemical area, include

1. providing technical assistance in areas concerning review of the EAs and SCPs and subsequent updates,
2. providing technical assistance for as-yet undesignated repositories,
3. developing a fully evaluated geochemical data base for NRC licensing use, and
4. participation in repository licensing activities.