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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555

JUL 16 1991

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MEMORANDUM FOR: The Chairman  
Commissioner Rogers  
Commissioner Curtiss  
Commissioner Remick

FROM: James M. Taylor  
Executive Director  
for Operations

SUBJECT: STAFF REQUIREMENTS -- BRIEFING ON ACTIVITIES OF THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES AND ACTIVITIES OF THE U.S. NUCLEAR REGULATORY COMMISSION IN THE HIGH-LEVEL WASTE PROGRAM [REFERENCE M910314A]

By Staff Requirements Memorandum dated April 19, 1991, the Commission directed the staff to: (1) provide the Commission with documentation of specific contributions the Center for Nuclear Waste Regulatory Analyses (CNWRA) makes to U.S. Nuclear Regulatory Commission (NRC) technical decisions; (2) continue to devote the necessary resources to the development of a performance assessment capability and remain abreast of current technology; and (3) continue interactions with the U.S. Environmental Protection Agency (EPA), to resolve NRC's comments on the high-level waste standard, and to submit to the Commission a prompt evaluation of the next draft EPA standard (Draft #3) when it becomes available, focusing specifically on (i) how EPA responded to NRC's earlier comments, and (ii) what new issues or provisions have been introduced in this draft standard.

The Commission's first request was for the staff to document specific contributions the CNWRA has made to NRC decisions. At this stage of the high-level waste program, the staff has not made any decisions in the typical licensing sense. The only activity undertaken by the staff that would be comparable to a decision would be its review of the U.S. Department of Energy's (DOE's) Site Characterization Plan. During this pre-licensing consultation phase of the program, the staff is developing its review capabilities as well as working on technical issues that may result in future rulemakings and Staff Technical Positions. All of this work is being conducted using the Systematic Regulatory Analysis, developed by the CNWRA, and results in the establishment of staff positions.

The CNWRA contributes to this staff technical work by supporting the staff through the development of various technical products that are used as part of the staff's overall basis for its technical work. Enclosed is a list of major CNWRA products developed in the last two years and a discussion of how they contributed to staff work. CNWRA products include technical reports, inputs to Staff Technical Positions, evaluations of DOE technical reports, evaluations of staff review plans, and participation in quality assurance audits.

The Commission also directed the staff to identify CNWRA contributions on an ongoing basis. In response, the staff will provide a discussion of CNWRA products and contributions in its Quarterly Progress Reports to the Commission.

In the second request, the staff was encouraged to continue to devote the necessary resources to the development of a performance assessment capability within the NRC staff. The staff was also urged to continue with initiatives that ensure that the high-level waste team remains abreast of current technology.

At present, the staff is continuing to develop its performance assessment modeling capability. Based on the completion of its initial work in Iterative Performance Assessment (IPA), the staff determined that the resources budgeted to perform that work were not sufficient. Therefore, in Fiscal Years (FY) 91 and beyond, the staff increased the amount of in-house and CNWRA resources that it will apply to IPA.

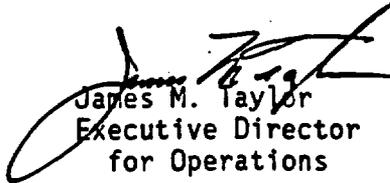
Several initiatives are used to assure that the staff remains abreast of current technology. Staff members attend and participate in technical conferences and symposia, such as the International High-Level Radioactive Waste Management Conference, the annual Waste Management meeting, and the Probabilistic Safety Assessment and Management Conference. At these conferences, the staff has an opportunity to present papers and attend sessions where work being done by other organizations is discussed. This gives the staff exposure to ongoing work being performed by DOE and other groups such as the Electric Power Research Institute (EPRI).

The staff also participates in interactions with DOE to gain better insight into activities being undertaken by the Department in IPA, and with others to discuss recent progress in performance assessment. Several interactions involving the staff and DOE are scheduled during the remainder of this fiscal year. One involves staff attendance at a round-table discussion between DOE's Office of Civilian Radioactive Waste Management and DOE's Office of Environmental Restoration and Waste Management about performance assessment experience from the Waste Isolation Pilot Plant and its applicability to Yucca Mountain. A second is a technical exchange between the staff and DOE to discuss DOE's ongoing performance assessment work to address staff concerns in the Site Characterization Analysis. The staff will work with DOE to schedule future interactions on IPA as needed. Examples of other meetings attended by the staff include the Advisory Committee on Nuclear Waste, the Nuclear Waste Technical Review Board, and the EPRI workshop on performance assessment.

The NRC staff also participates in several international activities at which current developments in performance assessment are discussed. These activities include: chairing the Organization for Economic Cooperation and Development (OECD)/Nuclear Energy Agency (NEA) Performance Assessment Advisory Group, participating in the OECD/NEA Probabilistic System Assessment Group, and participating in the International Project for the Validation of Hydrologic Transport Models sponsored by the Swedish Nuclear Power Inspectorate. Participation in these international organizations gives the staff an opportunity to understand work being done in other countries. Finally, the NRC has also developed an in-house training class on performance assessment, to expand the pool of staff familiar with this technology and enhance the capability of those staff already familiar with it.

As for the third request, the staff has continued to interact with EPA to resolve comments on the high-level waste standard. During the past year, the staff has had a number of informal interactions with EPA aimed at resolution of potential implementation difficulties associated with EPA's standard. These interactions have been relatively successful, although the loss of key technical staff at EPA has hampered progress on resolution of major issues. The staff will continue to maintain close contact with EPA to identify and resolve potential implementation issues to the extent practical.

In response to the second part of the third request, the staff is currently reviewing Working Draft #3 of the EPA Standard and anticipates forwarding a Commission paper, in July 1991, that will provide the staff's analysis of the draft to the Commission. The Paper will also discuss how EPA has responded to earlier NRC comments as well as any new issues in Working Draft #3.

  
James M. Taylor  
Executive Director  
for Operations

Enclosure: CNWRA Contributions  
to NRC Tech. Decisions  
or Products

cc: SECY  
OGC  
GPA

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES  
CONTRIBUTIONS TO NRC TECHNICAL PRODUCTS

GEOSCIENCES

Center Product:

"Evaluation of Computer-Assisted Cross Section Balancing Methods for Analysis of Subsurface Fault Geometry in the Vicinity of Yucca Mountain, Nevada - A Pilot Study"

Contributions to NRC Products:

This pilot study demonstrated and evaluated the usefulness of computer-assisted geological cross section balancing methods to analyze a fault model of Yucca Mountain proposed by the U.S. Department of Energy (DOE). The study provided staff with a fundamental framework for assessing potential hazards related to seismotectonic events, fault displacement, volcanism and the influence of faulting and related fracturing on groundwater flow. The results of this study were used as input to flow and transport models under development at the Center for the joint iterative performance assessment program. Also, the study's affirmation of the feasibility of using such computer-assisted methods provided the basis for the decision to perform sensitivity studies on the Yucca Mountain fault model in both 2-D and 3-D modes.

Center Product:

"Critical Assessment of Seismic and Geomechanics Literature Related to a High-Level Nuclear Waste Underground Repository"

Contributions to NRC Products:

This report contains a literature review of seismic and geomechanics aspects applicable to the design of the Yucca Mountain high-level repository. It provided the state of knowledge relevant to dynamic performance of underground excavations and facilities and gave the staff the technical input for task direction to the Center to conduct laboratory experiments and field testing, and assess the validity of the modeling methods used for seismic analysis at Yucca Mountain.

ENCLOSURE

Center Product:

"Focused Review of: 'Conceptual Considerations of the Yucca Mountain Groundwater System with Special Emphasis on the Adequacy of this System to Accommodate a High-Level Nuclear Waste Repository,' by Jerry S. Szymanski, U.S. Dept. of Energy, Las Vegas, Nevada, July 26, 1989."

Contributions to NRC Products:

The focus of the report was an in-depth review of the mathematical formulation of conceptual models and quantitative deductions as presented in a controversial scientific report written by a DOE staff scientist. This report was summarized in and used as an attachment to the staff's review of the DOE report and served along with NRC staff analyses to confirm the appropriateness of NRC comments in the Site Characterization Analysis (SCA).

Center Product:

"Approaches to Large Scale Unsaturated Flow in Heterogeneous, Stratified, and Fractured Geologic Media." (to be published as NUREG/CR 5743)

Contributions to NRC Products:

This report contains the results of the literature review, an assessment of field data requirements, and the basic concepts for a stochastic hydrologic model that may be used in flow and transport predictions. The staff intends to use this report in its review of DOE study plans for the characterization of the unsaturated zone at Yucca Mountain.

Center Product:

"Constraints on the Chemistry of Groundwater in the Unsaturated Zone at Yucca Mountain, Nevada, and in the Proposed Repository at the Site."

Contributions to NRC Products:

This report discussed existing literature pertaining to the geochemistry of the unsaturated zone at Yucca Mountain. There are many gaps in the existing literature resulting in considerable uncertainty. This report identifies the areas where constraints can be placed on the unsaturated zone chemistry and areas where more information is needed. It identified areas where future work is needed and provided a basis for discussion at an NRC-DOE Technical Exchange on Mineral Stability and Radionuclide Transport at Los Alamos, New Mexico in March, 1991.

Center Product:

"Progress in Experimental Studies on the Thermodynamics and Ion Exchange Properties of Clinoptilolite."

Contributions to NRC Products:

This report describes experimental theoretical studies on the thermodynamic and ion exchange properties of clinoptilolite performed at the Center. Some of this information was presented at the NRC-DOE Technical Exchange on Mineral Stability and Radionuclide Transport at Los Alamos, New Mexico in March 1991. This work is in its earliest stages and should contribute to the understanding of sorption processes in zeolitic tuff.

ENGINEERING

Center Product:

Review and input to "Technical Position of Postclosure Seals, Barriers, and Drainage System in an Unsaturated Medium." (NUREG-1317)

Contributions to NRC Products:

The Center, along with its subcontractor (ITASCA), reviewed several drafts of the above staff document and provided significant comments and input and helped finalize the Staff Technical Position (STP). The STP is being used as prelicensing guidance to DOE and has been published as a NUREG. It provides guidance on acceptable methods for designing repository seals.

Center Product:

Review and input to draft and final "Staff Technical Position on Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility." (NUREG-1439)

Contributions to NRC Products:

The Center Staff, along with its subcontractor (ITASCA), reviewed several drafts of the above staff product and provided significant input to finalizing the STP. The STP has been used as a prelicensing guidance document in the crucial area of exploratory shaft facility (ESF) design and construction. It provides guidance to DOE on an acceptable approach for coordinating the repository and ESF design.

Center Product:

Review and input to "Staff Technical Position on the Geologic Repository Underground Facility Design--Thermal Loads."

**Contribution to NRC Products:**

The Center, along with its subcontractor (ITASCA), prepared the technical bases for the STP on the above topic. The Center also reviewed several drafts of the STP, prepared input for the presentation to the Advisory Committee on Nuclear Waste, and has helped in preparing the public comment draft. This STP provides precicensing guidance to DOE on an acceptable method for demonstrating compliance with 10 CFR 60.133(i).

Center Product:

Technical Review of DOE's "ESF Subsystem Design Requirement" Document.

**Contributions to NRC Products:**

The Center reviewed the above document which discusses how DOE incorporated the 10 CFR Part 60 requirements into specific design criteria and provided comments to the staff. The staff utilized the Center comments in preparing SCA comments which noted an objection to the Site Characterization Plan. This product also provided input to the STP on "Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility," (NUREG-1439).

Center Product:

Technical Review of draft "White Paper on Excavation Methods."

**Contributions to NRC Products:**

The Center reviewed the NRC staff's draft white paper on various methods of excavation that could be applied to the high-level waste repository. The Center's review helped focus the NRC staff's views on this complex technical topic and helped to reach a technical consensus among the staff.

Center Products:

The Center provided three products on the technical feasibility of furnishing quantitative assessments for the meaning of the term, "Substantially Complete Containment."

"Technical Considerations for Evaluating Substantially Complete Containment of HLW Within the Waste Package," (NUREG/CR-5638)

"Uncertainty Evaluation Methods for Waste Package Performance," (NUREG/CR-5639)

"Substantially Complete Containment Feasibility Assessment and Alternatives."

**Contributions to the NRC Products:**

In the first of three reports, the Center described the technical considerations that must be evaluated in demonstrating the efficacy of an engineered barrier system for the containment of high-level waste. In the second report, uncertainty evaluation methodologies (distribution approach, bounding approach, expert judgment, and sensitivity analysis) considered suitable for evaluating the performance uncertainty associated with these technical considerations were outlined. In the third report, four alternatives were described for reducing the regulatory uncertainty associated with the use, in 10 CFR Part 60, of the qualitative term "substantially complete containment." The results of this work demonstrated that it is feasible (using the methodology suggested) to quantify the degree to which containment can be achieved in a system designed to operate under repository conditions.

Center Product:

"CONVO Evaluation and Enhancement Plan."

**Contributions to NRC Products:**

This report contains the independent Center evaluation of the computer code CONVO which had been sponsored and funded by NRC for the purpose of analyzing the Basalt Waste Isolation Project waste package containment life. As a result of this evaluation, a framework for a source code, Engineered Barrier System Performance Assessment Code, was formed for future NRC evaluation of the Yucca Mountain Project's engineered barrier system design.

Center Product:

"Fast Probabilistic Performance Assessment (FPPA) Methodology Evaluation."

**Contributions to NRC Products:**

This report documents a numerical method which has the capability of performing calculation and sensitivity analyses faster than Monte Carlo and Latin Hypercube methods. In the past, the latter two methods had been used more commonly in high-level waste performance studies. The FPPA method identified in this report will be used to expedite performance analyses being developed by the Center for NRC.

SYSTEMATIC REGULATORY ANALYSIS AND QUALITY ASSURANCE

Center Product:

"Identification and Evaluation of Regulatory and Institutional Uncertainties in 10 CFR Part 60."

Contributions to NRC Products:

This report contains the independent Center analysis and identification of regulatory and institutional uncertainties in 10 CFR Part 60. This study was a part of the Systematic Regulatory Analysis approach to identify areas where the rule is unclear in its meaning or in the roles of agencies involved in the high-level waste program. The result of this effort was to identify, for the staff, potential regulatory institutional uncertainties that may need to be addressed. The staff subsequently analyzed these potential uncertainties and recommended uncertainty reduction approaches.

Center Product:

Participation in and draft input to 12 observations of DOE's quality assurance (QA) audits since January 1, 1990.

Contributions to NRC Products:

The Center provides highly qualified QA professionals to the NRC teams which observe DOE QA audits. The Center personnel contribute directly to the NRC staff evaluations and decisions on the effectiveness of the DOE audit teams and the adequacy and degree of implementation of the QA programs being audited.

Center Product:

"NRC Performance Assessment Strategy for a High-Level Nuclear Waste Repository."

Contributions to NRC Products:

Served as input to the staff's performance assessment strategy entitled "NRC Post-Closure Performance Assessment Strategy For a High-Level Nuclear Waste Repository." This staff document described in general terms the approach the staff is following to develop an integrated, multi-disciplinary performance assessment methodology. It also addresses both total system requirements of the U.S. Environmental Protection Agency's Standard and the subsystem requirements of 10 CFR Part 60.