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

Reply to:
301 E. Stewart Ave., #203
Las Vegas, NV 89101
Tel: (702) 388-6125)

M E M O R A N D U M

DATE: JUNE 17, 1993

TO: Joseph Holonich, Director
Repository Licensing and Quality Assurance Project Directorate

FROM: Philip S. Justus, On-Site Licensing Representative, HLPD

SUBJECT: YUCCA MOUNTAIN PROJECT ON-SITE LICENSING REPRESENTATIVE'S REPORT FOR APRIL 1993

INTRODUCTION

During the eighth month as On-Site Licensing Representative (OR), I participated in three meetings in Las Vegas and one in Knoxville, TN, visited the Yucca Mountain site four times, hosted a visiting French delegation, observed a 50% design review and was interviewed by DOE and NRC Inspector's General staff pursuing three different investigations, among other things. This report summarizes those activities that I consider particularly relevant to staff work.

A principal purpose of these OR reports is to alert NRC staff, managers and contractors to information from DOE's programs for site characterization, repository design, performance assessment and environmental studies that may be of use in fulfilling NRC's role during prelicensing consultation. Relevant information includes such things as new technical data, DOE's plans and schedules and the status of activities to pursue site suitability and Exploratory Studies Facility (ESF) development. In addition to communication of information, any potential licensing concerns identified are reported, as appropriate. The principal focus of this and future ORs reports will be on DOE's programs for ESF, surface-based testing (SBT) and data management.



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EXPLORATORY STUDIES FACILITY (ESF)

1) SECRETARY OF ENERGY DECIDED TO PROCEED WITH UNDERGROUND EXPLORATION OF YUCCA MOUNTAIN. On 4/2, Secretary H. O'Leary announced her decision to continue certain HLW activities as currently planned, such as excavation and tunneling for the ESF. (Enclosure 1, faxed to you immediately upon OR receipt). Subsequently, throughout April, I observed various excavation activities, such as drilling, blasting, mucking, rock bolting-meshing and grouting. These appear to have been conducted as planned or adjusted to meet field conditions. Geologic mapping was conducted similarly, but results were not available.

2) NORTH PORTAL TUNNEL EXCAVATION CONCEPT AND START-UP. Prior to blasting, on 4/8, I attended a field review and discussion with the on-site REECo and QA staff led by my OR colleague, J. Gilray, of selected drawings, specifications, work procedures and QA checklist associated with the drilling and blasting operations. Overall, the personnel appeared to have a sound knowledge and understanding of the procedural requirements and the importance of interactions between REECo on-site technical and QA personnel to ensure all requirements were complied with. Specific hold and witness points were identified on the spec checklist for the REECo QA staff to inspect and sign-off prior to proceeding to subsequent significant work functions. Vibratory and stress effects from blasting will be monitored by Sandia National Laboratory beginning with the first blast. Each drill penetration will be in 10-feet increments, although the charges needn't be placed the full length.

The excavation concept calls for sequential removal of six sections of rock starting with the crown block. The drill and blasted starter tunnel is expected to advance 200-feet into Exile Hill by 10/30/93. Geologic mapping started on the second shift, after the first pilot hole blast occurred at 4:15 pm, 4/13. The first round excavated four feet; the second, on 4/14, six feet. Rock bolts have to be grouted and pull-tested and meet certain specs prior to blasting. A third eight-hour shift started at the end of April. Development of ESF is the primary underground exploration activity; the ORs will continue to observe and report on ESF progress and associated issues.

3) SELECTED OBSERVATIONS FIRST WEEK OF DRILLING. a) GROUTING - YMPO engineers indicated that more grout was needed to secure rock bolts on the high-wall than was expected; this was apparently due to greater than expected capability of existing fractures and litho-physae (voids that were volcanic gas pockets) to transmit grout;

b) GEOLOGIC MAPPING - U. S. Bureau of Reclamation geologist indicated that the fortuitous timing of the exposure of the rocks in the large drainage channel above the North Portal would allow them to be mapped;

c) SEISMIC ZONE DESIGNATION - YMPO engineers discussed the need to clearly specify the seismic design input as Uniform Building Code Zone 3 or 4 in regard to surface facilities and steel-arch design. YMPO scientists and engineers are working on these items; ORs will continue to observe and report on developments.

4) NOTIFICATION OF PROBABLE SHOTCRETING OF BOXCUT. On 4/8 I was notified by phone by a YMPO engineer that the North Portal high-wall was to be shotcreted for safety reasons; that the USGS had completed geologic mapping of that wall (It was also pointed out that part of the north wing-wall was not to be shotcreted in order to allow additional mapping of faults and Tiva Canyon caprock exposed there); that he was drafting a letter to the ESF Branch Chief that would, in effect, release custody of the high-wall to the constructor (which would allow shotcreting to proceed); and that he was seeking NRC concurrence.

As we discussed, at your direction, I called the engineer back to ensure that the NRC staff position was understood: the staff has no intention of interfering with or getting on critical path regarding safety decisions YMPO must make to protect its ESF workers; and, while ORs observed the boxcut on 3/30/93, the ORs made no value judgment about the cut or the geologic mapping (see my previous report). Also, the ORs were authorized to meet with YMPO staff, including the engineer, to discuss the development of notification protocols and thresholds. YMPO indicated that it is preparing to have such a meeting in the near future.

5) 50% DESIGN REVIEW OF ESF SURFACE FACILITIES PACKAGE. Attended first day of 50% Design Review of Surface Facility Job Package 1B, Title II, 4/12. Package 1B contains building and surface facilities at North Portal, surface utilities and communications systems. This is the second of 12 proposed ESF design/construction/test phases (see Enclosure 2 for complete list). Stated purpose of review was two-fold: 1-Management Review- provide assurance that each contracting organization's requirements are being met, 2- Technical Review- provide assurance that the design is technically correct and satisfactory. I have enclosed, for your information, a list of the 22 management team members and the 12 technical team members, their respective organizations and areas of responsibility. These individuals are currently some of the key YMPO ESF staff that the ORs interact with on ESF matters (Enclosures 3A, 3b). The details of engineering design process, "incremented development of ESF/Repository configuration" and QA

matters will likely appear in trip reports by the CNWRA staff in attendance. The various environmental considerations were enumerated in an excellent presentation by E. McCann, his handout, among others, is on file in the OR office.

6) SAFETY AT ESF. Staff and contractor visitors to the ESF are required by YMPO to adhere to various safety requirements. Mandatory actions include wearing hard hats, safety glasses, safety shoes when on the pad or in the boxcut; and, additionally, when in the tunnel, carrying a respirator (to neutralize CO) and a battery-powered lamp; closely associating with a qualified escort; having been trained in mine safety hazards and mitigation methods by a qualified instructor; physically logging in and out of the controlled area with a witness. The YMPO provides the equipment, escorts and training, by arrangement. Shorts and tank-tops are not allowed. YMPO is diligently enforcing the above regulations.

The ORs recommend that NRC staff and contractors who will visit the ESF frequently or for extended periods of observations obtain personal safety glasses and shoes because the clamp-on steel toes-over-street shoes provided to visitors are clumsy, and the plastic goggles provided are generally too small to fit securely over prescription glasses. Such visitors should copy the "ESF North Portal Blast Warning Signals" and bring it with them (Enclosure 4). Future surface facilities include a helipad to accommodate emergency medical air-evacuation contingencies.

SURFACE-BASED TESTING (SBT)

1) LM-300 DRILLRIG BEGINS SECOND DEEP UNSATURATED ZONE TEST HOLE. The LM-300 rig began drilling UZ-14. By 4/30 the hole was cored to a depth of 52 feet and reamed to 91 feet.

GENERAL

1) "REDIRECTION FOR RADIOACTIVE WASTE MANAGEMENT PROGRAM." This was the title of an announcement issued 4/2 (Enclosure 1). It was followed on 4/6 by specific requests for DOE action by DOE Secretary H. O'Leary appear to be of paramount importance to the nature and priorities of FY93 and 94 work at Yucca Mountain site and at the YMPO (Enclosure 5); we discussed some of these briefly. Most significant was the Secretary's decision to continue development of the ESF, that is, start the underground phase, (see ESF items 1 & 2, above). Other activities that apparently will continue are the development of a design for standardized containers; and a proposal for revolving fund legislation. Proposed activities include: creation of a Chief Scientist

position; initiation of negotiations with local governments on Payments Equal to Taxes; development of a program to increase the involvement of the Nevada University System in YM Site Characterization activities. Areas of further consideration include: consideration of an approach for the 1998 waste acceptance requirement; options for the near-term storage of spent fuel; and alternative licensing strategies.

2) REPORTABLE SITE EVENTS AND CONDITIONS. As I discussed with you, YMPO is taking the initiative in establishing thresholds and protocols for reporting site events and conditions to interested parties. Events such as the earthquakes under Little Skull Mountain in June, et seq., and the condition of loose-rock in the North Portal Boxcut (see ESF Item 4, above) have caused YMPO to consider what types, magnitude and potential significance of future events and conditions that will occur or be discovered during site characterization should be reported, how soon after occurrence/discovery and to whom they should be reported. As you directed, the ORs will meet with YMPO to provide input and feedback on this matter as maybe requested by YMPO.

3) ARCHIVING. An initiative by YMPO is underway, by letter and/or a procedural change, directed at Principal Investigators, that will in effect require unused samples to be returned to the Sample Management Facility. This was reported at the Sample Oversight Committee meeting on 4/14.

4) ATTEND SAMPLE OVERSIGHT COMMITTEE MEETING. On 4/14 I attended a Sample Oversight Committee Meeting (SOC) as an observer. My purpose was to learn the SOC process. The SOC is comprised of representatives from YMPO, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratories, U. S. Geological Survey, Nevada Site Management and Operating Contractor, Technical and Management Support Services contractor, Drilling Support and Sample Management Department, and YMPO Quality Assurance.

The SOC is responsible for ensuring that all YMP participating organizations and outside organizations are provided with appropriate geologic specimens related to site characterization activities and that representative samples, if required by the YMPO, are retained for archiving. The SOC review specimen requests from various YMP participating organizations and outside organizations and, based on present and future YMP needs, makes recommendations on specimen allocations.

The following selected agenda items and decisions provide some insight into the scope of the SOC's responsibilities:

(a) approved transfer of samples from one PI to another to assure accountability and traceability;
(b) assured that a potential conflict for use of same sample interval by different PIs was resolved (for example, on a request for same sample from an NRG hole by two PIs, informed a PI that his request could not be granted because the engineering-properties test on that sample took precedence);
(c) approved a PI's request for lab use of particular samples picked from core boxes by the PI;
(d) approved a PI's request for core of certain specifications, to be picked by SMF staff;
(e) discussed a request for samples of vein filling material from a drillhole not yet cored that could amount to a considerable fraction of the core being shipped to the PI (maybe an unacceptably large fraction) - to be discussed with the PI;
(f) considered returning sample requests to sender if packaging instructions are unclear or incomplete (SOC discussed need for it to not take responsibility for determining which packaging option to take);
(g) discussed YMPO concern that for some holes hydrologists sample requests required samples to be pulled and packaged prior to the core being logged in detail and prior to QA of lithology/fracture logging, thus leading to potential for certain core to be incompletely logged;
(h) discussed concern that users of logs weren't getting QA'd logs in timely manner; will recommend that SMF staff be qualified to produce qualified logs at the well-head.
(i) the following handouts at the meeting are available in the OR's office: Borehole prognosis logs for NRC-2A, NRG-4, SRG-1, SRG-5, preliminary field composite borehole logs for NRG-3, NRG-6, N-62.

5) PARTICIPATE IN THE INTERNATIONAL HIGH-LEVEL RADIOACTIVE WASTE MANAGEMENT CONFERENCE. I participated in this year's Conference as a co-author of a paper presented by K. McConnell, "U.S. NRC Staff Technical Position on Investigations to Identify Fault Displacement Hazards and Seismic Hazards at a Geologic Repository" (Enclosure 6), and as a co-chair of the session, "Saturated Zone - Flow Paths and Water Table," jointly with P. Grindrod of Intera-UK. This year's Conference appeared to contain a larger proportion of papers reporting results of work done rather than of plans to do work, than in previous years. Thus, the "Proceedings" of the Conference is a valuable source of data and analyses of DOE activities not yet available as DOE contractor publications (e.g., some USGS hydrology papers). I'll leave the details of the Conference to the trip reports of the 25 NRC-HQ staff who attended.

ON-SITE REP ACTIVITIES

1) SELECTED ACTIVITIES. (a) FRENCH VISITORS - HLW. I escorted a delegation of French regulatory scientists and engineers (Jean-Christophe Niel, Dominique Greneche, Francois Besnus, Dominique Delattre) on a DOE-hosted VIP tour of Yucca Mountain Site on 4/1 (Enclosure 7a is their itinerary and 7b the information package DOE handed out); this was a continuation of their cross-country tour begun at NRC-HQ;

b) FRENCH VISITORS - LLW. I hosted a briefing of the French delegation on LLW by Steve Marshall, U.S. Ecology VP, in OR Office 4/2;

c) DOE IG - AUDITORS. I was interviewed by DOE-IG staff J. Wall and M. Pollock who were conducting an audit of internal DOE-OCRWM matters, 4/5. I provided information on such things as NRC's role in site characterization, NRC's interactions with DOE, the licensing process and role of ORs;

d) DOE IG - INVESTIGATOR. I was interviewed by DOE-IG agent G. Allen, 4/22. The subject dealt with an allegation (not specified to me) concerning parts of the USGS involved in the Yucca Mountain Project. I responded to questions on such subjects as NRC's QA requirements and the USGS's response to them; whether organizations other than USGS could perform the functions of the USGS;

e) APPENDIX 7 SITE TOUR. I arranged and conducted part of Appendix 7 visit to Yucca Mountain site, 4/26, for selected NRC staff all of whom attended the International HLW Conference 4/27-30; see the trip reports of participants for details of the trip; the handout for trip participants is Enclosure 8;

f) NRC IG - AUDITORS. I was interviewed by NRC-IG staff R. Irish and K. Black, 4/28. The subject related to DHLWM's management of the Center for Nuclear Waste Regulatory Analyses (Center). I provided responses to questions on such subjects as history of Center, function of Center, relationship of Center to NRC-HQ and to DOE and management oversight of the Center by DHLWM and NMSS;

g) PARTICIPATE IN MEETING OF NYE COUNTY DELEGATION. I participated briefly in a meeting of Nye County delegation, 4/28, where J. Linehan provided a brief overview of NRC's and OR's role in the HLW-YM project; I responded to a question on what lessons learned as an OR I might pass along to the soon-to-arrive Nye County OR. I suggested that the new OR become reasonably knowledgeable about a site activity prior to showing up at the job site of that activity, e.g., review the relevant job package, test planning package, work plan, study plans and procedures and relevant audit

and surveillance reports, so as to focus on current issues with minimum disruption of DOE personnel or activities;

h) COOPERATE WITH U.S. ENVIRONMENTAL PROTECTION AGENCY REPRESENTATIVE. With your approval, J. Gilray and I held the first of several discussions with EPA staff, J. Benetti on the functions and operations of an OR office.. Mr. Benetti is acting on behalf of EPA to establish on-site representation of EPA at the Waste Isolation Pilot Project (WIPP), NM. We're introducing Mr. Benetti to the modus operandi of the OR office which he is using as a working model for EPA's purposes.

i) PRESENTATION TO AMERICAN SOCIETY OF QUALITY CONTROL ENGINEERS. With your approval, I accepted an invitation from ASQC to present a paper on behalf of NRC at the High-Level Nuclear Waste Management Issues Session, 4th International Environmental and Waste Management Conference, in Knoxville, TN on 4/21. The paper was entitled, "Role of U.S. Nuclear Regulatory Commission's On-Site Representatives in the High-Level Radioactive Waste Management Program Pre-Licensing Activities" (co-authored by J. Gilray). We identified the benefits of an on-site rep program. Enclosed is a copy of the attendees, published abstract, Vu-graphs used and an outline of the paper, respectively (Enclosures 9a,b,c,d).

2) NRC STAFF VISITORS. The following NRC staff visited the site and/or attended meetings in Las Vegas in April: J. Linehan, S. McDuffie, H. Lefevre, M. Delligatti, R. Johnson, D. Chery, J. Park, N. Eisenberg, N. Coleman, R. Codell, M. Nataraja, S. Treby, Wm. Reamer, M. Malsch, G. Birchard, J. Philip, J. Randall, T. Barchi, R. Irish, K. Black, R. Shideler, L. Deering, R. Major, Wm. Hinze, P. Pomeroy, H. Larson, R. Virgilio, Wm. Belke, J. Spraul, B. Jagannath.

Enclosures:

1. Secretary of Energy, H. O'Leary, "Redirection for Radioactive Waste Management Program", April 2, 1993
2. 50% Design Review, Proposed ESF Design/Construction/Test Phases, April 12, 1993

3a. 50% Design Review, Management Review Team Members
3b. 50% Design Review, Technical Review Team Members

4. ESF North Portal Blast Warning Signals
5. Secretary of Energy, H. O'Leary, "Guidance for the Site Characterization Plan at Yucca Mountain", April 6, 1993
6. K. McConnell, A.K. Ibrahim and P.S. Justus, "U.S. NRC Staff Technical Position on Investigations to Identify Fault Displacement Hazards and Seismic Hazards at a Geologic Repository: Proc. 4th Int'l Conf., High Level Radioactive Waste Mgmnt, American Nuclear Soc., 1993, pp. 175-181"

7a. DOE Itinerary, Visiting French Delegation, YM Site, April 1
7b. DOE Information Package, " " " " " " "
8. Itinerary and Guide for NRC staff visit to YM site, April 26
9a. ASQC, Knoxville, TN meeting attendees, April 21
9b. " " OR Abstract of talk, " "
9c. " " Vu-graphs used in talk, " "
9d. " " Outline of talk, " "

cc w/enc.:
C. Gertz, DOE
D. Shelor, DOE
T. Hickey, State Senator
W. Patrick, CNWRA

w/o enc.:
C. Abrams, M/S 4 H 3
B. Youngblood, M/S 4 H 3
J. Linehan, M/S 4 H 3
R. Bernero, M/S 6 E 6
H. Thompson, M/S 17 G 21
S. Gagner, M/S 2 G 5
S. Schwartz, M/S 3 D 23
J. Fouchard, M/S 2 G 5
E. O'Donnell, M/S NLS 260
R. Loux, State of NV
G. Cook, Region V
J. Martin, Region V
D. Kunihiro, Region V
S. Jones, DOE
R. Dyer, DOE
D. Foust, M&O
S. LeRoy, M&O
J. Russell, CNWRA
L. Reiter, NWTRB
D. Bechtel, Clark Co.
L. Bradshaw, Nye Co.

enclosure on the shelf

ENCLOSURE 1

# DOE NEWS

NEWS MEDIA CONTACTS:
Kathaleen Bechard, 202/586-5806
Joanne Johnson, 202/586-5806

FOR IMMEDIATE RELEASE
April 2, 1993

## REDIRECTION FOR RADIOACTIVE WASTE MANAGEMENT PROGRAM

Secretary of Energy Hazel R. O'Leary announced today a new program direction for the Office of Civilian Radioactive Waste Management and the Yucca Mountain project.

The Secretary has met with many interested parties and is conducting an internal review of the status of the Civilian Radioactive Waste Management Program.

"The program needs to refocus its efforts and improve in two broad areas: increased emphasis on the highest quality scientific work, and the inclusion of external parties in program development and implementation," Secretary O'Leary said.

Secretary O'Leary's examination of the program, which will include reports from several independent review bodies, may lead to the classification of program activities into three broad categories: 1) activities within the program that should proceed as presently planned; 2) new activities and policies that will be implemented now; and 3) those activities within the program that require further reconsideration and that will be reviewed formally with substantial external consultation.

(MORE)

R-93-047

1 Activities within the program that will continue as currently planned include continuation of excavation and tunneling activities for the exploratory studies facility at Yucca Mountain.

2 "In the course of this review, some decisions have been made that underground exploration is essential to determining Yucca Mountain's suitability. That activity should proceed on an orderly schedule. In 3 addition, I have concluded that a 25-foot diameter tunnel is appropriate to facilitate the years of exploratory underground work with due regard for worker health and safety," Secretary O'Leary said.

4 Other program activities that will continue are the development of a design for standardized containers to support spent nuclear fuel transportation, storage, and disposal; and a proposal for revolving fund 5 legislation for congressional consideration.

New activities and policies that the Secretary plans to initiate as part of her new program direction include:

6 o Creation of a Chief Scientist position for the Yucca Mountain Project organization;

7 o Initiation of negotiations with local governments of appropriate Payments Equal to Taxes;

8 o Development of a program to increase the involvement of the Nevada University System in Yucca Mountain Site characterization activities.

Areas of the program which will require further reconsideration include: 9 consideration of an approach for the 1998 waste acceptance requirement, 10 including utility compensation alternatives; a full range of options for the near-term storage of spent fuel pending ultimate disposal; and alternative 11 repository licensing strategies.

"These are the program issues that, in my mind require a thorough consultative process," said Secretary O'Leary. "I believe interested parties and members of the public can work together with us in crafting a new strategy 12 for the program. Devising an acceptable strategy for the long-term management of nuclear waste is both a national priority and an opportunity for the United States to set the standard for an international environmental initiative of overwhelming consequence."

-DOE-

R-93-047

# SCOPE OF ESF

## PROPOSED DESIGN/CONSTRUCTION/TEST PHASES

* 1A. Site preparation and partial portal of North Ramp
1B. Surface facilities at North Portal
2. North Ramp from portal to Topopah Springs (TS) level
3A. Site preparation and partial portal of South Ramp
3B. Surface facilities at South Portal
4. South Ramp from portal to TS level
5. North Ramp from Calico Hills (CH) turnout to CH level
6. South Ramp from CH turnout to CH level
7. Exploration drifts at CH level
8. Exploration drifts at TS level
9. Main test level core area at the TS level
10. Shaft at north end: Surface to TS level

* Not necessarily the order of construction

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ENCLOSURE 2

# Management Review Team Members

| | | |
|---|---|---|
| J. T. Gardiner | DOE/EDD | Surface |
| R. S. Waters | DOE/EDD | Mining |
| T. I. Fortner | DOE/EDD | Electrical |
| D. R. Williams | DOE/RSED | Geology |
| W. A. Wilson | DOE/SO | Field |
| R. J. White | DOE/SO | Field |
| R. B. Baumeister | DOE/SO | Safety |
| J. Blaylock | DOE/QA | QA |
| B. J. Verna | DOE/EDD | Requirements |
| J. M. Boak | DOE/RSED | Performance Assessment |
| Dave Kessel | SNL | Testing |
| R. R. Kovach | LANL | Testing |
| D. Edwards | USGS | Testing |
| J. A. Blink | LLNL | Testing |
| B. G. Cruz | M&O | Specialty Engineering |
| R. C. McDonald | M&O | Construction |
| G. M. Teraoka | M&O | Requirements |
| E. M. Cikanek | M&O | Repository Interface |
| R. D. Nations | M&O | Safety & Health |
| T. H. Pysto | T&MSS | Environmental |
| R. Quittmeyer | M&O | Surface-Based Testing Interface |
| T. M. Leonard | REECo | Construction |

ENCLOSURE 3a

# Technical Review Team Members

| | | |
|---|---|---|
| J. W. Keiffer | M&O | Mining |
| S. Romanos | M&O | Structural Engineering |
| D. Vanica | M&O | Mechanical Engineering |
| B. Reed | M&O | Electrical Engineering |
| M. Weaver | M&O | Regulatory Requirements |
| Ned Elkins | TCO-LANL | Testing |
| R. Schreiner | RSN | Systems Engineering |
| R. G. Musick Jr. | RSN | Civil Engineering |
| T. G. Nelson | RSN | Electrical Engineering |
| B. H. Anzai | RSN | Mechanical Engineering |
| S. A. Nordick | RSN | Structural Engineering |
| D. Barreres | RSN | Fire Protection |
| R. C. Greenwold | RSN | Surface Facilities |

LOSURE 3b

# ESF NORTH PORTAL BLAST WARNING SIGNALS

## WARNING SIGNAL - 5 MINUTES BEFORE BLASTING

3 - LONG WHISTLES

## BLAST SIGNAL - 1 MINUTE BEFORE BLASTING

3 - SHORT WHISTLES

## ALL CLEAR SIGNAL

1 - LONG WHISTLE

NOTE: LONG WHISTLE 5 SECOND DURATION
SHORT WHISTLE 1 SECOND DURATION

ENCLOSURE 5

The Secretary of Energy
Washington, DC 20585

April 6, 1993

MEMORANDUM FOR LAKE H. BARRETT, ACTING DIRECTOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

SUBJECT: Guidance for the Site Characterization Plan at Yucca Mountain

The successful completion of the mission of the Civilian Radioactive Waste Management program is one of the most critical environmental challenges facing the Nation. Since becoming the Secretary of Energy, I have met with many interested parties, have reviewed numerous written reports and have been reviewing the status of the program. During this early stage of my review I have found that the program needs to refocus its efforts to improve in two broad areas: increased emphasis on the highest quality scientific work and the more effective inclusion of external parties in program development and implementation.

As my review of the program continues, I will determine the classification of program activities into three broad categories: (1) activities within the program that should proceed as presently planned; (2) new activities and policies that will be implemented now; and (3) those activities within the program that require further reconsideration and that will be reviewed formally with substantial external consultation.

My assessment of the scientific viewpoints on the issue of pursuing underground explorations of Yucca Mountain at this time has convinced me that the key to determining site suitability lies in exploration of the underground geology and hydrology through tunnel excavation. Excavation and tunneling activities for the exploratory studies facility at Yucca Mountain will continue as currently planned.

I have also reviewed the tunnel sizing issue for the exploratory studies activity. After carefully considering comments from various perspectives and in keeping with my commitment to the highest standards of worker health and safety conditions for the Department's work force; in recognizing that there will be many uncertainties as the scientific exploration continues; and given my responsibilities under the Nuclear Waste Policy Act and associated regulations to protect the integrity of the site, should it be found suitable for geologic disposal, I have concluded that a 25-foot diameter tunnel is appropriate.

Other program activities may continue while my reviews continue. Examples of such are the development of a design for standardized containers to support spent fuel transportation, storage, and disposal and a proposal for revolving fund legislation for congressional consideration.

To enhance the program's scientific credibility, I want a plan developed to initiate the creation of a senior position for a Chief Scientist to oversee the scientific investigations at Yucca Mountain. The role of the Chief Scientist would be to assure that all work conducted at Yucca Mountain achieves the highest scientific quality and that the work is focused on resolving the issues that are critical to determining the suitability of the site. The Chief Scientist would also be charged with establishing a systematic peer review process for the program, that will include nationally recognized experts in appropriate scientific disciplines.

The program has fallen into the untenable position of attempting to meet unrealistic schedules without adequate resources. To alleviate this problem, I plan to no longer allow the program to be unnecessarily schedule driven, with the attendant risk of sacrificing high quality science to meet artificial and unrealistic deadlines. However, I do expect measurable and continued progress toward meeting program goals and continued results in cost reduction and containment. Thus, to assure consistent resources for the program, and as I indicated above, I want a proposal developed for legislation for the establishment of a revolving fund for the program.

During my review, one of the major criticisms I have heard consistently about the program is its lack of process for ensuring the serious and systematic involvement of the program's stakeholders in shaping program decisions. To improve this area, I want the program to confer with key national stakeholders and to report back to me within 60 days with a plan for broad consultation on specific issues I have identified. As part of that consultation, the program will work with stakeholders to develop, for my approval, a process for their regular involvement in the program.

During this consultation all viewpoints will be brought together by an independent facilitator, who will frame an approach to each issue for my consideration. Special emphasis should be given to the views of elected and appointed public officials having direct constituent responsibilities. The program's activities should also be closely coordinated with separate discussions with Governors and with the consultative activities initiated by the National Association of Regulatory Utility Commissioners.

Areas of the program which likely will require further reconsideration include: consideration of an approach for the 1998 waste acceptance requirement, including utility compensation alternatives; a full range of options for the near-term storage of spent fuel pending ultimate disposal; and alternative repository licensing strategies.

Among the important stakeholders are the States and counties in which site characterization had, or is continuing, to take place. The issue of payments-equal-to-taxes continues to be a contentious issue with these governments, and I would like to see the Department initiate negotiations to identify whether grounds for agreements can be reached.

Devising an acceptable strategy for the long term management of nuclear waste is both a national priority and an opportunity for the United States to set the standard for an international environmental initiative of overwhelming consequence.

Hazel R. O'Leary

ENCLOSURE 6

Proc. 4th Int'l Conf., High Level Radioactive Waste Mgmnt, American Nuclear Soc., 1993, pp. 175-181"

# U.S. NUCLEAR REGULATORY COMMISSION STAFF TECHNICAL POSITION ON INVESTIGATIONS TO IDENTIFY FAULT DISPLACEMENT HAZARDS AND SEISMIC HAZARDS AT A GEOLOGIC REPOSITORY

KEITH I. McCONNELL
Division of High-Level Waste Management 4-H-3
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
301-504-2532

ABOU-BAKR K. IBRAHIM
Division of High-Level Waste Management 4-H-3
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
301-504-2532

PHILIP S. JUSTUS
U.S. Nuclear Regulatory Commission
301 East Stewart Avenue, #203
Las Vegas, Nevada 89101
702-388-6125

## ABSTRACT

This paper outlines the guidance provided to the U.S. Department of Energy by the Nuclear Regulatory Commission (NRC) staff in its Staff Technical Position (STP)[1] on appropriate investigations that can be used to identify fault displacement hazards and seismic hazards at a geologic repository. The STP defines an acceptable approach to the identification and investigation of fault displacement hazards, which in turn leads to the identification of three types of faults: Type III faults - need not be investigated in detail; Type II faults - candidates for detailed investigation; Type I faults - should be investigated in detail because they are subject to displacement and are of sufficient length and located such that they may affect repository design and/or performance or could provide significant input into models used to assess repository performance. The STP also describes an acceptable approach to conducting investigations to provide input for the analysis of vibratory ground motion with emphasis on those earthquakes that could generate the equivalent of .1g or greater ground acceleration at the location of the controlled area.

## I. INTRODUCTION

10 CFR Part 60[2] does not specify the manner in which potential fault displacement hazards and seismic hazards at a candidate site for a geologic repository are to be identified. The purpose of the STP, therefore, is to provide guidance to the U.S. Department of Energy (DOE) on acceptable geologic repository investigations that can be used to identify fault displacement hazards and seismic hazards. An analysis of the information acquired through these investigations should lead to an estimation of the rates of fault slip and of seismic activity.

In addition, there are several other motivating factors behind the staff's development of a position on an acceptable approach to the identification of fault displacement hazards and seismic hazards at a geologic repository. Specifically, the STP encompasses a systematic process to achieve the following: (1) document the identification and assessment of all faults or fault zones within the region identified for investigation; (2) identify those faults or fault zones that are of potential importance to the design and performance of the geologic repository, and as a result require detailed investigation; and (3) provide a formal record for review of those faults or fault zones that are eliminated from further consideration, but that may require reexamination, based on the results of site characterization.

## II. STAFF TECHNICAL POSITIONS AND ACCEPTABLE APPROACHES

The NRC staff has taken the position that the approach to the identification of fault displacement hazards and seismic hazards, defined in the STP[1] and outlined in succeeding parts of this paper, would be acceptable to geologic repository investigations. Further, the approach to investigations for fault displacement and seismic phenomena described in this paper can be expected to result in the collection of sufficient data for input to analyses of fault displacement hazards and seismic hazards, both for the preclosure period and the postclosure period of performance. However, performance assessments such as those used to demonstrate compliance with the overall system performance requirements (i.e. 10 CFR 60.112) may result in the need for additional investigations beyond those described.

The staff has also taken the position that the approach to the characterization of those potentially adverse conditions that relate to the identification of fault displacement hazards and seismic hazards (i.e. 10 CFR 60.122(c)(3), 60.122(c)(4), 60.122(c)(11), 60.122(c)(12), 60.122(c)(13), 60.122(c)(14), should rely on deterministic criteria to determine which faults require detailed investigation. Deterministic criteria provided in the STP[1] include "displacement in the Quaternary Period," and "seismicity associated with the fault," as well as other criteria that relate to fault length and location. These criteria are considered to be sufficiently comprehensive such that their implementation is expected to result in the collection of data

sufficient to demonstrate that the potential adverse conditions have been characterized adequately.

The steps in the identification and investigation of fault displacement and seismic hazards provided by the STP[1] are illustrated in Fig. 1 and described in succeeding parts of this paper.

The first step in the identification of fault displacement hazards and seismic hazards is the identification of the region encompassing features relating to the hazards that can be those used as the basis for geologic repository investigations. An acceptable approach would employ the following considerations:

(1) The boundaries of the region to be investigated for fault displacement hazards and seismic hazards should be determined by the geologic setting where the proposed repository site is located. The geologic setting can be viewed as a hierarchy with the "geologic setting " element as the uppermost element in the hierarchy. The geologic setting, as defined in 10 CFR 60.2[2], encompasses the geologic, hydrologic, and geochemical systems present in the region in which a potential repository site is to be located. These systems can have constituent components (e.g. the "faulting" component of the "geologic" system within the geologic setting). The final definition of the geologic setting would result from the investigation of all of the components of each of the systems that may affect repository design and/or performance.

(2) Faulting and seismicity are interrelated, but separate, components of the "geologic" system, acting within the geologic setting. Therefore, the boundary of the region to be investigated for fault displacement hazard (i.e. the boundary of the "faulting" component of the "geologic" system) will in all likelihood not coincide with the boundary of the region to be investigated for seismic hazard (i.e the boundary of the "seismic" component of the "geologic" system). The boundaries of the components should be based on assessments of the potential to affect repository design and/or performance.

(3) In identifying the region to be investigated, the selection of component boundaries for the faulting and seismicity components should be based on a review of the pertinent literature, relevant field investigations, and the consideration of alternative tectonic models.

(4) The results of site characterization should be factored into the initial identification of the region to be investigated, to ensure that the size of the region is sufficient to permit adequate characterization of the hazards.

After identifying the region to be investigated, those faults or fault zones in the geologic setting that may require detailed investigation should be identified. An acceptable approach would include the following:

(a) If faulting during the Quaternary Period i characteristic of the controlled area, any fault o fault zone, any part of which is inside the controlle area, should be considered as a candidate for detaile investigation (i.e. a "Type II" fault).

(b) Where fault displacement outside the controlled are may affect isolation within the controlled area, faul: or fault zones outside the controlled area, but withi the geologic setting, should also be considered a candidates for detailed investigation (i.e. "Type II faults).

The determination of which faults outside th controlled area, are relevant to geologic repositor investigations, should be based primarily o assessments of fault length and location. Addition: fault characteristics, such as fault (zone) width, ma also be considered. Fault length and location can b used as coarse screens to judge when displaceme along a fault may require consideration in repositor design and in evaluations of performance c structures, systems, and components important t safety, containment or waste isolation, or ma provide significant input into models used i assessing design and performance. The staff ha taken the position that initial assessments, of whic faults outside of the controlled area are relevar should be deterministic, but recognizes the utility c probabilistic analyses in supporting the: deterministic assessments.

(c) Those faults outside the controlled area n considered as candidates for detailed investigation: according to Item (2) of this subsection (i.e "Type III" faults) will require no furth investigation except as outlined in succeedin sections of this paper.

## III. IDENTIFICATION OF FAULTS THAT REQUIRE DETAILED INVESTIGATION (i.e. THE IDENTIFICATION OF "TYPE I" FAULTS)

After the initial identification of candidate faults to b considered for detailed investigation (i.e. "Type II" faults Those faults or fault zones that require detailed investigatic can be identified by the following process.

(1) Faults requiring detailed investigation (i.e. "Type I faults) are those faults that:

(a) are subject to displacement (see Step No. 1 below)
(b) may affect the design and/or performance c structures, systems, and components important t safety, containment, or waste isolation, and/or

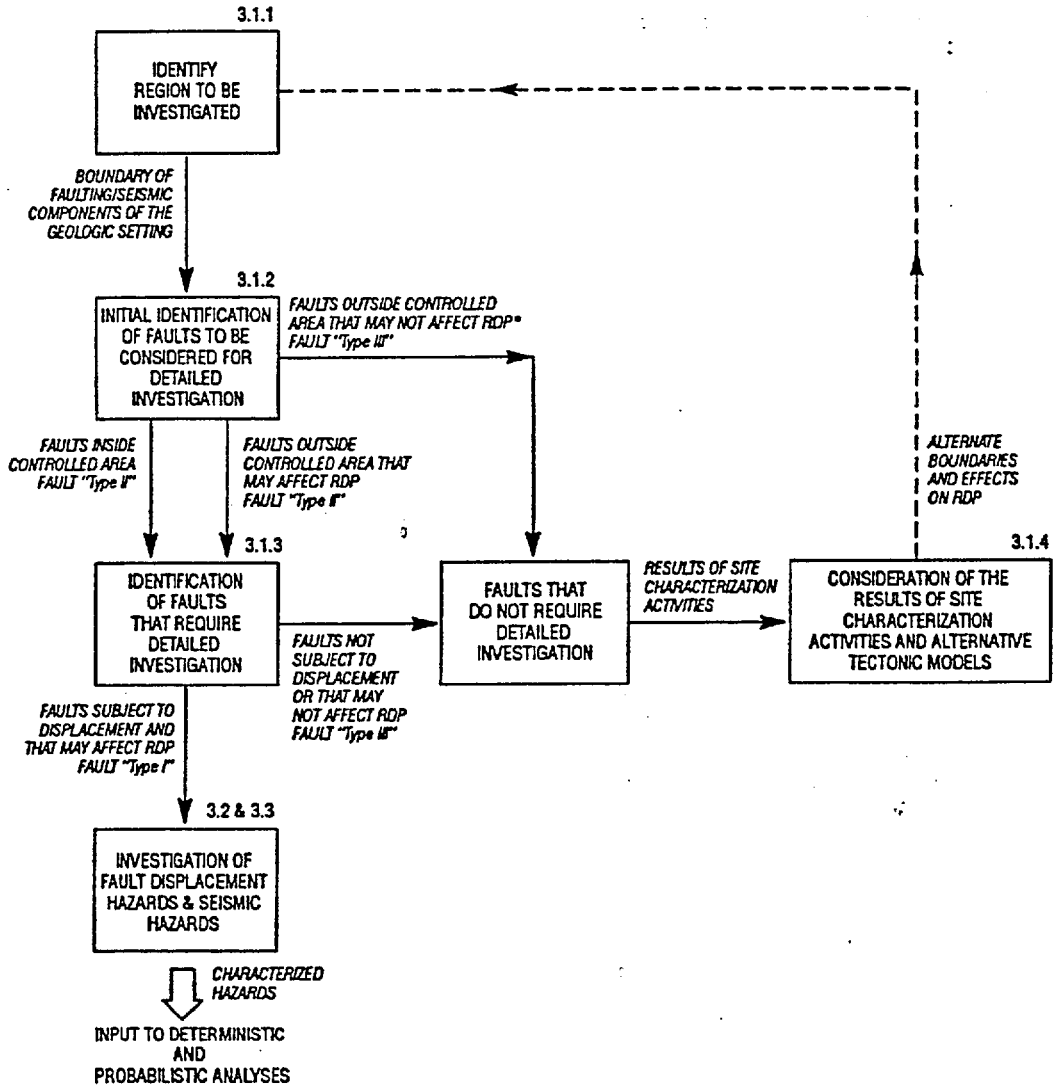


FIGURE 1 — Example of an Acceptable Approach to the Identification of Fault Displacement Hazards and Seismic Hazards. Numbers next to the process blocks correspond to the technical position statements described in the text.

* "RDP" means repository design and/or performance.

(c) may provide significant input into models used in the design or in the assessment of the performance of structures, systems, and components important to safety, containment, or waste isolation.

(2) The identification of "Type I" faults or fault zones can be described as a two-step process. This process is described below and illustrated in Fig. 2. Only those faults that meet the criteria described in both Step Nos. 1 and 2 below, need to be considered as "Type I" faults and, therefore, characterized in detail.

### A. PROCESS TO IDENTIFY "TYPE I" FAULTS - STEP NO. 1: IDENTIFICATION OF FAULTS SUBJECT TO DISPLACEMENT

The primary criterion for the identification of faults subject to displacement is evidence of displacement during the Quaternary Period. Any candidate fault, identified in the screening process that has evidence of displacement in the Quaternary Period, is considered to be subject to displacement and should continue to be a candidate for detailed investigation.

In cases where the Quaternary record is incomplete or unclear, the following additional criteria should be applied to the candidate faults, to determine if such faults could be subject to displacement. Specifically, faults are considered subject to displacement if they exhibit one or more of the following criteria:

(a) have seismicity, instrumentally determined, with records of sufficient precision, that suggests a direct relationship with a candidate fault, or
(b) have a structural relationship (i.e. displacement on one fault could cause displacement on another) to a fault that meets one or more of the other criteria (i.e. Quaternary-age displacement or Items (a) and (c) or
(c) are oriented such that they are subject to displacement in the existing stress field.

For those cases where, after consideration, the technical basis for making a judgment about a particular criterion described above (and shown in Fig. 2) is unclear or inconclusive, the next criterion should be considered to ensure that faults of potential significance to repository design and/or performance are not overlooked.

Prudence dictates that even in cases where no Quaternary displacement can be documented along a particular fault, the aforementioned additional criteria in Step No. 1 should be considered.

An acceptable approach to providing the information necessary for evaluating the criteria indicated in Step No. 1 would include:

(a) investigation of geologic conditions within the boundaries of the component, such as lithology, stratigraphy, structural geology, stress field, and geologic history
(b) determination of the existence of Quaternary-age displacement on faults within the component boundaries
(c) tabulation of each historically reported and instrumentally recorded earthquake that can reasonable be associated with a fault or fault zone, including the date of occurrence, magnitude or highest intensity, and a plot of the epicenter or region of highest intensity, and
(d) consideration of alternative tectonic models for the geologic setting, where the alternative models may indicate that one or more of the criteria in Step No. 1 may apply.

### B. PROCESS TO IDENTIFY "TYPE I" FAULTS - STEP NO. 2: ASSESSMENT OF THE POTENTIAL EFFECTS OF FAULTS SUBJECT TO DISPLACEMENT

Fault length should be used as a measure to assess the possible effects of fault displacement on repository design and/or performance. As fault or fault zone length was applied as a discriminator used for screening faults or fault zones outside the controlled area for further investigation, length also can be considered in determining which faults or fault zones inside the controlled area continue to be relevant to geologic repository investigations. The evaluation should take into account the potential effects of faults on the design and performance of structures, systems, and components important to safety, containment, or waste isolation, or on models used in assessing the design and performance of these structures, systems, and components. The staff's technical position leaves to DOE the development of criteria for identifying what length faults or fault zones, assuming that displacement will occur, may affect repository design and/or performance.

Faults that meet the criteria in Step No. 1, but do not meet the criteria of Step No. 2, are not considered "Type I" faults, but are considered "Type III" faults.

"Type III" faults may require further investigation based on the results of site characterization activities, development of alternative tectonic models for the site and region, and iterative assessments of performance.

The approach described above leads to the identification of three types of faults:

> "Type III" faults: Faults or fault zones either (1) not subject to displacement or (2) subject to displacement, but of such length, or located in such a manner, that they will not affect repository design and/or performance. Consequently, they do not need to be investigated in detail.

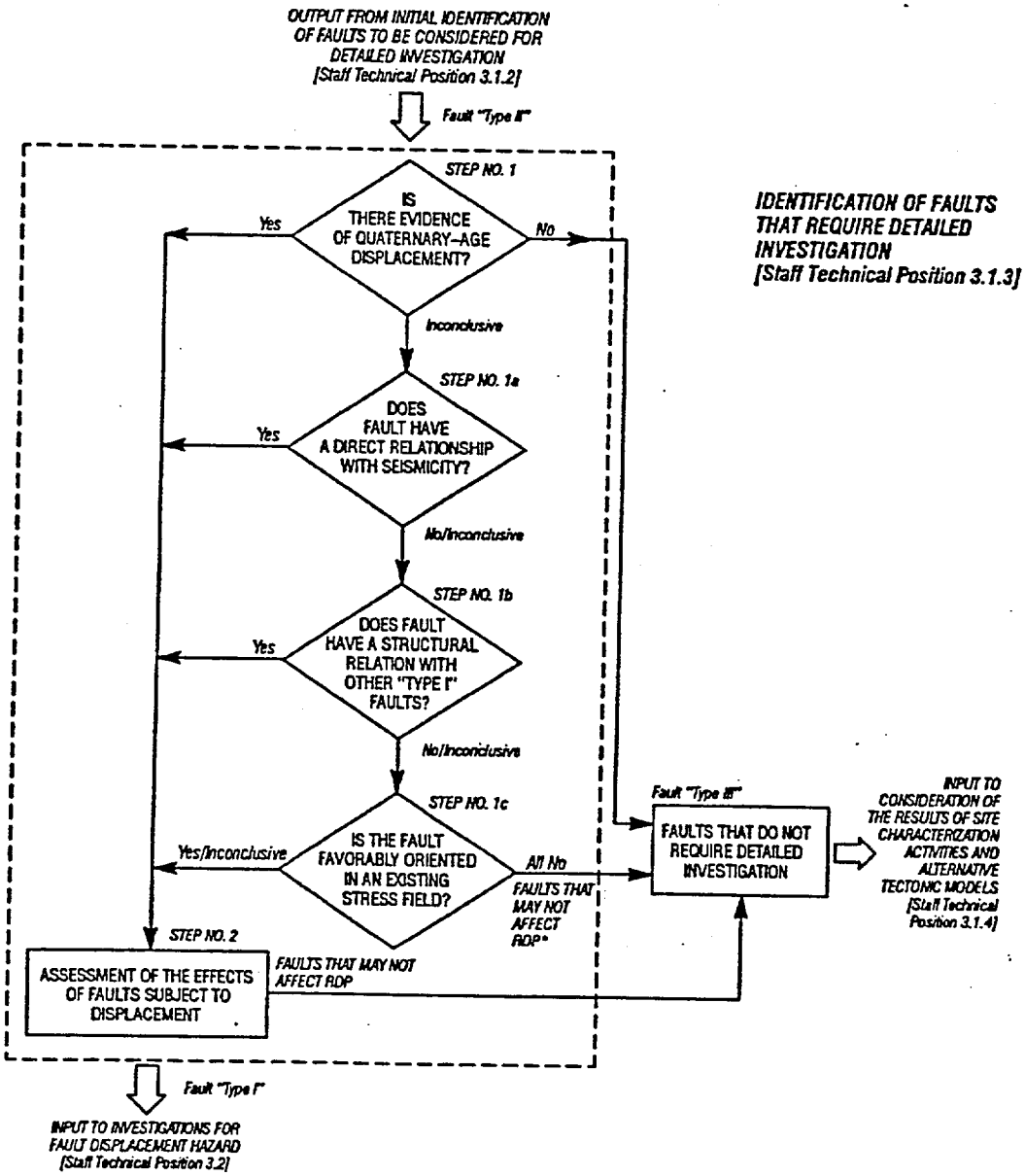


Figure 2 — Staff Technical Position 3.1.3: Detail to the "Approach to the Identification of Faults that Require Detailed Investigation (i.e., "Type I" Faults)". Refer to the text for the discussion of this two-step process. Also see Figure 1.
* "RDP" means repository design and/or performance.

"Type II" faults: Faults or fault zones that are candidates for detailed investigation, and

"Type I" faults: Faults or fault zones that are subject to displacement and of sufficient length and located such that they will affect repository design and/or performance. As such, they should be investigated in detail. Only faults that are determined to be "Type I" are of regulatory concern, because it is those faults, both inside and outside the controlled area, that may require consideration in repository design, could have an effect on repository performance, or could provide significant input into models used to assess repository performance.

## IV. INVESTIGATIONS FOR FAULT DISPLACEMENT HAZARDS

After identification of "Type I" faults, consideration should be given to the detailed investigation of "Type I" faults. The investigations should provide sufficient data for input to analyses of the fault displacement for both the preclosure and the postclosure periods of performance.

(1) an acceptable approach to the detailed investigation of "Type I" faults or fault zones should include:

(a) a description of the character of the fault or fault zone, including its three dimensional geometry (e.g. geometry determined using geophysical and/or borehole techniques)
(b) a description of the relationship of the fault or fault zone to other tectonic structures in the controlled area and within the boundaries of the component(s)
(c) nature, magnitude, and geologic history (e.g. slip rates) of displacements along the fault or fault zone, including particularly the estimated Quaternary-age displacement. For each event, the length of rupture, amount of displacement, and area of rupture surface should be described
(d) correlation of hypocenters, or locations of highest intensity, of historically reported and instrumentally recorded earthquakes with faults or fault zones, any parts of which are within the component boundaries, and
(e) consideration of alternative tectonic models at the scale of the controlled area or larger area, as they may affect alternative interpretations of the character and significance of "Type I" faults

(2) These investigations apply to both "Type I" faults expressed at the surface and those with no surface expression (i.e. those faults identified or inferred in the subsurface).

## V. INVESTIGATIONS FOR SEISMIC HAZARDS

In addition to the investigations described in the preceding section, an acceptable vibratory ground motion hazard investigation should include the following:

(1) An assessment of the physical evidence concerning the behavior during prior earthquakes of surficial materials and the geologic substrata underlying the site.

(2) A determination of the static and dynamic engineering properties of the materials underlying the site, as well as an assessment of the properties needed to determine the behavior of the underlying materials as a result of earthquakes, and the characteristics (such as seismic wave velocities, density, water content, porosity, and strength) of the underlying materials in transmitting earthquake-induced motions to those structures, systems, and components important to safety, containment, or waste isolation.

(3) Tabulation of all historically reported and instrumentally recorded earthquakes that have affected or that could reasonably be expected to have affected the site, including the date of occurrence and the following measured or estimated data: magnitude or highest intensity, and a plot of the epicenter or location of highest intensity. Where historically reported or instrumentally recorded earthquakes could have caused a ground acceleration of at lease one-tenth the acceleration of gravity (0.1g) at the site, the acceleration or intensity, and duration of ground-shaking at the site, should also be estimated. (For earthquakes that produce ground accelerations of less than 0.1g. data should be tabulated to the extent necessary to support the values used to ensure that the design incorporates such features as may be needed to achieve the performance objectives.) Where available, the time history for those earthquakes that may be significant in an analysis of liquefaction and other design factors should be provided. (Since earthquakes have been reported in terms of various parameters such as magnitude, intensity at a given location, and effect on ground, structures, and people at a specific location, some of these data may have to be estimated by use of appropriate empirical relationships. Measured data, when available, are preferable to estimated data.) A description and comparison of the characteristics of the material underlying the epicentral location or region of highest intensity, to the material underlying the site in transmitting earthquake vibratory ground motion, should also be considered.

(4) An estimation of the regional attenuation of vibratory ground motion.

(5) A correlation of epicenters or locations of highest intensity of historically reported and instrumentally recorded earthquakes, where possible, with tectonic

structures. Epicenters or locations of highest intensity that cannot be reasonably correlated with tectonic structures should be associated with seismic source zones.

(6) (a) An estimation of which "Type I" faults may be important in the consideration of vibratory ground motion for design. The "Type I" faults that should be considered are those with displacements sufficient to generate an earthquake with the equivalent of 0.1g or greater ground acceleration at the location of the controlled area. "Type I" faults that can produce earthquakes with vibratory ground motion of less than 0.1g at a site will require no additional investigation, under the guidance in this STP, for the identification of vibratory ground hazard, except as described in previous sections, and

(b) A determination of the fault parameters of those "Type I" faults that may be important in establishing the design basis vibratory ground motion.

It should be noted that vibratory ground motion determinations for a point on the surface, using accepted attenuation functions that are typically derived from surface observations, will generally be conservative for the underground facility beneath the surface point (except for cases of unusual channeling of the motion). However, if "Type I" faults are located such that there is a potential for vibratory ground motion to impact the underground facility, investigations should be undertaken to determine if areas exist, within the underground facility, where vibratory ground motion at depth would be higher than at the surface. Vibratory ground motion should also be monitored as early as possible during the site characterization phase, both on the surface above the proposed underground facility and at the level of the proposed underground facility itself, to observe possible differences in the motion between these locations. Observed differences may be used, in conjunction with analytical techniques, to estimate the vibratory ground motion attenuation with depth.

## VI. REFERENCES

1. U.S. Nuclear Regulatory Commission, "Staff Technical Position on Investigations to Identify Fault Displacement Hazards and Seismic Hazards at a Geologic Repository," NUREG-1451, July 1992.

2. Code of Federal Regulations, "Disposal of High-Level Radioactive Wastes in Geologic Repositories," Part 60, Chapter 1, Title 10, 'Energy.'

ENCLOSURE 7a

61-1

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ITINERARY
YUCCA MOUNTAIN SITE TOUR
APRIL 1, 1993
for
THE FRENCH RAD WASTE REGULATORY AGENCY
and
U.S. DEPARTMENT OF ENERGY, OFFICE OF INSPECTOR GENERAL

7:10am Pick up at hotel. [NRC Van]

7:30am Meet at the YMIO, 4101 Meadows Lane (across from the Meadows Mall and adjacent to the YMCA)

STOP 1

7:30 - 8:30 Tour YMIO / badging / general overview presentation / coffee and doughnuts

8:30 - 10:00 Travel to Gate 510 for badge check [DoE Bus]

10:00 - 10:55 Travel to Yucca Mountain Crest

STOP 2

10:55 - 11:25 Yucca Mountain Crest - Briefings on Volcanism, Geology, the Site Characterization Program, and Hydrology

POTENTIAL REPOSITORY WOULD BE LOCATED APPROXIMATELY 1200 FEET BENEATH CREST - FROM THE CREST THERE IS A VIEW OF CRATER FLAT TO THE WEST WHERE VOLCANISM STUDIES ARE UNDERWAY, AND AREA 25 TO THE EAST.

11:25 - 11:55 Travel to LM-300 drill site

STOP 3

11:55 - 12:15pm Briefing on drilling activities

THE LM-300 DRILL RIG WAS SPECIALLY DESIGNED FOR YUCCA MOUNTAIN ACTIVITIES REQUIRING DRY DRILLING AND DRY CORING TECHNIQUES AT EXTENSIVE DEPTHS.

12:15 - 12:30 Travel to Midway Valley / Exploratory Studies Facilities (ESF) construction pad

STOP 4

12:30 - 12:45 Briefing on ESF and construction activities

FROM THIS POINT, ONE CAN VIEW MIDWAY VALLEY WHERE THE FIRST PHASE IN PREPARING FOR THE EXPLORATORY STUDIES FACILITIES (ESF) AND THE INITIAL WORK FOR THE ESF PAD CONSTRUCTION IS UNDERWAY.

12:45 - 1:10 Travel to the Field Operations Center

STOP 5

1:10 - 1:45 Lunch / view exhibits

1:45 - 1:50 Travel to Sample Management Facility

STOP 6

1:50 - 2:20 Tour Sample Management Facility

SAMPLE MANAGEMENT FACILITY: LOCATION WHERE CORE IS HANDLED, CATALOGUED, AND STORED AFTER REMOVAL FROM THE YUCCA MOUNTAIN TESTING AREAS.

STOP 7

2:20 - 2:50 Walk to USGS Hydrologic Research Facility and tour facility

THIS SOPHISTICATED LABORATORY CONDUCTS STUDIES TO DETERMINE THE GEOCHEMICAL CHARACTERISTICS OF WATER AND PHYSICAL ROCK CHARACTERISTICS.

2:50 - 3:05 Travel to Gate 510 for badge collection

STOP 8

3:05 - 4:35 Return to YMIO in Las Vegas.

approx. 4:50 Return to hotel.