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.

220074
9306240237 930617
PDR WASTE
WM-11 PDR

102
WM-11
NH03

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 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

OVESFDRP.126/4-6-93

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

ENCLOSURE 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 hi taken the position that initial assessments, of whic faults outside of the controlled area are relevai should be deterministic, but recognizes the utility c probabilistic analyses in supporting the deterministic assessments.

(c) Those faults outside the controlled area m 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 succeedir 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

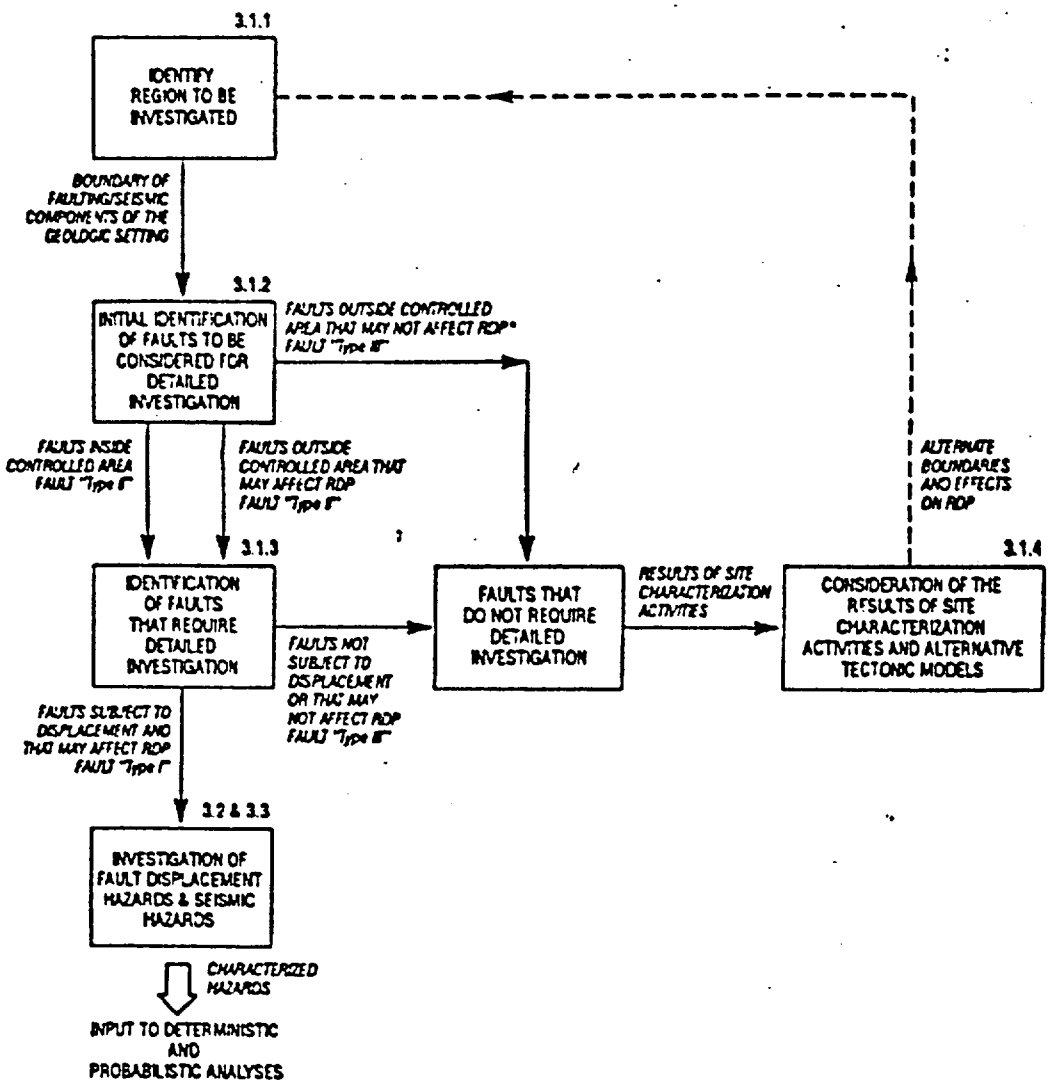


FIGURE 1 — Example of an Acceptable Approach to the Identification of Fault Displacement Hazards and Seismic Hazards. Numbers next to the process blocks correspond to the technical position statements described in the text.

* "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.

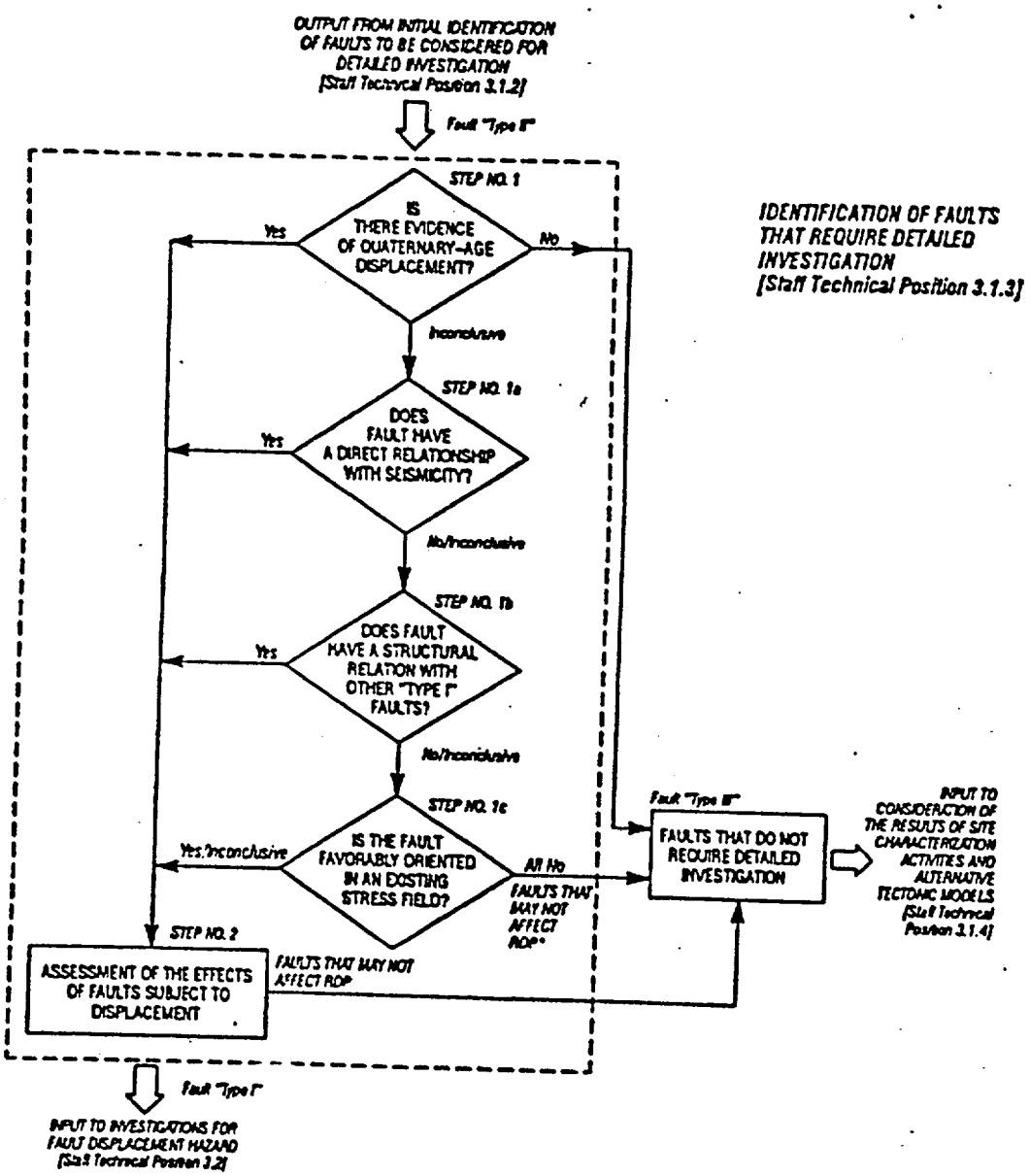


Figure 2 — Staff Technical Position 3.1.3: Detail to the "Approach to the Identification of Faults that Require Detailed Investigation (i.e., "Type I" Faults)". Refer to the text for the discussion of this two-step process. Also see Figure 1.
* "RDP" means repository design and/or performance.

"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

recd 3/25/93 PJ

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

03 23 93 05:04 FAX 7027945015 SAIC 002

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.

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

YUCCA MOUNTAIN: GENERAL OVERVIEW

PRESENTED TO

FRENCH RADIOACTIVE WASTE REGULATORY AGENCY
&
OFFICE OF INSPECTOR GENERAL

PRESENTED BY

MAXWELL B. BLANCHARD
DEPUTY PROJECT MANAGER

APRIL 1, 1993

ENCLOSURE 7b

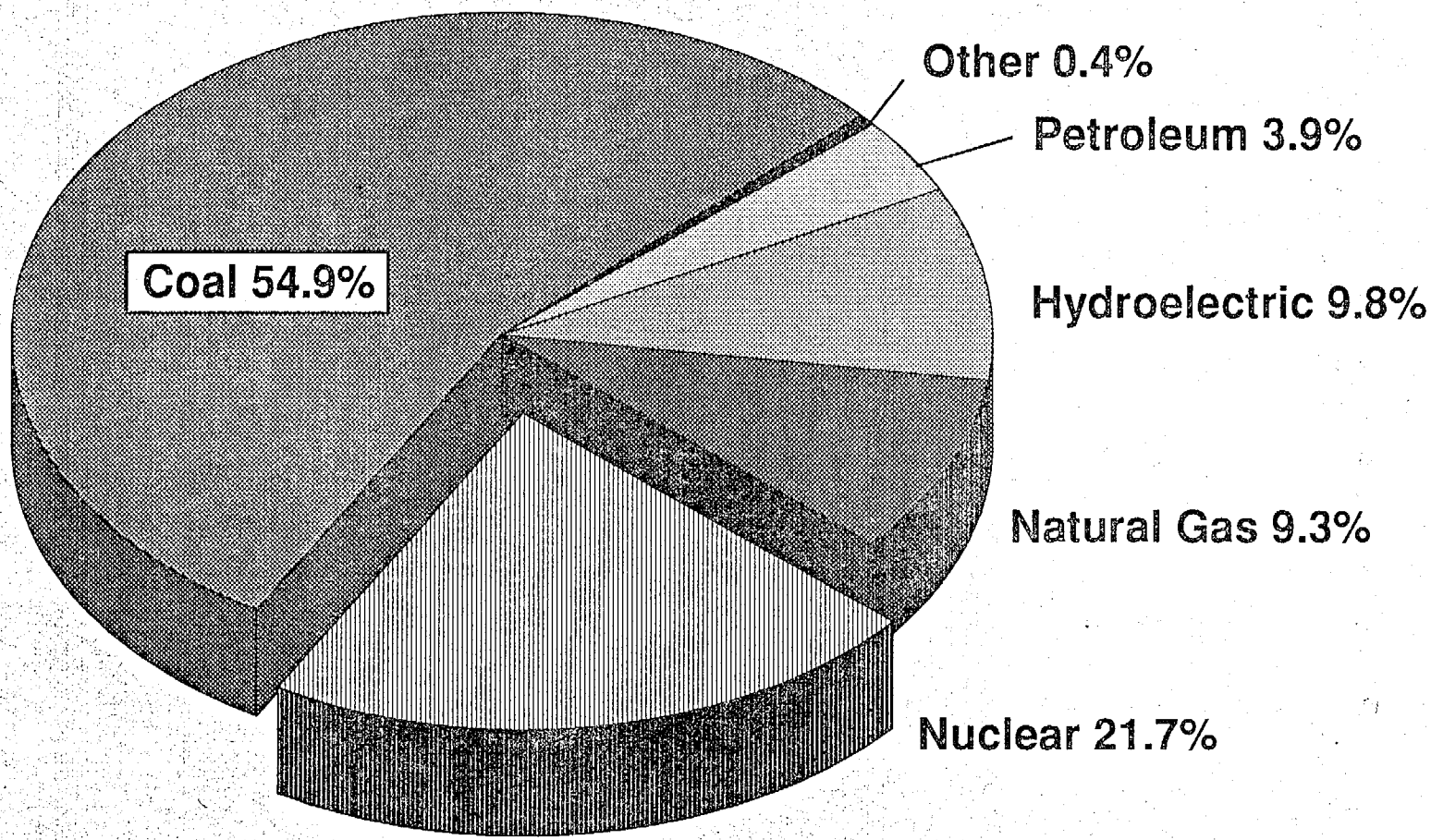
Is Yucca Mountain A Safe Place For A High-Level Nuclear Waste Repository?

ALYMPP3.CPG/3-8-93

GOAL

- Solve existing environmental problem
  - 20,000 metric tons of spent fuel currently in storage
  - By the year 2000, approximately 40,000 metric tons will be in storage

NUCLEAR ENERGY IS AMERICA'S #2 SOURCE OF ELECTRICITY

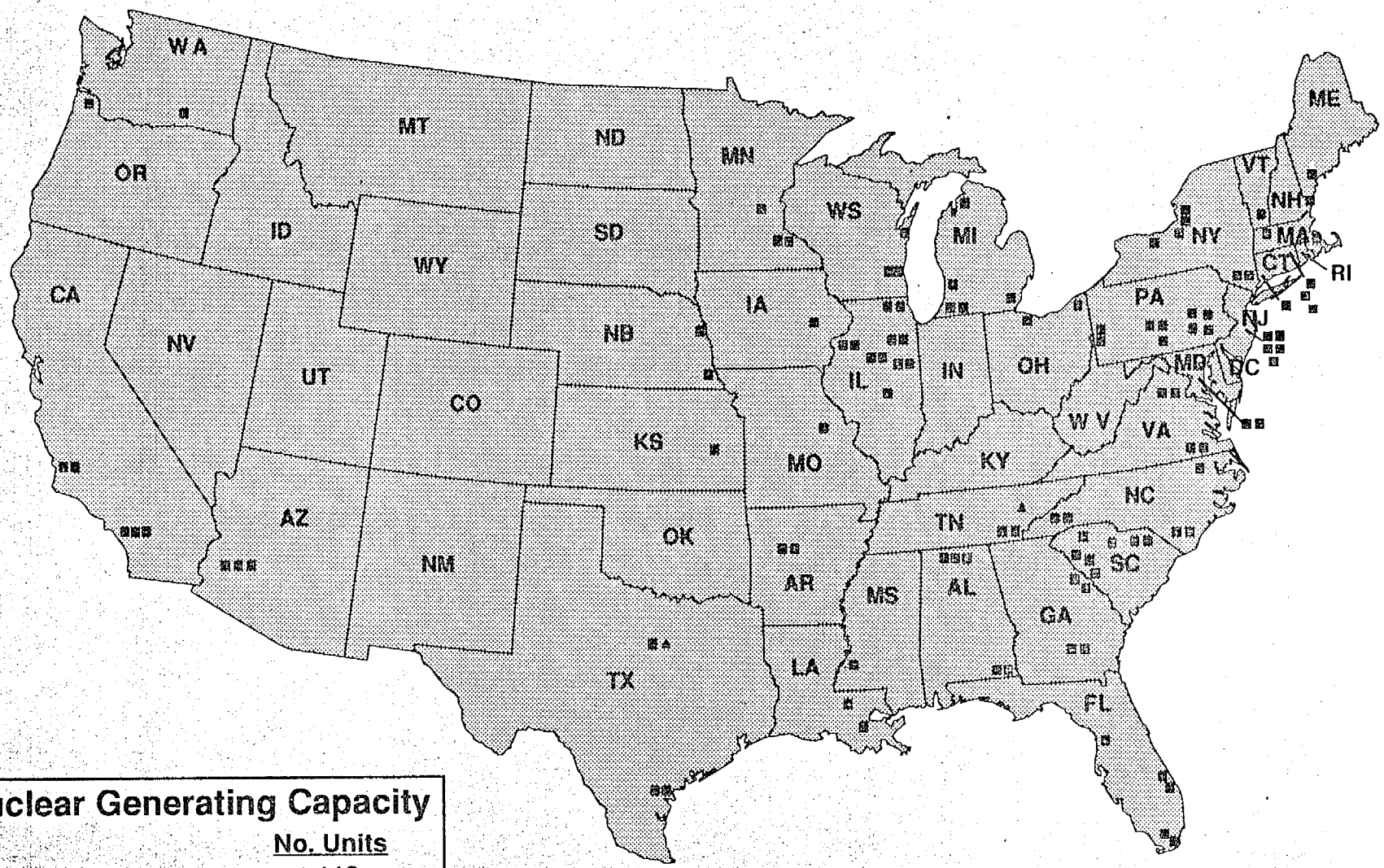


Nuclear power plants produced over 20% of our Nation's electricity in 1991.

Source: USCEA

NUKEPIE.CPG/12-7-92

NUCLEAR POWER REACTORS IN THE UNITED STATES

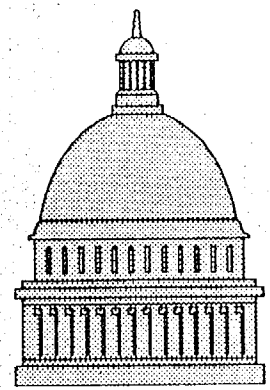


Nuclear Generating Capacity	No. Units
■ Operable	112
▲ Being Built	2
TOTAL	114

Symbols do not reflect precise locations
Source: DOE/NRC
As of: August 1991

NPRUSCP1.GERTZ/1-25-93

PROJECT ELEMENTS

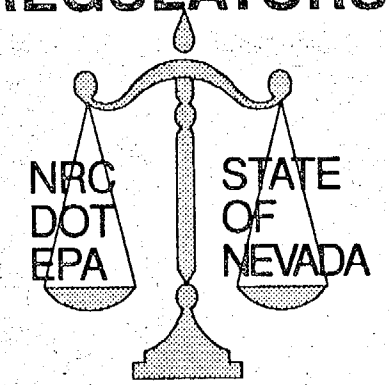


CONGRESS

U.S. DOE
Participants

- Lawrence Livermore
- Los Alamos
- M&O - TRW
- Raytheon
- REECo
- SAIC
- Sandia
- United States Geological Survey

REGULATORS



OVERSIGHT

- Federal Government (GAO, IG, OMB)
- State/Local Government
- Independent Groups (EEI, NARUC)
- National Academy of Sciences
- Nuclear Waste Technical Review Board

BENEFITS AVAILABLE

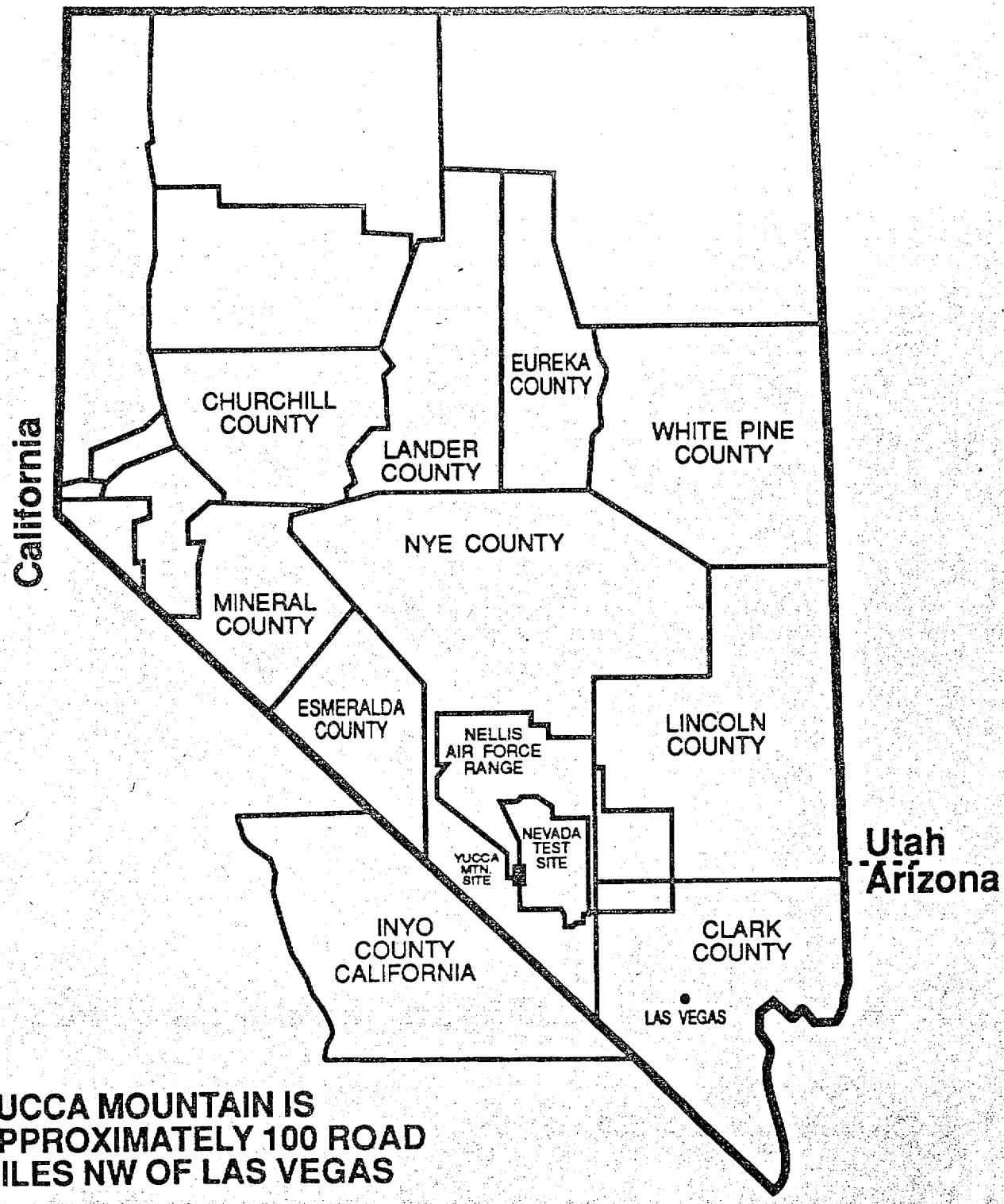
- Benefits Package
- Impact Assistance
- Work with Negotiator

PRGELEMP.GERTZ/1-20-93

NUCLEAR WASTE POLICY ACT (NWPA) 1982

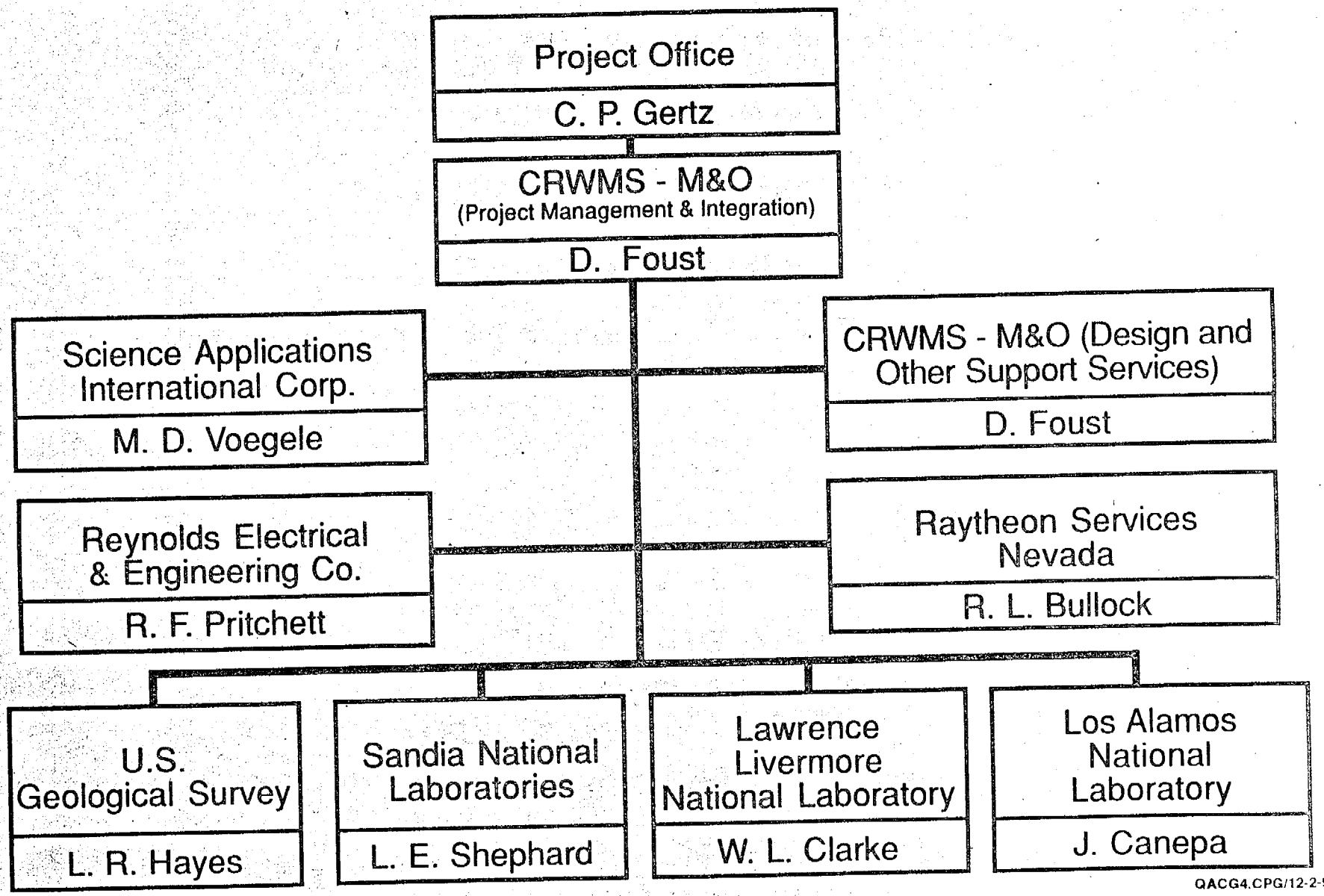
- Department of Energy - created Office of Civilian Radioactive Waste Management (OCRWM) to manage disposal of high-level radioactive waste in mined geologic repositories
- Nuclear Regulatory Commission - assigned the responsibility to license repositories for construction, operation, closure and decommissioning
- Environmental Protection Agency - assigned the responsibility to set limits for radionuclides reaching the accessible environment in 10,000 years

IN 1987, CONGRESS TOLD DOE TO STUDY ONLY YUCCA MOUNTAIN



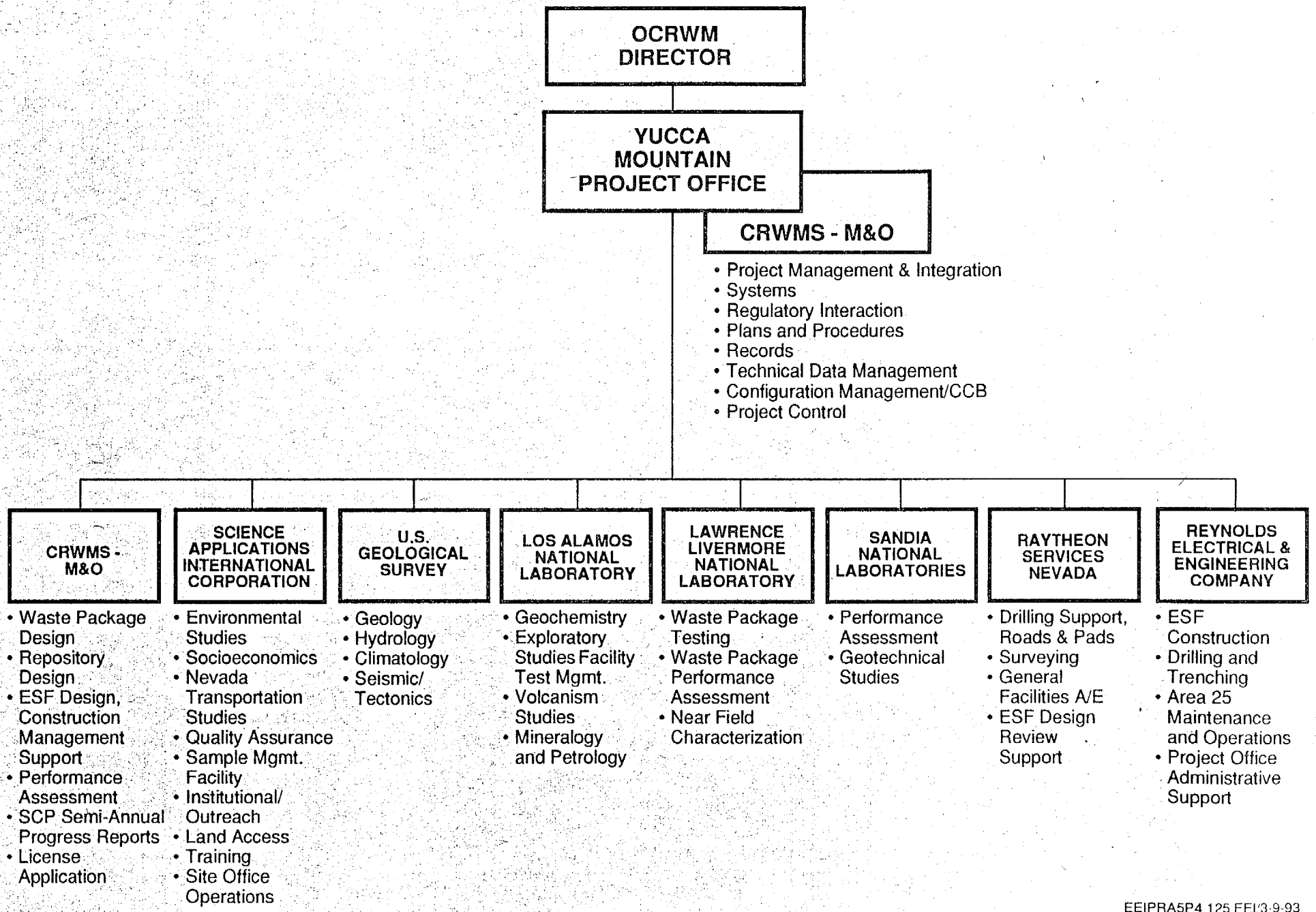
YUCCA MOUNTAIN IS APPROXIMATELY 100 ROAD MILES NW OF LAS VEGAS

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT



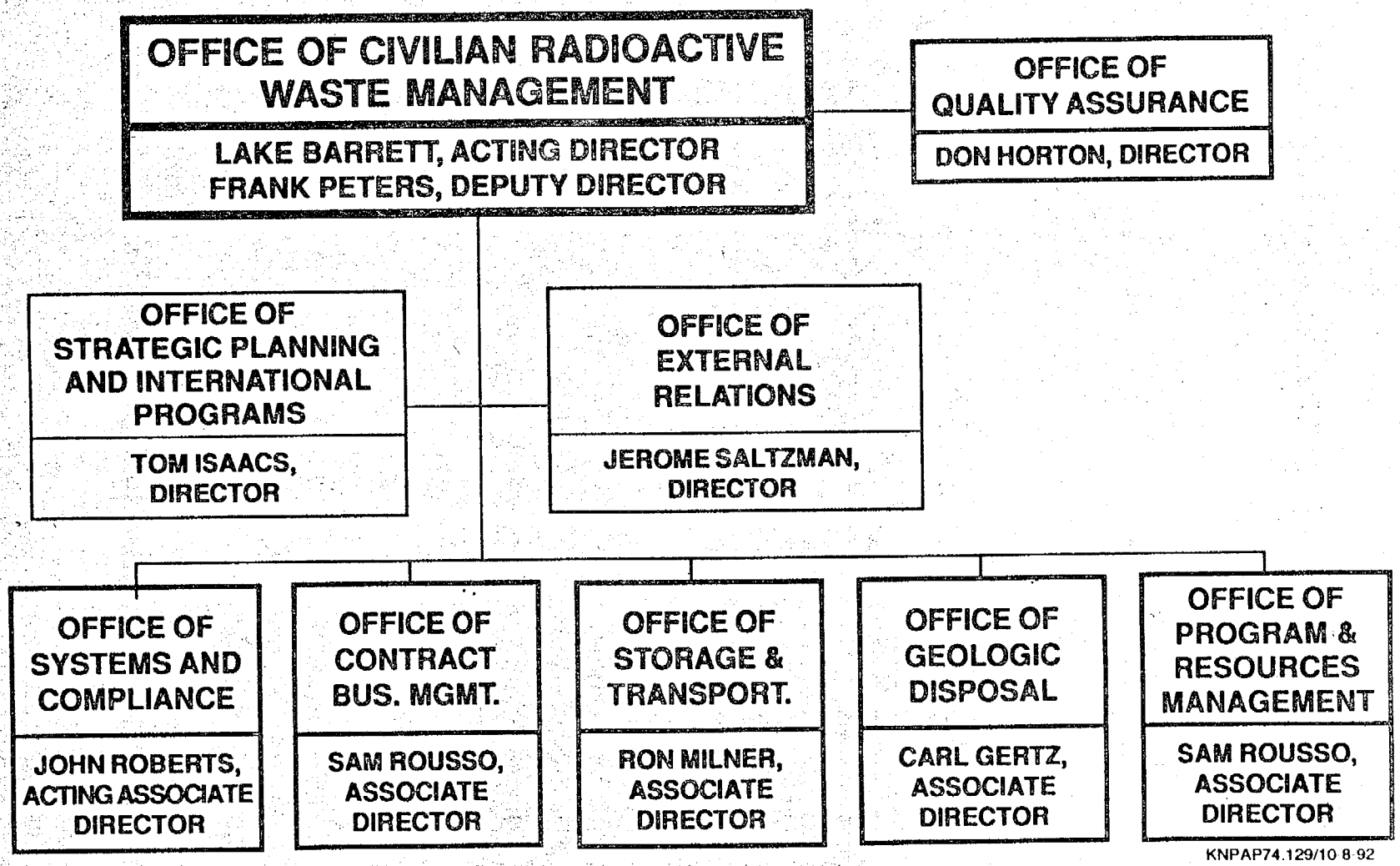
QACG4.CPG/12-2-92

ROLES OF PROJECT PARTICIPANTS



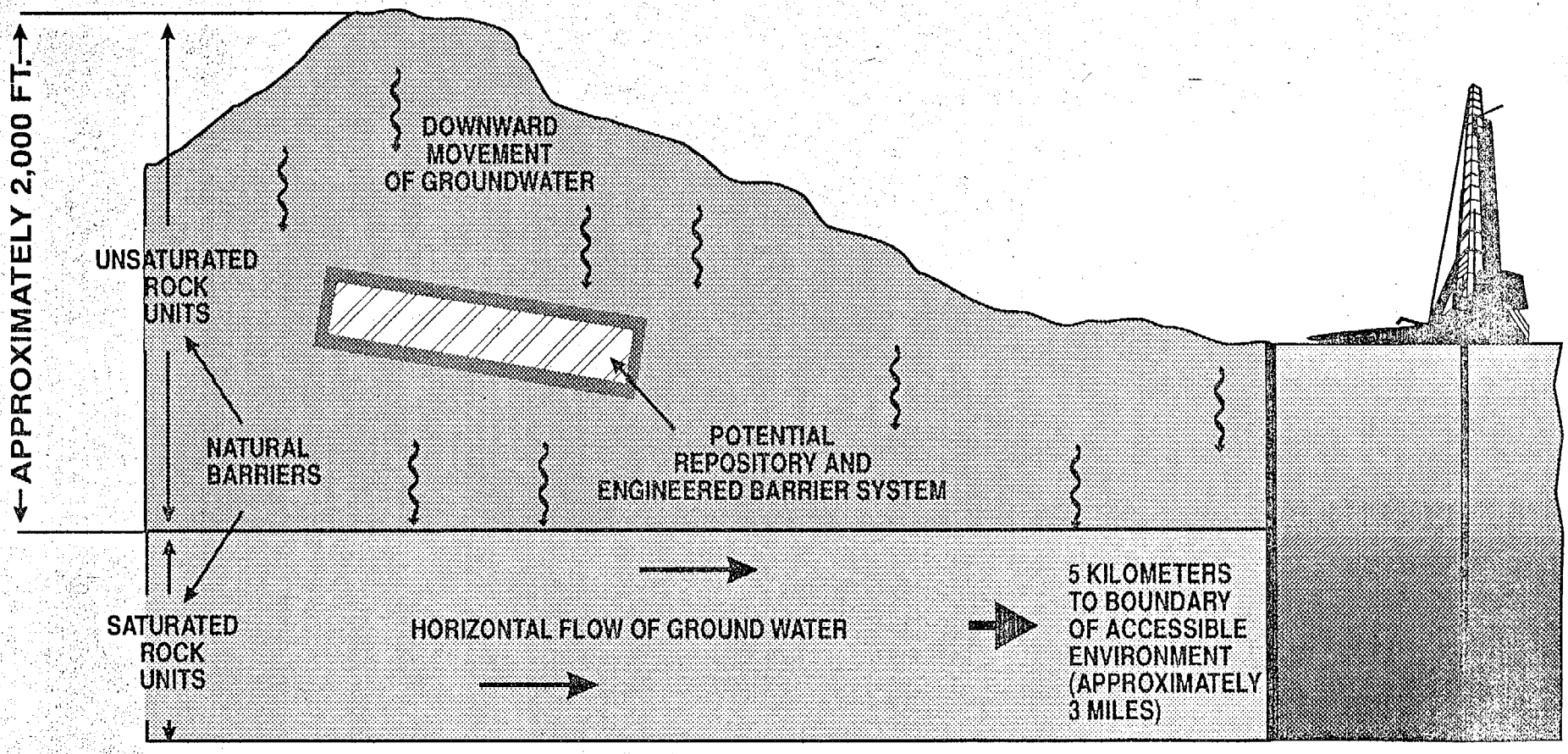
EEIPRA5P4.125.EEI/3-9-93

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT



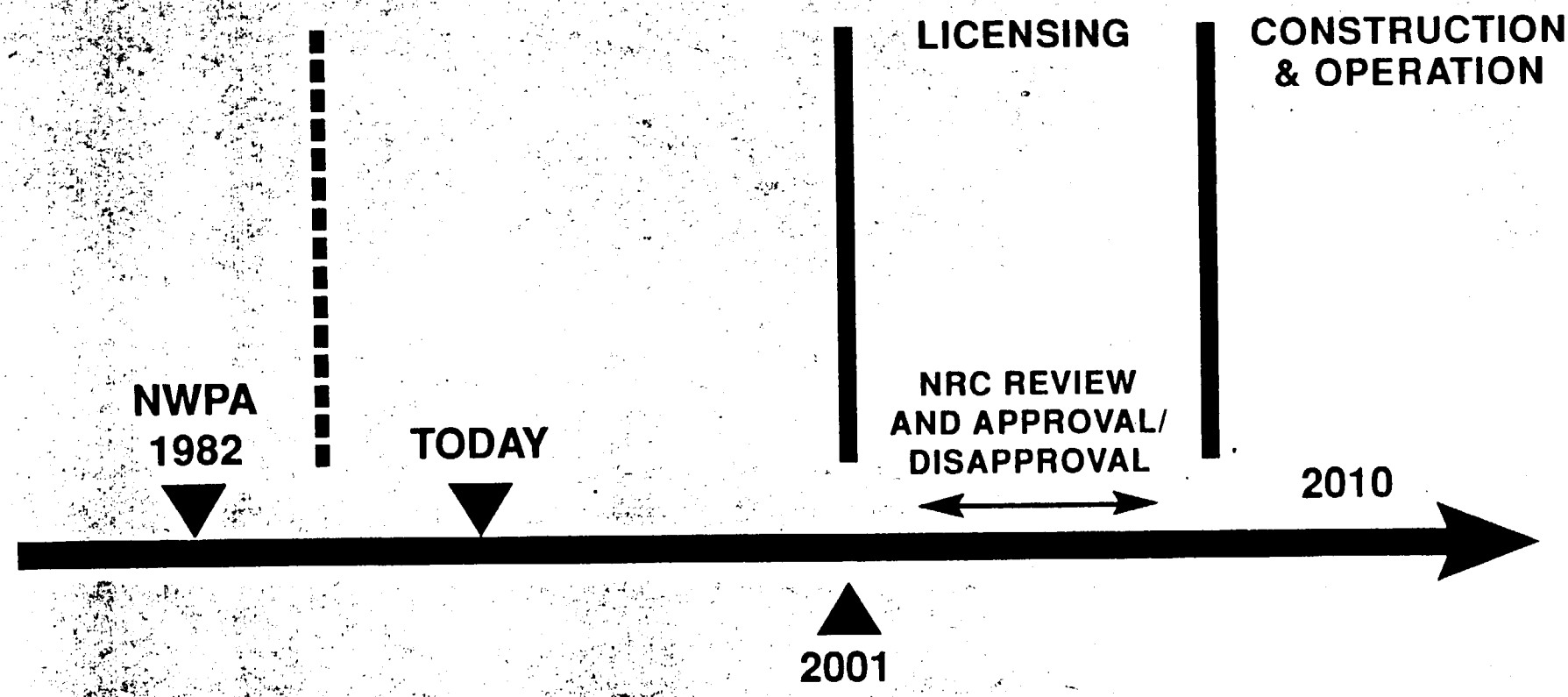
KNPAP74.129/10 8 92

OBJECTIVE OF SCIENTIFIC STUDIES IS TO DETERMINE IF YUCCA MOUNTAIN CAN ISOLATE RADIOACTIVE MATERIALS BY USING NATURAL AND ENGINEERED BARRIERS



XSECTBWC.XSECTIONS/9-14-92

SCIENTIFIC STUDIES WILL DETERMINE IF YUCCA MOUNTAIN CAN BE RECOMMENDED AS A REPOSITORY



PUMSTUAP5 GERTZ/2 17 93
PUMSTUA CPG/11 9 92

POSITIVE FEATURES OF YUCCA MOUNTAIN

- Repository Would be in Unsaturated Zone
- Desert Environment
- Zeolite Minerals Present
- Remote Location
- Scientific Studies are not Likely to Impact the Environment

POTENTIALLY ADVERSE CONDITIONS

- Site Characterization Relatively Difficult to Characterize and Model
- Evidence of Active Faulting and Volcanic Activity

THE YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT HAS A BALANCED SITE CHARACTERIZATION PROGRAM TO MEET REQUIREMENTS

- Published Site Characterization Plan in accordance with requirements of the NWPA and NRC
- Reviewed by public, external and oversight groups; comments received and responses generated
- NRC, EPA, USGS found the site characterization program to be adequate
- Detailed study plans prepared and reviewed by NRC
- Controls in place to revise characterization plans as needed

ALYMPP1.CPG/3-8-93

THE SITE CHARACTERIZATION TESTING PROGRAM INCLUDES ACTIVITIES TO ESTABLISH THE GEOLOGIC CONDITIONS AND HISTORY OF THE SITE

- **Surface-Based tests**
  - Extend the results of ESF tests to the entire site area
  - Laboratory studies
    - * Geochemistry; fracture flow; waste package
- **Exploratory Studies Facility (ESF) tests**
  - Waste isolation performance
  - Effects of ESF construction
  - Establish underground conditions

ESF MISSION IS TO PROVIDE ACCESS TO GEOLOGIC HORIZONS TO EVALUATE SUITABILITY OF GEOLOGIC BARRIERS TO ISOLATE WASTE

- Enable testing in "underground laboratory"
- Determine the suitability/unsuitability of Yucca Mountain as a potential repository site
  - Provide access to the potential repository horizon (Topopah Spring) for inspection and testing
  - Provide access to the Calico Hills level for testing and inspection
    -- Primary barrier for radionuclide transport
- Develop data for potential repository design and construction

WORK UNDERWAY AT SEVERAL LOCATIONS

Summary

- ESF site preparation/construction began on 11/30/92
- Drilling completed at North Ramp Geologic (NRG) holes for NRG-1 (150 ft), NRG-2 (215 ft), NRG-6 (1100 ft)
- NRG-3 drilling began March 3, 1993; core depth 238 ft as of March 19
- Drilling at borehole UZ-16 completed at 1686 ft; water table was reached at a depth of approximately 1600 ft
- 23 neutron access boreholes completed for natural infiltration studies; N-39 borehole approval in process
- 28 soil test pits and 4 trenches were excavated in Midway Valley study area

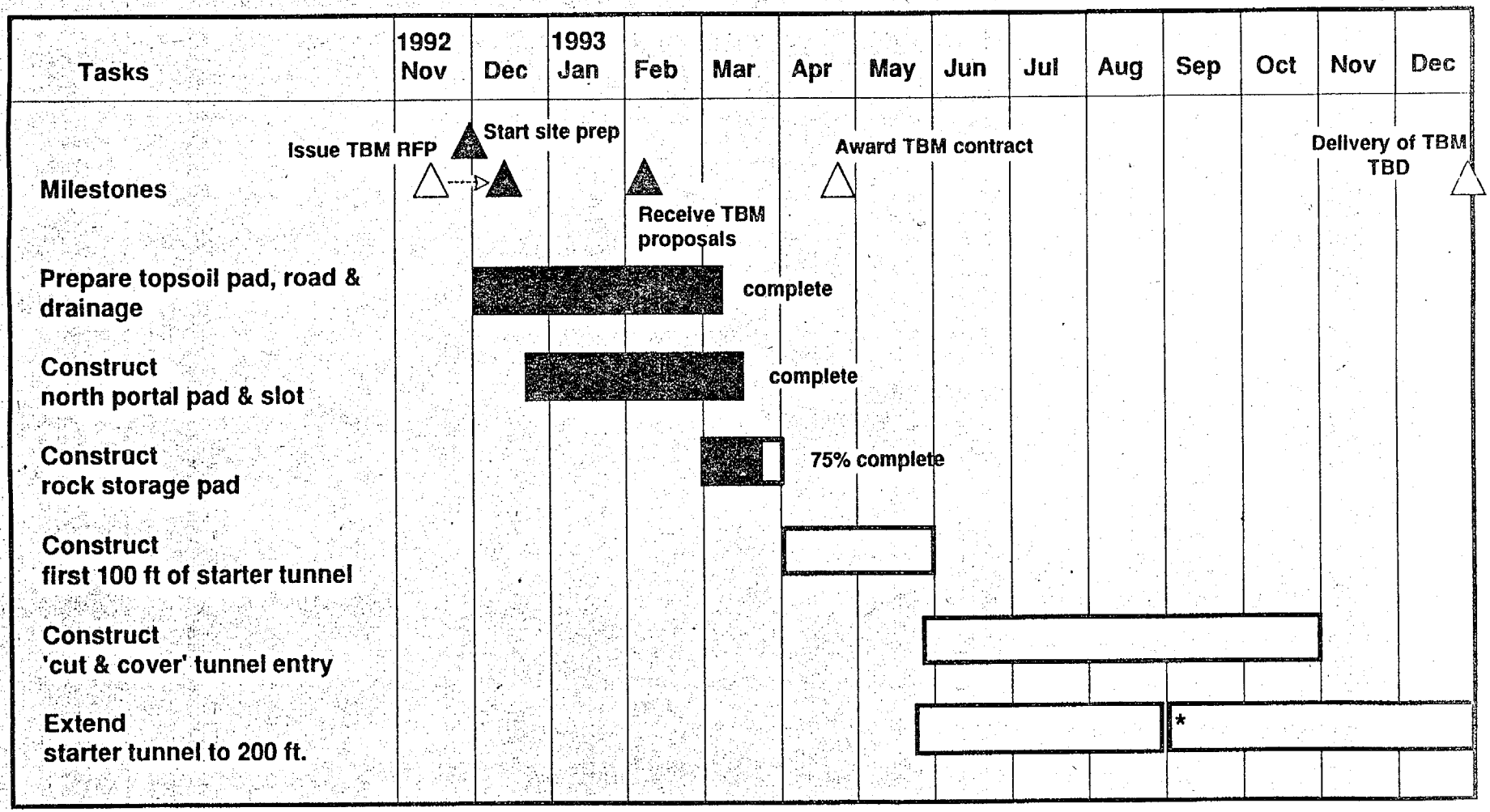
WORK UNDERWAY
(CONTINUED)

Summary (Continued)

- 33 test pits (Phase I) excavated as part of Soil and Rock Properties investigations related to north area surface and subsurface access facilities. An additional 39 test pits (Phase II) excavated as part of design data for access roads and other surface facilities
- 6 trenches excavated and 4 pavements cleared for Quaternary fault studies
- Drilling of JF-3 environmental monitoring well (1,300 ft) completed and monitoring equipment installed; fulfills commitment to National Park Service
- Fran Ridge photogrammetric studies began
- Volcanism studies - 45 excavations completed

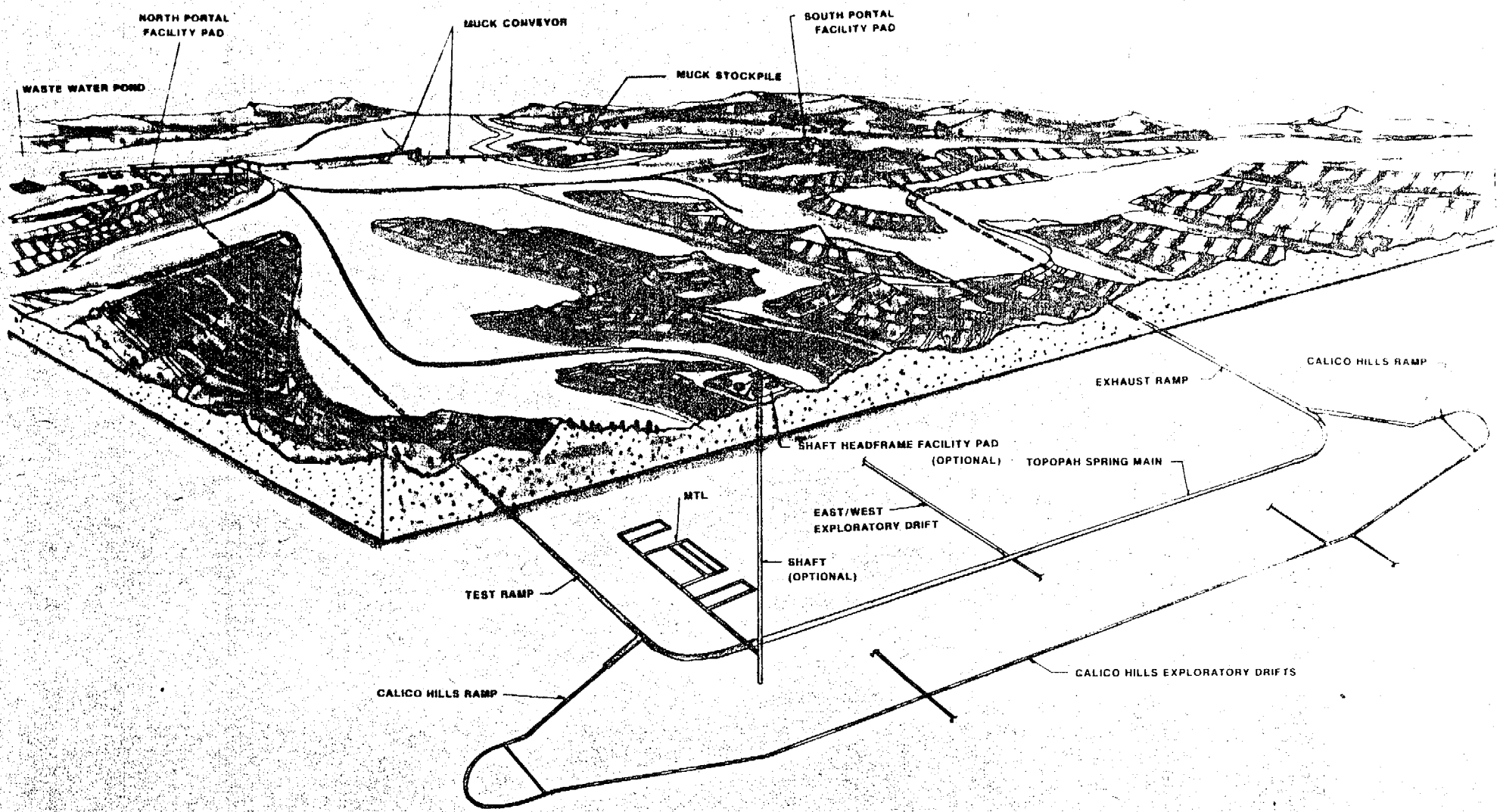
PRELIMINARY CONSTRUCTION SUMMARY SCHEDULE

As of 3-19-93



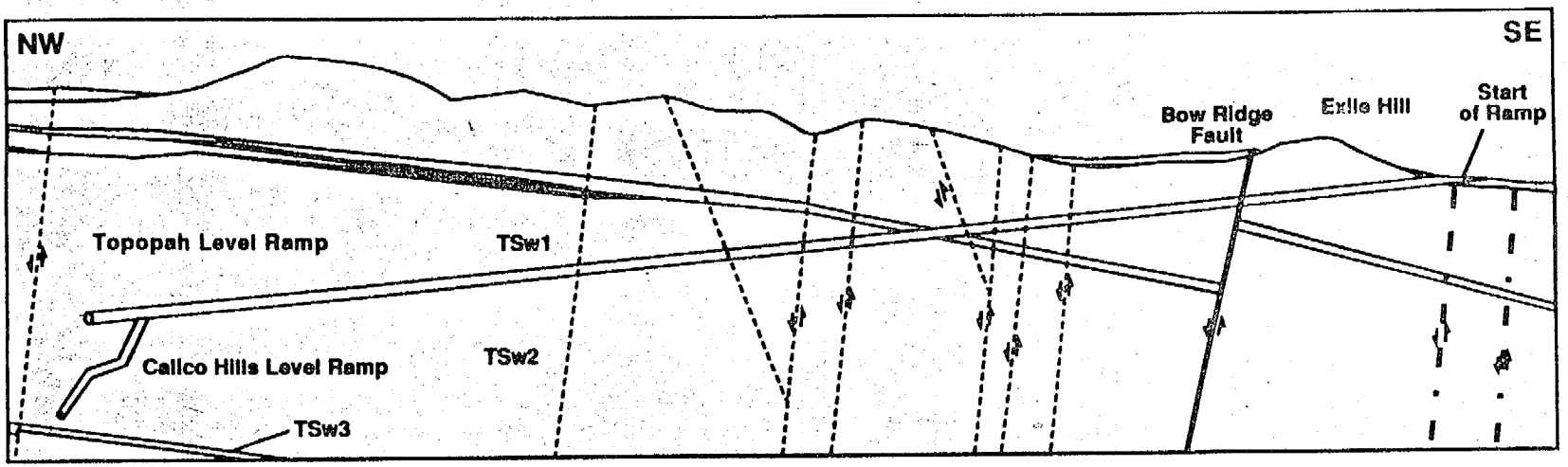
* Option to continue beyond 200 FT depending on rock condition and TBM delivery

ESFCHT6.GERTZ/3-19-93



PRELIMINARY DESIGN

NORTH RAMP DESIGN WILL INCLUDE AREAS OF GEOLOGIC INTEREST TO BE STUDIED



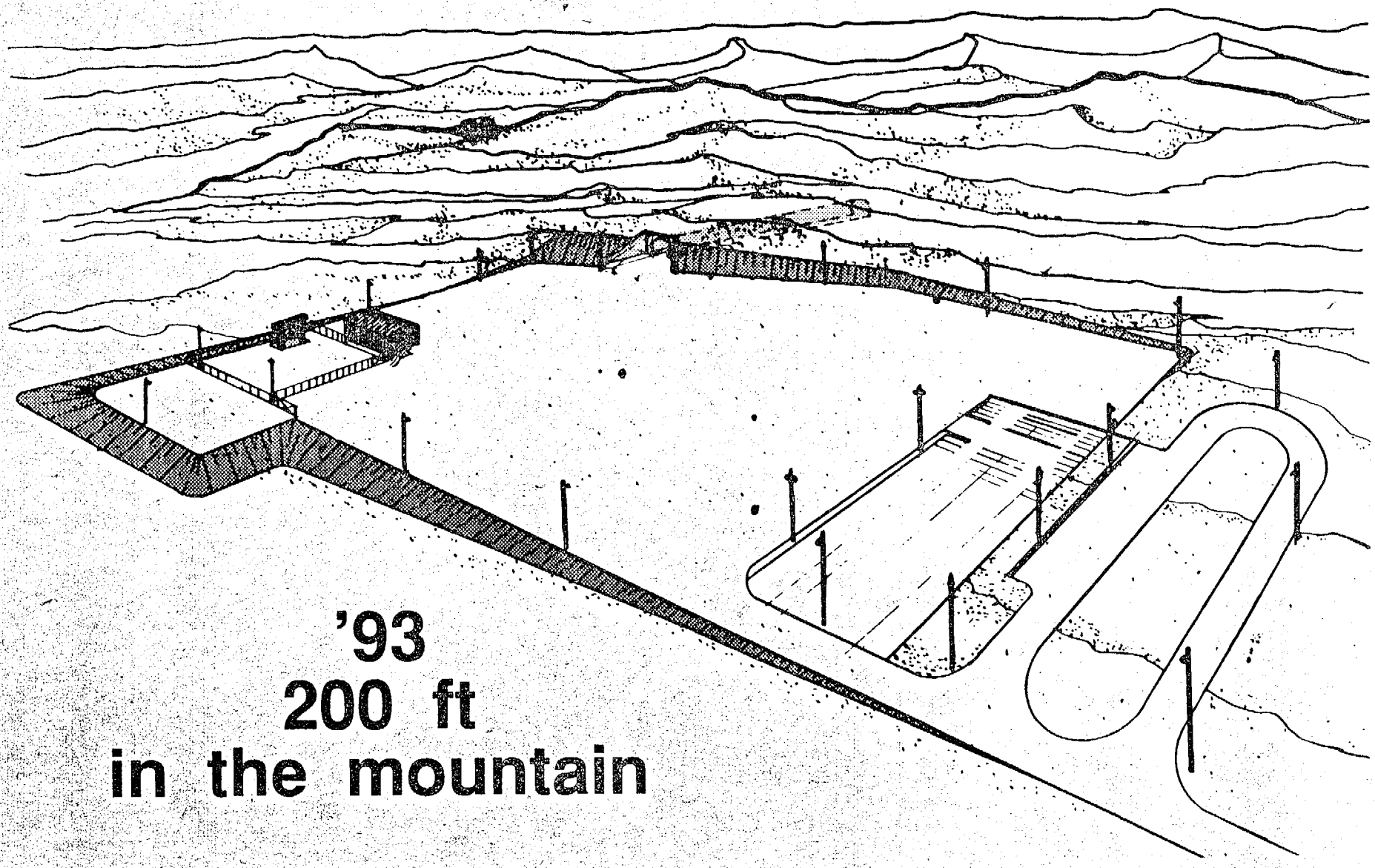
Thermal/Mechanical Units

Tcw		Tiva Canyon Member
PTn		Yucca Mountain Member Pah Canyon Member
TSw1 TSw2		Topopah Spring Member
TSw3		Topopah Spring Member
CHn		Tuffaceous Beds of Calico Hills
TZZ	— —	Zeolite-Vitric Contact in Calico Hills (TZZ) (Not Present on This Selection)

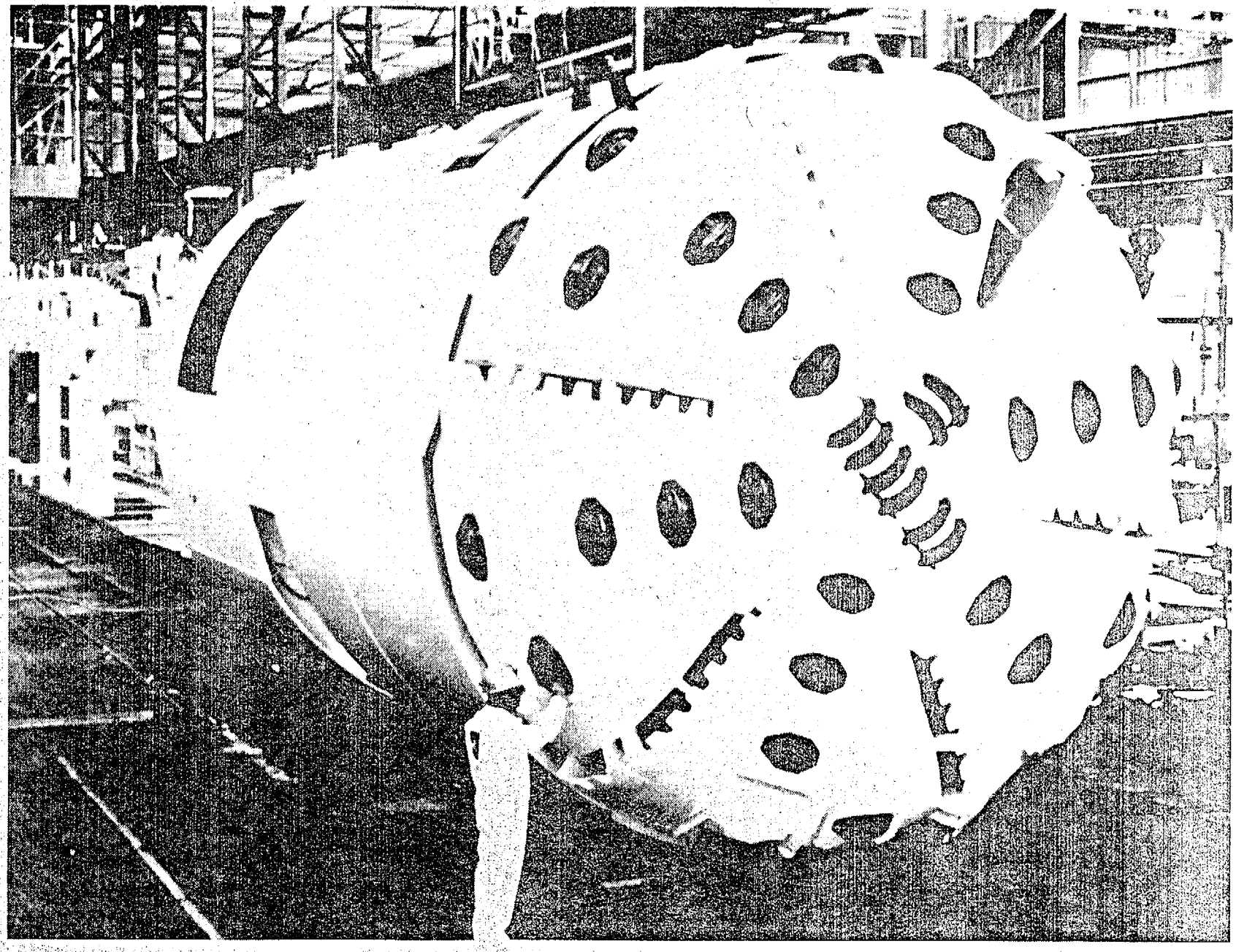
Conceptual Illustration
Not To Scale

NRAMPBW.XSECT/7-10-92

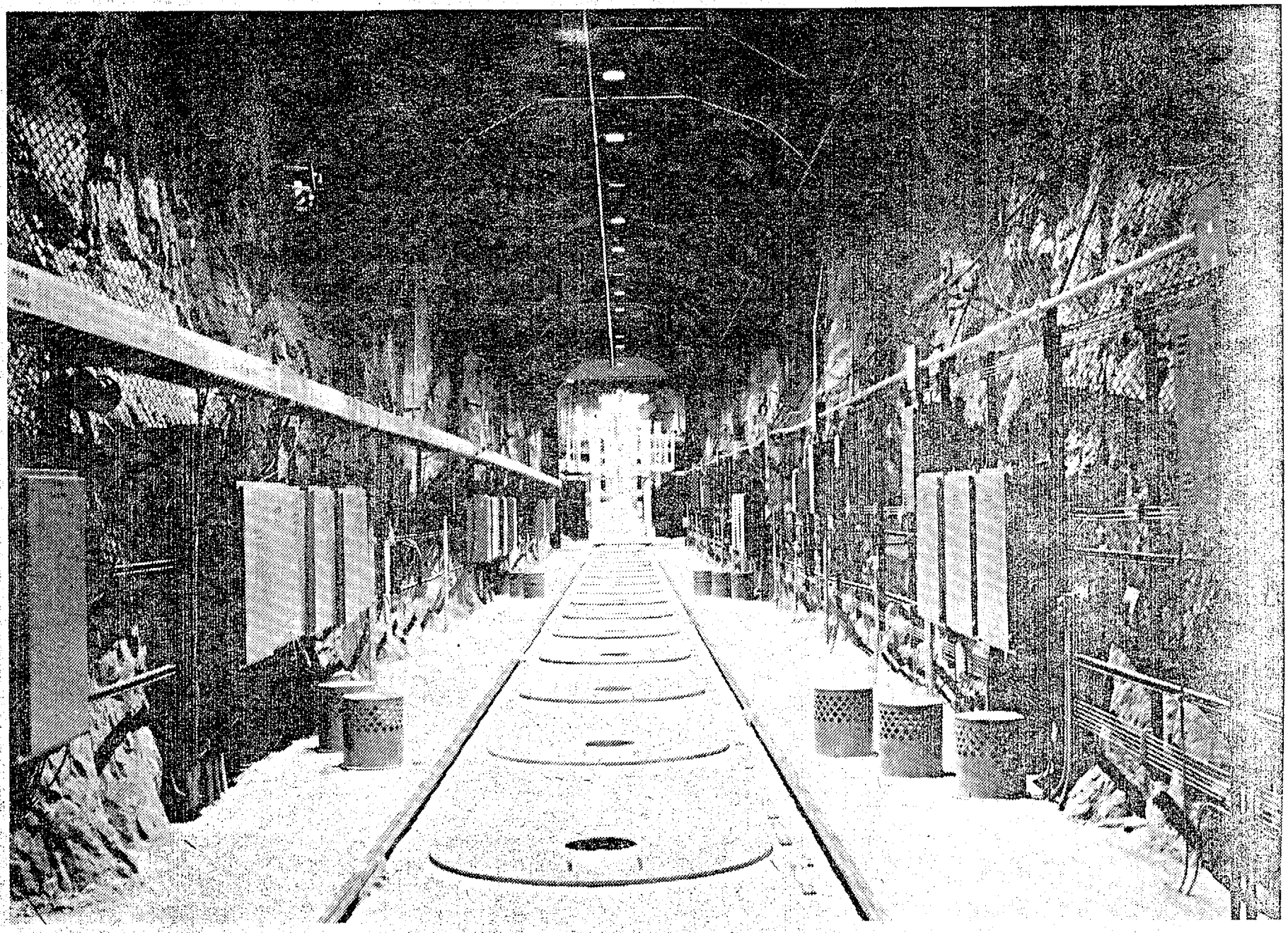
ESF NORTH PORTAL DESIGN PACKAGE 1A



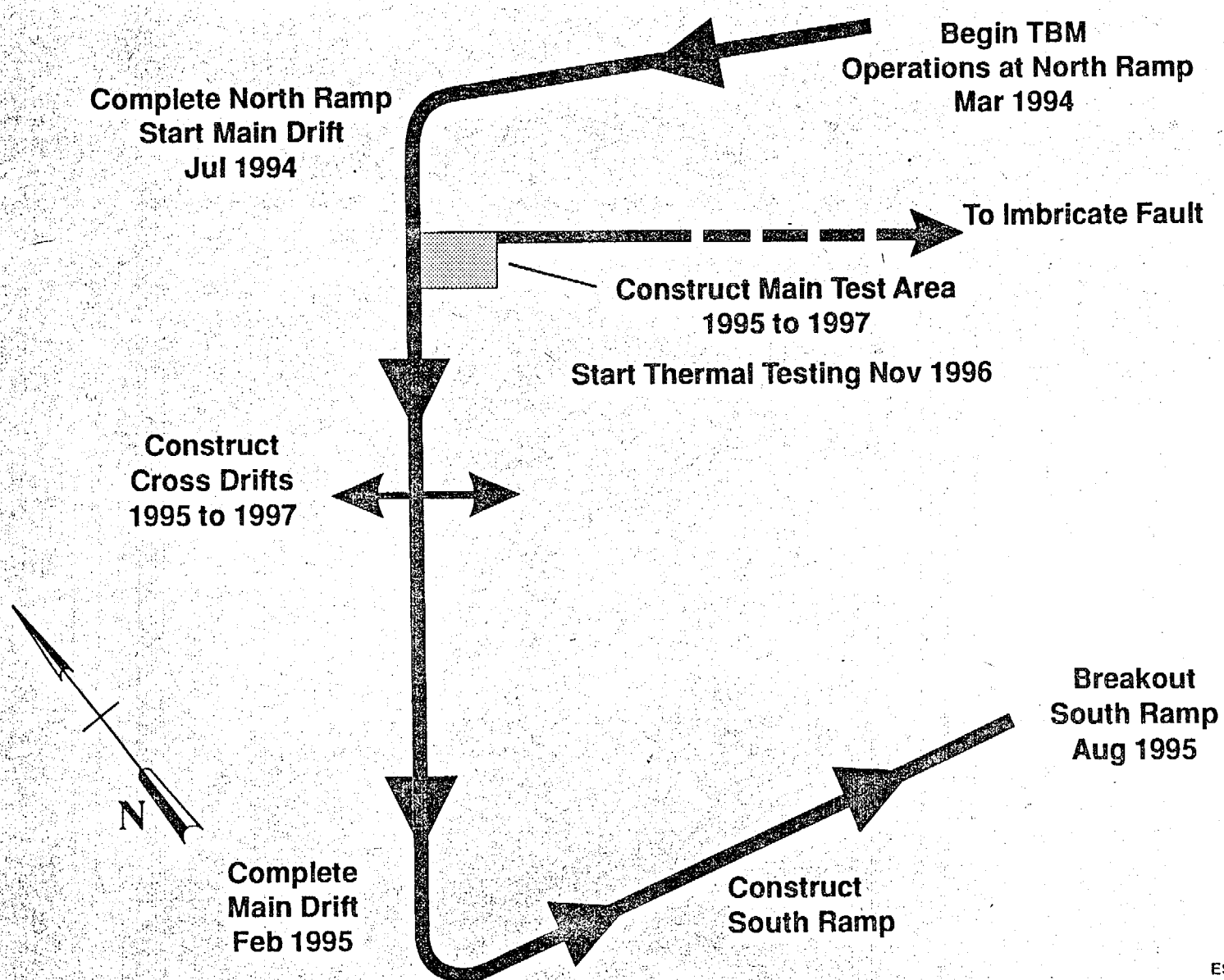
TUNNEL BORING MACHINE



SPENT FUEL TEST - CLIMAX



INITIAL 5-MILE RAMP/DRIFT LOOP WILL PROVIDE EARLY SITE SUITABILITY INFORMATION



Plan View

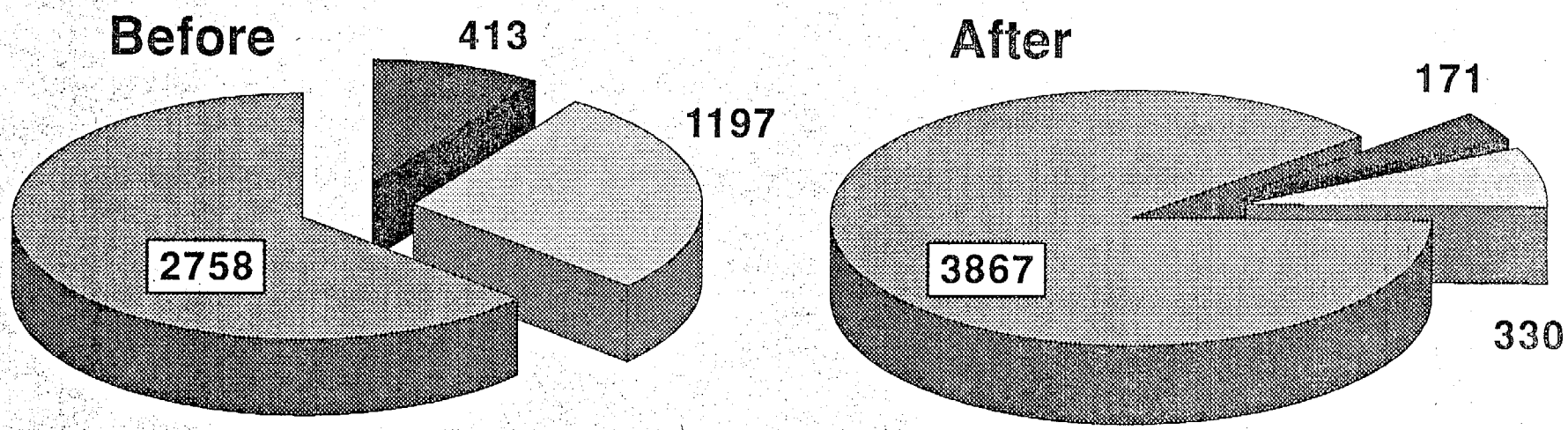
ESFCON6.125.NWTRB\3-1-93

YMP IS COMMITTED TO KEEPING THE PUBLIC INFORMED

- Over 300 public presentations made each year
- Exhibits set up throughout Nevada
- Information offices in Las Vegas, Beatty, and Pahrump
- YMP responds to all media inquiries
- Six Public Update Meetings held each year
- Public tours of Yucca Mountain given to over 400 people each month

ALYMPP13.CPG/3-24-93

POST-TOUR SURVEYS REVEALED 88% OF PUBLIC TOUR ATTENDEES FAVOR THE STUDY OF YUCCA MOUNTAIN



As of 2/20/93

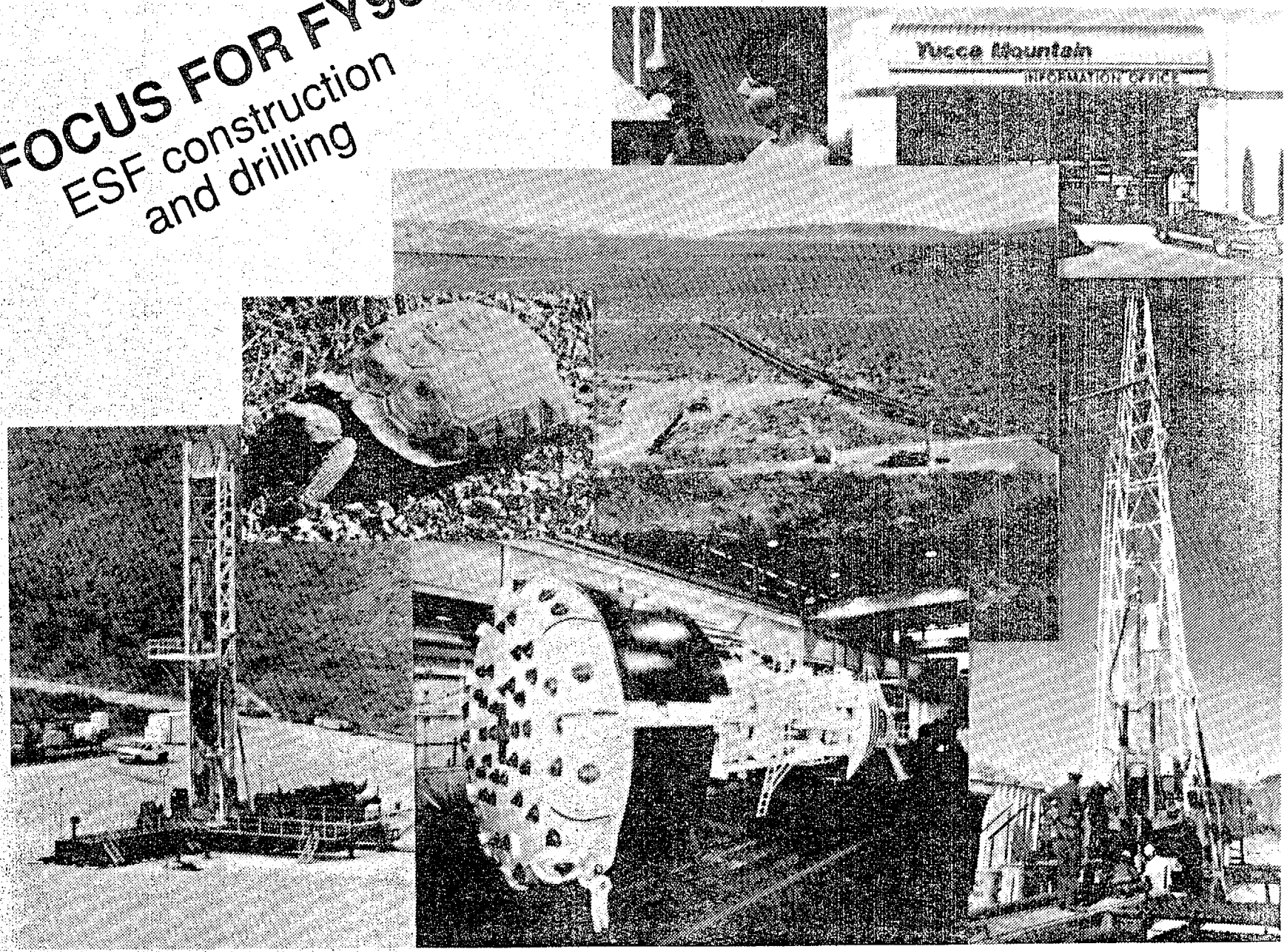
63%	Completely or somewhat in favor of the study	88%	Completely or somewhat in favor of the study
27%	Undecided	8%	Undecided
10%	Completely or somewhat opposed to the study	4%	Completely or somewhat opposed to the study

YMPIE5P.CPG/2-26-93

FY 1993 CHALLENGES/ISSUES

- Modify program as appropriate to be consistent with new Energy Legislation
  - Complex science/10,000 year question
- Adamant political opposition/Intense media attention
- Adequate funding
  - Revolving account
- Issue Resolution/Focus of Program/ Cost Consciousness

FOCUS FOR FY93
ESF construction and drilling



ENCLOSURE 8 rev. 4/19/93

ITINERARY
MONDAY APRIL 26, 1993
NRC HQ STAFF VISIT TO YUCCA MOUNTAIN, NV

7:00	DEPART LAS VEGAS. Leave from MIRAGE Hotel front volcano entrance. [Have breakfast prior to departure]	
8:00 - 8:15	INDIAN SPRINGS. Pit stop; buy: snacks, weather-protection.	
9:00 - 9:10	GATE 510. Get badged. [bring photo ID]	
9:25 - 9:45	FIELD OPERATIONS CENTER. Pit stop. Exhibits. NRC office.	NRC briefing. (P. Justus)
10:05-11:00	ESF - NORTH PORTAL.	DOE briefing. (tbd)
11:10-11:30	LM-300 DRILLRIG.	DOE briefing. (tbd)
11:30-11:55	LUNCH. At LM-300 Site. [Boxed lunch, COD]	
12:30-1:00	YUCCA MOUNTAIN CREST.	NRC briefing. (P. Justus)
1:25 - 1:45	TRENCH 14.	NRC briefing. (P. Justus)
2:10 - 2:40	HYDROLOGIC RESEARCH FACILITY.	DOE briefing. (tbd)
2:45 - 3:15	SAMPLE MANAGEMENT FACILITY.	DOE briefing. (tbd)
3:30	GATE 510. Surrender badges.	
4:15 - 4:30	INDIAN SPRINGS. Gas and pit stop.	
5:30	RETURN TO LAS VEGAS. Hotel Drop-offs.	

NOTES:

1. NRC vehicle with K. McConnell, J. Gilray and others will rendesvous with this group at the ESF - North Portal, then split.

2. Prepare for desert spring conditions. Expect heat (80s), sun, dry air, dusty-pollinated winds. Hat, skin balm, sunglasses, wind-breaker recommended.

3. Items furnished: water, cups, first-aid kit, 2-way radio, safety gear.

4. Call Phil if you have questions, change of plans (o) 702-388-6125. (h) 656-1771

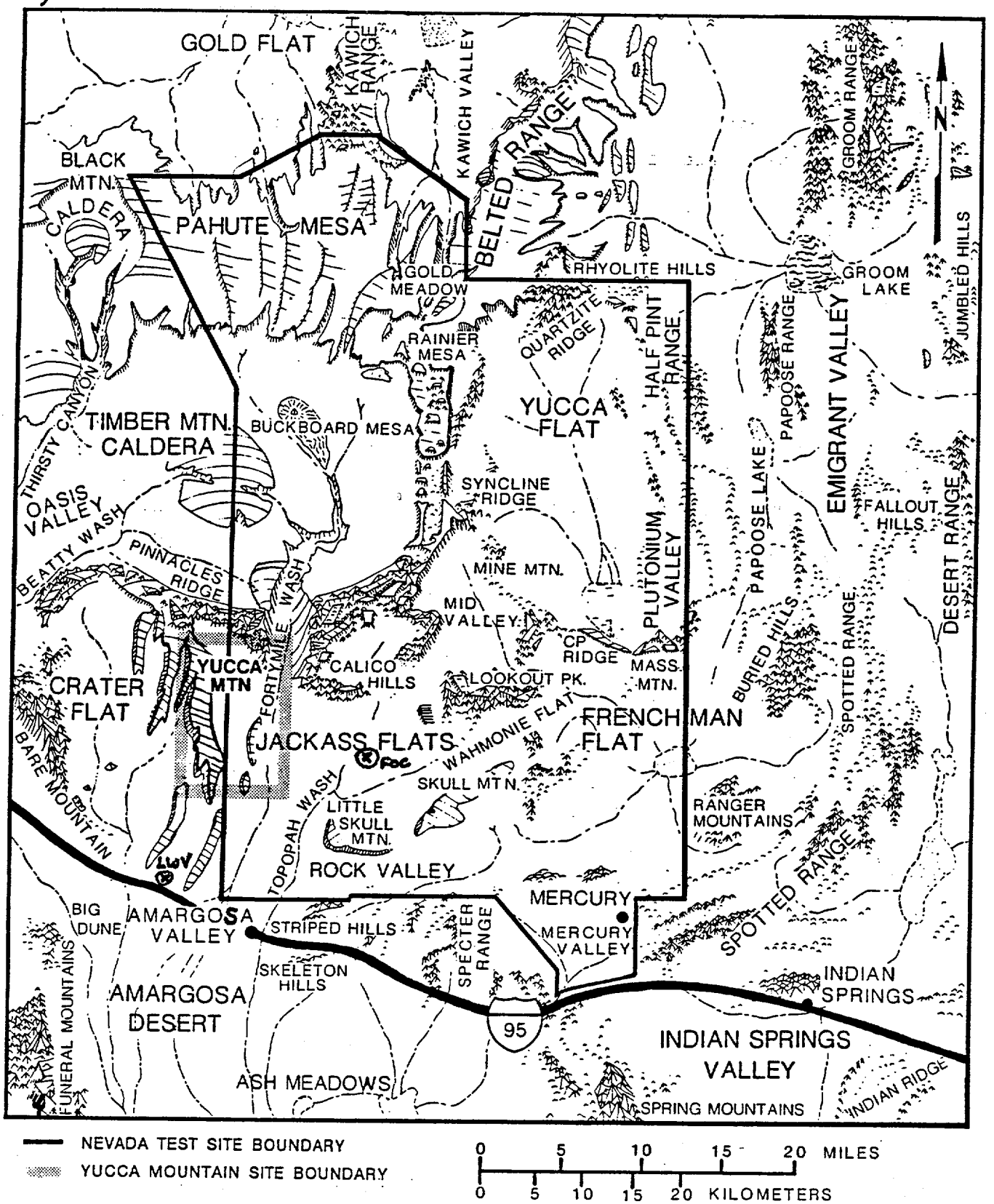
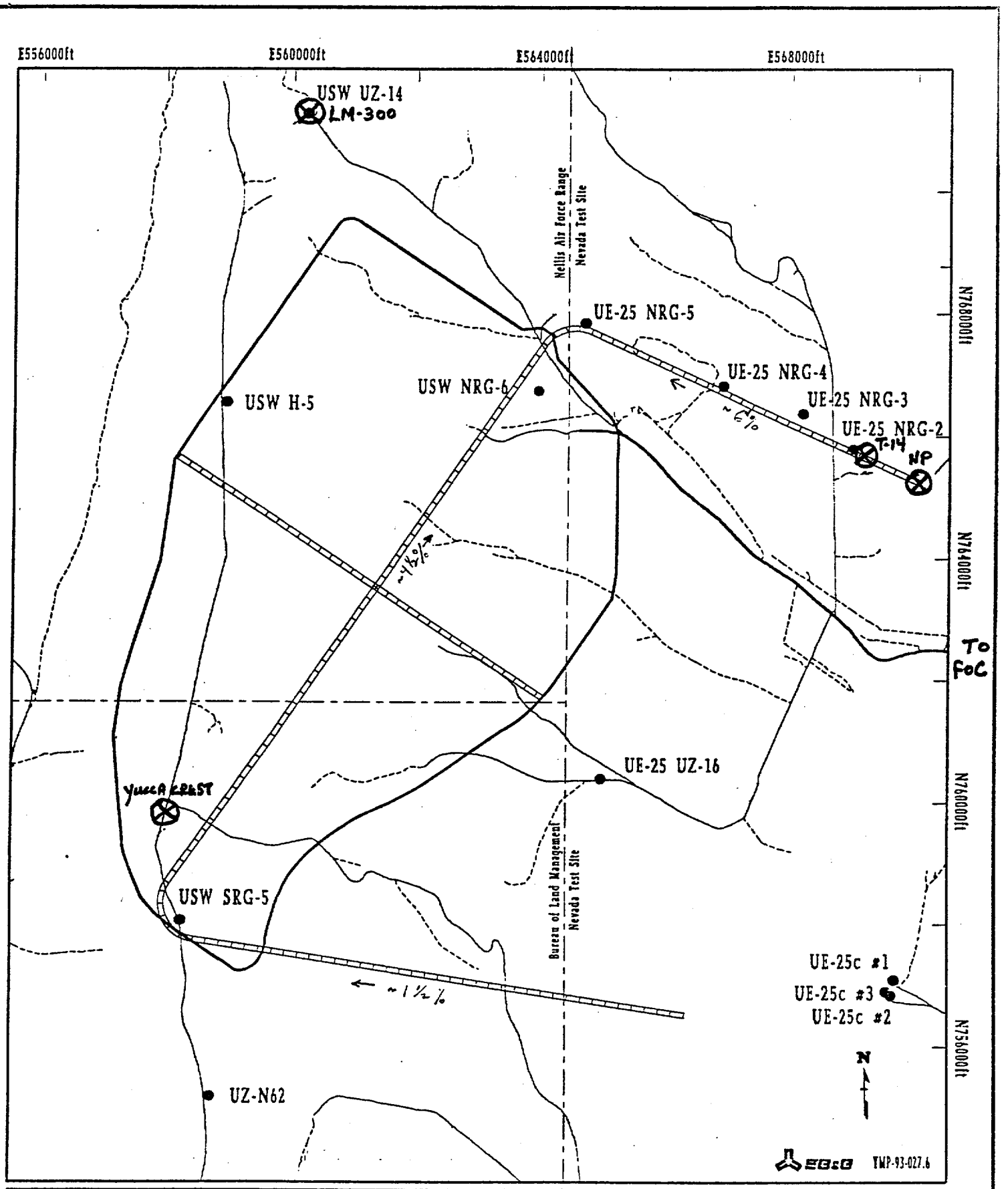
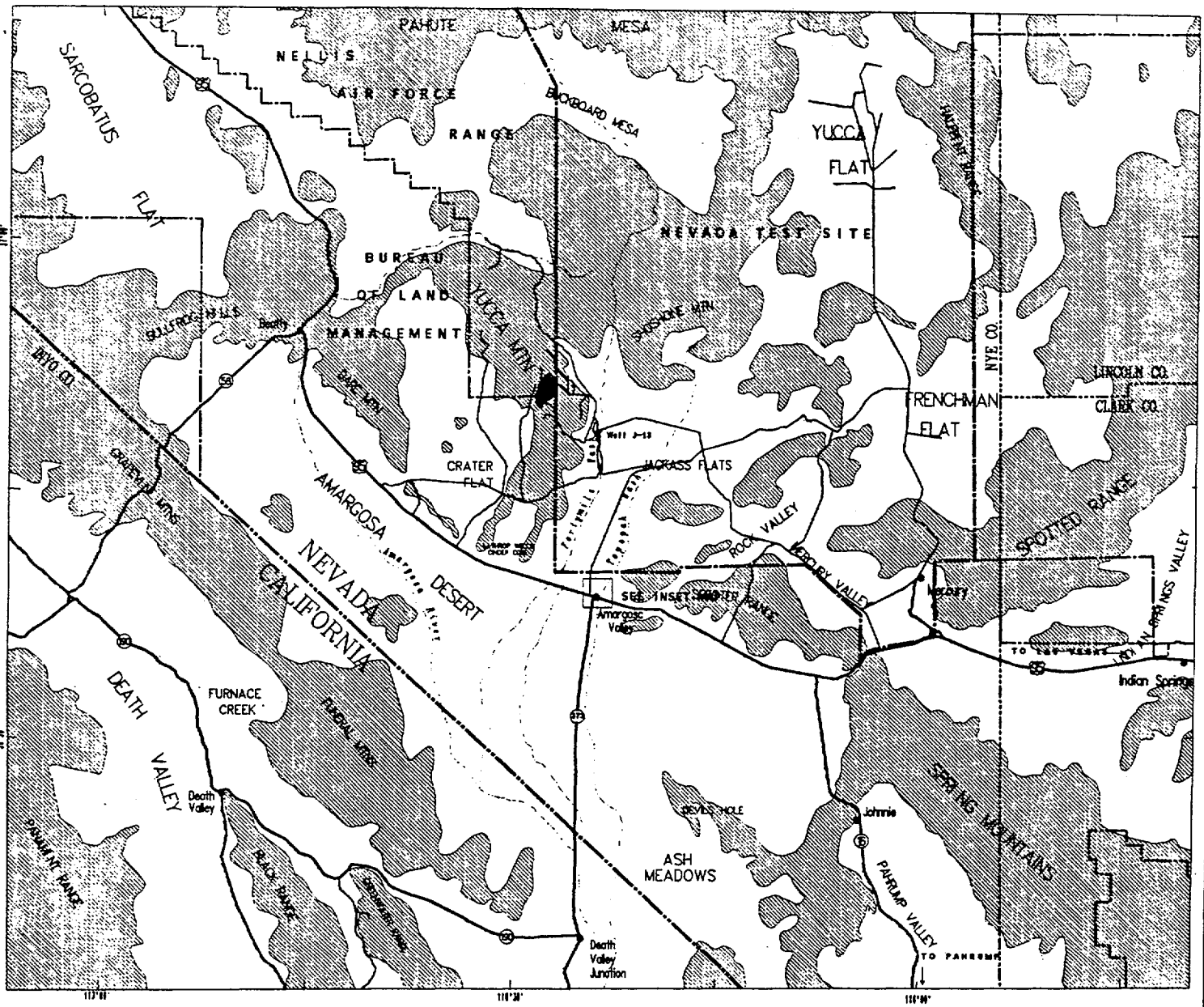


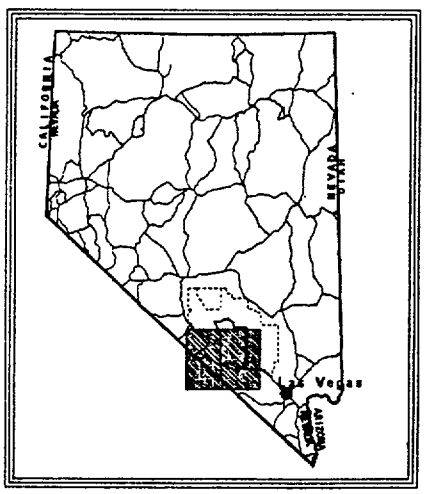
Figure 1-5. Physiographic features in the site area. Modified from Sinnock (1982).

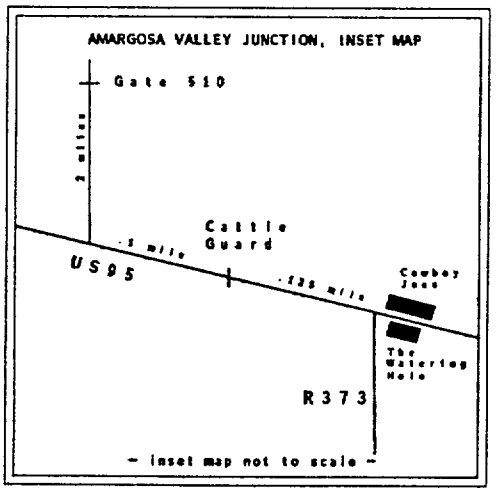


- In Progress Boreholes
- Proposed Boreholes
- Recently Completed Boreholes
- Boreholes to be Reworked
- C-Well Complex Boreholes

Borehole Program Activity







YUCCA MOUNTAIN

SITE CHARACTERIZATION PROJECT REGIONAL AREA MAP

10 5 0 10 MILES

15 10 5 0 15 KILOMETERS

- Primary Highway
- Secondary Highway
- Light-Duty Road
- Surface Drainage Channel
- State Line
- County Line
- Administrative Boundary
- Conceptual Perimeter Drift Area

N

EG&G MAP-91-044.1

ROLES OF PROJECT PARTICIPANTS

OCRWM DIRECTOR

YUCCA MOUNTAIN PROJECT OFFICE

CRWMS - M&O

- Project Management & Integration
- Systems
- Regulatory Interaction
- Plans and Procedures
- Records
- Technical Data Management
- Configuration Management/CCB
- Project Control

CRWMS - M&O

- Waste Package Design
- Repository Design
- ESF Design, Construction Management Support
- Performance Assessment
- SCP Semi-Annual Progress Reports
- License Application

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

- Environmental Studies
- Socioeconomics
- Nevada Transportation Studies
- ~~Quality Assurance~~
- Sample Mgmt. Facility
- Institutional/ Outreach
- Land Access
- Training
- Site Office Operations

U.S. GEOLOGICAL SURVEY

- Geology
- Hydrology
- Climatology
- Seismic/ Tectonics

LOS ALAMOS NATIONAL LABORATORY

- Geochemistry
- Exploratory Studies Facility Test Mgmt.
- Volcanism Studies
- Mineralogy and Petrology

LAWRENCE LIVERMORE NATIONAL LABORATORY

- Waste Package Testing
- Waste Package Performance Assessment
- Near Field Characterization

SANDIA NATIONAL LABORATORIES

- Performance Assessment
- Geotechnical Studies

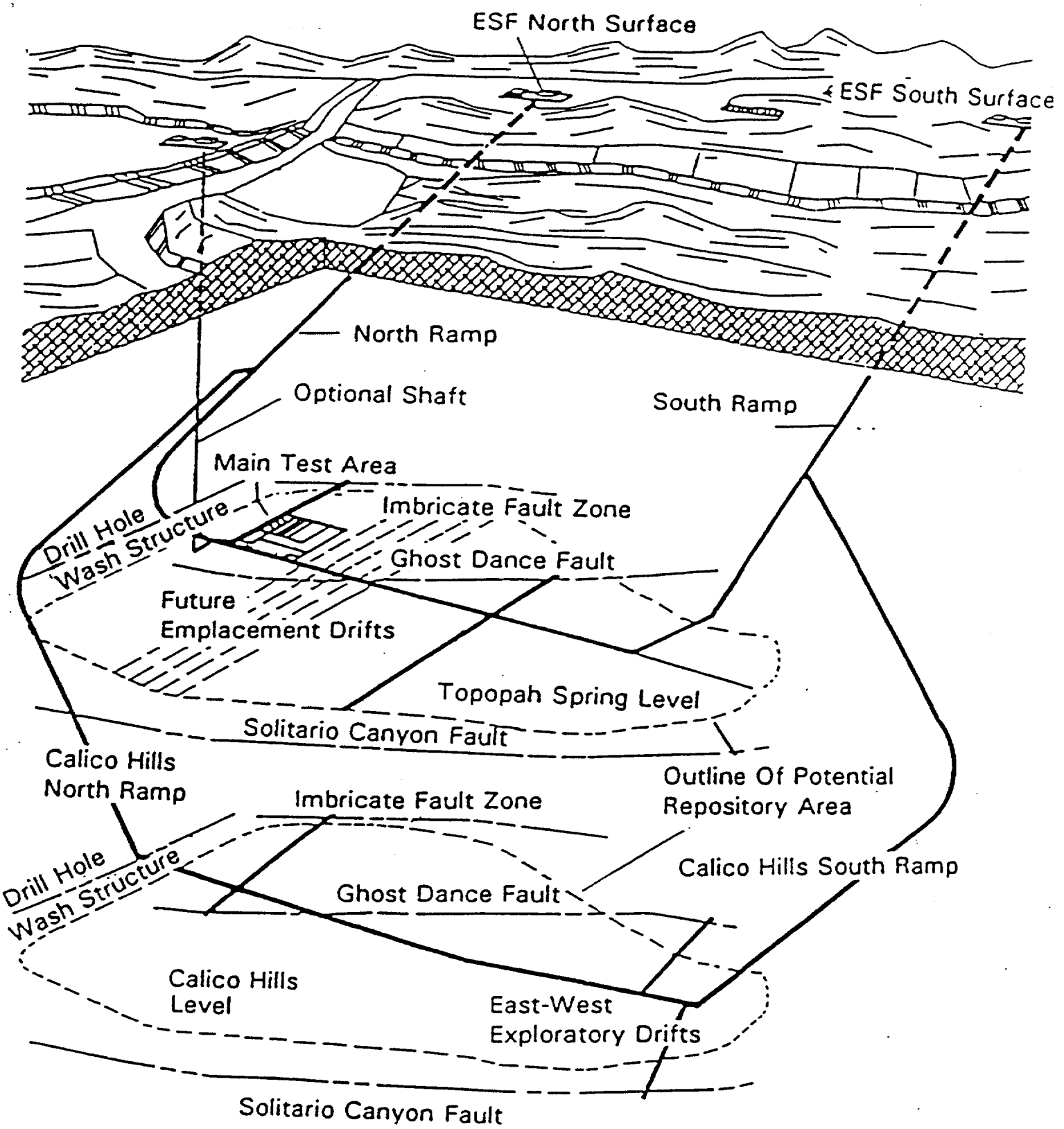
RAYTHEON SERVICES NEVADA

- Drilling Support, Roads & Pads
- Surveying
- General Facilities A/E
- ESF Design Review Support

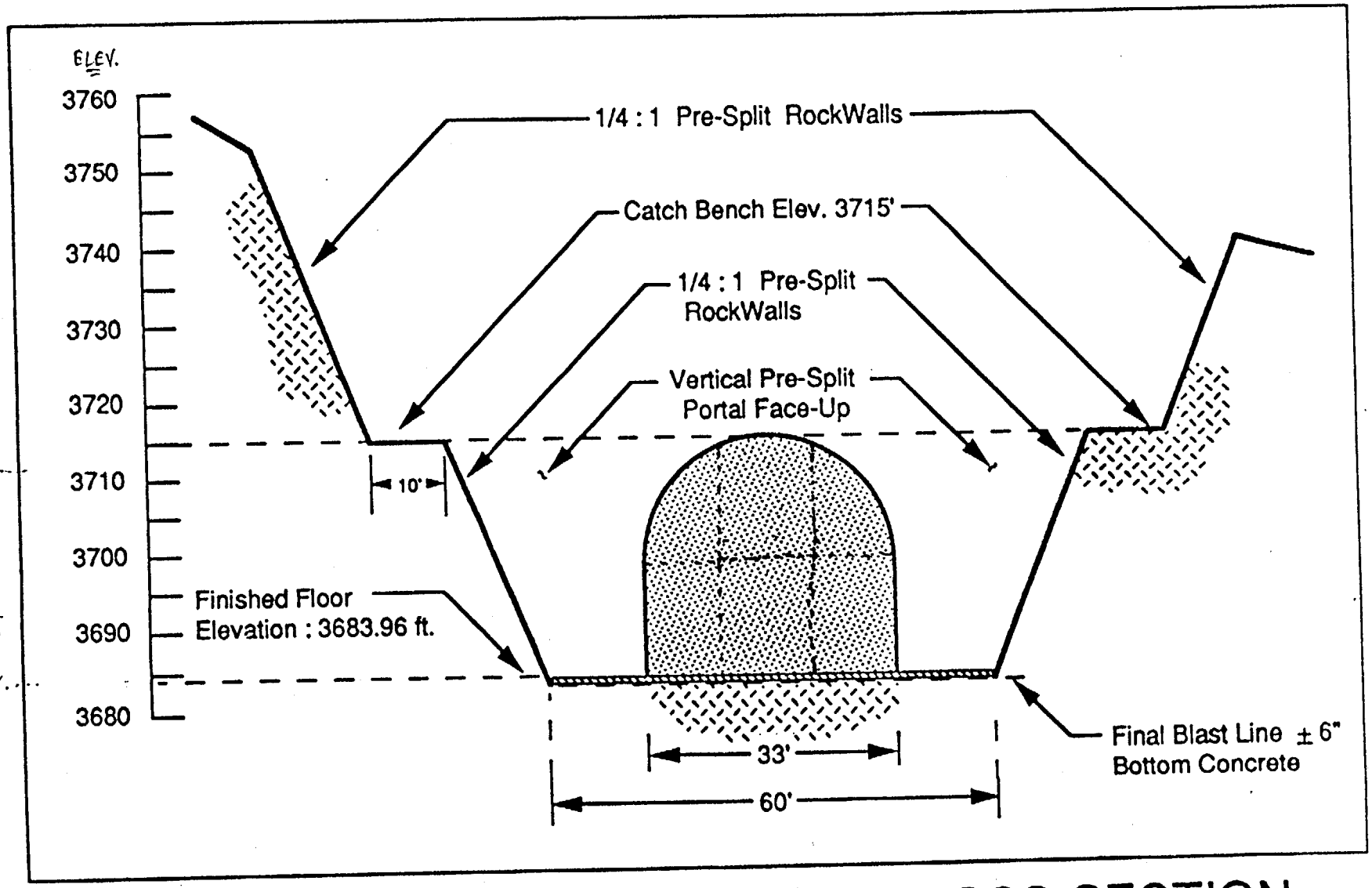
REYNOLDS ELECTRICAL & ENGINEERING COMPANY

- ESF Construction
- Drilling and Trenching
- Area 25 Maintenance and Operations
- Project Office Administrative Support

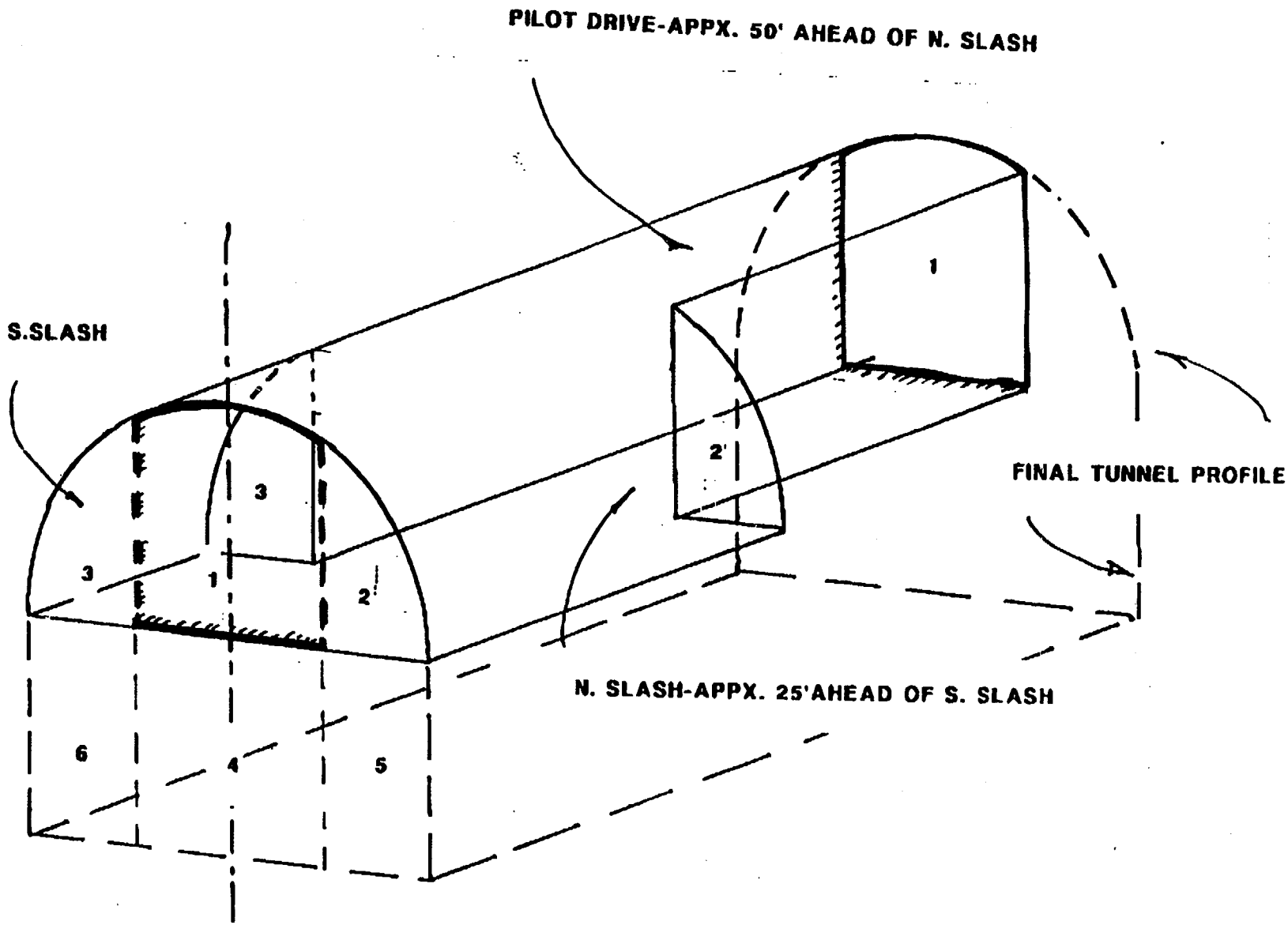
EEIPRA5P6.125.EEI/3-9-93



CONCEPTUAL ILLUSTRATION OF THE EXPLORATORY STUDIES FACILITY

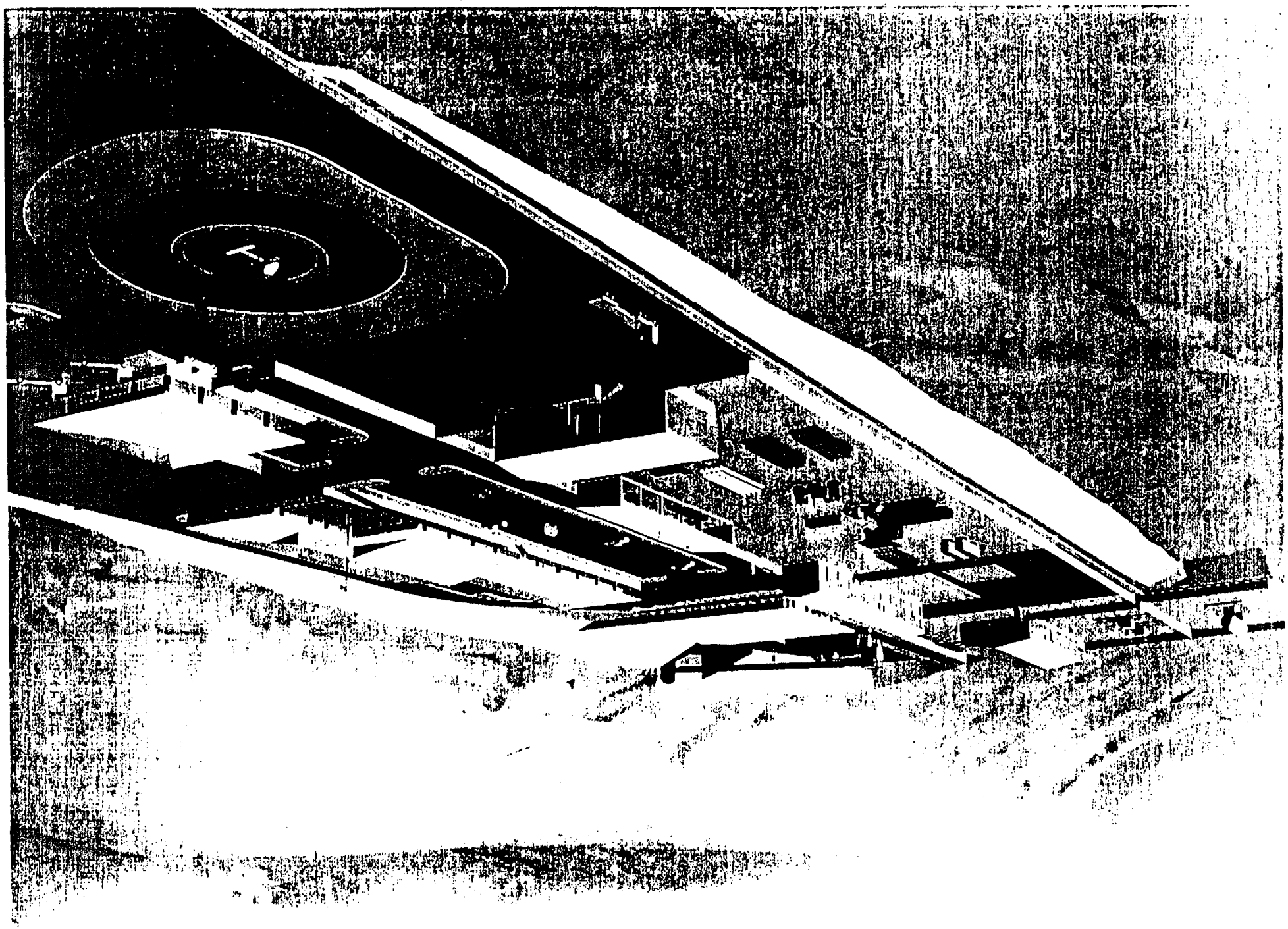


MAPPED AREA OF ESF PORTAL CROSS-SECTION



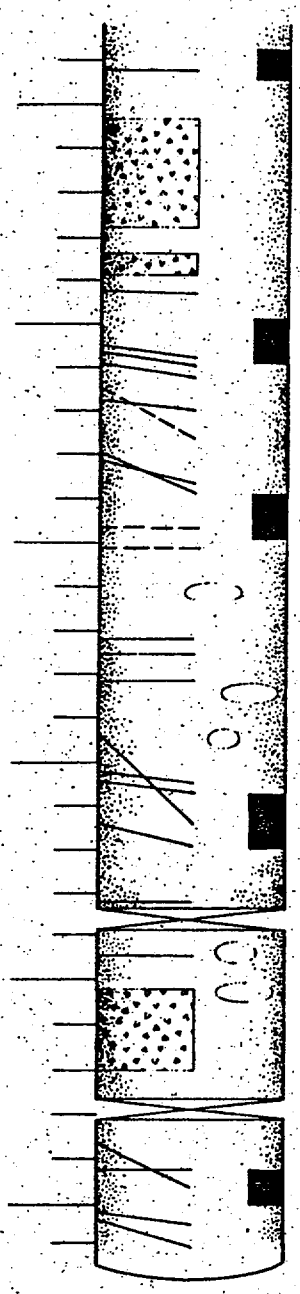
ESF STARTER TUNNEL EXCAVATION SEQUENCE

recd 3/25/93 pf



Earth Sciences

LM-300 Drill Rig



In 1988, a group of nationally renowned scientists, engineers and mining experts gathered in Las Vegas to consider a unique problem: How could they bore some 800 meters (2,600 feet) through a mountain's unsaturated zone – the layer of rocks and soil above the water table – with minimal change to the existent moisture, air or other substances? And could the hole be bored and preserved without further harmful effect?

Conventional drilling techniques couldn't assure such pristine results. Commercial oil drilling rigs blast pressurized air, water or mud into the borehole, forcing rock fragments and other debris to the surface. Though effective, this invariably contaminates the surrounding areas. What was needed at Yucca Mountain was a rig capable of removing core samples and rock fragments from the mountain without significantly altering its geochemical properties or changing it physically.

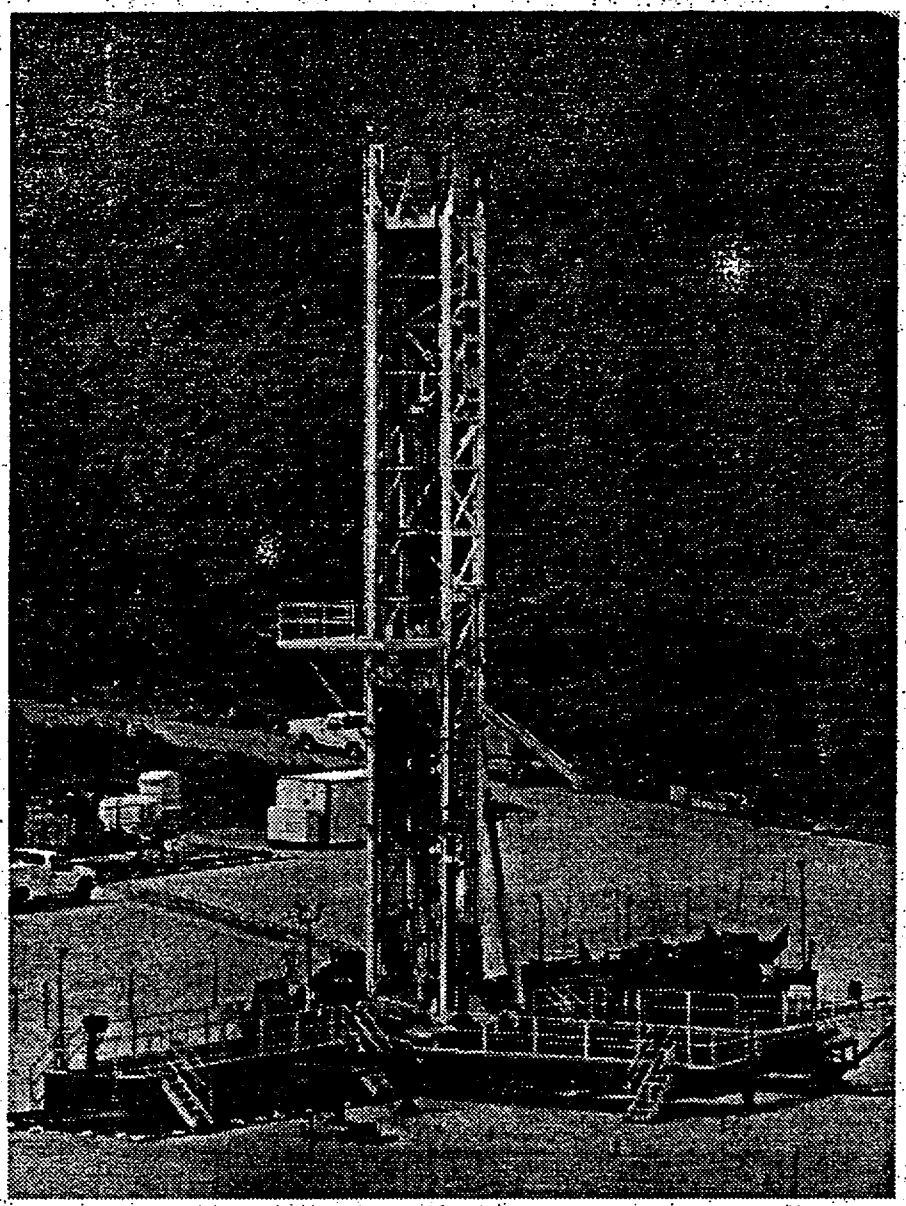
The $3.2 million LM-300 Drill Rig in use at Yucca Mountain was designed with precisely such a task in mind. Its mast towers 24 meters (80 feet), and can lift loads of up to 136,000 kilograms (300,000 pounds) above the ground. The LM-300 can bore a 31 cm-in-diameter (12 inch) hole into the Earth's crust.

The key to the rig's drilling capability lies in the dual-wall pipe it bores into the ground. The dual-wall system is essentially a pipe within a pipe. The space between the two pipes can be used to circulate preconditioned, cool air down into the ground. On the return trip, the same air carries the rock and soil fragments dislodged by the drill bits.

Because water is neither pumped into the ground nor formed by condensation as a result of this preconditioning, there is no seepage through geological fractures penetrated by the drill, and no mud cakes the borehole walls. Keeping the borehole wall close to its original condition is especially important in gauging how quickly and how far naturally occurring water might move through the rock.

The rock fragments and dust from the borehole are fed by vacuum into a container at the ground surface. Shaped like an upside-down cone this "cyclone," so called because the air and debris funneled into it circulates quickly, removes debris. In so doing the device helps control the release of dust. Air from the cyclone is then funneled into another filtration system, and is subsequently monitored. During a day's operation, the LM-300 creates very little dust – less than a car driving up to the drill site.

The dual-wall pipe is attached to a special drill bit capable of removing core samples, which scientists use to



The LM-300 Drill Rig in use at Yucca Mountain.

determine the geology of the mountain. An open-ended, industrial diamond-studded bit is sent into the ground 12 meters (40 feet) ahead of the regular, tungsten carbide drilling, or "reaming" bit. The diamond-studded bit removes coring samples, which are then returned to the surface in a container lifted by wire.

Apart from being cooled and having moisture controlled so as neither to dry the rock nor to allow moisture condensation, the air pumped into the ground has also been tagged with minute quantities of a benign compound, sulfur hexafluoride. Scientists use this chemical to study how the borehole reverts to its original condition and to ensure that the hydrologic data taken from the hole represents the true character of the mountain.

The LM-300 is now working a borehole designated "UZ-16" (the letters stand for "unsaturated zone"). This borehole, and 45 others, will descend as low as the water table, which is located about 550 meters (1800 feet) below the ground. A number of other, shallower boreholes about 125 meters (400 feet) deep will be dug as well. The core samples removed will provide scientists with the data they need to determine the structure of the Yucca Mountain substrata, or underlying foundation, in a comprehensive and thorough fashion.

U.S. Department of Energy

YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

P.O. Box 98608
Las Vegas, NV 89193-8608
(702) 794-7900

DOE/RW-0392P
February 1993

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
BOREHOLE PROGNOSIS

BOREHOLE ID: USW UZ-14
ESTIMATED ELEVATION: 4500' GL
ESTIMATED COORDINATES N: 771,276 E: 560,221
PROPOSED DEPTH: 1,815' (EST)

Alluvium
Bedded Tuff
Vitrophyre

Non-welded
Partially welded
Moderately welded
Densely welded

Geology by Drilling Support, T&MSS Date Completed 2/4/93 by DDS

COMMENTS: Data used for this prognosis was taken from drill holes USW UZ-1 and USW G-1, which are located adjacent to proposed borehole and 1000 ft respectively to the southeast. This purpose of this borehole is: 1) to study soil and rock properties of potential locations of surface and sub-surface access facilities; and 2) systematic acquisition of site-specific, sub-surface information.

WELDING		ROCK UNITS	DEPTH (TOP) EST	DEPTH (TOP) ACTUAL
		ALLUVIUM	0	
	TIVA CANYON	CAPROCK		
		UPPER LITHOPHYSAL		
		NONLITHOPHYSAL		
		LOWER LITHOPHYSAL		
		HACKLY		
		COLUMNAR		
		SHARDY BASE		
		BEDDED TUFF		
		YUCCA MOUNTAIN	60	
		BEDDED TUFF	80	
		PAH CANYON	105	
		BEDDED TUFF	235	
	TOPOPAH SPRING	NON-PARTIALLY WELDED	255	
		CAPROCK	280	
		UPPER LITHOPHYSAL	440	
		MIDDLE NONLITHOPHYSAL	715	
		LOWER LITHOPHYSAL	770	
		LOWER NONLITHOPHYSAL	1,200	
		VITROPHYRE	1,290	
		PARTIALLY WELDED	1,360	
		BEDDED TUFF	1,405	
		TUFFS OF CALICO HILLS	1,425	
		BEDDED TUFF	1,735	
	CRATER FLAT	PROW PASS	1,800	
		BEDDED TUFF		
		BULLFROG		
		BEDDED TUFF		
		TRAM		

LITHOLOGY / REMARKS

Alluvium- stream, fan, and terrace deposits locally cemented by caliche. Mainly sand to boulder sized clasts of nonwelded to densely welded tuff.

Yucca Mountain Member- medium light gray to yellowish-brown, nonwelded to partially welded, ashflow tuff.

Bedded Tuff- very light gray, nonwelded, and vitric, airfall tuff.

Pah Canyon Member- moderate pink to orange, nonwelded, vitric.

Bedded Tuff- pale yellowish-brown, nonwelded, reworked and airfall tuff.

Caprock- black, densely welded, devitrified vitrophere.

Upper Lithophysal- dark reddish-brown, densely welded, devitrified, 15% lithophysae.

Middle Nonlithophysal- grayish-orange to pale red, moderate to densely welded, devitrified.

Lower Lithophysal- moderate orange-pink to brownish-orange, moderate to densely welded, devitrified, 10-15% lithophysae.

Lower Nonlithophysal- brownish-orange to brick red, moderately to densely welded, devitrified.

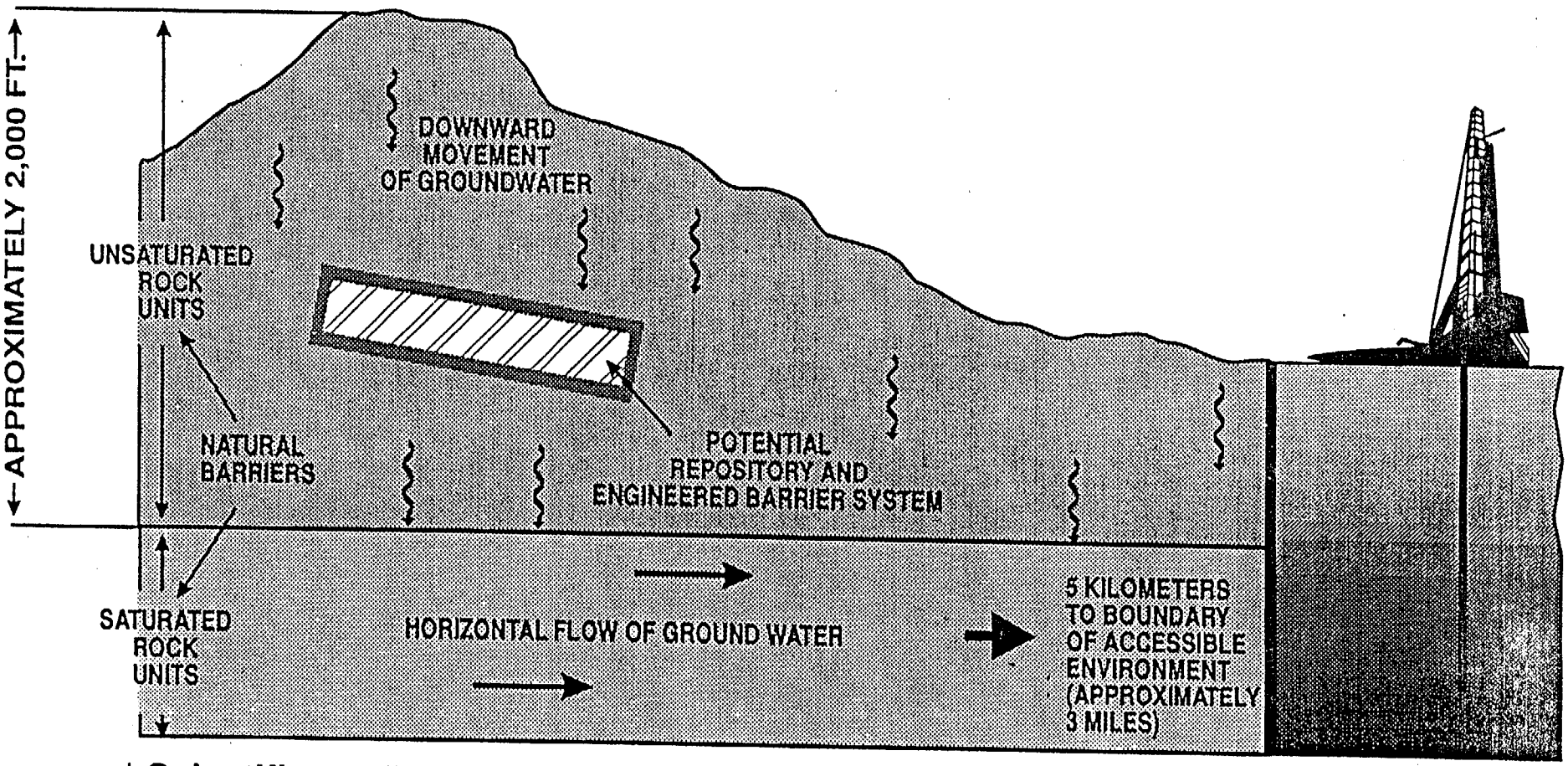
Vitrophyre- dark gray to black, densely welded, vitric.

Partially Welded Zone- moderate orange-pink with black to brownish gray shards, nonwelded to partially welded, vitric.

Tuffs of Calico Hills/Bedded Tuffs- vary pale orange to grayish-yellow to pale greenish-yellow, nonwelded to partially welded, ashflow and airfall tuffs.

Prow Pass- medium light-gray to brownish gray, nonwelded to moderately welded, devitrified, simple cooling unit, ashflow tuff.

OBJECTIVE OF SCIENTIFIC STUDIES* IS TO DETERMINE SITE SUITABILITY

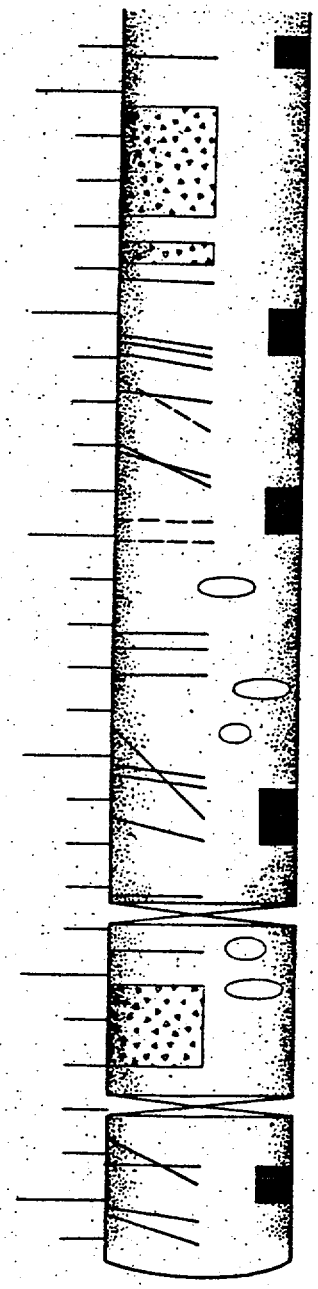


* Scientific studies must consider repository design but do not include waste emplacement which will occur after NRC licensing

XSECTBWC.XSECTIONS/3-25-93

Earth Sciences

How the Sample Management Facility works



The Sample Management Facility (SMF) stores rock and other geotechnical samples for the Yucca Mountain Site Characterization Project. Most of these samples are rock cores and cuttings taken from holes drilled into Yucca Mountain. Eventually, samples from exploratory work deep underground may be stored here, too.

This facility makes certain that the collection and handling of rock samples is documented. It makes certain that rock samples can be traced to their origins and that each person who has access to the samples is documented. In this way, a complete record can be kept of each sample, who handled it, and the tests performed on it. The Department of Energy has implemented this "chain of custody" to keep permanent records about each rock sample.

Recording this chain of custody begins at the drill site. When rock core is removed from a borehole, it is pulled out of the ground in about 3-meter (10-foot) increments. It is shaped like a cylinder and is about 6 centimeters (2.4 inches) in diameter. Blue and red orientation stripes are marked on the core to ensure the pieces aren't mixed up or reversed, since the core sections can be in several pieces. The core is then packaged and bar coded. Core documentation begins in the field and continues at the SMF, creating a complete record for all core coming from each borehole.

As you walk through the Sample Management Facility, you will see a number of processes used to record the origin of the samples kept here. We have listed the various tour stops below in the order in which samples generally pass through them. For practical reasons, you may not walk through in the same order, but the stops are numbered for easy reference to this guide.

Field Core Logging Trailer (Station 1)

Field processing is the first step in documenting the core and cuttings. This trailer will be set up at a drill site for handling and processing core and cuttings in the field. Lithologic (describing the rock) and structural logs are begun as soon as samples are taken from the ground. Logging includes marking core with depth and orientation marks and describing the character of the rock. Structural features such as fractures also are described. The computer here is used to generate preliminary lithologic and structural logs and begin data entry in the field.

Sample Receiving Area (Station 2)

Boxes of core arriving from the field are processed in the shipping and receiving area. Computer terminals are used to enter data into a sample-tracking data base, creating a numbering system for the rock

samples. By entering the number into the computer, or scanning a bar code number, information can be obtained about the rock, including what hole it came from and what processes it has undergone.

Borehole water samples and cores from the unsaturated zone, that is, the rock at Yucca Mountain above the saturated zone (commonly called the water table), are kept in cold storage areas. The temperature, which is about 4 degrees centigrade (40 degrees Fahrenheit), minimizes changes in the samples from biological and chemical activity. As much as 29,000 meters (96,000 linear feet) of rock core can be stored here. As with other areas, whenever a box is moved in or out of the cold storage area, the bar code is scanned so that the computer tracks sample locations at all times.

Specimen Processing Room (Station 5)

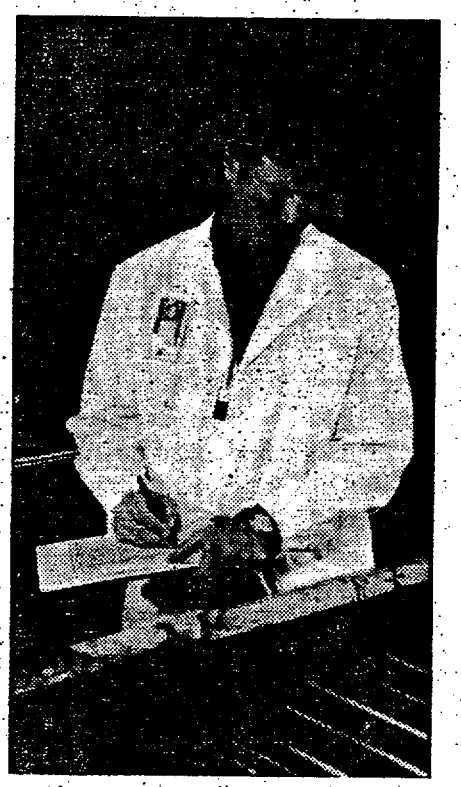
Ground-up rock chips from the drilling process are called cuttings. They can be as small as dust or as big as pebbles, depending on the size of the drill bit used. Cuttings are studied in a variety of ways, including visual exams and experiments, and geochemical tests. These samples are processed here. This includes washing off drill-hole fluids and packaging the samples.

Core Saw Room (Station 4)

Sections of core are sawed here, so that scientists can look for minerals in the rocks, evidence of possible faulting, or a specific rock feature. The saws can cut up to about 29 meters (96 feet) of core an hour, wet or dry, and a dust collection system protects the staff's health. Other pieces of rock-processing equipment here include a large slab saw and a core plugger.

Core Examination Room (Station 6)

Authorized visitors, such as Project geologists or hydrologists, examine samples in this room. The sliding work tables have lighting systems, and are outfitted with binocular microscopes and petrographic microscopes which specialists use to examine sections of rock ground so thin that light shines through them. Here, scientists also study the history of the core and determine what's happened to the rock during its long history. This data will provide clues to what the Yucca Mountain region might be like thousands of years from now.



SMF geologist logging core to describe the rocks.

Sample Storage (Station 3)

Here is the primary core storage area with a capacity of 51,000 meters (168,000 linear feet) of 6 centimeter (2.4 inch) core. This area also stores cuttings, bulk samples and specimen remnants returned to the SMF by researchers. As always, the location and origin of all core is tracked by the computerized bar code system.

U.S. Department of Energy

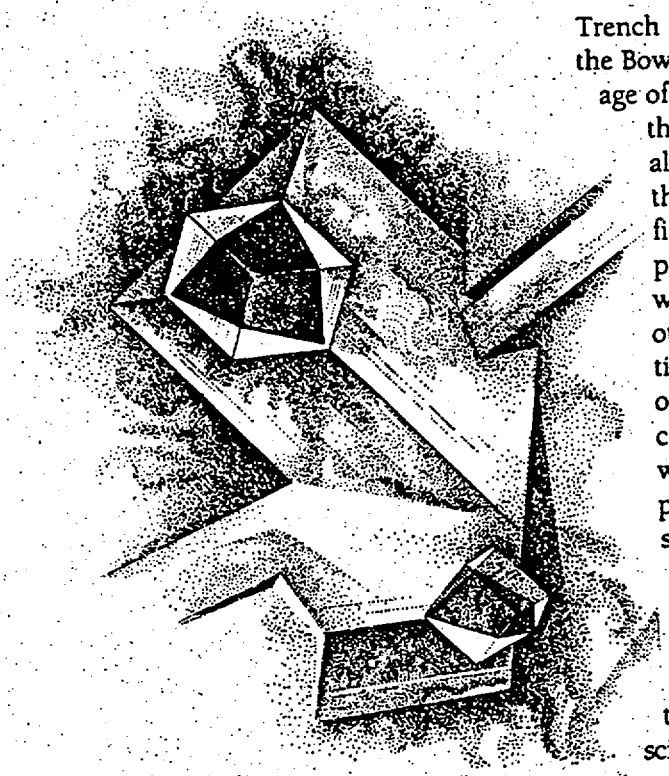
YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

P.O. Box 98608
Las Vegas, NV 89193-8608
(702) 794-7900

DOE/RW-0339P
October 1992

Earth Sciences

Trench 14 dug to study Bow Ridge Fault



Trench 14 was dug in 1984 across the Bow Ridge Fault to study the age of this fault and how often the earth may have moved along it. The excavation of the trench revealed veins filled with white mineral deposits of calcite-silica that were not as prominent in other nearby trenches. Scientific opinion about the origin of these deposits has been controversial. The trench was deepened in 1991, as part of site characterization studies, to further explore these deposits.

The Department of Energy (DOE) conducted a workshop in 1988 to assess these mineral deposits. DOE scientists, independent scientists and university professors who are experts in the origins of calcite-silica deposits, as well as technical staff from the Nuclear Regulatory Commission (NRC), determined that these vein deposits have the characteristics of caliche, which is commonly found in desert areas.

Some scientists have suggested that these whitish veins in Trench 14 were created by groundwater being forced upward from within the earth. If evidence existed to support this it would be important because scientists need to know whether an earthquake or other geologic events could cause a sudden, dramatic rise in the water table which could possibly flood a repository at Yucca Mountain. Scientific evidence indicates that these deposits have characteristics consistent with deposits formed in desert soils, and were left by rainwater and melted snow percolating downward from the surface. Reviews by other professionals, including scientists from the National Academy of Science, agree that the veins were formed by the downward movement of rainwater along the path of the fault surface.

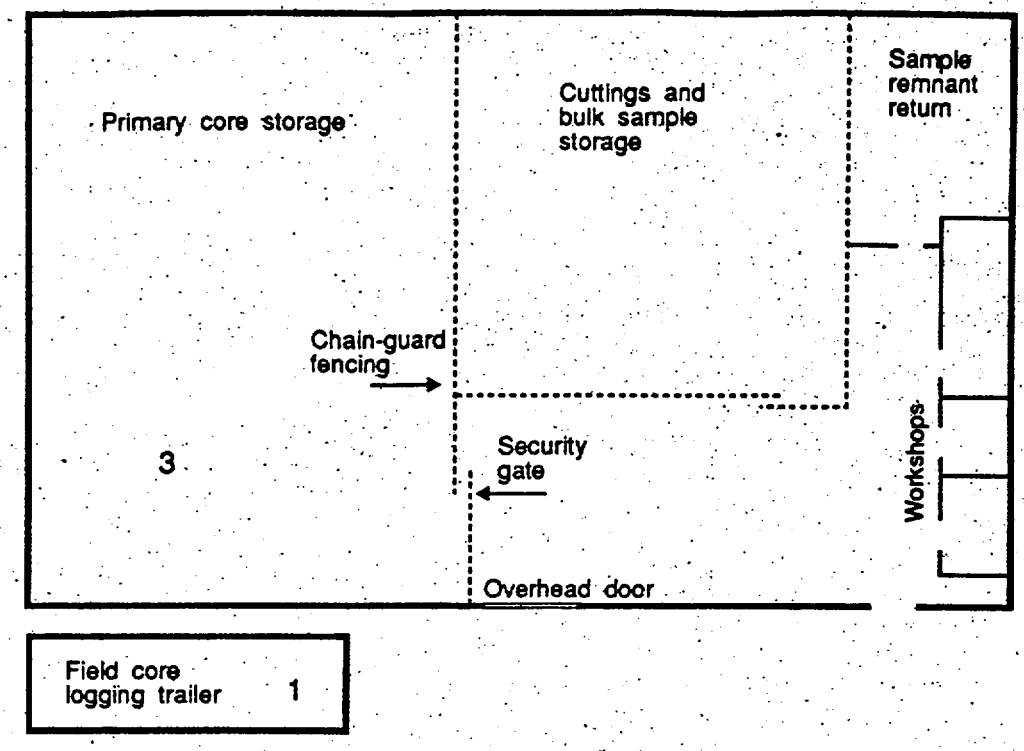
U.S. Department of Energy

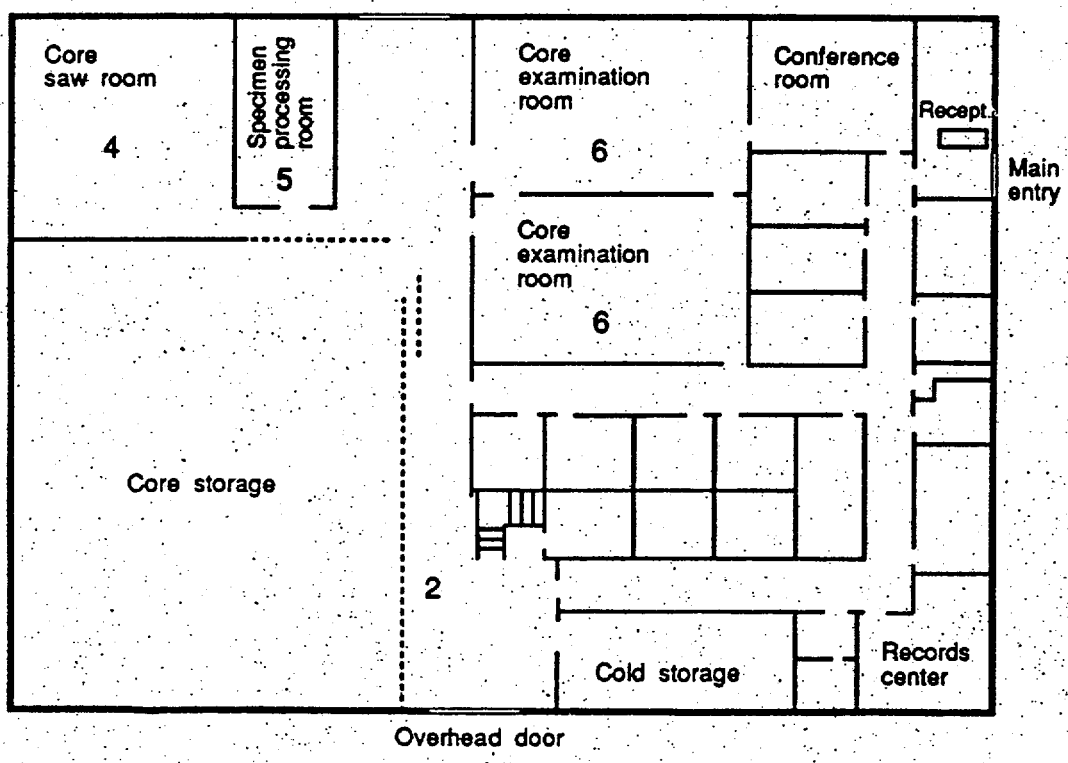
YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

P.O. Box 98608
Las Vegas, NV 89193-8608
(702) 794-7900

DOE/RW-0390P
February 1993

Sample Management Facility





HYDROLOGIC RESEARCH FACILITY

U.S. GEOLOGICAL SURVEY–YUCCA MOUNTAIN PROJECT

INTRODUCTION

The Hydrologic Research Facility (HRF) was established by the U.S. Department of Energy in 1989 to provide office and laboratory space for Federal employees and contractors of the U.S. Geological Survey (USGS) working on the Yucca Mountain Project. The USGS is a bureau of the Department of the Interior, and is cooperating with the Department of Energy on this project through an interagency agreement. The USGS is a world-class Earth science organization, and is applying this expertise to the study of Yucca Mountain. Over 20 Nevada-based research and technical personnel are permanently assigned to the HRF, but the numbers can increase significantly during field season or because of special project events.

The U.S. Geological Survey is responsible for characterizing the geologic and hydrologic properties of Yucca Mountain. The geologic studies of the composition, structure and natural history of Yucca Mountain are carried out primarily by personnel based in Denver. Most of the studies conducted at the HRF concentrate on the hydrology of Yucca Mountain. The on-site researchers measure precipitation, runoff, infiltration and evaporation; moisture content, hydraulic and physical properties of the soil and rock material, and groundwater levels, flow rates and flow directions under the mountain.

RESEARCH PROGRAMS

USGS hydrologic research at Yucca Mountain falls into two main groups: Saturated Zone (SZ) Hydrology, and Unsaturated Zone (UZ) Hydrology. The saturated zone occurs where the pores and fractures in a rock or soil unit are filled with groundwater; the top of this zone is known as the water table. At the crest of Yucca Mountain, the water table is located nearly 2000 feet below the surface. The SZ studies are investigating recharge, discharge, flow rates, direction of flow, and groundwater chemistry. These studies will help to better define the nature of the groundwater system under Yucca Mountain.

The rock and soil units above the water table are unsaturated, which means the pores and fractures are only partially filled with water. The UZ research is studying the amount of water which enters the mountain from rain or snow (infiltration), and determining the rate at which it makes its way down through the unsaturated rock to the water table (percolation). The infiltration work includes a meteorology program to investigate the relationships between weather patterns that affect southern Nevada and the nature of precipitation on Yucca Mountain.

FACILITIES

A map of the facilities is on the reverse side of this handout. Some of these are described below:

* **Map Room:** A Geographic Information System (GIS) is used for overlaying and correlating map data.
* **Saturated Zone Studies:** Wall posters show the groundwater system in maps and cross-sections; well instrumentation and groundwater sampling.
* **Geochemistry Lab:** Chemical and isotopic analysis of subsurface gas and water; extraction of samples.
* **Hydrology Lab:** Measurement of physical properties, hydraulic properties and moisture characteristic functions in unsaturated zone rocks.
* **Meteorology:** Weather satellite data collection and lightning sensor system. Time-lapse cloud studies.
* **UZ Calibration Lab:** Precision calibration and long term monitoring of deep borehole instrumentation.
* **Controlled Humidity Room:** Walk-in chamber with the temperature and humidity carefully controlled for sensitive hydrologic analyses.
* **Sample Preparation Lab:** Rock saws, diamond core drills and other equipment for preparing samples.
* **Sample Processing Annex:** Working laboratory for measuring physical properties and drying cores.
* **Logging Van:** Specially-equipped van for running borehole geophysical (wireline) measurements in the unsaturated zone in Yucca Mountain drill holes.

Please do not touch any equipment. Many items are fragile, and may be dangerous if mishandled.

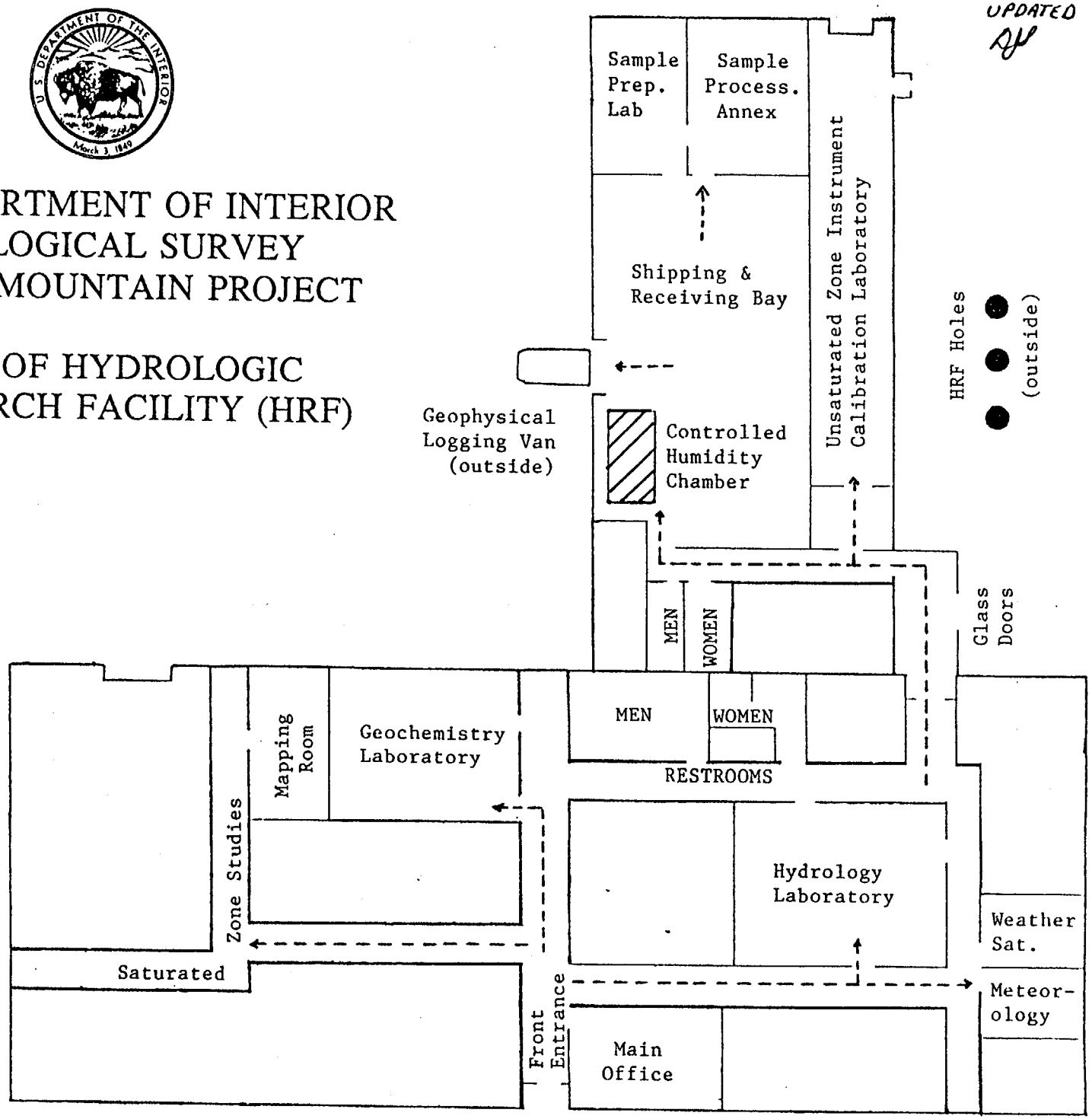
THANK YOU FOR VISITING...WE HOPE YOU ENJOY THE TOUR. U.S. Geological Survey

(Rev 1/13/93)

UPDATED 1-12-93

U.S. DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY
YUCCA MOUNTAIN PROJECT

MAP OF HYDROLOGIC RESEARCH FACILITY (HRF)



Preliminary Draft
for Information Only

SI
APERTURE
CARD

Also Available On
Aperture Card

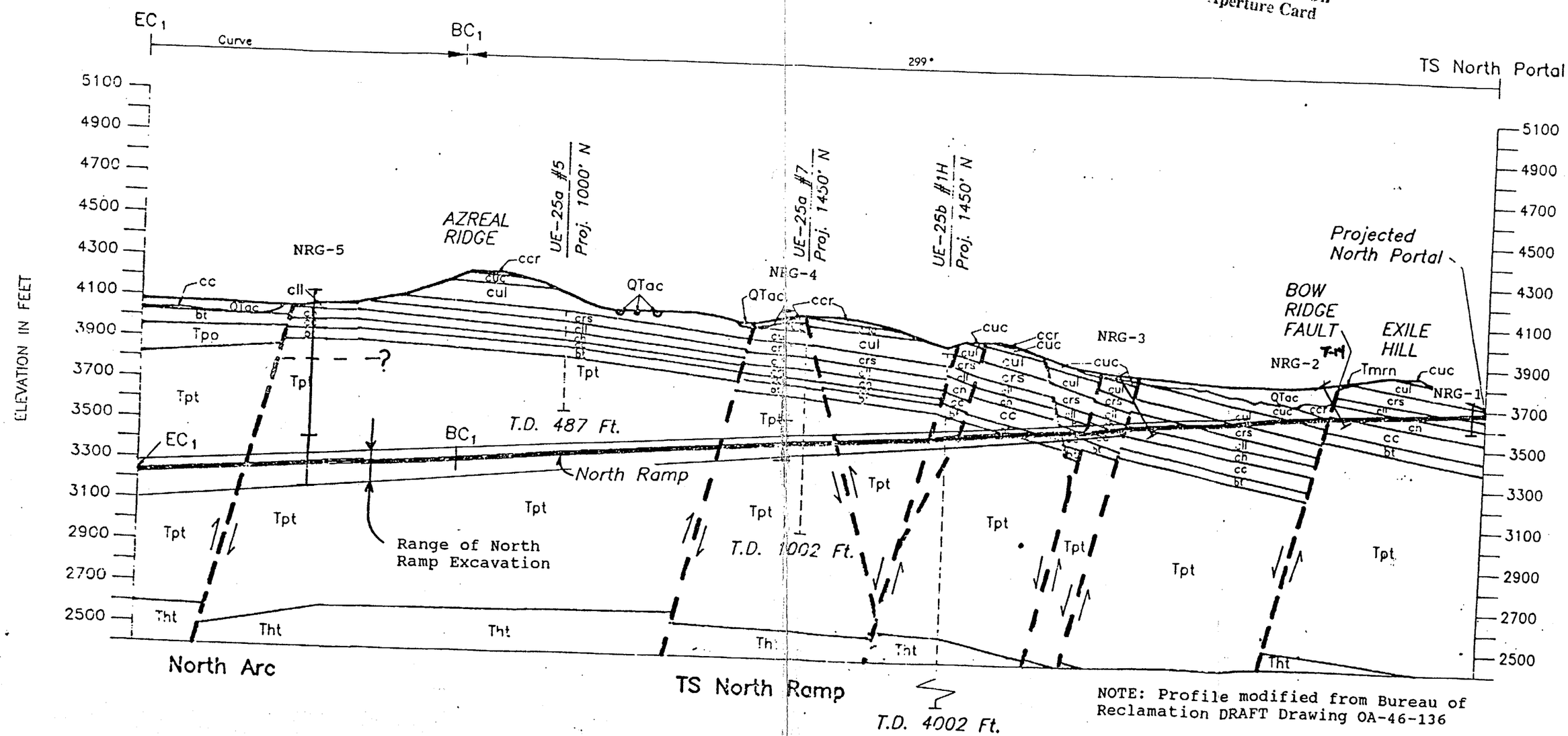


FIGURE 2 - NORTH RAMP PROFILE

9306240237-01

ATTENDEE LIST
AMERICAN SOCIETY FOR QUALITY CONTROL
4TH INTERNATIONAL ENVIRONMENTAL AND WASTE MANAGEMENT CONFERENCE

April 18-21, 1993 - Knoxville, Tennesee

Janice S. Allison
Bechtel National, Inc.
P. O. Box 350
Oak Ridge, TN 37831

Scott Altmayer
EG&G Idaho, Inc.
P. O. Box 1625
Idaho Falls, ID 83415-3960

Rusty Anderson
CH2M Hill
599 Oak Ridge Turnpike
Oak Ridge, TN 37849

Carl A. Anderson
National Research Council
2101 Constitution Avenue
Room HA 456
Washington, DC 20418

Thomas D. Anderson
US Dept. of Energy
Washington, DC

H. W. (Bud) Arrowsmith
Scientific Ecology Group
P. O. Box 2530
Oak Ridge, TN 37831

M. B. Baer
Martin Marietta Energy Systems
P. O. Box 2003
Oak Ridge, TN 37831

John Bain
SAIC
P. O. Box 99
West Paducah, KY 42086

Angela R. Barnard-Hatmaker
MMES
P. O. Box 2003, MS 7261
Oak Ridge, TN 37831

Sid Bass
IIT Research Institute
P. O. Box 1305
Skokie, IL 60076

Lanny D. Bates
Martin Marietta Energy Systems
P. O. Box 2003
Oak Ridge, TN 37831

Gary Benda
RUST Remedial Services
140 Stoneridge Drive
Columbia, SC 29210

Jim Bentley
ENSECO

Dale Bewley
Martin Marietta Energy Systems
P. O. Box 2008
Oak Ridge, TN 37831

Case Biezenbos
MMES - HAZWRAP
921 Turnberry Drive
Knoxville, TN 37923

Bud Bjoro
US Dept. of Energy
4026 Pebble Branch Road
Baltimore, MD 21042

Michael S. Blair
Chemrad Tennessee Corporation
1055 Commerce Park Drive
Oak Ridge, TN 37830

Arnold A. Bonne
SCK/CEN
Boeretang 200
2400 Mol, Belgium

Karen Bowdle
Martin Marietta Energy Systems
P. O. Box 2003
Oak Ridge, TN 37831

Thomas E. Bowman
Nuclear Fuel Services

Pamela Anne Brammer
Westinghouse Savannah River Company
P. O. Box 616
Aiken, SC 29801

Bill Bryant
Texas LLRW Authority
7703 North Lamar, #300
Austin, TX 78752

Elaine G. Bullington
Oak Ridge Associated University
Oak Ridge Institute of Science Education
P. O. Box 117
Oak Ridge, TN 37920

Thomas E. Burdette
Tennessee Valley Authority
OSB-1A
Chattanooga, TN 37402

Jim H. Burkhardt, Jr.
Martin Marietta Energy Systems
P. O. Box 2009
Oak Ridge, TN 37831

Richard Burtnett
Engineering-Science
701 Illinois, #F-103
Oak Ridge, TN 37830

Thomas E. Campbell
ABB Environmental Services, Inc.
110 Free Street
Portland, ME 04112

David M. Carden
US Dept. of Energy
Oak Ridge Field Office
P. O. Box 2001, EW-913

Smiley Clapp
Institute for Public Service
University of Tennessee
Knoxville, TN

Bruce Clemens
University of Tennessee
327 South Stadium Hall
Knoxville, TN 37990

A. Edward Cocoros
MACTEC
2556 Golfside Drive
Las Vegas, NV 89134

Carl A. Cole, Jr.
Tennessee Valley Authority
NFE 2M
Muscle Shoals, AL 35660-1010

James S. Colley
Martin Marietta Energy Systems
P. O. Box 2009
Oak Ridge, TN 37830-7596

David G. Collins
Westinghouse Savannah River Company
P. O. Box 616
Aiken, SC 29802

Charles Comiskey
Integrated Computer Systems, Inc.
215 South Rutgers Avenue
Oak Ridge, TN 37830

J. Michael Conlon
US EPA

Donald Cooke
Integrated Computer Systems, Inc.
215 South Rutgers Avenue
Oak Ridge, TN 37830

Gary L. Cottrell
Martin Marietta Energy Systems
136 High Point Lane
Oak Ridge, TN 378310

Conrad Coulombe
GTS Duratek
8955 Guilford Road, #200
Columbia, MD 21046

Glen Cowart
SAIC
301 Laboratory Road
Oak Ridge, TN 37831

Robert B. Craig
HAZWRAP

Carroll Croes
Route 7, Box 457-1
Clinton, TN 37716

John Croes
SAIC
P. O. Box 2501
Oak Ridge, TN 37831

James R. Cross
BNFL, Inc.
9302 Lee Highway, Suite 950
Fairfax, VA 22031

Larry D. Dale
Program Manager for Rocky Mtn. Arsenal
Attn: AMXRM-LSQ
Commerce City, CO 80022-2180

Marcia C. Davies
Army Corps of Engineers
12565 West Center Road
Omaha, NE 68132

John D. DeFelice
Precision Components Corporation
P. O. Box 15101
York, PA 17404

Mark S. Denton
SAIC
800 Oak Ridge Turnpike
Oak Ridge, TN 38731

Gail DeRuzzo
Roy F. Weston, Inc.
208 Welsh Pool Road
Lionville, PA 19341

Mike Dickerson
EG&G Idaho, Inc.
P. O. Box 1625
Idaho Falls, ID 83415-1400

James Donnelly
US Dept. of Energy
P. O. Box 2001
Oak Ridge, TN 37831

W. I. Dothard
Martin Marietta Energy Systems
1109 Burton Road
Knoxville, TN 37919

Karen Douglas
US Dept. of Energy
P. O. Box 5400
Albuqerque, NM 87115

RoseMary Ellersick
CDM Federal Programs Corp.
13135 Lee Jackson Memorial Hwy.
Fairfax, VA 22030

Robert D. Elliott
Ellis & Watts
4400 Glen Willow Lake Lane
Batavia, OH 45103

Leonard C. Emma
Brookhaven National Laboratory
Safety & Environmental Protection
Bldg. 535A
Upton, NY 11973

John R. Ench
US Ecology, Inc.
9200 Shelbyville Road, #300
Louisville, KY 40222

Marcy L. Espergren
Oak Ridge National Laboratory
P. O. Box 2567
Grand Junction, CO 81502

Gordon M. Evans
US EPA
26 West Martin L. King
Cincinnati, OH 45268

J. Erich Evered
FERMCO
498 Circle Freeway Drive
Cincinnati, OH 45246

Alan Farmer
US EPA

Joan Fisk
Los Alamos National Lab
P. O. Box 1663; EM-9, MS K484
Los Alamos, NM 87544

Susan L. Flakus
CDM Federal Programs Corporation
111 Fulton Street, Suite 710
New York, NY 10038

Karen Fordstrom
Bechtel
P. O. Box 350
Oak Ridge, TN 37831

Raymond Frederici
Weston Analytics
2417 Bond Street
University Park, IL 60466

Charles M. Garvich
Tennessee Valley Authority
OSB-1A Riverside Drive
Chattanooga, TN 37402

Dale Gergely
NFS, Inc.
675-A Emory Valley Road
Oak Ridge, TN 37830

H. K. Gibson
Analytical Technologies
426 Heatherbrook Drive
Jefferson City, TN 37760

Sherry Gibson
US Dept. of Energy
Washington, DC 20585-0002

H. Steve Giles
Martin Marietta Energy Systems
P. O. Box 2008, MS 6312
Oak Ridge, TN 37831

C. Bruce Godfrey
Curtis & Tompkins Laboratories
2323 Fifth Street
Berkeley, CA 94710

Mark D. Goodell
Westinghouse Savannah River
Company
Savannah River Site, 773-41A
Aiken, SC 29808

Bonita Gorsche
Dept. of Land Use & Transportation
Washington County, Oregon
2960 SE Cypress Avenue
Hillsboro, OR 97123-7363

Myrna J. Goss
Advanced Sciences, Inc.
6739 Academy Road NE
Albuquerque, NM 87109

L. Barry Goss
SAIC
P. O. Box 2501
Oak Ridge, TN 37831

Michael Greaves
Brookhaven National Laboratory
Safety & Environmental Protection
Bldg. 535A
Upton, NY 11973

Roger L. Griffith
Tennessee Valley Authority
P. O. Box 1010
Muscle Shoals, AL 35660

David Guthrie
EG&G Rocky Flats
P. O. Box 464
Golden, CO 80402-0464

Michelle A. Hallmark
Reynolds Electrical
Engineering Co.
P. O. Box 98521
Las Vegas, NV 89193-8521

Richard Hand
Westinghouse Hanford Co.
P. O. Box 1970, M/S H4-16
Richland, WA 99352

Denise Hawkins
Oak Ridge Institute for Science & Education
P. O. Box 177
Knoxville, TN 37831-0117

Dale Hedges
Scientific Ecology Group
P. O. Box 2530
Oak Ridge, TN 37831

Walter A. Hedzik
Parsons
6120 South Gilmore Road
Fairfield, OH 45244

Peter Hershey
Roy F. Weston, Inc.
208 Welsh Pool Road
Lionville, PA 19341

G. M. (Sue) High
Martin Marietta Energy Systems
P. O. Box 2009
Oak Ridge, TN 37831

Robert R. Highfill
Chemrad Tennessee Corporation
1055 Commerce Park Drive
Oak Ridge, TN 37830

Clyde Hopkins
Martin Marietta Energy Systems
Oak Ridge, TN 37830

Robert Hottel
Westinghouse Savannah River
P. O. Box 616
Aiken, SC 29802

Laurent (Larry) Hourcle
National Law Center
George Washington University
2000 H Street NW
Washington, DC 20052

Kenneth Howerton
Tennessee Valley Authority
FOR 1C
Norris, TN 37828-2019

Daniel Hovater
Tennessee Valley Authority
MPB 1E-17
Muscle Shoals, AL 35630

Cliff S. Hsieh
US Dept. of Energy
P. O. Box 2001, SE-34
Oak Ridge, TN 37831

Greg Huddleston
Bechtel National, Inc.
P. O. Box 350
Oak Ridge, TN 37831

Mona Huffaker
EG&G Idaho
P. O. Box 1625, MS 1400
Idaho Falls, ID 83405

Melissa Jensen
Oak Ridge National Laboratory
2597 B 3/4 Road
Grand Junction, CO 81503

Gary L. Johnson
US EPA
MD-75
Research Triange Park, NC 27711

Jon Johnston
US EPA

David B. Jones
Martin Marietta Energy Systems
P. O. Box 2003
Oak Ridge, TN 37831-7606

Phil Justus
US Nuclear Regulatory Commission
301 East Stewart Avenue #203
Las Vegas, NV 89101

Margaret M. Kelly
US EPA
401 M Street SW, OS-110W
Washington, DC 20460

T. W. Kerlin
University of Tennessee
Nuclear Engineering Dept.
Knoxville, TN 37996

Richard Rex Knott
Martin Marietta Energy Systems
P. O. Box 2567
Grand Junction, CO 81502

Mary Anne Koltowich
Ogden Environmental & Energy Services
1009 Commerce Park Drive #100
Oak Ridge, TN 37830

Donald T. Krisha
Bechtel Corporation
P. O. Box 193965
San Francisco, CA 94119-3965

Istvan Kromer
Oak Ridge National Laboratory
P. O. Box 2003
Oak Ridge, TN 37831-6070

Ronald J. Kuhn
US Dept. of Energy
P. O. Box A
Aiken, SC 29802

Joe LaGrone
US Dept. of Energy
Oak Ridge Field Office
Oak Ridge, TN

Kimberley R. Leone
SCIENTECH, Inc.
11821 Parklawn Drive
Rockville, MD 20852

Pete Lesslie
SAIC
800 Oak Ridge Turnpike
Oak Ridge, TN 37830

Sandra Lewis-Lambert
Martin Marietta Energy Systems
P. O. Box 2008, MS 6198
Oak Ridge, TN 37831-6052

Howard Lilligh
Bechtel Savannah River
818 Park Chase Drive
Evans, GA 30809

William Lockerby
Turaer, Harper & Associates
932 Hungerford Drive #32B
Rockville, MD 20850

Val Loiselle
Quadrex Recycle Center
109 Flint Road
Oak Ridge, TN 37830

Terry Lyons
US EPA

Marshall A. Maez
Los Alamos National Laboratory
P. O. Box 1663, MS C307
Los Alamos, NM 87545

Victor Magnus
Rust Geotech
P. O. Box 14000
Grand Junction, CO 81502

Mark Marcus
U.S. Pollution Control, Inc.

Leo R. Martinez
Bechtel National, Inc.
50 Beale Street
San Francisco, CA 94105

Doug McCoy
TN Dept. of Environment & Conservation

Jay G. McDonald
Oak Ridge Institute for Science & Education
P. O. Box 117
Oak Ridge, TN 37831-0117

Gloria D. Mencer
Martin Marietta Energy Systems
P. O. Box 2003
Oak Ridge, TN 37831-7155

Erich R. Merz
Research Center
Julich, Germany

Gregory B. Mohrman
Program Manager Rocky Mountain Arsenal
Laboratory Support Division
72nd & Quebec
Commerce City, CO 80022-2180

John O. Moore
US Dept. of Energy
P. O. Box 2001
Oak Ridge, TN 37831

Kevin Newman
SAIC
800 Oak Ridge Turnpike
Oak Ridge, TN 37830

Carl Oaks
Gilbert/Commonwealth
1055 Commerce Park Drive
Oak Ridge, TN 37830

Dr. Reinhard Odoj
Forschungsanlage Julich GmbH
Postfach 1913
D-5170 Julich, Germany

Raj Pai
Bechtel National, Inc.
P. O. Box 350
Oak Ridge, TN 37831

Joseph A. Palausky
Engineering-Science, Inc.
710 South Illinois, #F-103
Oak Ridge, TN 37830

G. Joseph Pardue, Jr.
Martin Marietta Energy Systems
P. O. Box 2003
Oak Ridge, TN 37831-7169

Randy A. Parker
US EPA

Frank Parlier
Kewaunee Scientific Corporation
2700 West Front Street
Statesville, NC 28677-2072

Douglas K. Pennington
TRW, Inc.
One Space Park, R2/1133
Redondo Beach, CA 90276

C. W. (Cal) Pepper
Martin Marietta Energy Systems
P. O. Box 2003
Oak Ridge, TN 37831

Charles R. Porter
Haz Rad Lab, Inc.
3619 Wiley Road
Montgomery, AL 36106-3229

Jim M. Raines
Tennessee Valley Authority
400 West Summit Hill Drive (100 PSB)
Knoxville, TN 37902

Gregory D. Reed
University of Tennessee

J. C. (Jay) Reynolds
EG&G Idaho
P. O. Box 1625
Idaho Falls, ID 83415

Nawlene Reynolds
EG&G Idaho, Inc.
P. O. Box 1625
Idaho Falls, ID 83415-3960

Teri L. Richardson
US EPA

Susan R. Rizk
SAIC
P. O. Box 2501
Oak Ridge, TN 37831

Arsene Saas
CEA-BECC
CE Cadarache
13108 St. Paul Lez Durance, France

David G. Salladay
Tennessee Valley Authority
NFE 2M
Muscle Shoals, AL 35660-1010

John San Severino
Center for Bioremediation
University of Tennessee
Knoxville, TN

Chuck W. Scott
Oak Ridge Institute for Science & Education
P. O. Box 117
Oak Ridge, TN 37831

Robert J. Selfridge
Automated Sciences Group, Inc.
Oliver Springs, TN

James W. (Jock) Sharp
EODT Services

Gerald D. Shaver
Los Alamos National Laboratory
P. O. Box 1663, MS C307
Los Alamos, NM 87545

Bruce Sinclair
CMS International
4904 Eisenhower Blvd., #310
Tampa, FL 33634

Mark A. Slayton
Allied Signal Aerospace
P. O. Box 219159
Kansas City, MO 64141-6159

Patti Snorek
Battelle Pacific Northwest Laboratory
P. O. Box 999, K1-14
Richland, WA 99352

Jerry A. Stansberry
US Dept. of Energy
Rocky Flats
P. O. Box 928
Golden, CO 80402

Rod Strand
Martin Marietta/HAZWRAP
831 Tri-County Blvd.
Oliver Springs, TN 37840

Lee Strickland
Chemrad Tennessee Corporation
1055 Commerce Park Drive
Oak Ridge, TN 37830

Scott Stubblebine
SAIC
P. O. Box 2501
Oak Ridge, TN 37831

Martin H. Stutz
US Army Environmental Center
Attn: ENAEC-TS-C, Bldg. 84435
Aberdeen Proving Ground, MD 21010-5401

Leslie R. Tate
Tennessee Valley Authority
NFE2M
Muscle Shoals, AL 35660

Dianne S. Therry
Roy F. Weston, Inc.
208 Welsh Pool Road
Lionville, PA 19341

Catherine M. Thompson-Dymmer
Lockheed-Technologies Application Division
900 Grier Drive
Las Vegas, NV 89119

Thomas C. Trible
General Engineering Laboratories
2040 Savage Road
Charleston, SC 29417

Alvin W. (Al) Trivelpiece
Martin Marietta Energy Systems
Oak Ridge, TN 37830

Allen Vaughn
Nuclear Fuel Services, Inc.

James F. Villaume
PA Power & Light Co.
Two North Ninth Street
Allentown, PA 18101

Gary E. Voelker
US Dept. of Energy
Environmental Restoration & Waste Management
Washington, DC 20585

Janet Wagner
Martin Marietta Energy Systems
Oak Ridge National Lab
P. O. Box 2008
Oak Ridge, TN 37831-6142

Jeff Walker
US Dept. of Energy
19901 Gaithersburg Road
Gaithersburg, MD 20874

Tom D. Wantland
Oak Ridge Institute for Science & Education
P. O. Box 117
Oak Ridge, TN 37831

John Warren
US EPA
401 M Street
Washington, DC 20460

Ernie Webb
US Dept. of Energy
Savannah River Field Office
Aiken, SC 29802

Gerald E. Wigginton
Tennessee Valley Authority
MPB-1E
Muscle Shoals, AL 35630

Llewellyn R. Williams
US EPA
944 East Harmon
Las Vegas, NV 89119

David Wilson
SC Dept. of Health & Control

Robert M. Winn
SAIC
P. O. Box 99
West Paducah, KY 42086

Dean W. Wolfe
Bechtel Environmental
31 Hampton Court
Alameda, CA 94501

Martha Woody
Martin Marietta Energy Systems
P. O. Box 2009
Oak Ridge, TN 37830-7596

Jeffrey C. Worthington
TechLaw
12600 West Colfax Avenue
Lakewood, CO 80215

A. Thomas Young
Martin Marietta Energy Corp.
P. O. Box 2003
Oak Ridge, TN 37831

Gillen Young
DataTech Associates, Inc.
Wilmington, DE 19899

Michele Young
DataTech Associates, Inc.
Wilmington, DE 19899

SESSION O

ROLE OF U. S. NUCLEAR REGULATORY COMMISSION'S ON-SITE REPRESENTATIVES IN THE HIGH-LEVEL RADIOACTIVE WASTE MANAGEMENT PROGRAM PRE-LICENSING ACTIVITIES

Philip S. Justus
Sr. On-Site Licensing Representative
U. S. Nuclear Regulatory Commission
Las Vegas, Nevada

Under the Nuclear Waste Policy Act, the U. S. Department of Energy (DOE) and the U. S. Nuclear Regulatory Commission (NRC) are required to consult with each other prior to DOE's submittal of a license application to the nation's first high-level radioactive waste (HLW) repository (Nuclear Waste Policy Act, 1982). DOE and NRC entered into an agreement which, in part, enabled NRC on-site representatives (ORs) to be stationed at a HLW candidate site "principally to serve as a point of prompt informational exchange and consultation and to preliminarily identify concerns about such investigations relating to potential licensing issues."

OR direct observation of site characterization activities including construction of an underground studies facility provides NRC staff opportunities to help ensure that DOE will develop data which are appropriate to determine if the site will safely isolate waste and which will be defensible in a License Application (LA). The ORs, through supervision and input from the division of High-Level Waste Management, may consult with the DOE site project office and its contractor staff on items pertaining to management and program controls necessary to satisfy NRC licensing needs, such as demonstrated application of procedural controls and technical data that will support an LA. This presentation will provide examples of OR/DOE interactions through consultations with project staff, quality assurance (QA) workshops, observations of reviews of computer software and the Q-list, responses to audit and surveillance observations and day-to-day contact with DOE site management, QA staff, and technical investigators.

Contributor: John Gilray

ENCLOSURE 9c

Role of U.S. Nuclear Regulatory Commission's On-Site Representatives in the High-Level Radioactive Waste Management Program Pre-Licensing Activities

Philip S. Justus and John Gilray
Sr. On-Site Licensing Representatives
U.S. Nuclear Regulatory Commission
301 E. Stewart Ave. #203
Las Vegas, Nevada 89101
Phone: 702-388-6125

ASQC/4/21/93/1

Authority

- **Nuclear Waste Policy Act Of 1982**
  - Requires Pre-Licensing Consultation Between DOE and NRC
- **DOE/NRC Interagency Agreement of 1984, Under Revision**
  - Enables On-Site Reps To Be Stationed at a HLW Candidate Site

Mission

"Principally To Serve As a Point of Prompt Informational Exchange and Consultation and to Preliminarily Identify Concerns About Such Investigations Relating to Potential Licencing Issues"

Communicate
Consult
ID Concerns

Communication

- **A Principle Role Is To Facilitate Two-Way Communication of Such Things As**
  - Data
  - Plans
  - Schedules
  - Documents
  - Status of Activities
  - Pending Actions and Resolution

- **Focus On**
  - QA
  - Underground Studies
  - Surface-Based Testing
  - Design Controls
  - Data Management Systems
  - Performance Assessment
  - Environmental Studies

Consultation

- **A Principal Role Is To Consult With DOE Scientists/Engineers/Managers, With Input From NRC Division of HLW Management , on**
  - NRC Policy and Philosophy
  - Regulatory Environment
  - Implementation of Regulations

Identify Concerns

A Principal Role Is To Identify Areas in Site Characterization and Related Studies/ Activities/Procedures That Might Be of Concern to NRC Staff

Types of On-Site Rep/DOE Interactions

- **Observe, Interact and Report**
  - Site Investigations
  - ESF Design and Construction
  - Office/Lab/Prototype Activities
  - QA Audits/Surveillances
- **Participate, Interact and Report**
  - Meetings

Types of On-Site Rep/DOE Interactions (cont.)

- **Review, Interact and Report**
  - Selected DOE Documents
- **Brief, and Be Briefed by, DOE Staff**
  - Organizational Roles and Responsibilities
  - Plans
  - Activities & Status
- **Arrange 'Appendix 7' Visits**

Examples of On-Site Rep/DOE Interactions

- **QA Workshops - Involved**
  - QA Program
  - Software
  - Grading/Q-List
- **Audits and Surveillances - Observe**
  - Evaluate Audit & Surveillance Process
  - Evaluate Effectiveness of Organizations & Programs

Examples of On-Site Rep/DOE Interactions (cont.)

- **Design Reviews - Observed**
  - 50% and 90% Design Reviews
- **Site Activities - Consult**
  - Logging
  - Geologic Mapping
  - Archiving
  - QA Practice

Support Role

- **Help Ensure That DOE Will Prepare a High-Quality License Application and That Concerns Regarding Compliance Issues Will Be Addressed**

Outline

ROLE OF U. S. NUCLEAR REGULATORY COMMISSION'S ON-SITE REPRESENTATIVES IN THE HIGH-LEVEL RADIOACTIVE WASTE MANAGEMENT PROGRAM PRE-LICENSING ACTIVITIES

[presented to ASQC, Knoxville, TN, 4/21/93, P. S. Justus & J. Gilray]

VU-GRAPH #1 TITLE

Thank you, Dean Wolfe, Ladies and Gentlemen. Following the theme of this Conference - Ways of Managing Technology for Environmental Excellence - We would like to describe one way which DOE and NRC have agreed helps keep the National High-Level Waste Management program on track.

It's the On-Site Representative concept where NRC staff are located at each candidate High-Level Waste Repository site to serve as an immediate point-of-contact for DOE as well as for NRC Hq. staff. Currently John Gilray and I are NRC's On-Site Representatives (ORs) at the Yucca Mountain candidate site. NRC used to have ORs at Richland, WA, and Columbus, OH, when basalt and salt sites were under investigation.

VU-GRAPH #2 AUTHORITY

It's unusual for regulators to consult with potential applicants prior to License Application submittal. In this first of a kind program, Congress, in 1982 NWPA, said - "just do it".

Reason - Congress didn't want the License Application review and hearing to go as long as it did for nuclear power plants, about 8 yrs. It requested NRC to complete review in 3-4 years. To ensure quick action, requested pre-licensing consultation to identify and address issues prior to License Application submittal. An Interagency Agreement (IA) effected in 1984 worked out protocols for interaction by DOE and NRC staffs and ORs.

VU-GRAPH #3 MISSION

The IA states ORs will be prompt points-of-contact for Information Exchange = COMMUNICATION, CONSULTATION AND IDENTIFICATION OF CONCERNS.

DOE agreed to provide ORs with needed access to personnel, records, facilities, activities, schedules, software, samples, data, meetings, office space near its own and required training and clearance.

VU-GRAPH #A AIR PHOTO OF YUCCA MOUNTAIN

NRC is in Nevada because Congress directed DOE to investigate the Yucca Mountain site.

10 CFR 60 requires DOE to demonstrate that the Natural System of Barriers and Engineered System of Barriers act together over 10,000 years to achieve certain performance objectives.

(Performance objective, Site characterization activities, project status can be addressed after this report, if time and interest warrants it).

VU-GRAPH #B LM300 DRILL RIG

DOE has to understand this site well enough determine site suitability and, subsequently, in appropriate, to demonstrate compliance with licensing requirements.

DOE has innovated technology for this program. For instance dry drilling technique and hydrologic monitoring of the unsaturated zone (UZ). This drill rig has drilled dry and cored dry to 1686' in UZ volcanic tuff. This allows sampling core and pore water uncontaminated by drilling fluids and to leave borehole walls free of mud.

The ORs observe this and related activities and review compliance with QA procedures on the spot, for drilling and core logging. ORs have access to drillers, scientists, engineers, QA staff, technicians on-site.

VU-GRAPH # 4 COMMUNICATION

A principal role is to FACILITATE 2-WAY COMMUNICATION - To effect technical exchange of information between DOE & NRC. ORs look to share data, plans, etc., to achieve understanding of what has been done, what changes were made and why, what's happening and what's about to happen.

This month DOE began to construct its underground ESF. At this time COMMUNICATIONS are FOCUSING ON ALL seven items listed.

VU-GRAPH #5 CONSULTATION

A principal role of ORs is to CONSULT with DOE on matters of NRC Policy, the Environment of the Regulatory Process, and ways in which regulations are implemented.

Burden of proof of compliance is on DOE.

The License Application explains compliance measures and must provide confidence that a repository will function as it is designed to function.

Work done as a basis for License Application must have been done under a NRC-approved QA program, or it won't withstand the scrutiny of a licensing hearing.

QA is fundamental to a successful Licensing Application. There has been much consultation between DOE and NRC in this area.

Example, QA Workshop - An important consultation occurred over a 2 year period beginning 1990 after DOE committed to have a fully qualified QA program. DOE agreed to hold a series of workshops with its participants (such as DOE Labs/USGS) to discuss problems in QA implementation. TOPICS:

QA requirements/Software/Grading-Q-List.

Workshops helped define how DOE and contractor QA staff and technical staff could work together.

Simply - Participant scientists had difficulty working under the umbrella of NRC's QA requirements (10 CFR 50, App. B).

At workshop DOE/YMPO agreed that "...NRC requirements are not overly restrictive and are not the cause of the concerns of the scientists... problem lies in interpretation of these requirements and procedures to implement requirements".

ORs consult as QA audit/surveillance observers.

NRC cannot audit everything. To assess DOEs QA program, staff observes selected audits. That way NRC can evaluate both the audit process and the program being audited. Since 1988 NRC staff have observed at least 58 audits and 20 surveillances. The ORs are mainly observers to the YMPO QA activites. The NRC staff has been an influence of change with regard to QA.

(NRC has the privilege of conducting its own audits of DOE participants. One of two examples: Audited USGS after a self-imposed STOP WORK ORDER (SWO) - when USGS felt ready; SWO was lifted).

VU-GRAPH #6 ID CONCERNS

A principal role is to identify as early as possible areas of staff concern. A related role is to give timely, unbiased feedback of DOE's work to NRC HQ staff.

ORs and NRC have identified QA concerns such as: 1) CORE PROCESSING and 2) SCIENTIST'S DIFFICULTIES IN WORKING UNDER APPENDIX B to PART 50. Concerns dissippated: Solutions - 1) DOE developed acceptable QA procedures; constructed first class Sample Management Facility; hired, maintains trained staff. 2) Implemented SCIENTIFIC NOTEBOOK system giving flexibility to conduct hard-to-plan work, yet be able to retrace investigations and confirm results - or repeat with another investigator and get similar results.

VU-GRAPH #7 TYPES OF INTERACTIONS

This list indicates what ORs actually do to COMMUNICATE - CONSULT - IDENTIFY CONCERNS

OBSERVE SITE INVESTIGATIONS - AND REPORT
Ex. Trench closure

OBSERVE ESF DESIGN-CONSTRUCTION - AND REPORT
Ex. Portal geologic features before shotcreted

PARTICIPATE IN MEETINGS - and REPORT

Ex. ESF CONSTRUCTION PLANNING - get heads-up JOB PACKAGE/TPP/ WORK BREAKDOWN STRUCTURE/STATUS

VU-GRAPH #8 - TYPES Cont'd

REVIEW DOCUMENTS AND REPORT - before NRC staff gets item.
Ex. Extreme Erosion Report/Plans/Maps

BRIEF DOE -
Ex. How NRC operates/OR roles

GET BRIEFED AND REPORT -
- Plugging/Sealing Bore Hole
- Archiving
- Tracer injection into drill stem
- Rock unit ID - criteria inconsistently applied

ARRANGE NRC Staff/Commission/ACNW/CNWRA VISITS TO SITE

VU-GRAPHS #9, #10 EXAMPLES

Not presented on screen. Worked points into previous discussion.

VU-GRAPH #11 SUMMARY ROLE

ORS are in position to speed up 2-WAY COMMUNICATION and to CONSULT with DOE - day-to-day, face-to-face to help keep DOE on the regulatory trail.

Both NRC and DOE consider that the ORs help the National Program to Safely Dispose of High-Level Waste get the job done a little sooner and get done a little better than if the On-Site representatives weren't on-site.

Thank you for your attention.