



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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M E M O R A N D U M

DATE: December 31, 1992

FOR: Joseph Holonich
Repository Licensing and Quality Assurance Project
Directorate (HLPD)

FROM: Philip S. Justice, Sr. On-Site Licensing Representative,
HLPD *Philip S. Justice*

SUBJECT: YUCCA MOUNTAIN PROJECT OLR REPORT FOR NOVEMBER 1992

INTRODUCTION

During the third month as On-Site Licensing Representative (OLR), I participated in four meetings held in Nevada, visited the Yucca Mountain site six times and briefed DOE's Field Operations Center staff, among other things. This report summarizes those activities that I consider particularly relevant to staff work.

A principal purpose of these OLR 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 pre-licensing 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 OLR's reports will be on DOE's programs for ESF, surface-based testing, performance assessment, data management systems and environmental studies (at this time, mainly water resources).

EXPLORATORY STUDIES FACILITY (ESF)

1) ESF TUNNEL DESIGN AND CONSTRUCTION. I attended the Nuclear Waste Technical Review Board's Structural Geology and Geoengineering Panel Workshop on ESF Design and Construction Strategy in Las Vegas on 11/4/92. This meeting was transcribed

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and was attended by seven NRC staff, three of whom reported directly to DHLWM and one to RES upon their return to HQ. Therefore, I will not dwell on the technical information exchanged at the meeting (Enclosure 1, the agenda, indicates the scope of the presentations).

DOE introduced its plans for ESF design and construction. DOE plans to be underground by the end of FY93. It intends to drive a 'starter tunnel' about 200' into Exile Hill from the site of the North Portal (Enclosure 2A, ESF site map) using the drill and blast method. The end of this 'tunnel', about 28' diameter (Enclosure 2B, Starter Tunnel Profile), will be the launch spot for a tunnel-boring machine (TBM) that will complete the 26100' U-shaped tunnel at the proposed level of the repository (Enclosure 2C, ESF layout).

Discussions transpired concerning: the merits of a small-diameter tunnel (approximately 18') vs. large diameter tunnel (approximately 25-30'); the merits of delaying tunneling until surface-based testing is further along; tunneling into the Calico Hills level simultaneously with, or later than, the repository level excavation; and other matters.

Dr. L. Hayes, USGS, reminded the TRB that the ESF concept does not include all investigations necessary for a site suitability determination, for example, tectonics (also, volcanism, regional hydrology).

Responsibility for Title II design was transferred from Raytheon Services Nevada to CRWMS M&O effective 10/92. This office has on file selected handouts from the TRB Workshop. I will report regularly on the status of ESF activities, possibly including videos of them. However, YMPO will produce videos of ESF progress monthly; I will seek to obtain a copy for staff and CNWRA edification.

2) SCHEDULE FOR ESF CONSTRUCTION AND TESTING. DOE intends to begin construction of the pad for North Portal operations on 11/30/92 and to begin drill and blast phase on 4/2/92. The goal is to establish the launch tunnel for the TBM drive by the end of FY93 (Enclosure 3A, ESF Schedule). The schedule and sequencing of specific tests is not as clear. The excavation of the main test level is due to be completed 2/1/96; tunnelling schedules assume a TBM rate of 50fpm; ESF in situ test phase is due to start 6/3/96 (Enclosure 3B, ESF Major Milestones). While a test alcove is planned for the first 200' (Enclosure 3C, ESF North Portal Plan View), the test plan to use it is not yet available. I have requested the ESF test schedule and sequencing plan in light of the staff concerns in these areas expressed in the SCA (NUREG-1347).

3) BUSTED BUTTE UNDERGROUND TEST FACILITY. At the 11/4/92 TRB Workshop, DOE discussed the concept of a prototype underground test facility at Busted Butte, east side of Yucca Mountain. Some benefits and design details were mentioned. However, such a facility was not budgeted for FY93. It will remain a potential future option. The handout on this subject is on file in the OLR office.

SURFACE-BASED TESTING (SBT) PROGRAM

1) HYDROGENIC VEIN DEPOSITS & SZYMANSKI HYPOTHESIS. I attended a three-part public lecture in Las Vegas on 11/10 sponsored by the Southern Nevada Chapter of the Association of Engineering Geologists on "Evidence for Upwelling of Hydrothermal Fluids at Yucca Mountain." The speakers were G. Frazier, D. Livingston and M. Somerville of TRAC-Technology and Resource Assessment Corp. The speakers offered support of J. Szymanski's concepts by way of a critique of the National Academy of Sciences/National Research Council's panel report on hydrotectonic conditions at Yucca Mountain. The enclosed copy of the lecture-handout is useful for its succinct list of specific mineralogic, geochemical, hydrological, radiochronometric and geologic issues that the staff may want to consider when DOE (USGS lead) submits its summary of the hydrogenic vein issues, scheduled for FY93 (Enclosure 4; this was transmitted to you the week of 11/16). This office has on file two TRAC reports: Somerville and others, April 92, "Yucca Mountain Hydrothermal History", 14pp.; Somerville and others, August 92, "Critical Review of the National Research Council Report: Groundwater at Yucca Mountain: How High Can It Rise?," 52pp.

2) OBSERVATIONS OF MIDWAY VALLEY TRENCH T7 & T5A. In accordance with DOE/NRC Site Specific Agreement, this office was notified of the impending closure of trenches, T7 and T5 (C. Gertz to P. Justus letter dated October 12, 1992). NRC HQ was notified and elected not to send a HQ staff observer. On 11/19/92 I was briefed on site by M. Angell and B. Swan, Geomatrix subcontractors to USGS, and T. Sullivan, DOE, on their mapping and preliminary interpretation of Tertiary volcanic bedrock fractures and faults and fractures in the Quaternary sediments. I reported my observations to C. Abrams, K. McConnell and you. The following summarizes my observations.

TRENCH T7. This trench was expanded from a soil test pit that had exposed fractures in the Quaternary sediments that were along strike of some NNE (N10-20E) fractures in T5A. The T7 Quaternary fractures were traced to in situ bedrock faults. Thus, the fractures were considered by Geomatrix to be tectonic. Therefore, by analogy, the fractures in T5A, along strike, were deemed by it to be tectonic and the bedrock "step" in T5A was considered to be tectonic (formerly considered to be non-tectonic). As in T5A, these fractures had little or no perceptible vertical separation. Also, the mappers considered the horizontal separation to be nil

or small, less than a few cms, based upon their ability to resolve stratigraphic markers.

Bedrock contained numerous fractures and faults, some with brecciated zones and gouge. Bearings were NNE, NW (similar to the N18W trend mapped by Bureau of Reclamation on slopes above T7), and approximately E-W. Right- and left-lateral shear components were observed. Some shallow- to moderate-dipping calc-silica veins were slickensided, oblique. The age of last movement of the Quaternary fractures, post Q3 - pre Q4, was estimated by B. Swan to be about 100K years +/- 20K yrs. The highly faulted and fractured bedrock walls and ledge exposed in T7 I would describe as "shattered." It is possible that E-W-trending faults or fractures cut the Quaternary, but few trenches were oriented to detect this trend.

I observed workers exposing a bedrock fault continuous from one side of the trench across the floor to the other side. The fault continued as a fracture into the Quaternary sediments on both walls (the fractures are on strike with the T5A, NNE trending fractures). The staff should consider DOE's evaluation of the fault (i.e., Type 1 or Type 2) as soon as it becomes available given that it has an apparent Quaternary age and is located within the footprint of the North Portal pad under or proximal to surface facilities important to safety. I have requested the opportunity to observe trench photos, draft trench logs and report as soon as practicable in accordance with the Site-specific Agreement.

TRENCH T5A. On 11/19/92 M. Angell guided me along a newly exposed bedrock pavement that he mapped in a narrow band from the T5A bedrock "step" westward for a few tens of meters. He mapped small-offset faults of various orientations. He and others had recently concluded that the bedrock "step" (observed by NRC staff and others in the field on 9/18/92 and 10/19/92) was a fault, not a buried erosional scarp. This 1200' trench was due to be backfilled in a few days, except for the easternmost 200' which overlies the buried Midway Valley Fault. Staff should consider closely coordinating its reviews of DOE's reports on T5A and T7 neotectonics because of apparent structural similarities of faults and fractures in those trenches and their proximity to each other.

3) GEOPHYSICS INTEGRATION PHASE 2. Several sophisticated geophysical investigations are planned for FY93, among others: SEISMIC REFLECTION PROFILES - to be contracted after 2/1/93; about five lines, at least one to be tied to boreholes at UZ16, C-holes and G-5; lines are shown on EG&G Map 92-151.2, 1:24000. Gravity and magnetic surveys will be done along some lines by USGS. Seismic energy sources from both Mini-SOSIE and up-to-400lb charges are under consideration. Lines will likely cover parts of Crater Flat, Yucca Mt and 40-Mile Wash. VERTICAL SEISMIC PROFILING - this borehole technique will be used in UZ16, due to start in spring 1993. (For background on Phase 2 see my report for Sept-Oct 1992, Enclosure 6- from DOE's briefing package on FY93 planned work).

4) REGIONAL TECTONICS. I attended a public lecture in Las Vegas sponsored by the Geological Society of Southern Nevada on 11/19. Dr. Ernie Anderson, USGS, summarized a concept of regional tectonics of the southern Basin and Range that he has been developing over the last decade or so. He considers that the southern part of NTS has a deformational signature of strain different from the region south of the Lake Mead shear zone in Arizona. His concepts are, by his own admission, contrary to B. Wernicke's (Wernicke has developed tectonic models of the region that include Yucca Mt.; these models, among others, are being considered by DOE; also, Wernicke is a consultant to the CNWRA). This is a heads up that Anderson is developing apparently relevant alternative tectonic models of the site region that may be factored into DOE's reports on regional tectonics. The staff would likely want to consider Anderson's models when he publishes them, if it's timely to do so.

5) VOLCANISM. I attended a field review of selected sites of investigation of Lathrop Wells Volcano for USGS scientists led by Dr. Bruce Crowe, LASL, on 11/23/92. HQ and CNWRA staff were unavailable to observe the review. I am transmitting technical information presented by Dr. Crowe because some of it appears to be newly derived, and therefore, should be of interest to HQ and CNWRA staff experts who are preparing to evaluate the volcanism technical data report due out in FY93. Dr. Crowe pointed out evidence for three chronostratigraphic sequences, from oldest to youngest: III - lava flows of Hawaiite composition; dated by Uranium/Thorium (U/Th) isotope ratios to be about 120-140K yrs and by Potassium/Argon isotope ratios to be in the range of 70-150K yrs; II - main cinder cone and subsidiary cone mounds; dated by rock varnish method at about 28K yrs and by Helium method to be a minimum of 25 to 45K yrs. Sequences II and III are separated by an unconformity estimated to be about a few 10s of thousands of yrs. Evidence of the unconformity is geomorphic - erosion surface morphology - but no soils are preserved. I - tephra found at only one exposure; dated by U/Th at about 10K yrs; tephra contains soil horizons, therefore, must be a few thousand yrs old; tephra appears phreatomagmatic. The source is not likely to be the main cone because the geochemistry does not match; but the source has not been identified. The existence of such sequences would support the concept of polycyclic volcanism. If the staff chose to evaluate the issue of monogenetic (essentially one episode of volcanism at one place) vs. polycyclic (episodic volcanism at one place) volcanism, it would likely need to review the basis for the proposed chronostratigraphy.

Field trip handouts are enclosed. Enclosure 5A shows the distribution of basalts in the 8.5-10 M yr age bracket. Enclosure 5B shows basalts in the under 9 M yr age bracket, including Lathrop Wells (LW) shown as .07 M yrs old. Enclosure 5C shows a map of Lathrop Wells volcanic units (to be revised). Note in Enclosure 5B that the Crater Flat Volcanic Zone (CFVZ) is anchored by TM =

Thirsty Mesa and AV = Amargosa Valley (derived from well-cuttings from a wildcat oil well). Also note that the BB = Buckboard Mesa (2.8 M yrs) is of similar age as the CFVZ group, but is omitted from the group by geography alone. It appears that uncertainties remain in the grouping of similar age volcanoes such as those pointed out in the SCA and State of Nevada's review of the SCP and will likely be presented to the staff for its reconsideration.

However, Dr. Crowe indicated that because the measured ages of volcanism are equivocal, he will use both monogenetic and polycyclic models for risk calculations.

Dr. Crowe was impressed with the virtually bomb-free cinder of Lathrop Wells cone and the dearth of lava emanating from the main cone and satellite cones. He tentatively attributed this observation to a large gas-to-magma ratio. He suggested that this is characteristic of Strombolian-type eruptions known elsewhere. He further indicated that the plumbing system of such volcanoes may be definable, but has not been defined for the Yucca Mountain area volcanoes.

6) REECO HOLIDAY SHUTDOWN ANNOUNCED. On 11/10, W. Wilson, Manager of the Field Operations Center, announced the impending shutdown of the REECO field operations - drilling, trenching, site preparation and the like - for the period 12/18/92 - 1/3/93. This company apparently shuts down each year for the holiday period, though usually for one week rather than two.

7) CURRENT SBT ACTIVITIES. As of 11/24 there were drilling, trenching, securing old drillholes by grouting, pavement mapping, and various continuous monitoring activities going on (see Enclosure 6, SBT Activities Underway, sent to C. Abrams).

QUALITY AFFECTING PROCEDURES

1) DRILLING AND LOGGING. On 11/6 J. Gilray, W. Boyle and I observed implementation of drilling procedures at N58 (run DC-7) and core handling procedures at UZ16.

2) ARCHIVING. On 11/5 Commissioner de Planque inquired about YMPO's archiving policy and practices. P. Prestholt, J. Gilray and I checked into this (see Gilray/Prestholt memo to Holonich 12/8).

STUDY PLANS

1) YMPO's CONCERNS. While YMPO is aware that it can implement its study plans with or without NRC staff approval of the plans, it prefers to have NRC approval. YMPO has identified three study plans that are on critical path for its ESF start on 4/2/93. Two will be sent to the staff for review and approval the first week

in January, 8.3.1.2.2.4 - Characterization of Unsaturated Zone and Perched Water and 8.3.1.4.2.2 - Characterization of Structural Features in the Site Area, Rev.2 (esp. Activity 4). YMPO will provide the staff with the full 90 days the staff estimated would be needed to complete a review. Plan 8.3.1.2.2.2 - Chlorine 36, will be sent to the staff about 2/1/93 and DOE will request a 90 day, or less, review. This is a heads up.

INTERNATIONAL PROGRAMS

1) HANDOUT AVAILABLE. This office has a briefing package on file of DOE's International HLW activities and lessons learned, contrary to what I stated in my previous report.

GENERAL

1) BRIEF DOE'S FIELD OPERATIONS CENTER (FOC) STAFF. I presented information on and examples of NRC's role in the national program for the disposal of HLW and briefly discussed the role of the OLRs to the staff and managers of DOE's Field Operations Center on the NTS on 11/12. The OLR's role is specified in the Site-specific Agreement: "Principally to serve as a point of prompt informational exchange and consultation and to preliminarily identify concerns about and investigations relating to potential licensing issues." A copy of the briefing materials used is Enclosure 7.

2) OBSERVE A DOE SEMI-ANNUAL PUBLIC BRIEFING. On 11/12 I observed DOE's semi-annual public update of the Yucca Mountain project held at the University of Nevada - Reno. Similar meetings were held this week in Las Vegas and Amargosa Valley (see the Newspaper clippings for week of 11/9 for general descriptions of the Nevada meetings). Such meetings provide interested citizens the opportunity, among other things, to meet with YMPO scientists and engineers to become informed about the status of the project and to hear discussion of topics of current interest from DOE personnel who are directly involved. I attended to further my understanding of YMPO's activities, in this case the Outreach Program, and to determine how significant a source of information this forum might be. (It is unlikely that these meetings will be a first-time or primary source of information. However, depending upon the depth of knowledge of attending YMPO staff, useful historical summaries of issues with the latest developments on the subject are provided when asked. A shortcoming of these meetings for NRC observers is the eclectic nature of the agenda, its hit-or-miss regarding radiological safety and significant licensing issues). I will elaborate on the public briefing procedure below. However, future reports on these briefings will reflect only the substantive issues raised.

Prior to the meeting, citizens may question DOE technical staff who attend for the apparent purpose of telling people what, when,

where, why and how they do their respective investigations and analyses, and what the latest results are. Most of the staff volunteer for these assignments. The staff stand by exhibit booths in their subject areas. These displays focus attention on particular issues or topics, such as the Carbon 14 risk controversy, volcanism, earthquakes and rock toppling, waste package, archeological preservation, ESF with 3D model. There are handouts for each exhibit (I sent these to you; for example, replica of Commissioner Curtiss' briefing book provided by YMPO, sent in mid-December; rock sample of the Topopah Springs Formation, sent you mid-November). Also, several private citizens organizations participated with exhibits explaining their viewpoints.

The formal part of the public meeting consisted of DOE and contractor staff (YMPO Deputy Director, technical managers, technical staff experts) answering questions from the audience. Questions and comments were solicited in writing at the door and sorted by a professional moderator. The moderator controlled the meeting, strictly enforcing time limits, keeping questioners and responders focused on the point, and assuring that all who had questions and comments had a chance to express themselves. Max Blanchard was the 'technical director,' handling many of the questions himself, or directing them to the attending expert. Both the moderator and Dr. Blanchard were scrupulous in trying to assure that each questioner or commenter was satisfied.

Selected topics raised by the audience (generally hostile) that night included: individual vs. population dose, Ruby Valley Treaty with Western Shoshone Nation, contingency if site fails, cost of site characterization, nature of damage of the 6/29 earthquake, economic benefits to NV or the YMP, State not communicating with DOE to negotiate benefits, effect of New Mexico land value case, changing radiological health standards, effect of new Democratic administration on the YMP, safety of nuclear power, cancer deaths if all waste was stored at reactors for next 100 yrs, sufficiency of time to characterize the hydrologic system.

DOE and contractor staff addressed each question and comment in a professional (objective, factual, dignified) manner, even when subjected to "heat" from a hostile public. I found the DOE experts to be candid, objective (present various sides of an issue) and factual (at least in the areas I was familiar with), and, on occasion, humorous. I learned about a few things I had not considered before (for example, the Ruby Valley Treaty) and got a sense of some areas of public concern (albeit on a limited, if not biased, sample).

Topics of interest to NRC staff were discussed (see above), in my opinion, the staff is already well informed about them.

Nevertheless, I will attend as many of these briefings as practicable and report on substantive matters that arise.

3) OBSERVE A DOE PUBLIC TOUR OF YUCCA MOUNTAIN AND FACILITIES. I attended a public tour of the Yucca Mountain Project site and facilities with my wife and about 250 citizens on 11/18. My purposes were to (1) experience for myself this part of YMPO's Outreach Program that Mr Gertz reports tends to soften public opposition to continuation of site characterization activities, and (2) observe the nature of the technical descriptions of the various trip stops. I won't need to take this tour again. The stops will likely remain the same, perhaps with the addition of the ESF in the near future. The information provided at each stop will probably continue to be relevant and factual (provided that the experts in the subjects specific to a stop - the scientists and engineers who actually conduct the investigations - lecture on their respective subjects. The degree to which various sides of any issue will be discussed on the bus between stops appears to depend on the background and experience of the trip leader and his/her assistant(s). The three DOE/DOE Contractor personnel on my bus had decades of NTS and YMPO experience among them. They were knowledgeable of most topics participants asked about, and they were enthusiastic about sharing their knowledge.

The trip stops and topics discussed included: Yucca Mountain Information Office - general exhibits; Sample Management Facility (SMF) - core displays, coring procedures, sample management; Hydrologic Research Facility (HRF) - infiltration studies, meteorology; Yucca Crest - neotectonics, volcanism, hydrology, future gold exploration, attributes of the site; LM300 - pioneering effort to obtain uncontaminated samples, high cost of innovation; J-13 area of environmental restoration experiments - State and NEPA requirements, endangered species preservation.

I now better understand citizens' usually positive reaction to the need to continue YMP studies after participating on this tour. In my opinion, the attendees were generally impressed with the desolation of YM and with the apparent objectivity of the SMF/HRF scientists and engineers. Also, they seemed generally impressed by the dedication of the scientists and engineers toward understanding how the site works. Further, they seemed generally impressed that the experts they queried apparently did not know whether or not the site would be found suitable. The personal experience of 'being there' and hearing the actual investigators explain why they need to continue to gather data seemed to dispel, or at least 'soften,' some preconceived ideas held by the attendees.

I thought there was too little discussion of radiation risk prevention and of the regulatory process, including the concept of specific requirements such as the quantitative performance objectives. I passed this opinion along in writing in the post-

tour questionnaire. Nevertheless, the tour appeared to be a reasonable, albeit expensive, way to inform the interested public about the national program for HLW disposal, YMP in particular. There does not seem to be a substitute for first-hand observation of the site and of the people working on it to provide direct evidence of the scale and scope of activities and credibility of the project scientists and engineers.

4) SUMMARY OF YUCCA MOUNTAIN PROJECT OFFICE (YMPO) DIRECTOR'S ANNUAL 'STATE OF THE PROJECT' SPEECH TO YMPO STAFF. At an annual meeting of the YMPO staff, the Director summarizes the previous year's accomplishments and lays out the current year's plans. I attended C. Gertz's annual 'State of the Project' meeting on 11/20. What follows is a summary of his presentation. He set forth three purposes for the meeting. The staff should: (1) be knowledgeable about the entire operation to do your job well, (2) be knowledgeable about the entire operation to explain the basic elements to others, i.e., support the Outreach Program, (3) know the Director's priorities to adjust to changes when they are made. Mr. Gertz enumerated the FY92 accomplishments in WBS order, as he had done for TRB and ACNW in October (see my previous report for detailed lists; also I obtained and sent to HQ a copy of the 5 min video shown at this meeting on those accomplishments).

The principal FY93 priorities enumerated were: (1) get 200' underground at ESF, (2) continue surface-based testing with three drill rigs, (3) develop alternative conceptual designs for Waste Package and repository, (4) address closure of extreme erosion and seismic hazards issues, (5) respond to Energy Bill action items regarding NAS and EPA activities. Mr. Gertz reported that he is now responsible for (a) site suitability issues, (b) EIS, (c) License Application.

He established the following schedules for WBS 1.2.6 - ESF (these and others budgeted at \$49M):

11/92	start ESF site preparation
11/92	issue TBM RFP (delayed)
1/93	receive proposals
4/93	award contract
1/93	upgrade power supply to accommodate TBM
4/93	start TBM tunnel
7/94	reach repository level from North Portal
7/95	tunnel into Topopah Springs Formation
6/96	exit through to South Portal.

Schedule for WBS 1.2.3 - Site Characterization (these and others budgeted \$50M):

3/93	complete UZ16BH (LM300); start vertical seismic profile test
4/93	start UZ14BH (LM300)
9/93	complete NRG BHs.

This office will report frequently on the status of all planned significant activities. Also, I am following these three activities, among others, mentioned by Mr. Gertz: (1) Integrated Test Evaluation Framework Reference Book, (2) Issue Resolution Methodology, (3) Accelerated Seismic Hazard Action Plan.

5) "MISSION 2001" REPORT. In response to an inquiry about available YMPO information on long-range planning, Mr. Gertz provided this office with several copies of YMPO's "Mission 2001 Final Report". He acknowledged that a copy would be placed in the Public Document Room when received at NRC HQ.

6) YMPO RESPONSIBILITIES EXPANDED. The YMPO will be responsible for (1) site suitability evaluations, (2) EIS, NEPA activities and, now, (3) license application preparation. As we discussed, this office's highest priority activities currently are associated with YMPO areas of responsibility (1) and (3), above.

Mr. Gertz mentioned the possibility of YMPO physically moving to another location in the area at an unspecified time; an unspecified northwest Las Vegas location, closer to the site, was a possibility.

7) DOE ORDERS - EMERGENCY MANAGEMENT SYSTEM. It was pointed out to me that three DOE Orders, 5500.1B, 5500.2B and 5500.3A, provide an unspecified role for NRC in the matter of emergency management planning for an NRC-licensed facility. I have obtained copies of these orders and highlighted the parts that refer to NRC and forwarded them to you for further consideration, if needed. SAIC is preparing a report on this subject to be available in the early part of 1993. I have asked to gain cognizance of the report as soon as practicable.

8) NRC'S INDEPENDENT ROLE. At the TRB Workshop on the ESF Design and Construction Strategy, 11/4, Mr. R. Robertson, M&O, and Dr. W. North, TRB, made several statements that appeared to challenge the independent role of NRC in licensing. One of them stated to the effect that NRC is a surrogate for the public, if the public fusses then NRC would not issue a license. NRC and YMPO managers, R. Ballard and C. Gertz, respectively, responded on the matter of NRC independence with historic examples and affirmation of current practice. Given that the statutory independent role of NRC in the national HLW program should be well understood by all parties, contractors and advisory groups, as I discussed with you at the workshop, I suggest that the transcript of that dialogue be reviewed by HQ staff for consideration of possible clarification.

9) NRC OFFICE IN FIELD OPERATIONS CENTER (FOC) IS OPERATIONAL. The interior office in the FOC provided by DOE in accordance with the Site-specific Agreement is operational. It contains modular compartments similar to those in WFN. So far there are three operational telephones (phone numbers have been assigned: 702-295-5929, 5938, 5967), two chairs and one drafting table in the six-

cubicle office. Some basic office supplies were furnished by this office. We are storing NRC hardhats there. The room is locked. A key can be picked up at the front desk at the FOC and returned each day or borrowed from this office, as needed. Also, I can arrange to have reference materials, such as maps and engineering drawings of the ESF needed by visiting staff brought to the FOC office.

There are services available to facilitate work for prolonged periods, overnight or longer. For example, staff are eligible, along with any other visiting scientists or engineers, to borrow a field vehicle and radio transmitter/receiver for use in Area 25 and Yucca Mountain vicinity. Further, staff would have a choice of boarding overnight in Mercury, Beatty or Las Vegas, depending on time, budget and vehicle-use constraints. The usual badging requirements apply; however, an OLR escort is no longer necessary for staff to access the site, in general. Our 12/22 video affords a glimpse of the FOC office. FOC Manager, Mr. Win Wilson, has been very cooperative in helping to make the office functional.

10) IDENTIFY POTENTIAL SITES FOR A FUTURE COMMISSION MEETING. At the direction of Deputy Executive Director, H. Thompson, I identified candidate meeting rooms in the Las Vegas area suitable for a Commission meeting that could hold an audience of 300-500 and reported my findings to him the next day. Five possibilities developed, one was considered especially suitable and this office reported the particulars. Thus, at least one suitable location for a meeting of the specified size has been identified for future use.

11) NRC STAFF VISITORS. The following NRC staff visited the site and/or attended meetings in Las Vegas in November: J. Holonich, R. Ballard, W. Boyle, P. Prestholt, Commissioner E.G. de Planque, K. Whitfield and J. Philip. Staff visitor in September, in addition to those listed in my previous report: Rose Byrne.

Enclosures:

1. Agenda, TRB ESF Workshop, 11/4-5
- 2A. ESF site map - C. Gertz, 11/4-5
- 2B. Starter tunnel profile - " "
- 2C. ESF layout - U-shape 26,100'-E. Petrie, 11/4-5
- 3A. ESF schedule - C. Gertz, 11/4-5
- 3B. ESF major milestones - " "
- 3C. ESF north portal plan view " "
4. TRAC handout
- 5A. Volc 8.5 - 10M yrs - B. Crowe, 11/23
- 5B. Volc <9M yrs " "
- 5C. Volc - Lathrop Wells " "
6. SBT activity underway - 11/24
7. Role of NRC/OLR's - 11/12

cc: w/ encl.: C. Gertz, DOE
J. Roberts, DOE

cc: w/o encl.: C. Abrams, M/S 4H3
B. Youngblood, M/S 4H3
J. Linehan, M/S 4H3
R. Bernero, M/S 6A4
H. Thompson, M/S 17G21
H. Denton, M/S 27F2
S. Gagner, M/S 2G5
E. O'Donnell, M/S NLS 260
W. Patrick, CNWRA
R. Loux, State of NV
G. Cook, Region V
J. Martin, Region V
D. Kunihiro, Region V
S. Jones, DOE
R. Dyer, DOE
S. Schwartz, NRC
D. Faust, M&O
J. Fouchard, NRC
J. Russell, CNWRA



UNITED STATES
 NUCLEAR WASTE TECHNICAL REVIEW BOARD
 1100 Wilson Boulevard, Suite 910
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Agenda

Panel on Structural Geology & Geoengineering Workshop on the Exploratory Studies Facility (ESF) Design and Construction Strategy

Plaza-Suite Hotel
 4255 South Paradise
 Las Vegas, NV 89109
 (702) 369-4400

November 4 & 5, 1992

The Nuclear Waste Technical Review Board's (the Board) fourth and fifth reports to Congress and the Secretary of Energy discuss the need for access to the underground as a key part of the early assessment of the suitability of Yucca Mountain as a potential site for a deep geologic repository for the nation's spent nuclear fuel and defense high-level waste. The reports also recommended that strategies be developed to allow underground construction and testing to proceed with reduced budgets. In recent months, the Board has emphasized the need to minimize start-up costs of tunneling so that limited funds could be applied to starting tunneling with a single tunnel boring machine in late fiscal year (FY) 1993 or early FY 1994. The Department of Energy (DOE) has recently allocated the FY 1993 funds and developed plans to accomplish such a result. The purpose of this Board-sponsored workshop is to define and discuss the technical merits, costs, and schedules of strategies for underground construction and testing in the ESF.

This workshop is organized around four sessions that are intended to bring together construction, testing, and management perspectives. In an effort to seek broad and open participation, a major portion of each session is devoted to round-table discussions following minimum introductory presentations.

Wednesday, November 4, 1992

8:00 A.M. **Welcome**
 Clarence R. Allen
 Nuclear Waste Technical Review Board (NWTRB)

Opening Remarks
 John E. Cantlon
 Chairman, NWTRB

Overview and Intent of the Workshop
 Edward J. Cording, NWTRB

Telephone: 703-235-4473 Fax: 703-235-4495

Wednesday, November 4, 1992 - continued

Session 1 begins with an introductory presentation that will briefly review the baseline configuration, construction sequence, cost, and schedule for the ESF. This will be followed by a short presentation of the proposed FY 1993 plans for proceeding with the development of the ESF. The round-table discussion follows, with active participation by all attendees encouraged.

Baseline Configuration

William Simecka, Department of Energy (DOE)

- ESF preliminary design
- Phased approach to implementing the baseline configuration
- Baseline cost and schedule

FY 1993 Approach for Developing the ESF

Carl Gertz, Yucca Mountain Site Characterization Project Office (YMPO)

- FY 1993 Yucca Mountain Project \$244.7M budget
- Early access to the underground

Round-table Discussion

Given reduced budgets, what strategies can be defined to allow the construction of the baseline configuration, and surface and underground site-characterization programs to proceed toward the goal of early determination of site suitability and efficient ESF development?

Approaches to constructing the baseline configuration (layouts, methods, phasing, costs, and schedules) for:

- Portals, surface facilities, site preparation
- Ramps and access drifts to main test level
- Access to Calico Hills and other levels
- Excavation of side drifts and tunnel enlargements
- Constraints on construction of the ESF/proposed repository site: organics, concrete, shotcrete, grouts, water, potential for subsidence
- Nuclear weapons testing facility construction standards applied to the ESF
- Utilities (power lines, vent line, fire/water line, cable trays, etc.)
- Safety codes

Alternatives strategies for developing the ESF:

- Maximizing use of tunnel boring machines
- Size and turn radius of access tunnels
- Geometry and location of alcoves
- Excavating alcoves and turnouts

Wednesday, November 4, 1992 - continued

- Ventilation requirements
- Excavation slopes, mucking, and transportation
- Construction of separate access to the Calico Hills formation

KEY PARTICIPANTS:

Carl Gertz, YMPO

Thomas Statton, Woodward/Clyde, Management & Operations (M&O)

Thomas Blejwas, Sandia National Laboratories

Neil Dahmen, The Robbins Company

Lok Home, Boretec, Inc.

James Friant, Colorado School of Mines

Joseph Sperry, NWTRB consultant

Hugh Cronin, NWTRB consultant

S.H. Bartholomew, NWTRB consultant

11:45 A.M. LUNCH

12:45 P.M. Overview of Session 2 - Exploration and Testing

A key part of the ESF development strategy is the definition of what early exploration and testing are needed, and how the ESF can best be used to accomplish key elements of the site-suitability and site-characterization programs. The session will start with a presentation on integrated testing evaluation, followed by a presentation on the need for an alternative testing facility and its functions. Round-table discussion by all workshop participants will then explore the proposed tests to be conducted in the ESF and their relevance to the issue of early assessment of site suitability.

Integrated Testing Evaluation

Russ Dyer, DOE

- Early testing priorities

Why an Alternative Testing Facility?

William Simecka, DOE

- Thermal testing
- Excavation testing

Round-table Discussion

Testing to be conducted in the ramps, alcoves, main test level, and in Calico Hills formation

- What are we testing for?
 - Regulatory compliance?
 - Scientific confidence through exploration?
 - Scientific confidence through testing?

Wednesday, November 4, 1992 - continued

- What should be the early, high priority objectives for observation or testing in the ESF?
- What are the testing priorities and requirements for:
 - observations across faults?
 - observations across lithologic boundaries?
 - observations in ramps and drifts?
 - testing in alcoves?
 - underground drilling and testing?
 - main test level activities?
- Can the tunnel boring machine be advanced through the ESF without delays for testing?
- How can a balance between surface-based and underground testing be maintained?
 - Where does required testing in deep, dry drillholes fit in?
 - Can the ESF be used for tests that were formerly part of the surface-based program?
- What should be the timing of access to the Calico Hills?
- Should there be direct access to Calico Hills outside the geologic repository operational area?
- Should early access to Pah Canyon be considered?
- What are the constraints on construction of the ESF/proposed repository site in terms of organics, concrete, shotcrete, grouts, water, and potential for subsidence?

KEY PARTICIPANTS:

William Simecka, DOE

Russell Dyer, DOE

Uel Clanton, DOE

Lawrence Hayes, U.S. Geological Survey

Thomas Statton, Woodward/Clyde (M&O)

Scott Sinnock, TRW (M&O)

Ned Elkins, Los Alamos National Laboratory

Dale Wilder, Lawrence Livermore National Laboratory

Thomas Blejwas, Sandia National Laboratories

6:00 P.M.

RECESS

Thursday, November 5, 1992

8:00 A.M. Overview of Session 3 - Management and Acquisition Strategies

This session is directed toward a review of the process of design, construction, construction management, contract type, and possible alternative means of obtaining an early delivery of construction at minimum cost. The session opens with a short presentation explaining the current process being used at Yucca Mountain in terms of roles, responsibilities, and authority.

**The Yucca Mountain ESF Design and Construction Program -
Management and Implementation**
William Simecka, DOE

Round-table Discussion

Alternative management and acquisition strategies

- Roles, responsibilities, and authority
- Equipment and material acquisition, mark-ups
- Fixed price contracts, cost reimbursable contracts, target cost/schedule incentive fees, award fees
- Disputes review board

KEY PARTICIPANTS:

Carl Gertz, YMPO

William Simecka, DOE

James Allen, Morrison-Knudsen, M&O

Robert Pritchett, Reynolds Electrical and Engineering Co.

Dale Frasier, Reynolds Electrical and Engineering Co.

Joseph Sperry, NWTRB consultant

Hugh Cronin, NWTRB consultant

Robert M. Matyas, NWTRB consultant

S. H. Bartholomew, NWTRB consultant

11:45 A.M. LUNCH

12:45 P.M. Overview of Session 4 - The Design and Construction of ESF Alternative Scenarios and Strategies

The purpose of this session is to seek definition or direction on promising strategies for development of the ESF. Integration of construction, testing, and management strategies is emphasized in this wrap-up discussion. All workshop attendees are encouraged to take part.

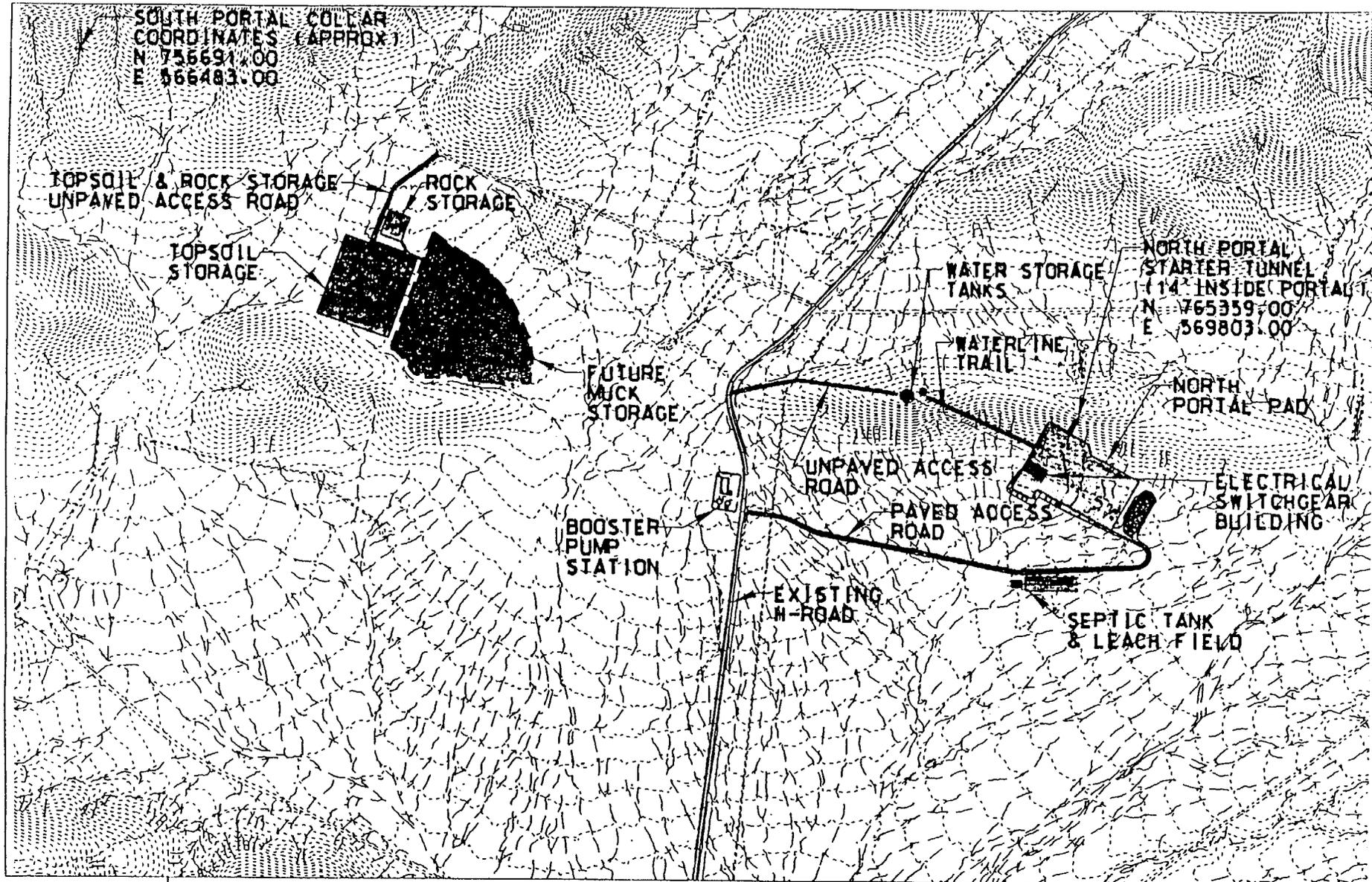
Thursday, November 5, 1992 - continued

Round-table Discussion

- Are there promising alternative strategies to developing the ESF?
- What are the implications of the testing requirements vs. constructibility, cost, and schedule?
- Can the excavation process be implemented without delay for testing?
- What is the impact of repository design evolution on the ESF design in terms of planning for changes in location and size of potential repository excavations?
- Is there a precedence for the government buying a tunnel boring machine, then asking a contractor to build a tunnel using an award fee type contract?
- What are the incentives for the contractor to perform?
- Are there alternative strategies for acquisition of underground construction?
- What are the constraints on construction of the ESF/proposed repository site in terms of organics, concrete, shotcrete, grouts, water, and potential for subsidence?

*KEY PARTICIPANTS:
All workshop attendees*

6:00 P.M. ADJOURNMENT

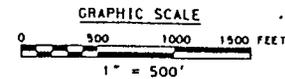


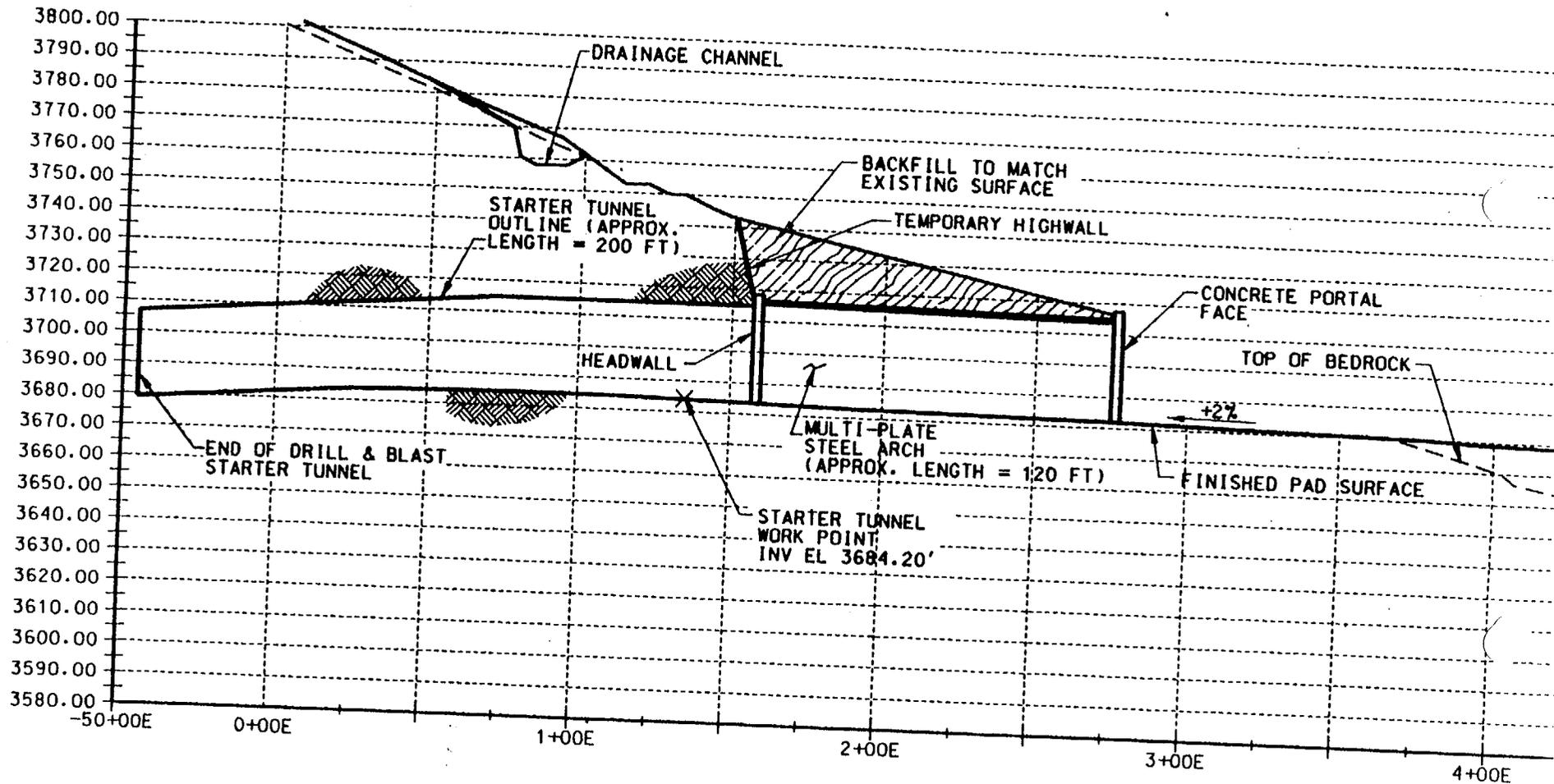
ESF PACKAGE 1A
 OVERALL SITE
PLAN
 REFERENCE

YMP-025-1-CIVL-PL111



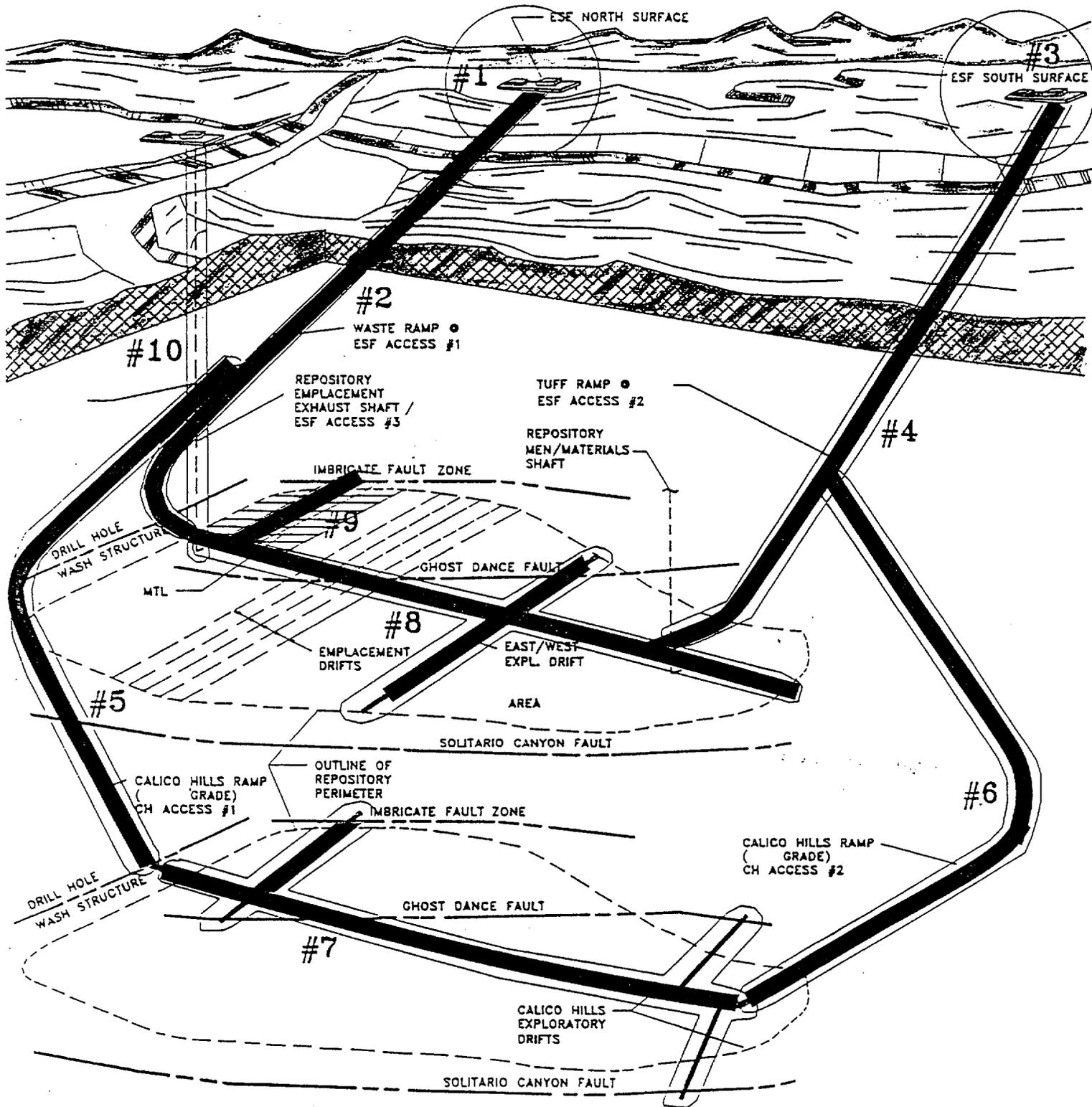
ELECTRICAL POWER LINE
 FROM CANYON SUBSTATION





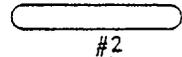
**ESF NORTH PORTAL
CROSS SECTION**

ESF LAYOUT



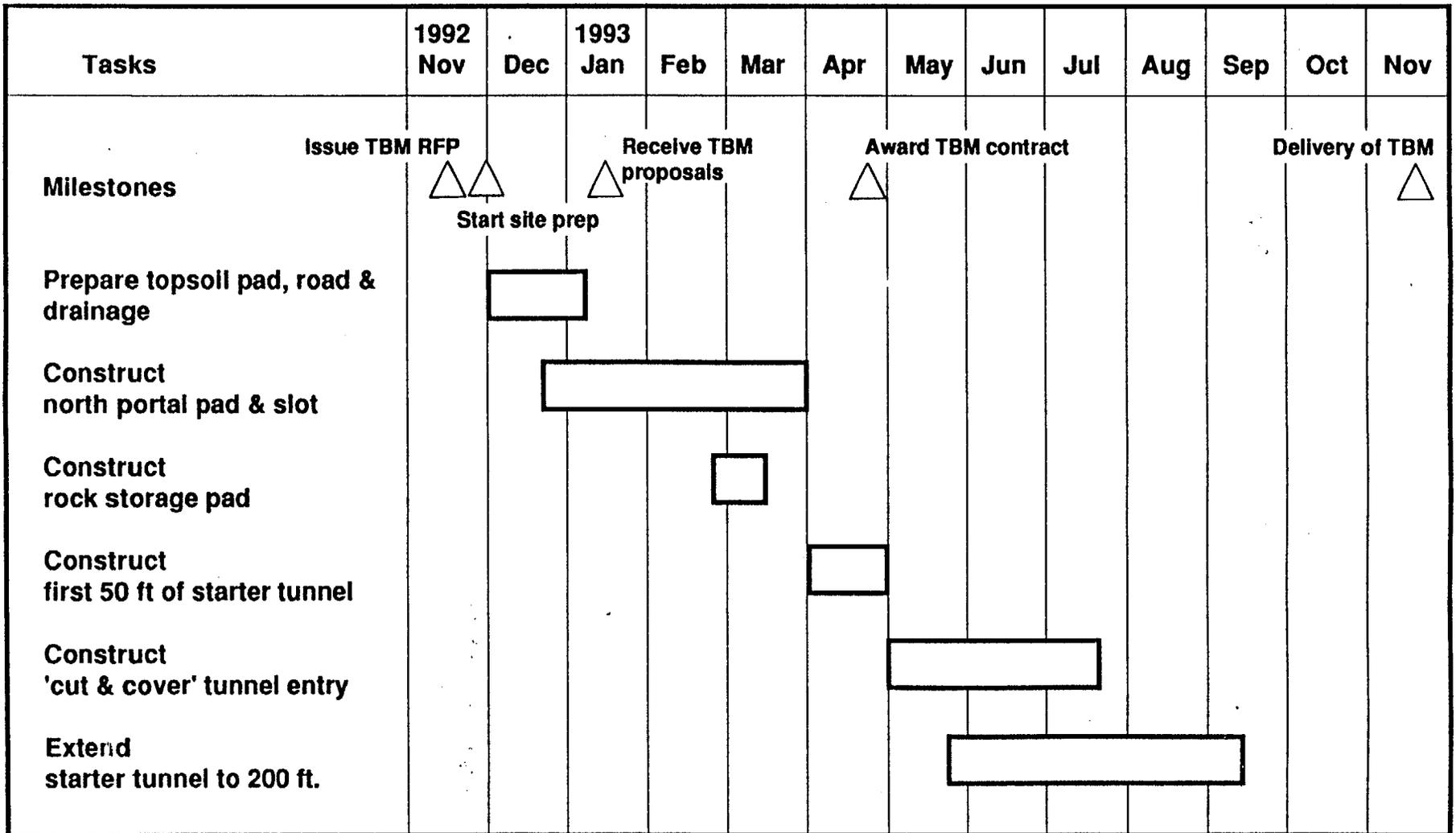
NOTE: THIS IS PICTORIAL ONLY AND NOT DRAWN TO SCALE

NOTE: DESIGN, CONSTRUCTION, AND TESTING PHASES SHOWN



#2

PRELIMINARY ESF CONSTRUCTION SUMMARY SCHEDULE



ESFCHT1.GERTZ/10-23-92

Exploratory Studies Facility (ESF) Preliminary Major Milestones

<u>ESF FY93</u>	<u>Scheduled</u>	<u>Expected/ Actual</u>
• Complete design of north portal, pad, and TBM launch chamber	9/30/92	11/23/92 (E)
• Start Title II design of north ramp	10/1/92	
• Start Title II design of selected north access surface facilities	10/1/92	
• Issue Tunnel Boring Machine (TBM) Request For Proposal (RFP)	11/16/92	

Exploratory Studies Facility (ESF) Preliminary Major Milestones

(Continued)

<u>ESF FY93</u>	<u>Scheduled</u>	<u>Expected/ Actual</u>
• Start site preparation	11/30/92	
• Start excavating TBM launch chamber	4/2/93	
• Complete TBM launch chamber	9/15/93	
• Complete design of north ramp	9/30/93	
• Complete design of selected north access surface facilities	9/30/93	

Exploratory Studies Facility (ESF) Preliminary Major Milestones

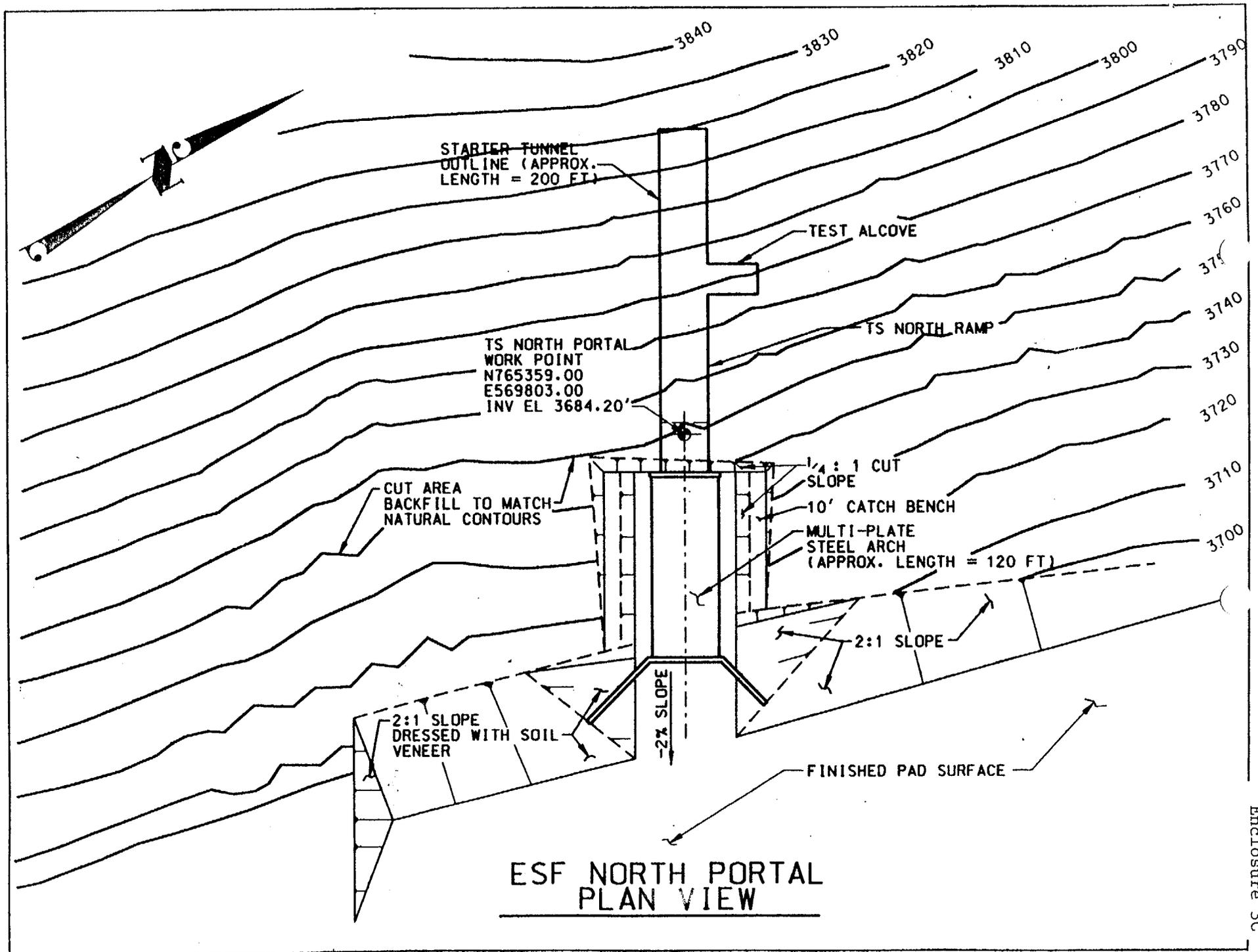
(Continued)

<u>ESF FY94</u>	<u>Scheduled</u>	<u>Expected/ Actual</u>
• Start Title II design of the Topopah Spring Level (TSL) main and cross drifts	10/1/93	
• Start Title II design of remaining north access surface facilities	10/1/93	
• Start Title II design of TSL core test area	10/1/93	
• Deliver TBM to site	12/15/93	
• Start TBM operations (north ramp)	3/15/94	

Exploratory Studies Facility (ESF) Preliminary Major Milestones

(Continued)

<u>ESF FY94</u>	<u>Scheduled</u>	<u>Expected/ Actual</u>
• Complete north ramp excavation	7/1/94	
• Complete design of the TSL main and cross drifts	7/30/94	
• Complete design of remaining north access surface facilities	9/30/94	
• Complete design of TSL core test area	9/30/94	
• Start Title II design of Calico Hills Level (CHL) north ramp	10/1/94	
• Complete design of CHL north ramp	9/30/95	



TRAC *Technology and Resource Assessment Corporation*

3800 Arapahoe Avenue, Suite 225
Boulder, Colorado 80303
(303) 443-3700 FAX No. (303) 443-8626

Comments on NAS/NRC Report on Hydrotectonic Conditions at Yucca Mountain

Presented to
Association of Engineering Geologists
Southwestern Section

November 10, 1992

Authored by:

**Dr. Gerald Frazier
Dr. Donald Livingston
Dr. Malcolm Somerville**

COMMENTS ON NAS/NRC REPORT ON HYDRO-TECTONIC CONDITIONS AT YUCCA MOUNTAIN

1. The basic approach was not valid. In conflict with geodynamic conditions at Yucca Mountain,

"... the panel discounted hydrothermal systems as a potential mechanism for raising the water table level in the Yucca Mountain area." (pg. 130)

Consequently, the Panel did not inquire about indications of hydrothermal activity or consider the possibility of hydrothermal origins for data that were cited, such as the isotope content of vein minerals.

2. Relevant data were ignored. Examples:

- radiometric ages of and shallow occurrences of zeolites and other alteration products.
- indications of high temperature fluids, e.g.: $\delta^{18}\text{O}$ gradients with depth; fluid inclusion temperatures; and mineral alteration temperatures.
- metasomatic alterations of tuffaceous rock.
- isotope similarities between local veins and known hydrothermal waters and deposits in the region.
- field evidence for paleo spring discharges at Yucca Mountain, e.g.: soil veins; thick bands of hydrogenic silica in soils; floating textures of detritus in hydrogenic minerals; calcite coatings over exposed bedrock downslope from apparent vein sources; visible alterations of adjacent rock.

COMMENTS ON NAS/NRC REPORT ON HYDRO-TECTONIC CONDITIONS AT YUCCA MOUNTAIN (continued)

3. Facts were misrepresented.

First example: The argument given for prolonged stability of the paleo water table in its presently deep configuration is based on an alleged boundary between altered and unaltered tuffs at Yucca Mountain:

"The boundary between altered and vitric tuffs indicated that water reached its highest levels and receded downward from 12.8-11.6 Ma, and that since that time the water level at central Yucca Mountain has probably not risen more than 60 m above its present position." (pg. 48)

Related facts: The alleged boundary does not exist. Glass appears >100 m below the water table and zeolites extend to the topographic surface with ages nearly uniformly distributed over past 10 million years. The Panel misrepresents distributions of alteration minerals and ignores radiometric ages.

3. Facts were misrepresented. (continued)

Second example: The only analytic data used by the Panel to support the claim that the last hydrothermal event occurred over 10 million years ago are fission track ages of zircons embedded in breccia cements. The Panel mischaracterized these results as follows:

"... within the analytical uncertainty, most of the ages are about 10-12 Ma, or about the same as those of the dominant volcanic rocks in the region."

Related facts: The referenced work stated:

"... there are zircons from multiple sources present. In both samples there are crystals significantly younger and significantly older than the age of the tuff." (Levy and Naeser, 1992)

The fission track ages display a multiply peaked distribution. The youngest is 4.8 ± 2.5 Ma for the ninety percent confidence interval. Most of the annealing ages for zircons are younger than host tuff, which is given by K/Ar dating as 13 Ma.

**COMMENTS ON NAS/NRC REPORT ON HYDRO-TECTONIC CONDITIONS AT YUCCA MOUNTAIN
(continued)**

4. Faulty logic was used.

First example: Without checking for isotope compatibilities of vein calcites with infiltrating rainwater or with known hydrothermal waters or deposits in the region, the Panel concluded on the basis of isotopes that:

*"Trench 14 and Busted Butte vein carbonates have isotopic contents within the range characteristic of soil carbonates in the region, showing the veins formed from rainwater and soil-forming processes."
(pg. 5)*

The Panel's deduction is equivalent to assuming the answer. The logical deduction from isotopic affiliations is that vein and soil calcites were precipitated from a common source of water, a deduction that is conspicuously apparent from field observations.

COMMENTS ON NAS/NRC REPORT ON HYDRO-TECTONIC CONDITIONS AT YUCCA MOUNTAIN (continued)

5. Major conclusions were unsupported by facts and in conflict with data. Example:

"The panel's overall conclusion was that none of the evidence cited as proof of ground-water upwelling in and around Yucca Mountain could be reasonably attributed to that process." (pg. 3)

Conspicuous indications of upwelling water were either scarcely addressed or ignored. Accordingly, the Panel's overall conclusion is unsupported. Furthermore, the conclusion is directly contradicted by multiple lines of independent evidence, such as:

- data on zeolitization in the vadose zone,
- young radiometric ages for alteration minerals and veins,
- geothermometry data indicating hot paleo fluids;
- presence of vertical veins in soils that resemble spring orifices and not supergene pedogenesis;
- presence of thick bands of calcite and silica in soils indicating rapid precipitation of minerals, alternating water chemistry, and origins from hot fluids;
- affiliations of chemical and isotopic compositions of vein minerals with known hydrothermal deposits;
- chemical composition of remnant water found in pore spaces of unsaturated rock in the vadose zone;

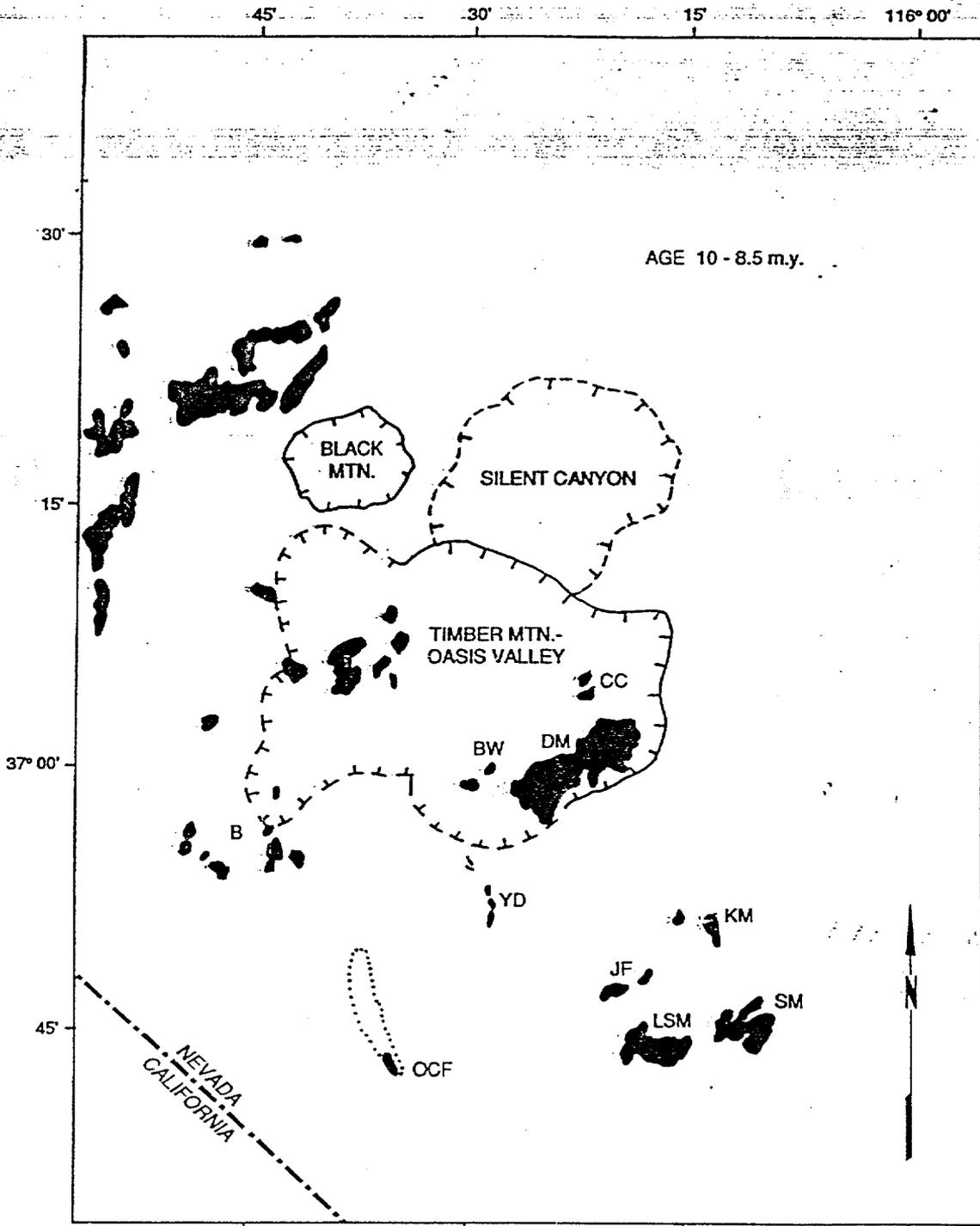
4. Faulty logic was used. (continued)

Second example: Without regard for dissimilarities in hydrologic conditions at Yucca Mountain and Devils Hole, the Panel argued that:

"Considering that Devils Hole is located in the same active tectonic region, and is extending at two to three times the rate of the Yucca Mountain area, the fact that earthquakes have not resulted in even a 15 m rise in the Devils Hole water table inspires serious doubt that the seismic pumping mechanism can cause a greater than 100 m rise in the water table in the Yucca Mountain area."

(pg. 55)

The analogue is conspicuously faulty. Whereas, the water table at Yucca Mountain is hundreds of meters deep, at Devils Hole, water is currently discharging along the immediate perimeter of the limestone outcrop containing Devils Hole. Additional upwelling water at Devils Hole would simply increase current volumes of surface runoff with little effect on water table elevations. Hence, it is not logical to attribute limited rises in water levels at Devils Hole to benign hydrotectonic processes in either location.



8.0-9.0
PM

BLACK
MTN.

SILENT
CANYON

0.3

TM

4.5

RW

8.0

TIMBER MTN.-
OASIS VALLEY
CALDERA
COMPLEX

BB

2.8

*few red
jaw-bros
eggs*
*Dave Sawyer
Thirsty Mesa
w/ls mapping
Ante Thirsty Camps*

SC
8.5
PR

NC
6.5

Pointe Ridge
Dye Camps

CFVZ

1.2

YM

3.7 (N-S cluster)

LW

0.07

AV

4.0

45'

30'

15'

116°

... ..

YUCCA MOUNTAIN PROJECT
SURFACE-BASED TESTING ACTIVITIES UNDERWAY DECEMBER 1, 1992

DRILLING

UZ-16	LM300	Geology/Vertical Seismic Profiling/Hydrogeochem	TD 1700'	@ 1085'
NRG-6	Joy225	Geology/Engr Properties in vicinity North Portal	TD 1100'	@ 6'
N59	CME850	Core for moisture/tritium east flank Yucca Mt	TD <200'	@ 13'

EXCAVATION/GROUTING/FILL[⊗]

SURFACE FACILITIES AREA - MIDWAY VALLEY

T-5A Seek absence of Late Quaternary faults. Backfilled 300m by 11/30 within ESF footprint. 70m of eastern end open for further study.

T-7 Seek Quaternary faults. Backfilled 11/25 totally within ESF footprint.

Fran Ridge Pit Experiment with stereophotogrammetric mapping technique. To be fenced. Open for study.

NRG-1 Pavement Mapping completed by BuRec 11/20. Lies within ESF footprint. To be covered.

RF-9, 10, 11 Existing shallow hydro holes in ESF footprint grouted with concrete 11/25. To be covered.

BUSTED BUTTE QUATERNARY FAULT STUDIES

Trenches/Pavements Estimate nature and rates of Paintbrush Canyon Quaternary Fault movements. On-going.

> CRATER FLAT/SOLITARIO CANYON FAULT STUDIES - Trenches. On-going.

LATHROP WELLS VOLCANO STUDIES

Trenches Seek buried soils to estimate time between (2 on North-side) volcanic eruptions. Sampling complete. Open for further study.

⊗ Note that dozens of soil pits and trenches remain open (e.g., T14)

YUCCA MOUNTAIN PROJECT
ESF CONSTRUCTION ACTIVITIES DECEMBER 1, 1992

Fill trenches in North Portal Pad footprint. COMPLETED
Grout existing boreholes in footprint. COMPLETED
Prepare Road Access and Drainage Ditches.
Scrape Topsoil and Set Aside.
Construct North Portal Pad and Slot. Cut and Fill.

YUCCA MOUNTAIN PROJECT
CONTINUOUS MONITORING ACTIVITIES ON-GOING DECEMBER 1, 1992

HYDROLOGY - Water Levels, Rain/Meltwater Infiltration
METEOROLOGY - Weather, Lightning Strikes, Precip, Air T & P
SEISMOLOGY - Earthquake activity
ENVIRONMENTAL - Organisms, Vegetation, Habitats

THE HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL PROGRAM: ROLE OF THE U.S. NUCLEAR REGULATORY COMMISSION

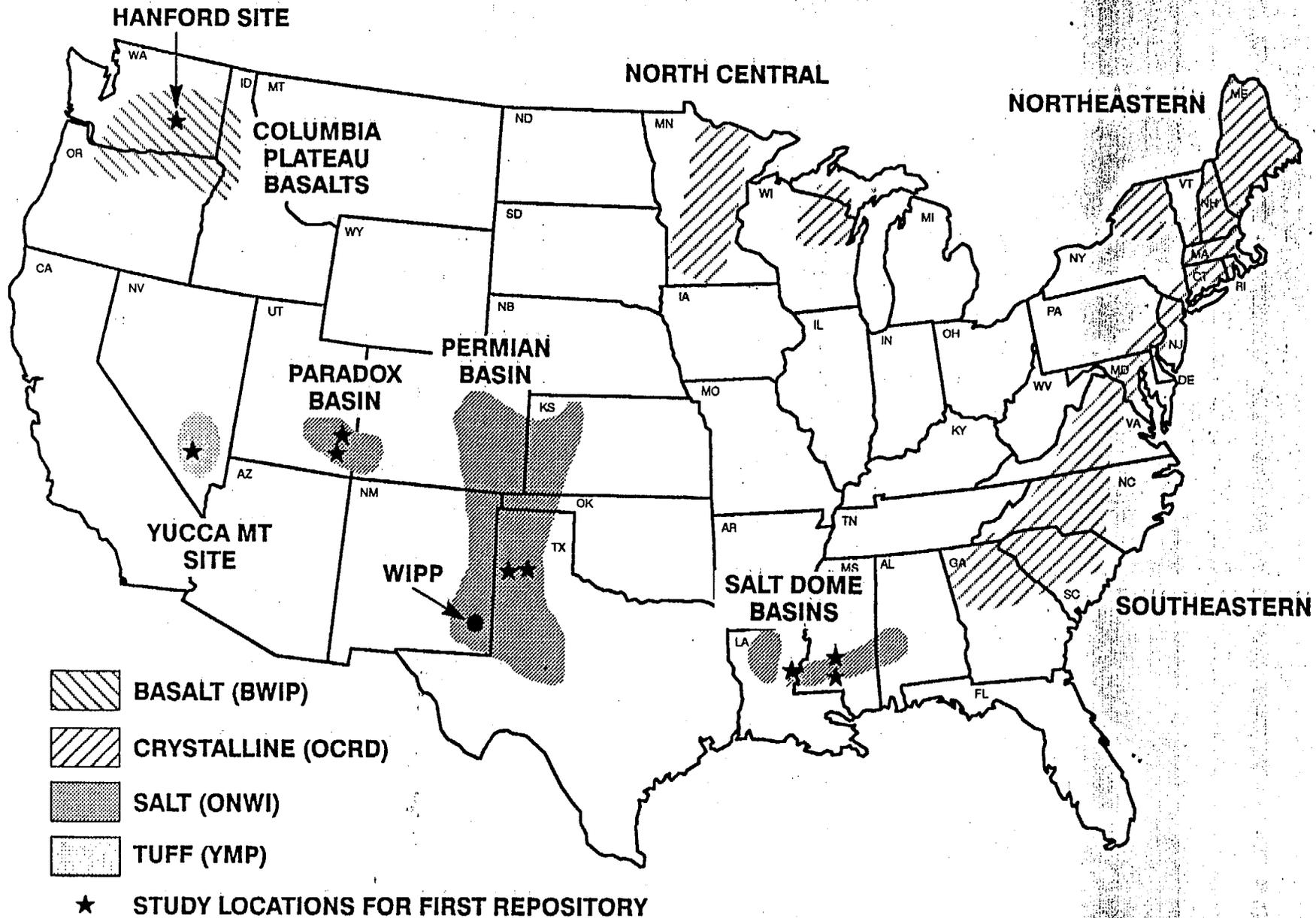


Philip S. Justus
Senior On-Site Licensing Representative
U.S. Nuclear Regulatory Commission
Las Vegas, Nevada

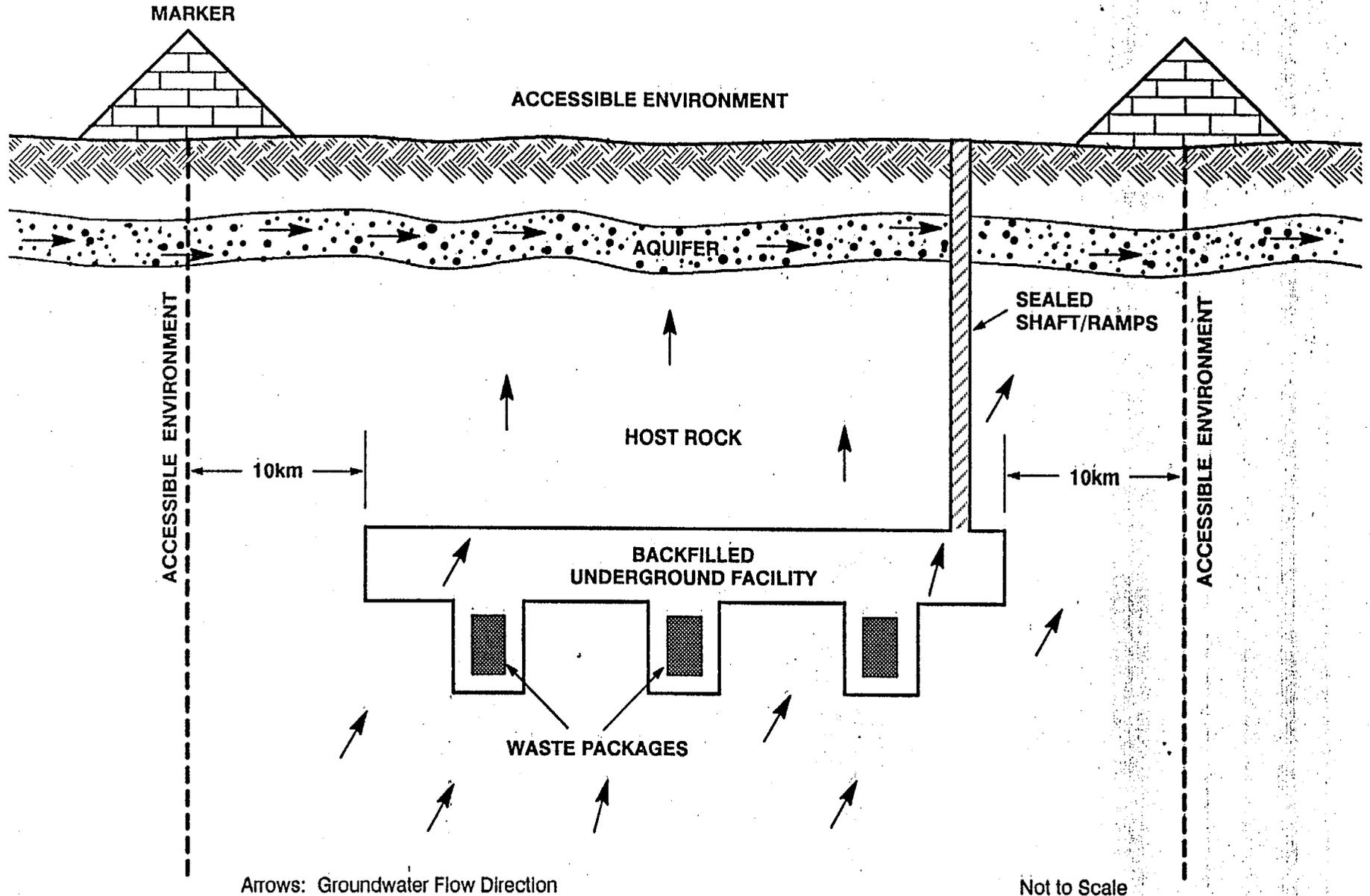
11/12/92

702-388-6125 (office)
1-800-368-5642 x2436 (HLW activities schedule)

REGIONS CONSIDERED FOR DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE

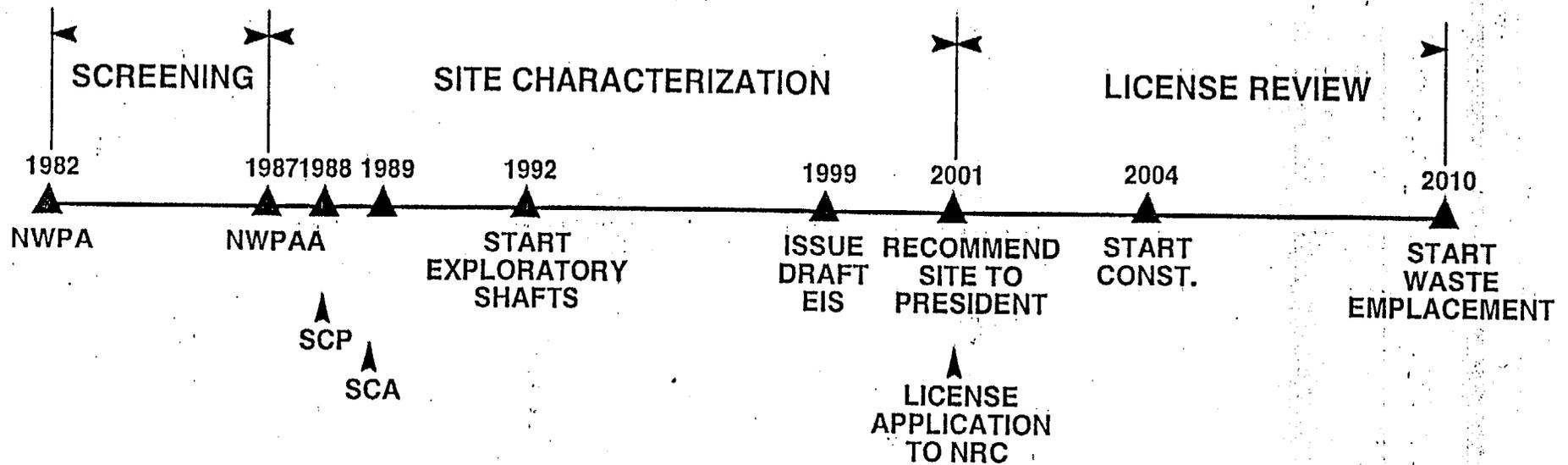


ELEMENTARY REPOSITORY CONCEPT



GEOLOGIC HLW REPOSITORY PROGRAM

DOE SCHEDULE



HIGH-LEVEL WASTE REPOSITORY PERFORMANCE CRITERIA

QUANTITATIVE

EPA	NRC
LIMITS AMOUNTS OF EACH RADIONUCLIDE RELEASED TO ENVIRONMENT	WASTE PACKAGES PROVIDE CONTAINMENT FOR 300 TO 1000 YEARS LIMITS RATE OF EACH RADIONUCLIDE RELEASED GROUND WATER TRAVEL TIME TO ACCESSIBLE ENVIRONMENT AT LEAST 1,000 YEARS

HLW LICENSING ISSUES

NATURE OF ISSUES

First-of-a-Kind Human Endeavor
Long-Term Hazard
Site-Specific Geology/Hydrology

TECHNICAL ISSUES

Hydrologic Systems
 Low-Permeability Units
 Fracture Flow
 Unsaturated Flow
Thermal Loads
Geochemistry and Radionuclide Transport
Waste Form and Package
Modeling Coupled Processes
Rock Mechanics/Mining
Sealing of Shafts and Boreholes
Waste Retrieval
Quality Assurance
Expert Opinion
 Assessing Future Behavior

DISTINCTIONS BETWEEN DOE AND NRC HLW PROGRAMS

DOE PROGRAM

- **DEVELOP TECHNOLOGY**
 - Designs
 - Test Methods
 - Instrumentation
- **GENERATE NEEDED DATA**
- **DEMONSTRATE COMPLIANCE**

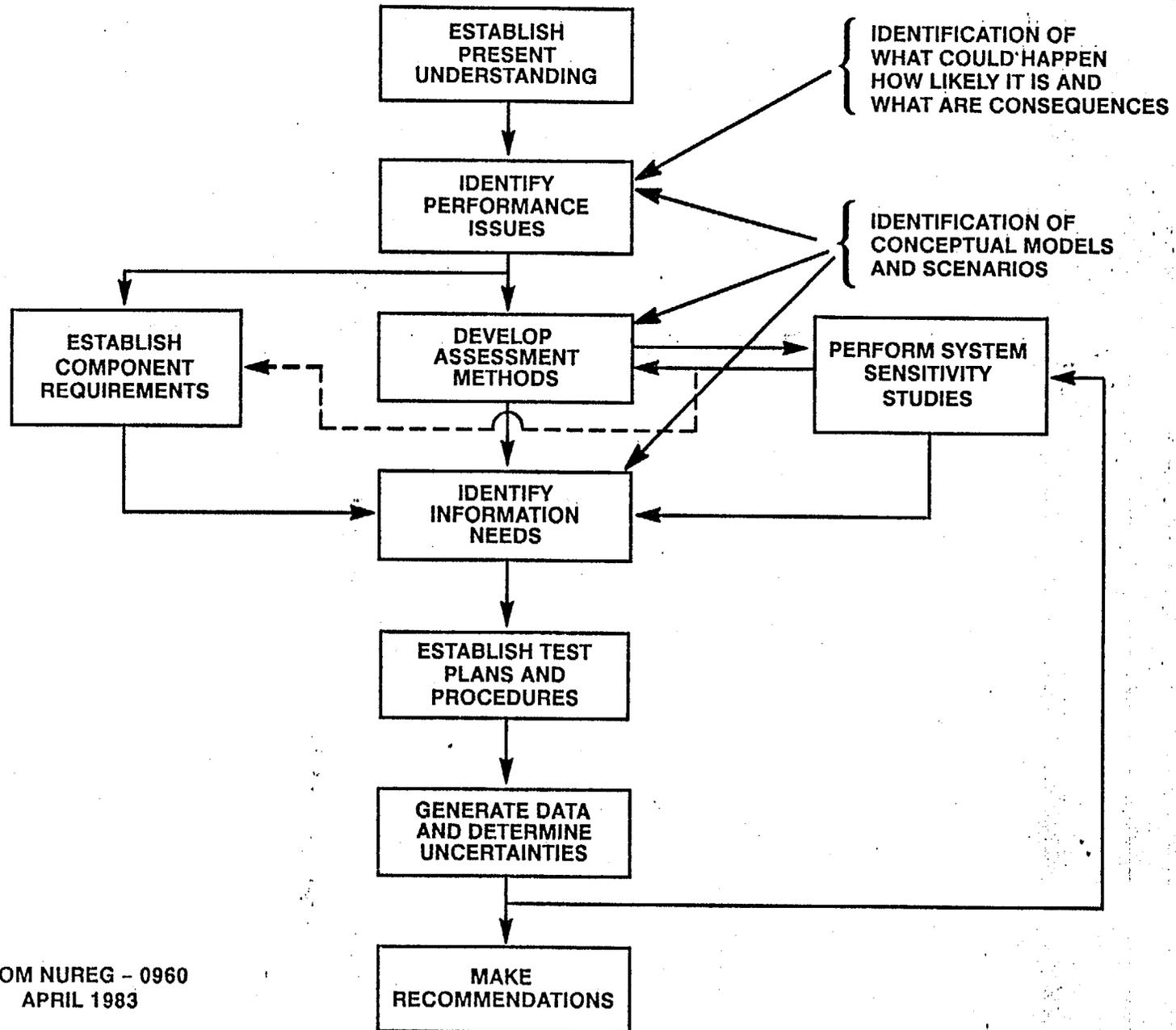
NRC PROGRAM

- **DEVELOP STAFF LICENSING CAPABILITY**
- **DEVELOP REGULATORY POSITIONS**
- **RESEARCH**
 - Understand Basic Phenomena
 - Understand Limitations/Uncertainties
- **CRITICAL REVIEWS OF DOE PROGRAM**
- **DETERMINE DOE COMPLIANCE**

ROLE OF NRC's
ON-SITE LICENSING REPRESENTATIVES
(Per NRC/DOE Procedural Agreement)

- COMMUNICATION
- CONSULTATION
- CONCERN

TECHNICAL APPROACH



FROM NUREG - 0960
APRIL 1983