March 11, 1996

0478

Mr. Ronald A. Milner, Director
for Program Management and Integration
Office of Civilian Radioactive Waste Management
U.S. Department of Energy, RW 30
1000 Independence Avenue, S.W.
Washington, D.C. 20585

SUBJECT: MINUTES OF THE FEBRUARY 15, 1996, EXPLORATORY STUDIES FACILITY MEETING

Dear Mr. Milner:

Enclosed are the minutes of the February 15, 1996, technical meeting between the staff of the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy (DOE) on items of mutual interest regarding the Exploratory Studies Facility (ESF) Design and Construction. This meeting, convened at noon, was held by videoconference at DOE Headquarters in Washington, D.C. and DOE offices in Las Vegas, Nevada, as part of a continuing series of bi-monthly ESF meetings.

Organizations other than NRC and DOE that were represented at the meeting were the State of Nevada Nuclear Waste Project Office and Nuclear Waste Task Force; Clark County, Nevada; Nye County, Nevada; U.S. Nuclear Waste Technical Review Board; U.S. Geological Survey; U.S. Environmental Protection Agency; U.S. General Accounting Office; DOE's Management and Operating Contractor; Weston; NRC's Center for Nuclear Waste Regulatory Analysis; National Congress of American Indians; and Kaiser Engineers.

If you have any questions regarding this letter or the meeting minutes, please contact Jack Spraul of my staff. He can be reached at (301) 415-6715.

Sincerely,

/S/

John H. Austin, Chief
Performance Assessment and High-Level
Waste Integration Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure: As stated

cc: See attached list

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CC List for letter to R. Milner dated March 11, 1996 :

cc: C. Johnson, State of Nevada
J. Meder, Nevada Legislative Counsel Bureau
M. Murphy, Nye County, NV
M. Baughman, Lincoln County, NV
D. Bechtel, Clark County, NV
P. Niedzielski-Eichner, Nye County, NV
B. Mettam, Inyo County, CA
V. Poe, Mineral County, NV
W. Cameron, White Pine County, NV
R. Williams, Lander County, NV
L. Fiorenzi, Eureka County, NV
J. Hoffman, Esmeralda County, NV
C. Schank, Churchill County, NV
L. Bradshaw, Nye County, NV
W. Barnard, NWTRB
R. Holden, NCAI
A. Melendez, NIEC
R. Arnold, Pahrump, NV
N. Stellavato, Nye County, NV
S. Brocoum, YMPO
W. Barnes, YMPO
D. Horton, YMPO
C. Einberg, DOE/Wash, DC

MINUTES OF THE FEBRUARY 15, 1996
U.S. NUCLEAR REGULATORY COMMISSION/U.S. DEPARTMENT OF ENERGY
TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

On February 15, 1996, staff from the U.S. Nuclear Regulatory Commission met with staff from the U.S. Department of Energy (DOE) to discuss items of mutual interest regarding progress at DOE's Exploratory Studies Facility (ESF) at Yucca Mountain: construction update, design status, and scientific programs update. The meeting, held by videoconference between DOE facilities in Washington, D.C., and Las Vegas, Nevada, was convened at noon Eastern Standard Time. Attachment 1 is the meeting agenda. Attachment 1 differs from the earlier agenda included with the meeting announcement. The earlier agenda was reformatted by DOE, and the subject of data collection related to the near-field environment had been deleted. During the meeting, DOE and NRC staff agreed that this subject would be addressed at a subsequent meeting.

Organizations other than NRC and DOE that were represented at the meeting were the State of Nevada Nuclear Waste Project Office (NWPO) and Nuclear Waste Task Force (NWTF); Clark County, Nevada; Nye County, Nevada; U.S. Nuclear Waste Technical Review Board (NWTRB); U.S. Geological Survey (USGS); U.S. Environmental Protection Agency (EPA); U.S. General Accounting Office (GAO); DOE's Management and Operating Contractor (M&O); Weston; NRC's Center for Nuclear Waste Regulatory Analyses (CNWRA); National Congress of American Indians (NCAI); and Kaiser Engineers. Attachment 2 is the attendance list for the meeting.

During the opening remarks, NRC stated that the objective or emphasis of these meetings should change from simply a general information exchange to an exchange of information pointed toward issue resolution, with this meeting being a transition meeting. DOE agreed that the meetings should be pointed toward the resolution of issues and that potential issues that are candidates for resolution need to be identified prior to the meeting.

DOE's first presentation was an update on construction of the ESF. It covered both the progress and status of the tunnel boring machine (TBM) and DOE's plans for the remainder of Fiscal Year 1996. Highlights of this presentation were that 1) TBM progress continues to be ahead of schedule with the half-way point in the ESF having been passed on January 25, 1996; 2) Alcove 4 excavation with the Alpine Miner had been completed last November; 3) Excavation of the Thermal Test Alcove with the Alpine Miner had been initiated ahead of schedule. DOE discussed the rationale for the location of the thermal test alcove within the repository. NRC staff found the rationale to be both logical and reasonable. In response to questions, DOE indicated that mapping of the Thermal Test Alcove was ongoing, that mapping of the main drift was essentially keeping up with the TBM, that two deliverables on mapping were

scheduled to go to DOE during Fiscal Year 1996, and that informal data drafts of the mapping would be available. Attachment 3 provides the handouts/overheads that were used during this discussion. Attachment 3 provides details on progress of the tunnel and includes the thermal testing schedule, an update of the activities of the Yucca Mountain Project Tunneling Board of Consultants, and copies of photographs of ESF activities.

Safety and health issues associated with ESF construction and worker safety were discussed next by DOE to satisfy a request from the State of Nevada. Attachment 4 provides the handouts/overheads that were used during this discussion. DOE described the ESF safety and health responsibilities for Yucca Mountain and the safety record at the site. DOE noted that there had not been a lost workday incident at the site since October 5, 1995. DOE's "Concerns Program" and its relationship to the safety and health plan were also discussed. In reaction to a comment by the NWPO representative, it was generally agreed that future ESF meetings should include only an update of what had transpired in the area of worker safety between meetings.

A presentation on the ESF design status was then given by DOE. The discussion centered around an update of the ESF design progress; DOE actions in response to recommendations made in the NRC in-field verification report (NRC [Holonich] letter of June 16, 1995 to DOE [Milner]) and in response to the NRC (Bell) letter of December 14, 1995, to DOE (Brocoum); and changes to the design control process. Attachment 5 provides the handouts/overheads that were used during the discussion. Completion dates shown in Attachment 5 are either actual dates of completion (A), dates when an Engineering Change Notice was issued (ECN), or planned dates (unmarked). DOE discussed the review that had been conducted to ensure that inspectors at the ESF covered the critical aspects of the work. DOE indicated that the inspection effort was being "graded" to emphasize activities important to safe and reliable construction. In response to NRC questions, DOE indicated that it currently plans to maintain the "Q" classification of the ESF ground supports and that the replacement of ground supports with concrete had not been considered.

DOE reported that the issue of rockbolt modeling that was a recommendation in the NRC in-field verification report has been addressed by DOE in its ground support design analysis that is to be forwarded to the NRC shortly. NRC's review is expected to resolve this issue if the information in DOE's submittal is satisfactory. Also, regarding the two issues presented in the NRC letter of December 14, 1995, to DOE, it was indicated that DOE was prepared to supply the NRC with the information requested as an example of an ESF design done to the new design process. Enclosure 5 indicates what is planned for submittal. NRC's review is expected to resolve this issue if the information in DOE's

submittal is satisfactory. The second issue from the December letter, DOE's revised requirements documents and the document hierarchy for the improved design process, is scheduled to go to DOE in mid-April, then to the NRC for review and potential resolution. Changes to DOE's design process were discussed. Specifically, changes to M&O procedures QAP-3-0, QAP-3-8, QAP-3-9, and QAP-3-10, were briefly described.

DOE then addressed the requirements status including the NRC's letter of December 14, 1995; the improvement of the document hierarchy; the status of a corrective action request (CAR-100) regarding the flowdown of requirements, and the quality assurance classification status of inverts. Attachment 6 is a copy of the handouts/overheads. DOE described what actions have been taken and the on-going actions to improve the flow-down of requirements that is the subject of CAR-100. DOE noted that CAR-100 has been replaced by a new CAR (in accordance with DOE's new procedure for handling deficiencies) and that a new response is being prepared. The open issue regarding flowdown of requirements cannot be resolved until the response is accepted by DOE and forwarded to the NRC. DOE indicated that the quality assurance classification of inverts was discussed in a 1995 "white paper," that there were many discussions on the subject, but that DOE had not taken any action. DOE indicated that a letter on the subject was in DOE's concurrence line and that a copy of the letter will go to NRC's on-site representatives.

DOE updated information on the Yucca Mountain Project's scientific programs. Attachment 7 provides the handouts/overheads that were used during this discussion. DOE's presentation covered structural features of the ESF, purpose and status of alcoves, rock mass quality, and 1996 deliverables. The NRC staff asked several questions of DOE at the end of this presentation. When asked whether there was conclusive evidence that the Drill Hole Wash Fault is as shown on the handout: "Tunnel Boring Machine Progress," DOE responded that the evidence was not conclusive and noted that 1) the corresponding overhead did not show the Drill Hole Wash Fault and 2) both the overhead and the handout were noted to be "Not to scale" and, therefore, the Drill Hole Wash Fault may not have been located accurately. DOE also indicated that Alcove 5 as shown on the same figure is no longer planned and that the Thermal Test Area shown on the figure will be designated as Alcove 5. DOE indicated that the ESF synthesis report, fully integrated - including results of surface and subsurface work, is due in August 1996. Finally, DOE provided some generalized information regarding gas phase permeability at Yucca Mountain.

The meeting concluded at 3:00 p.m. Eastern Standard Time with no discussion concerning the schedule for the next meeting.

John G. Sprall
Division of Waste Management
Office of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission

Christian E. Einberg
Regulatory Integration Division
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy

DOE-NRC TECHNICAL MEETING AGENDA
EXPLORATORY STUDIES FACILITY DESIGN AND CONSTRUCTION
VIDEO CONFERENCE
Bank of America Center, Blue Room, Las Vegas, Nevada
Forrestal Building, Room GF277, Washington, DC
February 15, 1996

9:00 PDT (Noon EDT)	Opening Remarks	DOE, NRC, NV, AUG
9:15 PDT (12:15 EDT)	ESF Construction Update - Workers Safety and Health Summary	DOE
9:45 PDT (12:45 EDT)	ESF Design Status - Design Progress Update - Response to NRC 12/14/95 Letter - Status of CAR 100	DOE
10:45 PDT (1:45 EDT)	Scientific Programs ESF Update - Structural features - Alcoves - Rock Mass Quality - 1996 Deliverables, schedule	DOE
11:45 PDT (2:45 EDT)	Closing Remarks and Discussion	DOE, NRC, NV, AUG
12:15 (3:15 EDT)	Adjourn	

ATTACHMENT 1

DOE/NRC ESF TECHNICAL MEETING

FEBRUARY 15, 1996

ATTENDANCE LIST

NAME	ORGANIZATION	PHONE
- Las Vegas, Nevada -		
Hawe, Tim	DOE	(702) 794-7967
Haghi, Ali	M&O	(702) 295-4873
Bjerstedt, Tom	DOE	(702) 794-7590
Tynan, Mark C.	DOE	(702) 794-7940
LeRoy, Steve	M&O	(702) 295-5563
Skipper, Ken	DOE	(702) 794-7480
Frishman, Steve	NV NWPO	(702) 687-3744
McKinna, Barbara	M&O	(702) 794-7813
Segrest, Alden	M&O	(702) 794-9704
Barton, Bob	DOE	(702) 794-7957
Treichel, Judy	NWTF	(702) 248-1127
v. Tiesenhausen, E.	Clark County	(702) 455-5175
Royer, Dennis	DOE	(702) 794-7501
Stellavato, Nick	Nye County	(702) 295-6142
Belke, Bill	NRC	(702) 388-6125
Glenn, Chad	NRC	(702) 388-6125
Fortner, Tom	DOE	(702) 794-7576
Snell, Dick	M&O	(702) 794-5360
- Washington, D.C. -		
Einberg, Chris	DOE	(202) 586-8869
Weller, Rick	NRC	(301) 415-7287
Wallace, Ray	USGS	(202) 586-1244
Krishna, Paul	M&O	(202) 448-2303
Spraul, Jack	NRC	(301) 415-6715
Nataraja, Mysore	NRC	(301) 415-6695

ATTACHMENT 2

NAME	ORGANIZATION	PHONE
	- Washington, D.C. -	
Bagnuld, Jack	GAO	(202) 512-6933
McFarland, Russ	NWTRB	(703) 235-4473
Jagannath, Banad	NRC	(301) 415-6653
Leslie, Bret	EPA	(202) 233-9201
Dossett, John	NCAI	(202) 466-7767
Rusell, John	CNWRA	(301) 881-0289
Pohle, Jeffrey	NRC	(301) 415-6703
Bradbury, John	NRC	(301) 415-6597
Woodward, Jeff	Kaiser Engineers	(703) 218-2749

YUCCA
MOUNTAIN
PROJECT

Studies

Exploratory Studies Facility Construction Update

Presented to:
DOE-NRC Technical Meeting on
Exploratory Studies Facility Design and Construction

Presented by:
Richard Craun
Assistant Manager, Engineering and Field Operations

February 15, 1996

U.S. Department of Energy
Office of Civilian Radioactive
Waste Management

ATTACHMENT 3

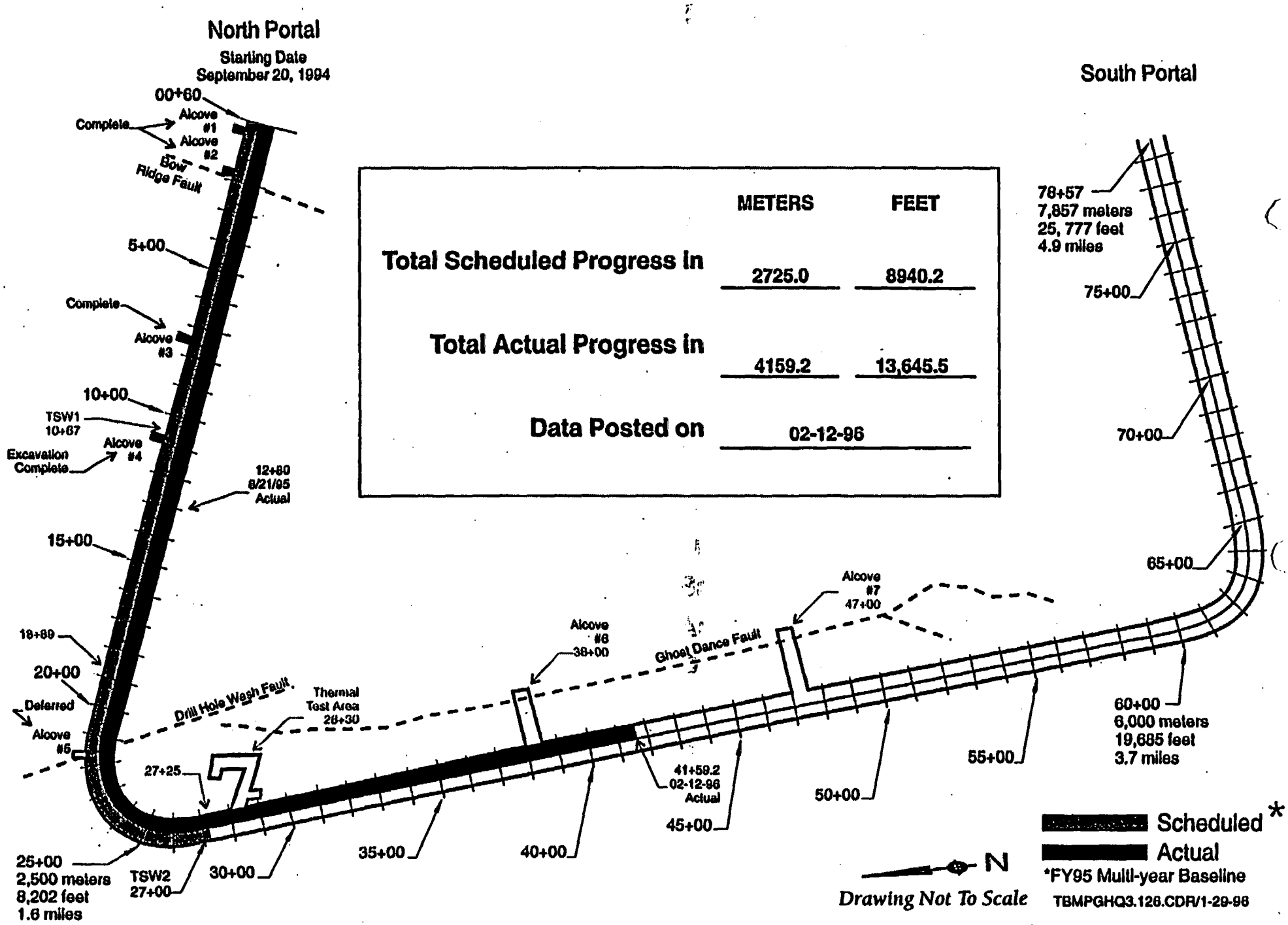
Outline

- TBM Progress
- FY96 Plans

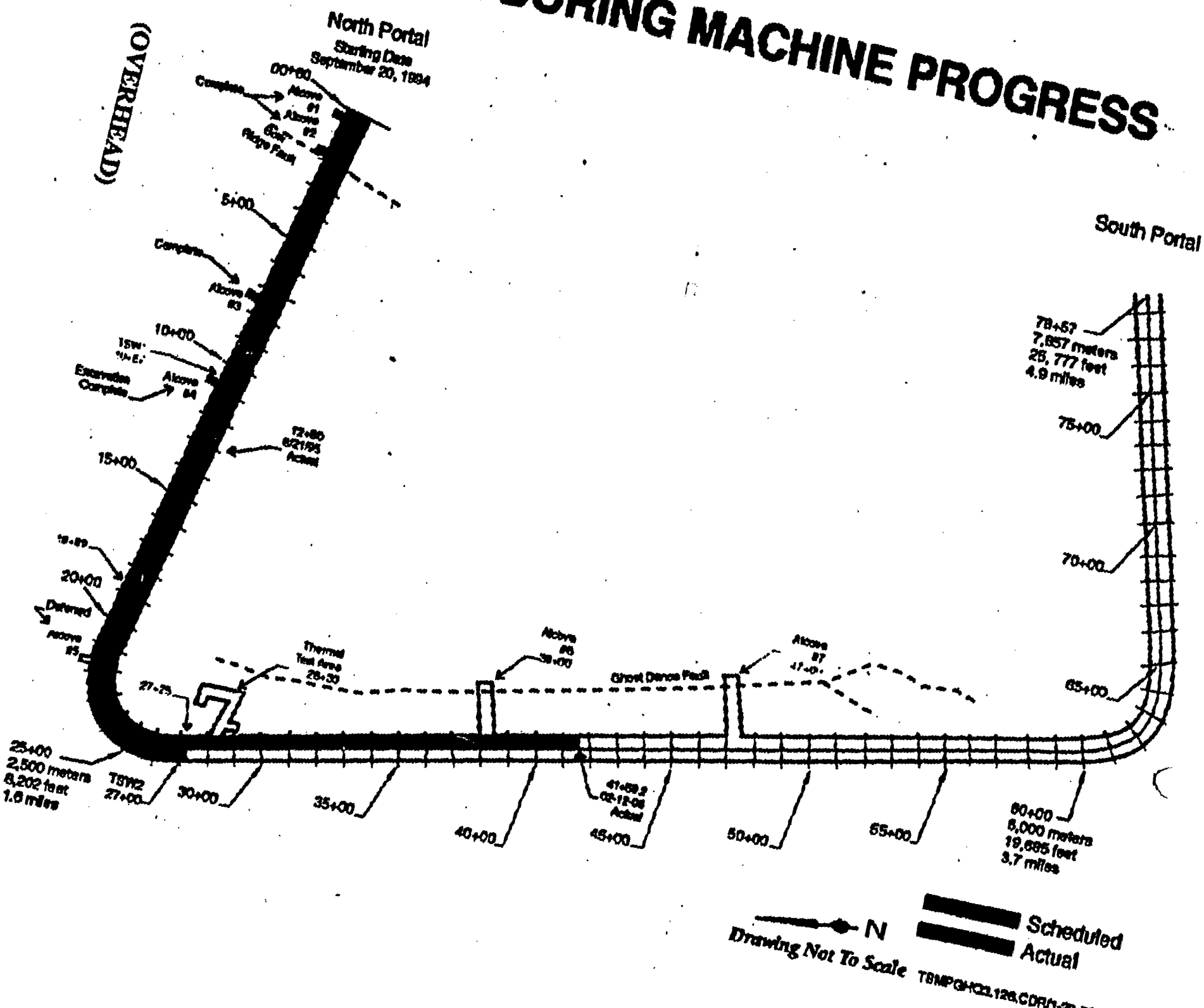
ESF Tunneling Operations Update

- TBM at Station 41+59.17 on February 12, 1996
- On January 25, 1996 the TBM passed the halfway point in the ESF
- Set potential world record for 7-9 meter diameter TBM with "best week" of 218.3 meters (November 27-December 1, 1995)
- Started excavation of Thermal Test Alcove with Alpine Miner on January 19, 1996; at Station 00+29.20 on February 12, 1996
- Completed Alcove 4 excavation with Alpine Miner November 13, 1995
- Reached repository horizon (TSw2) at Station 27+20 on November 9, 1995
- Completed 1000 hour maintenance December 10, 1995
  - Approximately 100 items checked normal, including
    - Cutter head
    - Main bearing and seal
    - Conveyor
    - Forward and gripping shields
    - Back Decks
    - Automatic fire suppression system
    - Oil, hydraulic fluids and seals
  - No indication of unusual contamination or premature wear

TUNNEL BORING MACHINE PROGRESS



NEL BORING MACHINE PROGRESS



FY96 Baseline

- Started FY96 722 meters ahead of plan
- Objective to maximize tunnel advance and to minimize cost
  - Excavate to Station 39+40
  - Excavate Alcove #4
  - Excavate Phase I of thermal test area
  - Excavate first Ghost Dance Fault Alcove
- Complete surface facilities
  - Change house, switchgear building, water/sewer, and subsurface wastewater system

FY96 Proposed Baseline Changes

- Operation efficiencies, faster excavation rates, and deferred surface facility construction create opportunities to
  - Excavate beyond 39+40
  - Support science program
  - Ensure designs are in place for FY97 ESF construction

THERMAL TESTING IN THE ESF – PHASE I
Illustrative Plan View Schematic

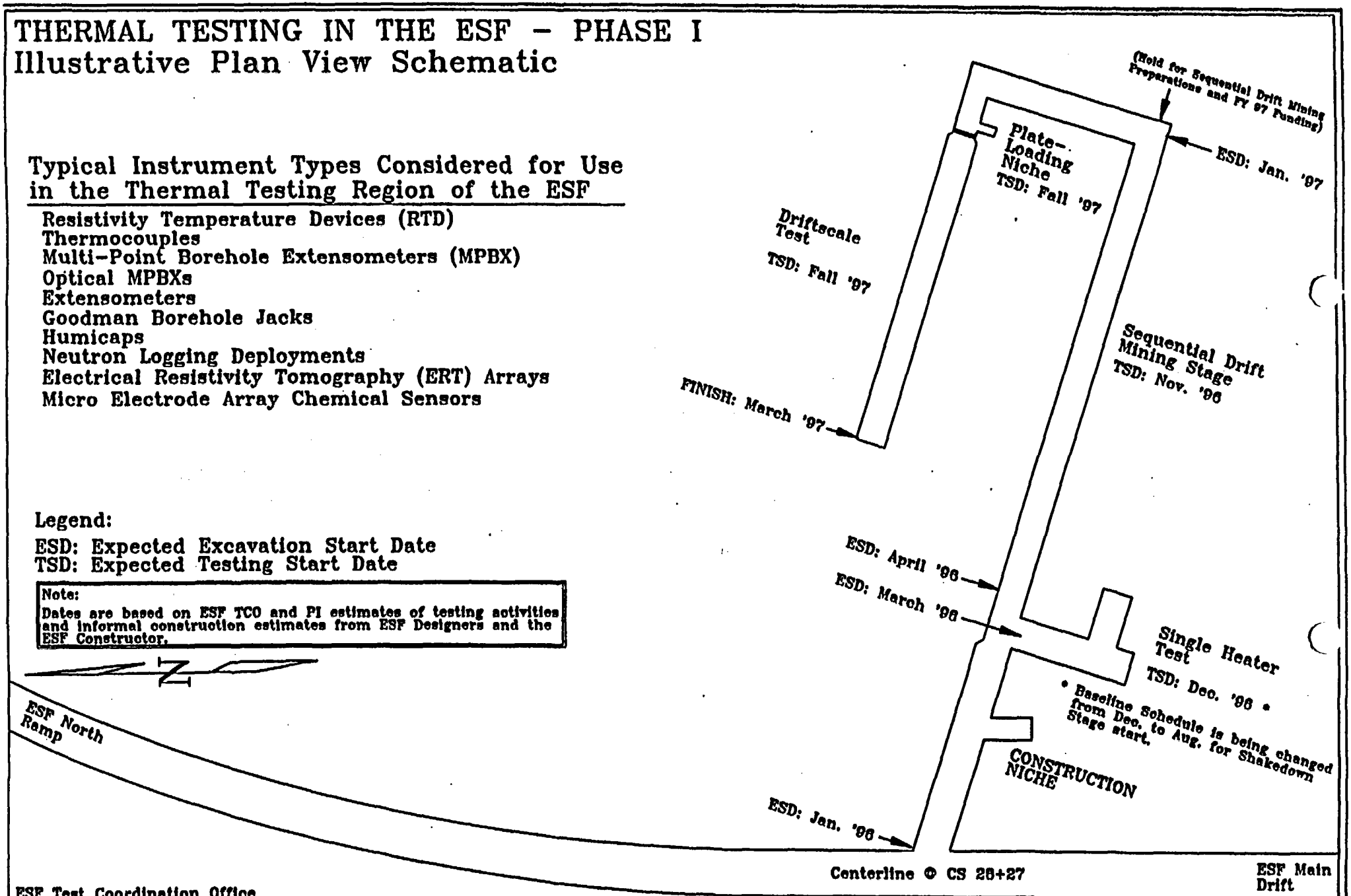
Typical Instrument Types Considered for Use in the Thermal Testing Region of the ESF

- Resistivity Temperature Devices (RTD)
- Thermocouples
- Multi-Point Borehole Extensometers (MPBX)
- Optical MPBXs
- Extensometers
- Goodman Borehole Jacks
- Humicaps
- Neutron Logging Deployments
- Electrical Resistivity Tomography (ERT) Arrays
- Micro Electrode Array Chemical Sensors

Legend:

ESD: Expected Excavation Start Date
TSD: Expected Testing Start Date

Note:
Dates are based on ESF TCO and PI estimates of testing activities and informal construction estimates from ESF Designers and the ESF Constructor.



ESF Test Coordination Office
Los Alamos National Laboratory

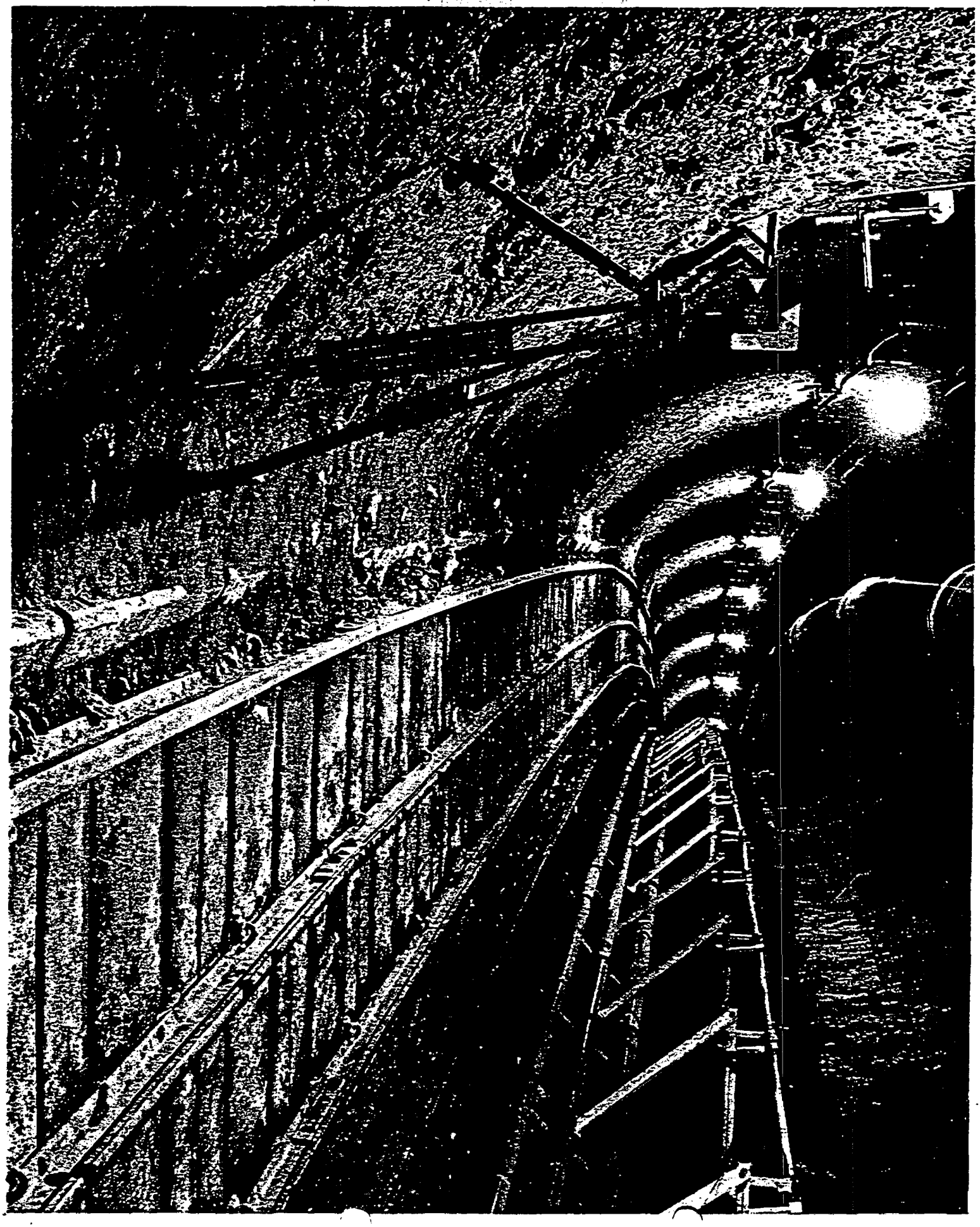
Thermal Testing Schedule

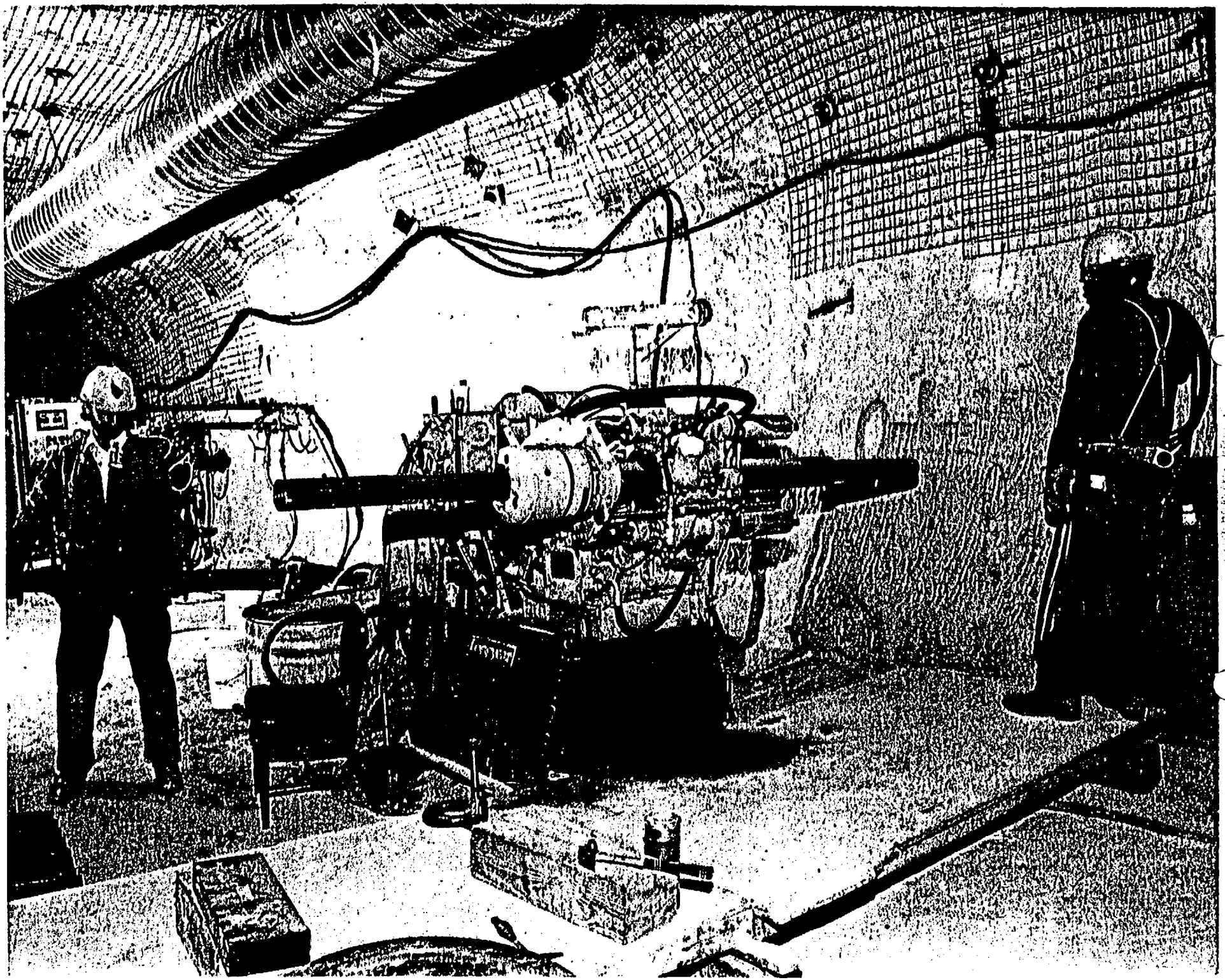
Activity		Proposed Schedule
Complete and control scientific program field work package		Feb/96
Complete PI authorized test design		Aug/96
ESF design for first 125 meter drive including single heater test	Completed	Dec/95
Breakout access drift from ESF main drift	Completed	Jan/96
Begin excavation of single heater test area		Mar/96
Complete excavation of single heater test area		Apr/96
Begin drilling/coring (single heater)		Apr/96
Complete instrumentation and DAS installation (single heater)		*Dec/96
turn single heater on		*Dec/96
Complete single heater test heating cycle and post-test characterization		Sep/97
Begin long-term monitoring		Sep/98
Complete excavation of the drift scale test		Mar/97
Complete drilling/coring, instrumentation & DAS installation (drift scale test)		Oct/97
Turn-on drift scale heater test		Oct/97
Complete drift scale heater test heating cycle and post-test characterization		Sep/01
Begin long-term monitoring		Sep/01

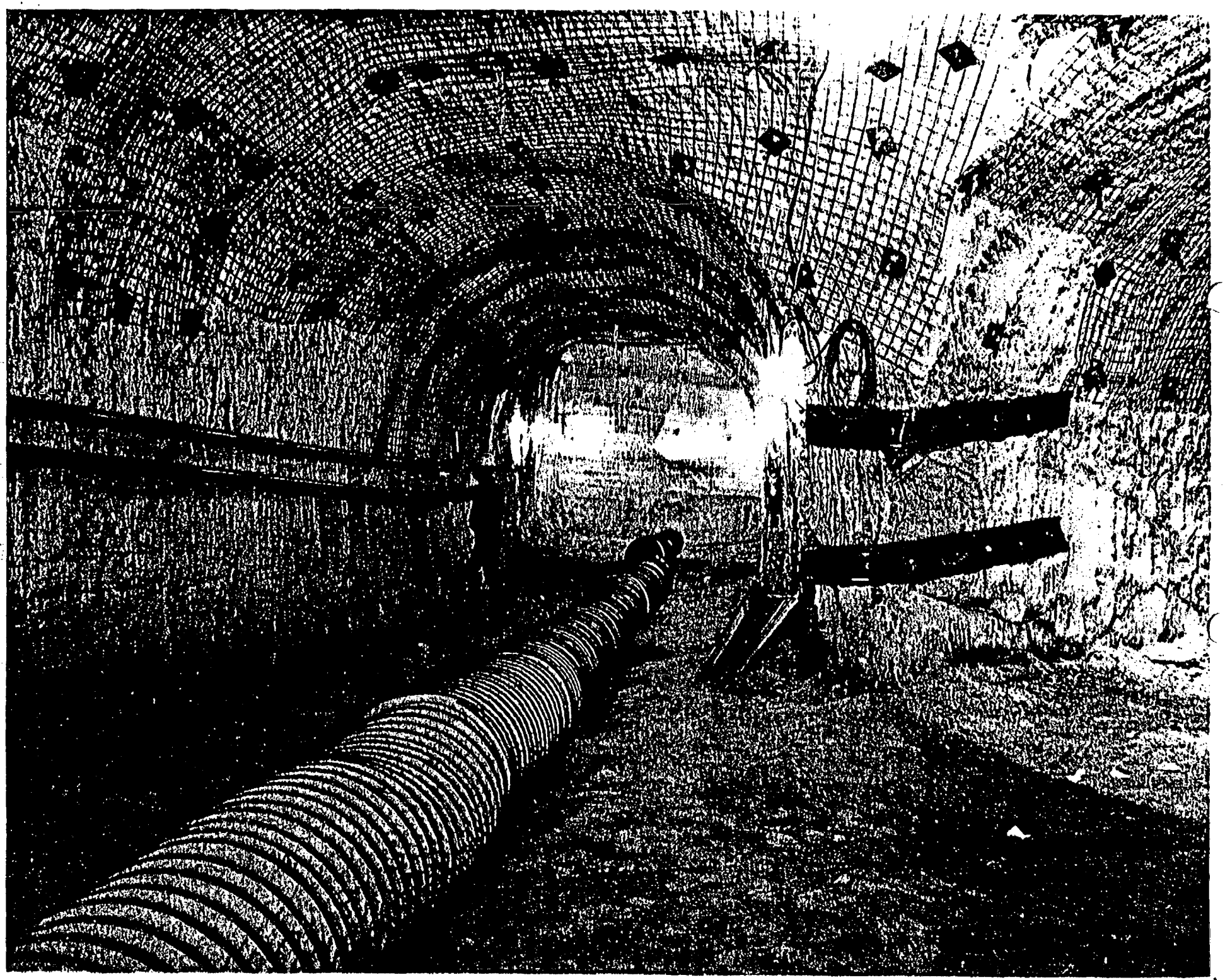
* Baseline schedule is being changed from December '96 to August '96 for the start of single heater test

Yucca Mountain Project Tunneling Board of Consultants Site Visits

- First meeting held October 24-25, 1995, in Las Vegas. First report noted
  - Safety: well-managed and safety-conscious
  - Cost effectiveness: alcove excavation does not interfere with TBM progress; mining hours being maximized; appearance and general housekeeping is very good
  - Adequacy of design: requested additional information about Q-list for ground support
- Draft Report from second meeting held December 11-13, 1995, in Las Vegas, indicates:
  - Safety: outstanding performance; lost time due to accidents is far superior to the norm for major tunneling projects
  - Cost Effectiveness: FY95 tunneling costs high due to start-up, learning curve, and adverse ground conditions on North Ramp; expect FY96 costs to be much less
  - Adequacy of Design: nothing to report at this time
- Next meeting scheduled for March 20-22, 1996
  - Rescheduled from February due to audit







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YMP Safety and Health

Presented to:
DOE-NRC Technical Meeting on
Exploratory Studies Facility Design and Construction

Presented by:
Wendy Dixon
Assistant Manager for Environment, Safety and Health

February 15, 1996

U.S. Department of Energy
Office of Civilian Radioactive
Waste Management

ATTACHMENT 4

ESF Worker Safety and Health Responsibilities

- M&O Contractor
  - Supervise daily activities
  - Provide compliance oversight
- YMSCO AMESH - Program direction
  - OCRWM concerns program addresses employee issues

ESF Worker Safety and Health Injuries and Illnesses

- DOE System mirrors OSHA
  - Reportable injuries/illnesses
  - Lost/restricted workdays
- Incident investigations
  - Supervisors
  - S&H Staff
- Causal analysis
- Lessons learned

ESF Worker Safety and Health

- Recordable injuries/illnesses
  - Recordable injuries and illnesses include work-related deaths and illnesses and injuries resulting in loss of consciousness, restriction of work or motion, transfer to another job or medical treatment beyond first aid.
- Lost Workdays
  - Lost workdays are days away from work or limited to restricted work activity because of an occupational injury or illness.

ESF Worker Safety and Health Injuries

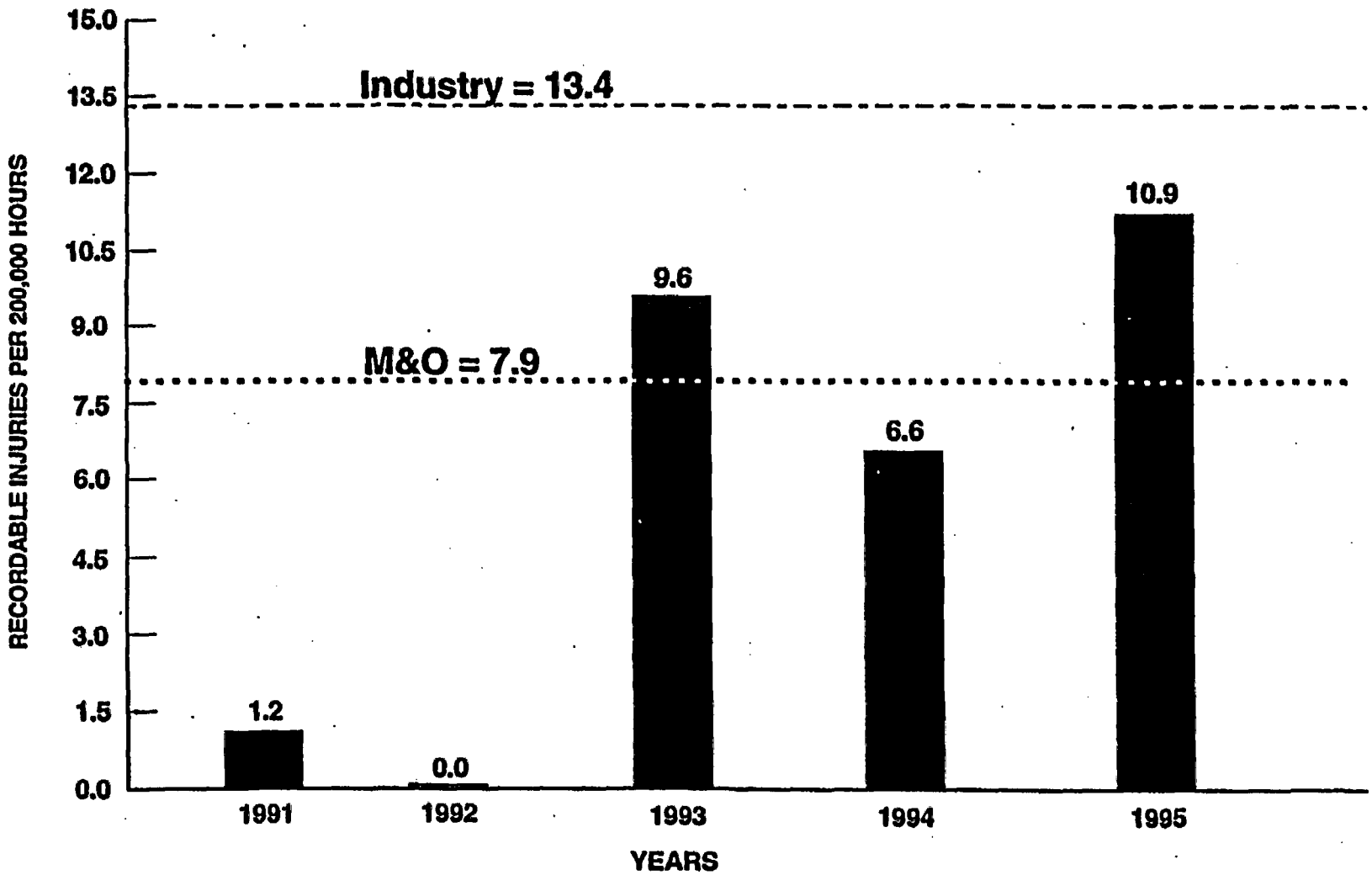
- Injuries (50)

– Strain	19
– Contusion/Laceration	17
– Fracture	5
– Eye Irritation	3
– Chipped Tooth	3
– Burn	1
– Paresthesia	1
– Dermatitis	1

- Lost Workdays - 325 (4 Incidents = 277 Days lost)
- Restricted Workdays - 127

Note: Data through third quarter 1995

Recordable Injury/Illness Incidence Rates
M&O Construction Contractors Compared to Industry



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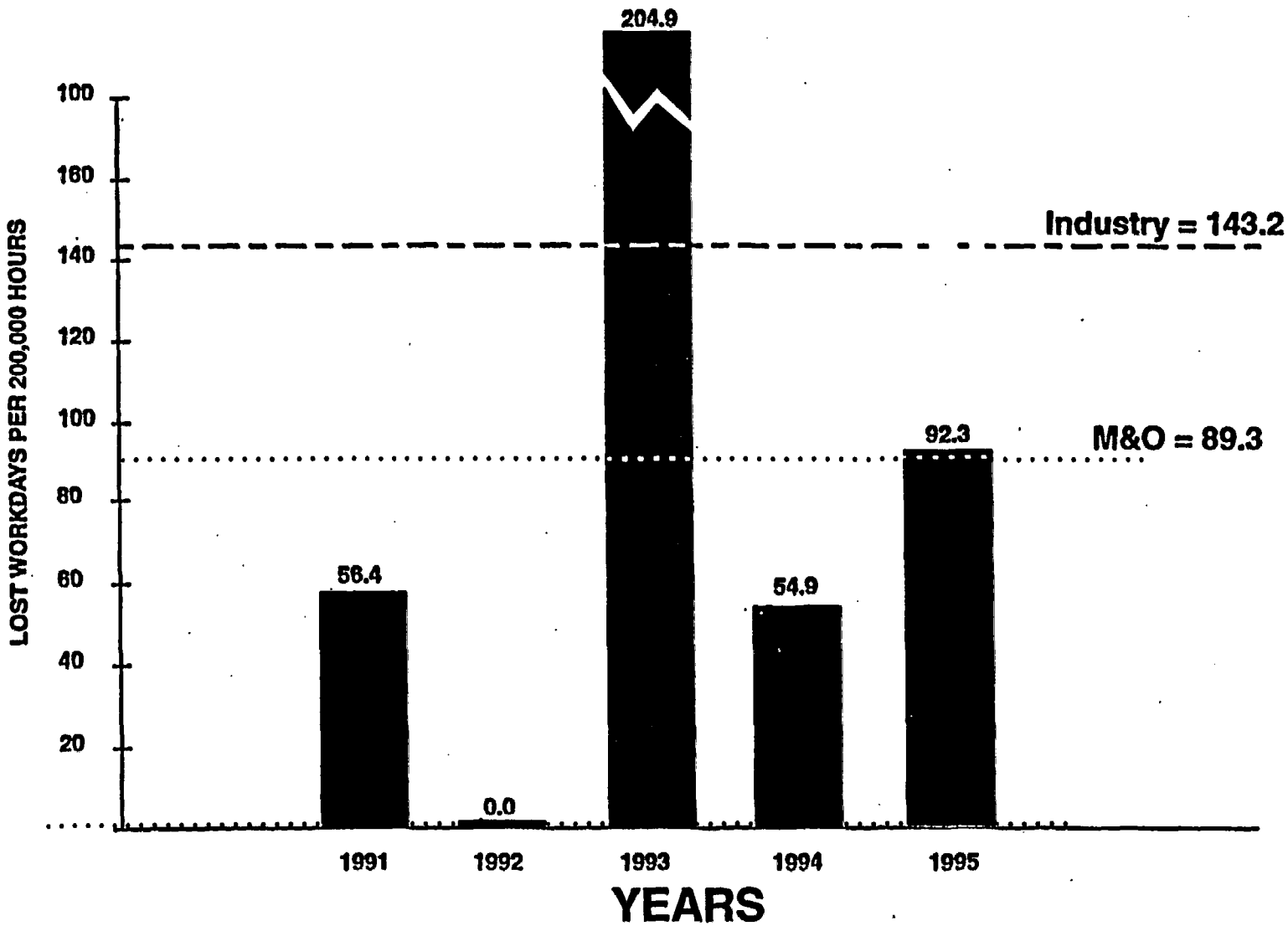
Lost Workday Incidence Rates
M&O Construction Contractors
Compared to Industry



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ESF Worker Safety and Health

- <u>No</u> lost workday incident since:

  OCTOBER 5, 1995

Employee Concerns Program

- Extent of awareness of Employee Concerns Program (ECP) purpose
- Awareness of other mechanisms within own organizations
- Are we missing other concerns <u>not</u> raised

Employee Concerns Program

(Continued)

Conclusions:

- Over 50% are aware of ECP
- There are other mechanisms within individual organizations
- Results to be shared in S&H stand-down

Safety Stand Down

- Really a stand-up for safety
- Management support
- Results of employee concerns review
- Training

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Studies

Exploratory Studies Facility Design Status

Presented to:
DOE/NRC Technical Exchange

Presented by:
R. D. Snell
Manager, Engineering and Integration Operations
CRWMS Management and Operations Contractor

DRAFT
February 5, 1996

U.S. Department of Energy
Office of Civilian Radioactive
Waste Management

ATTACHMENT 5

Scope

- Design Progress Update
- NRC In-Field Verification Recommendations
- NRC Dec. 14 Letter Requests
- Changes to Design Control Process

Design Progress Update

	Completion Date
• Analyses	
– ESF Alcove Ground Support Analysis Rev (All Alcoves)	12/18/95 (A)
– Matl Dedication Analysis Steel Sets Rev	01/23/96 (A)
– Steel Set Design Analysis Rev	02/01/96 (A)
• Specifications	
– Subsurface General Construction Spec.	
» Spec. Revision	12/01/95 (A)
» Field Change	01/03/96 ECR
– Invert Segment Installation Spec. Field Change	12/22/95 ECR

Design Progress Update (Con't)

	Completion Date
• Specifications (Con't)	
– Subsurface Drilling & Blasting Spec. Field Change	12/22/95 ECR
– Constructor QC/QA Spec. Field Change	12/22/95 ECR
– Steel Sets & Accessories Subsurface Spec.	
» Field Change	11/16/95 ECR
» Spec Revision	02/23/96
– Rockbolts, Accessories, & Assoc. Ground Support Matl	
» Field Change	01/16/96 ECR
» Spec. Revision	02/16/96

Design Progress Update (Con't)

	Completion Date
• Specifications (Con't)	
– Dry Process Shotcrete Spec. Revision	03/15/96
– Wet Process Shotcrete Spec. Revision	03/15/96

Design Progress Update (Con't)

	Completion Date
• Drawings	
– Thermal Test Alcove (New)	12/27/95 (A)
» Initial portion of alcove for thermal shakedown test	
– Thermal Test Alcove (New)	07/18/96
» Additional excavation to accommodate Heated Drift & Flat Jack Alcove	
– Ground Support Revision (7 Drawings)	01/31/96
– Ghost Dance Fault Test Alcove #1 (New)	05/17/96

NRC In-Field Verification Recommendations

Modeling of Rockbolts

- The NRC report on Phase 2 In-Field Verification recommended that "the numerical modeling of rock bolts be expanded to include all pertinent types and applications."

- The ESF Ground Support Design Analysis, DI: BABEE0000-01717-0200-00002 Rev 00 has incorporated the NRC recommendations as follows:
  - Included modeling in Rock Mass Categories 1 and 2
  - "Swellex" type Rockbolts modeled along with existing "Williams" grouted Bolts

NRC
Dec. 14th Letter Requests

Example Design Package

- ESF Designs are now done by discrete products - not in major packages
  - Increased efficiency
  - Better able to meet scheduling requirements
  - Increased flexibility
- Alcoves, Rockbolts, and Shotcrete Plan, Section & Elevation Drawing, DI: BABEE0000-01717-2100-40161 Rev 00, will be supplied to NRC as an example of an ESF design done to the new Design Processes

NRC
Dec. 14th Letter Requests (Con't)

Example Design Package

- The package sent to NRC will consist of the drawing and all design inputs
  - ESF Alcove Ground Support Analysis
  - ESF Ground Support Design Analysis
  - QA Classification Analysis of Ground Support Systems
  - Determination of Importance Evaluation of Subsurface ESF
  - Alcoves, Rockbolts and Shotcrete Drawing
  - Drawing Inputs List

Changes to Design Process

QAP-3-0 Rev 3 TO Rev 4
Effective Date: February 12, 1996

- Expand Interdiscipline Reviews - now called Design Reviews- to include organizations external to Engineering (e.g. DOE, TCO, Constructor)
- Retain External Review as Optional
- Allow M&O approval and baselining of design products without an additional DOE acceptance review
  - DOE participates in expanded I.D. review
  - DOE utilizes surveillance process for acceptance

Changes to Design Process (Con't)

QAP-3-0 Rev 3 TO Rev 4
Effective Date: February 12, 1996

- Remove references to Basis for Design (BFD) document
- Reflect QARD, Revision 5
  - Use of Unqualified Data clarified
  - Generation of "Q" Records clarified

Changes to Design Process

	Effective Date
• QAP-3-8 Rev 6, Specifications	01/03/96
– ID Reviews expanded to include external organizations	
– Input Lists not approved by DOE	
– Input Lists and Specifications checked at the same time	
• QAP-3-9 Rev 6, Design Analysis	01/03/96
– ID Reviews expanded to include external organizations	
– Clarified use and control of unqualified data	

Changes to Design Process

Effective Date

- QAP-3-10 Rev 6, Engineering Drawings — 01/03/96
  - ID Reviews expanded to include external organizations
  - Input Lists not approved by DOE
  - Input Lists and Drawings checked at the same time

YUCCA
MOUNTAIN
PROJECT

Studies

Requirements Status

Presented to:
DOE-NRC Technical Meeting on
Exploratory Studies Facility Design and Construction

Presented by:
Tom Geer

February 15, 1996

U.S. Department of Energy
Office of Civilian Radioactive
Waste Management

ATTACHMENT 6

Scope

- Initial Assessment of NRC 12/14/95 letter
- Hierarchy improvement status
- Status of CAR YM-94-100
- Invert classification status

Comments on NRC Assessment of the Regulatory Compliance Review Report

- The NRC agreed that:
  - the DOE has correctly identified 10 CFR 60 requirements applicable to design package 2C;
  - the DOE has correctly assessed the requirements
- The NRC identified that:
  - the RCRR does not address the issue of flowdown
  - there are some minor issues regarding a few specific 10 CFR 60 citations

Actions Taken to Address Flowdown

- Management review (Nov. 13-17, 1995)
  - "Requirements traceability, with few exceptions, exists within the upper tier requirements documents."
  - "Revisions to these documents should address issues related to traceability ease."
  - "Further work needed to ensure that requirements are fully implemented into design solutions and that design analysis feeds back into the design requirements."

Actions Taken to Address Flowdown

(Continued)

- M&O Surveillance (Nov. 6-20, 1995)
  - "The surveillance confirmed that, in general, the flowdown of requirements from upper to lower level documents is working more effectively than in the past."
  - "With respect to verfiying flowdown of 10 CFR 60 requirements into analysis, the surveillance determined that the existing process works, but it is still cumbersome."

Actions Taken to Address Flowdown

(Continued)

- Presented a successful demonstration of flowdown at the DOE/NRC November 8, 1995 Technical Meeting

- Improvements to ESFDR and Other Design Requirements Documents are currently in review

Specific Flowdown Improvements in ESFDR Rev.2

- Structured by Configuration Item
- Interpretation of 10CFR60 Requirements for the ESF
- Redundant requirements consolidated
- Document 10CFR60 application and interpretation in Appendix F (Specifically Addressing NUREG 1439 requirements)
- Status - Resolving final comments expected resolution mid February 96, effective by Mid March 96

Actions Taken to Improve Flowdown

- Reorganize all of the Design Requirements Documents by CI
- Indicate which requirements originate from 10 CFR 60 with bracketed reference (e.g., [10 CFR 60.122]
- Formed Team to Evaluate the OCRWM Document Hierarchy
- Status of Hierarchy actions
  - In process document revisions on hold
  - ESFDR progressing
  - ACD (R), MPC, Waste Containement and Isolation Strategy (WCIS) and results of team to be evaluated for potential update to hierarchy
  - 2 day offsite conducted on 1/30 & 31 (M&O Design, M&O System Engineering, WAST, PMO, AMSL, AMEFO , OQA)

Background and Status of CAR YM-94-100

- Adverse Condition: There is a lack of adequate flowdown and traceability of 10CFR Part 60 requirements to the ESFDR

- CAR 100 replaced by new CAR (YMQAD-96-C003) to enter the defiency into OQA's new system. A new response is being prepared based on the flowdown evaluations and improvements discussed previously (i.e., RCRR, M&O Surveillance, Mgmt. review)

YUCCA
MOUNTAIN
PROJECT

Studies

Scientific Programs Update

Presented to:
DOE-NRC Technical Meeting on
Exploratory Studies Facility Design and Construction

Presented by:
Mark C. Tynan
DOE Staff, Assistant Manager Scientific Programs

February 15, 1996

U.S. Department of Energy
Office of Civilian Radioactive
Waste Management

ATTACHMENT 7

Exploratory Studies Facility (ESF) Update Scientific Programs

- Structural features
  - Drill Hole Wash fault
  - Sundance fault
  - Ghost Dance fault
- Alcoves
  - Locations, status, objective, plans, results
  - Ghost Dance alcoves
  - Thermal test alcove (in-situ thermal testing)
- Rock mass quality
- Deliverables (1996)

ESF Update:
Geology Support Functions

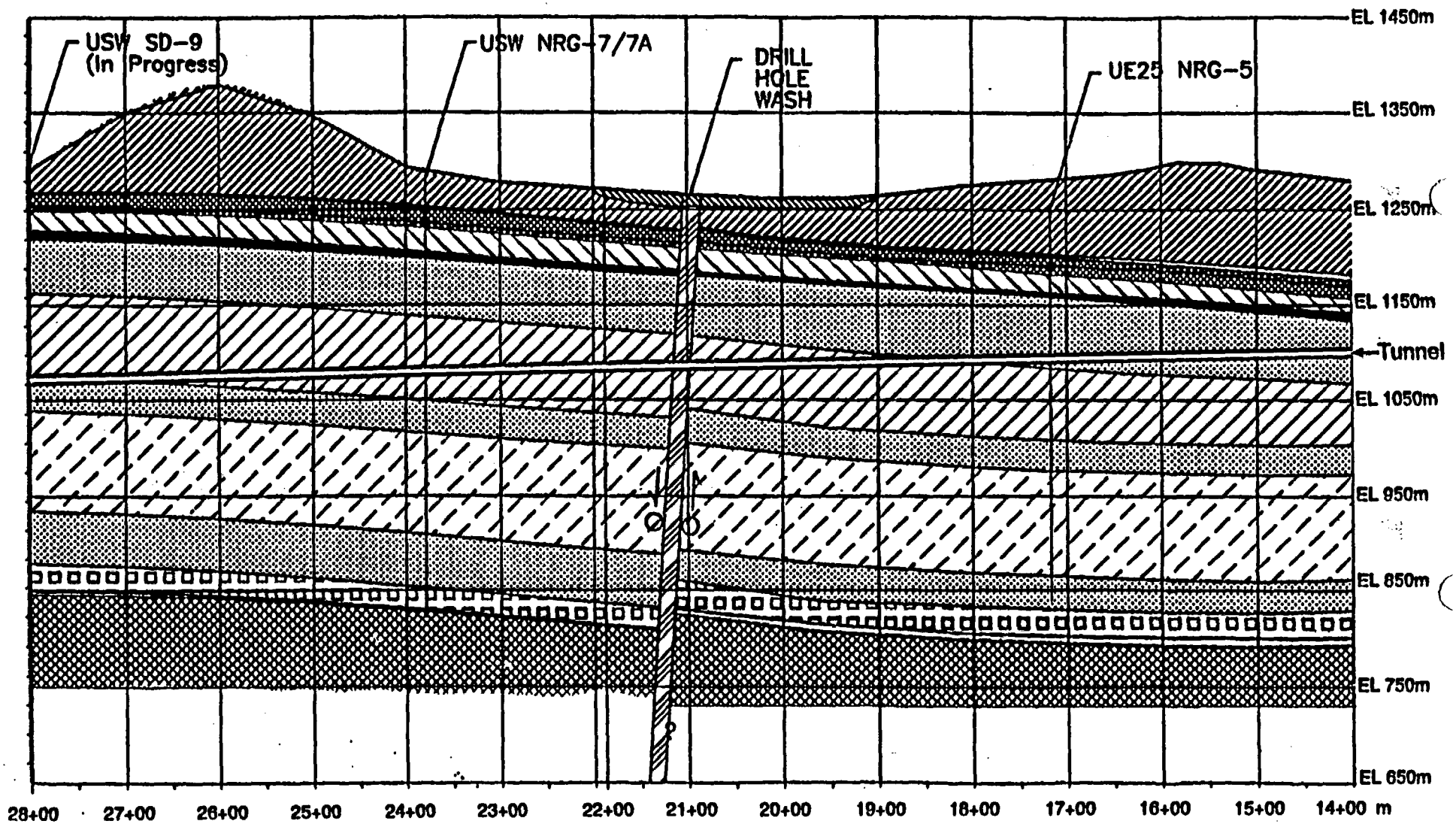
Status 2/14/96 7:30 a.m.

- TBM at station 41+89
- Full periphery mapping completed to station 41+00
- Detailed line survey completed to station 41+06
- Tunnel sterography completed to station 40+91
- RQD classification completed to station 40+76

ESF Update:
Drill Hole Wash Structure

- Two minor faults encountered in ESF north ramp at approximately 19+00 and 22+60
- Vertical displacement 4-6m and ~2.5m respectively
- Category 1 ground conditions throughout, no impact on construction
- No fault observed at predicted 21+00 location
- Based on mapping (surface fault to NE has ~10m displacement), borehole, and geophysical data, expected a strike slip fault characterized by a wide zone of deformation, small (<10m) vertical offset (N Ramp Report)
- DOE reevaluating basis for prediction

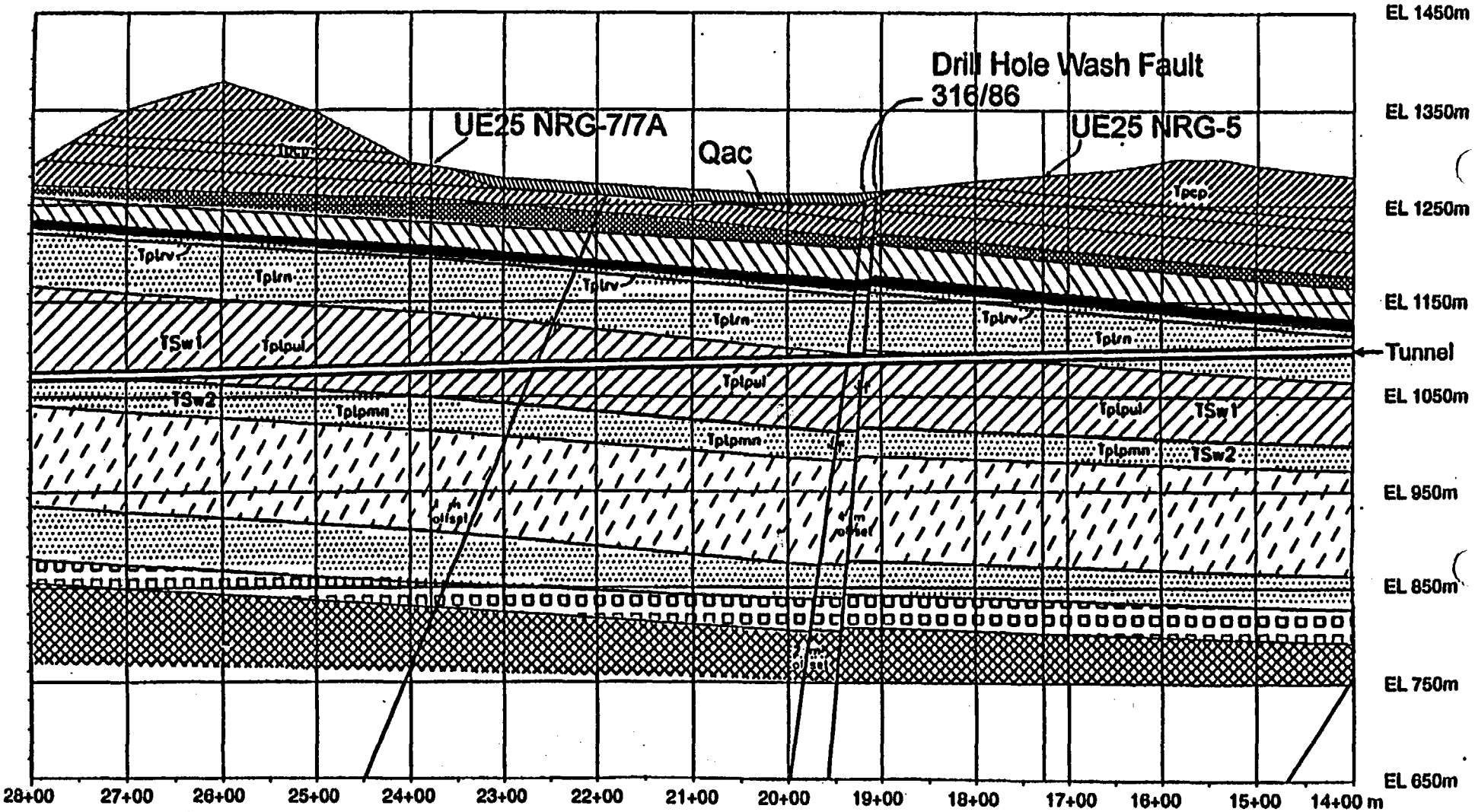
Preconstruction Section



Preliminary

CRSSMP.CDR.123/1-11-96

As-Built Section



Preliminary

CRSSMP.CDR.123/1-11-96

Symbols

GROUP	FORMATION	INFORMAL UNITS	THERMO-MECHANICAL UNITS
		Qac: Alluvium	
TIMBER MOUNTAIN TUFF	RAINIER MESA	Tmr: Rainier Mesa Tuff	
		Tmbt1: pre-Rainier Mesa Tuff bedded tuff	UO
		Tpki: tuff unit "X"	
		Tpbt5: pre-tuff unit "X" bedded tuff	
	TIVA CANYON	Tpc Tiva Canyon Tuff	TCw
		Tbbt4: pre-Tiva Canyon Tuff bedded tuff	
	YUCCA MTN.	Tpy: Yucca Mountain Tuff	
		Tpbt3: pre-Yucca Mountain Tuff bedded tuff	PTn
	PAH CANYON	Tpp: Pah Canyon Tuff	
PAINTBRUSH TUFF		Tpbt2: pre-Pah Canyon Tuff bedded tuff	
		Tptrn: Crystal-rich nonlithophysal crystal-rich vitric zone	TSw1
		Tptpul: Upper Lithophysal crystal-rich and crystal-poor parts	
	TOPOPAH SPRING	Tptpmn: Middle Nonlithophysal crystal-poor	
		Tptpll: Lower Lithophysal crystal-poor	TSw2
		Tptpln: Lower Nonlithophysal crystal-poor	
		Tptpv: Vitric vitrophyre and non welded subzones	TSw3
		Tpbt1: pre-Topopah Spring Tuff bedded tuff	
CALICO HILLS		Tacf: Calico Hill lava flow	
		Tacb: Calico Hills bedded tuff	

STRATIGRAPHIC NOMENCLATURE DEVELOPED BY USGS

DRILL HOLE WASH FAULT ZONE LOCATION AND ATTITUDE UNCERTAIN

BOW RIDGE FAULT ZONE

MINOR FAULT, ? -ATTITUDE UNCERTAIN

PROPOSED NORTH RAMP ALIGNMENT

APPROXIMATE

STRIKE-SLIP SEPARATION INTO PAGE

STRIKE-SLIP SEPARATION OUT OF PAGE

CROSS3.CDR.122/1-11-96

ESF Update: Sundance Fault

- ESF located SE of mapped surface position of Sundance; only minor features expected and encountered in excavation
- Northwest trending shears encountered between 35+85 and 36+40 in ESF
- Small discontinous fault planes
- Low angle and horizontal slickensides suggestive of small lateral movement
- Vertical offset cannot be documented
- Some minor breccia, no mineralization
- Within Topopah Spring crystal poor middle non-lithophysal zone
- Ground conditions category 1; no impact

Ghost Dance Fault Surface Mapping

1995 = Repository area surface mapping at 1:6000 scale indicates GDF:

- In part consists of segmented, and discontinuous fault planes
- Terminates at Wren Wash to North
- Bifurcates to join Abandon and Dune Wash faults to the south
- Maximum displacement occurs in central repoitory area (Whaleback Ridge)
  - 5-20' of throw at north and south ends; 60-100' in central area
- Characterized by west dips of 75°-85°

Subsurface Characteristics of the Ghost Dance Fault

- Surface mapping indicates fault terminates to south of the ESF North Ramp; fault feature not expected in ESF N/S main or North Ramp
- Fault was not encountered by ESF excavation, as expected
- Fault will be penetrated by alcoves 6 and 7 (see later discussion, plans for GDF alcoves)

Ghost Dance Fault

- Paleo seismic studies being finalized at Whaleback Ridge, Split Wash and Antler Ridge
- Whaleback Ridge: fault exposed in the Tiva, carbonate laminae dated at 80-90 ka overlie the fault; cosmogenic dates indicate long term stability of bedrock surfaces adjacent to the fault
- Split Wash: alluvial deposits trenched, but fault not epxosed in bedrock - only able to show that latest Pleistocene deposits overlie the fault
- Antler Ridge trench: fault exposed in the Tiva, but unable to conclusively demonstrate that pre-latest Pleistocene deposits overlie the fault
- Detailed topographic profiles at 2 locations on ridge tops show no steeply sloping scarp segments that can be associated with late Quarternary surface displacement

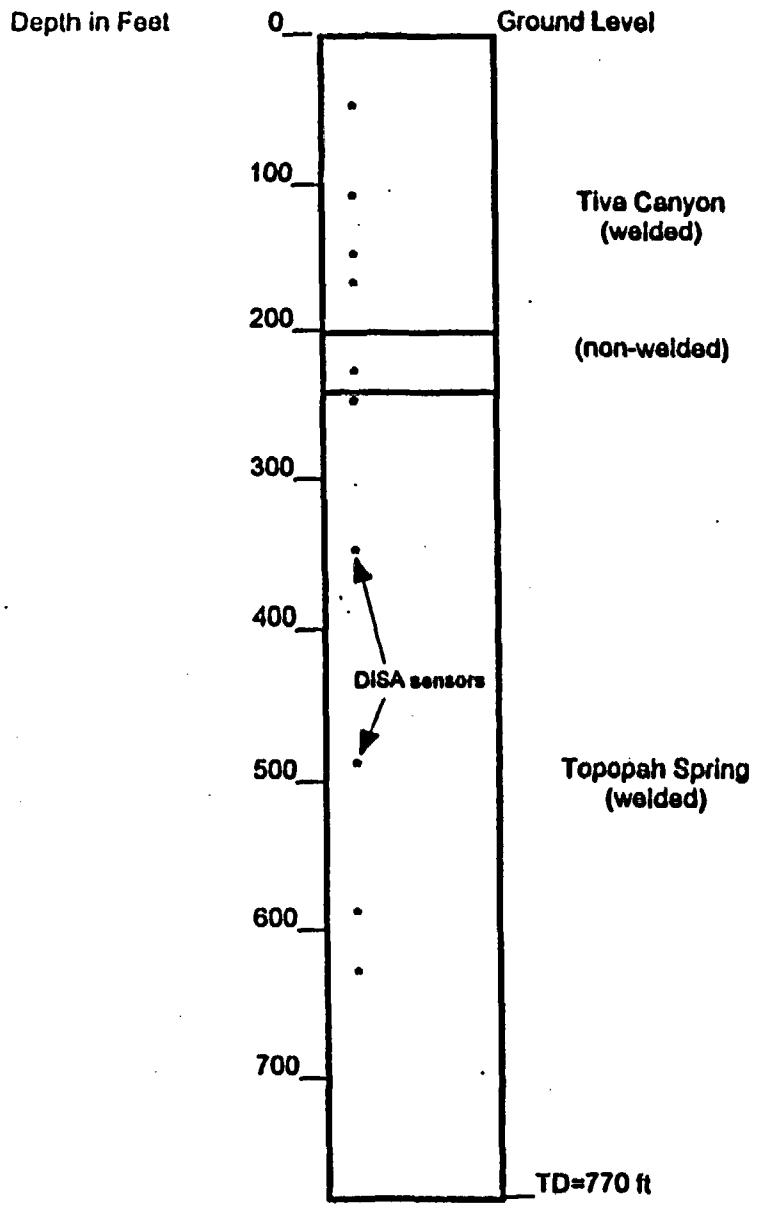
Ghost Dance Fault
Additional Work

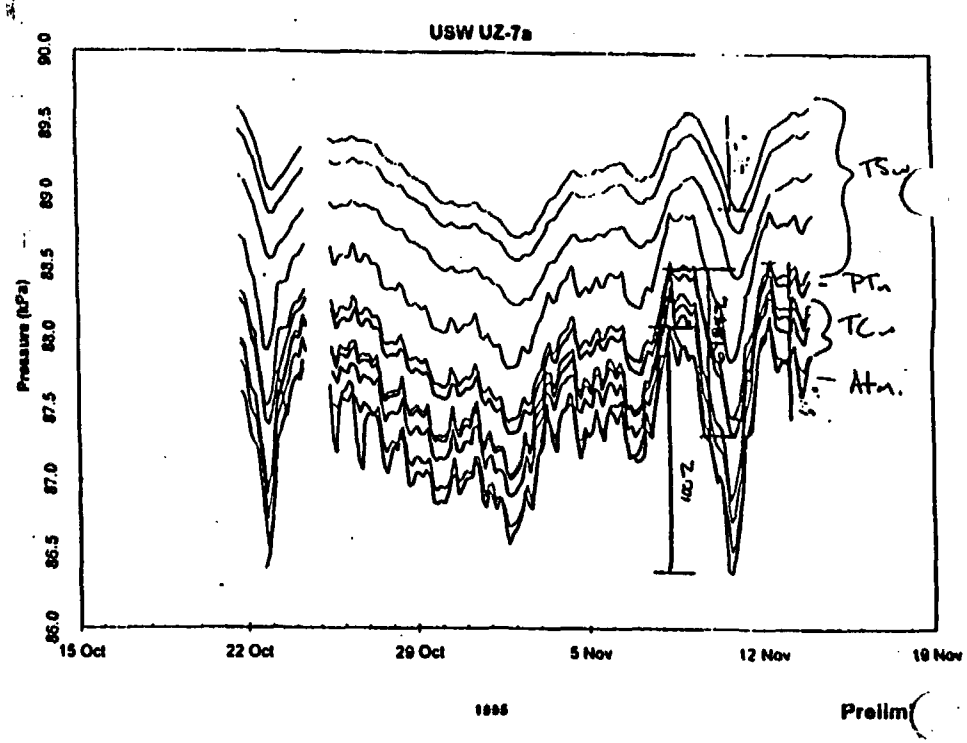
- No further field paleoseismic studies - complete logs of existing trenches
- Complete surface characterization as part of the 1:6000 central block mapping
- Characterize in the Topopah with exploratory drifts - define location, compare with surface characterization

Drilling and Testing Program Directed Toward Characterization of Ghost Dance Fault

- No surface drilling to investigate GDF planned for the fiscal year
- Alcove construction to be initiated in FY96 for exploration of GDF proximal to intersection with Sundance feature
- Completed instrumentation of UZ7a, for pneumatic pathways testing; will instrument SD7, March 1996
  - Preliminary results from UZ7a suggest no delay in response of air pressure to changes induced by barometrc pressure changes. Suggests open fracture system to depth, above Calico Hills unit.

Instrumentation for Pneumatic Testing Program
USW UZ-7a





UZ-7a

- **Preliminary pneumatic instrumentation response data shows no dampening or lagging of barometric signals throughout the borehole depth**
- **This is indicative of a highly fractured, open, fault zone**

* = DISA (Downhole Instrument Station Apparatus)

(OVERHEAD)

ESF Alcoves
Objectives, Status, Results

- Proposed and existing alcoves

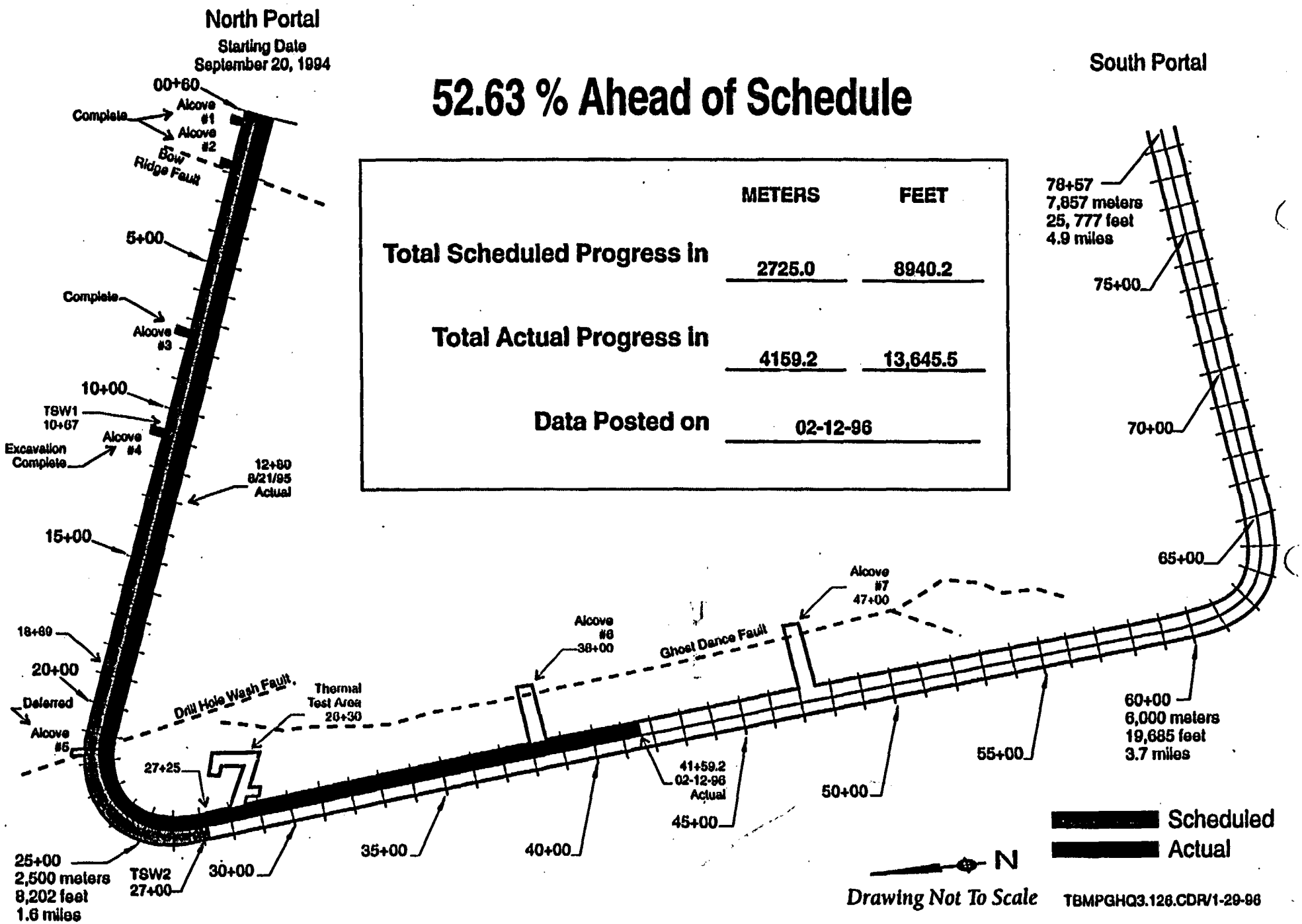
Alcove#	Construction Status	Objective
2	complete	test Bow Ridge fault
3	complete	Test lower Tiva welded
4	complete	Test PTn non-welded
5	constructing	Thermal testing
6,7?	designing	Test Ghost Dance fault

- Purpose of alcove testing
- Ghost Dance alcove testing
- Existing alcove test results
- Thermal alcove testing

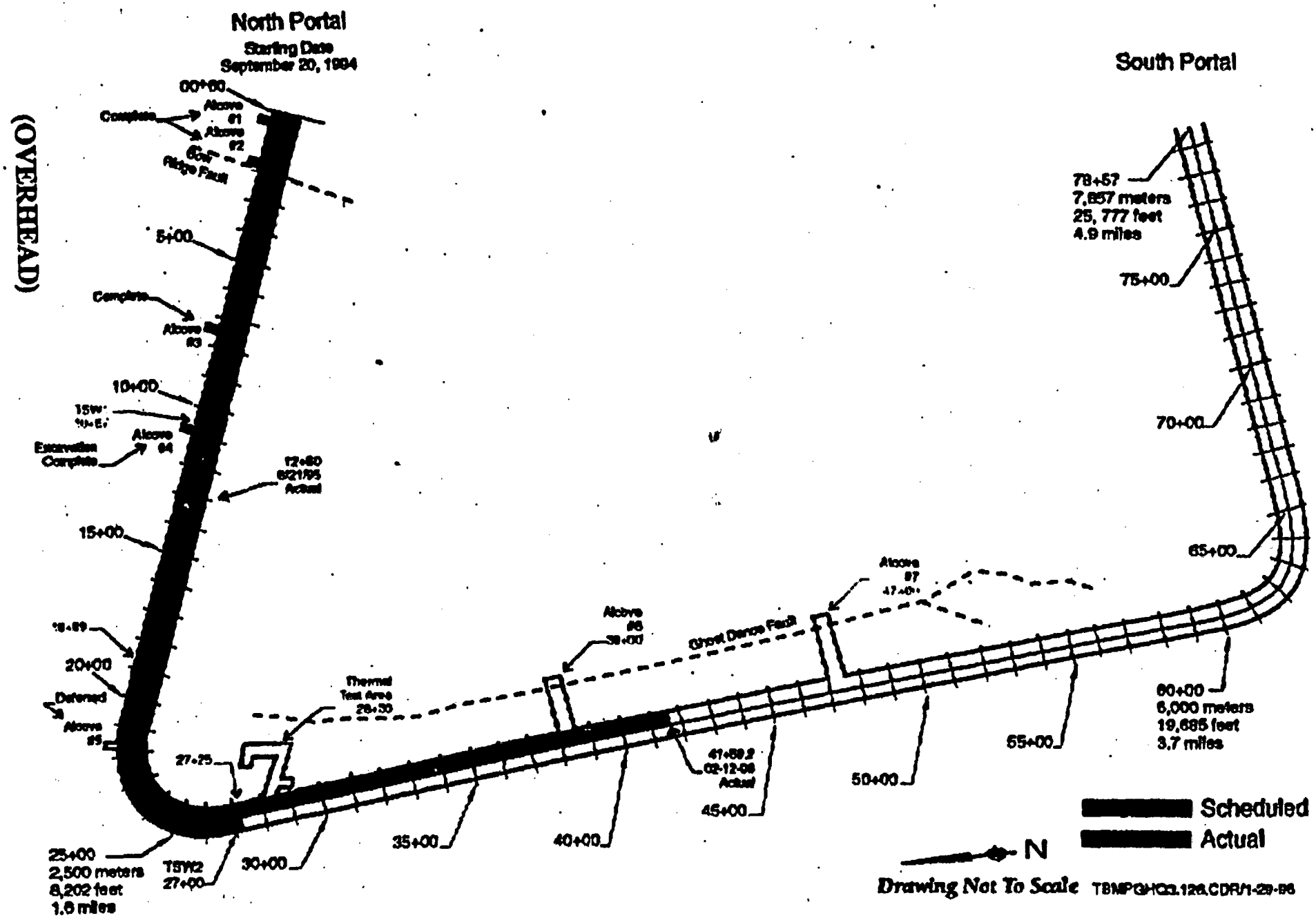
TUNNEL BORING MACHINE PROGRESS

52.63 % Ahead of Schedule

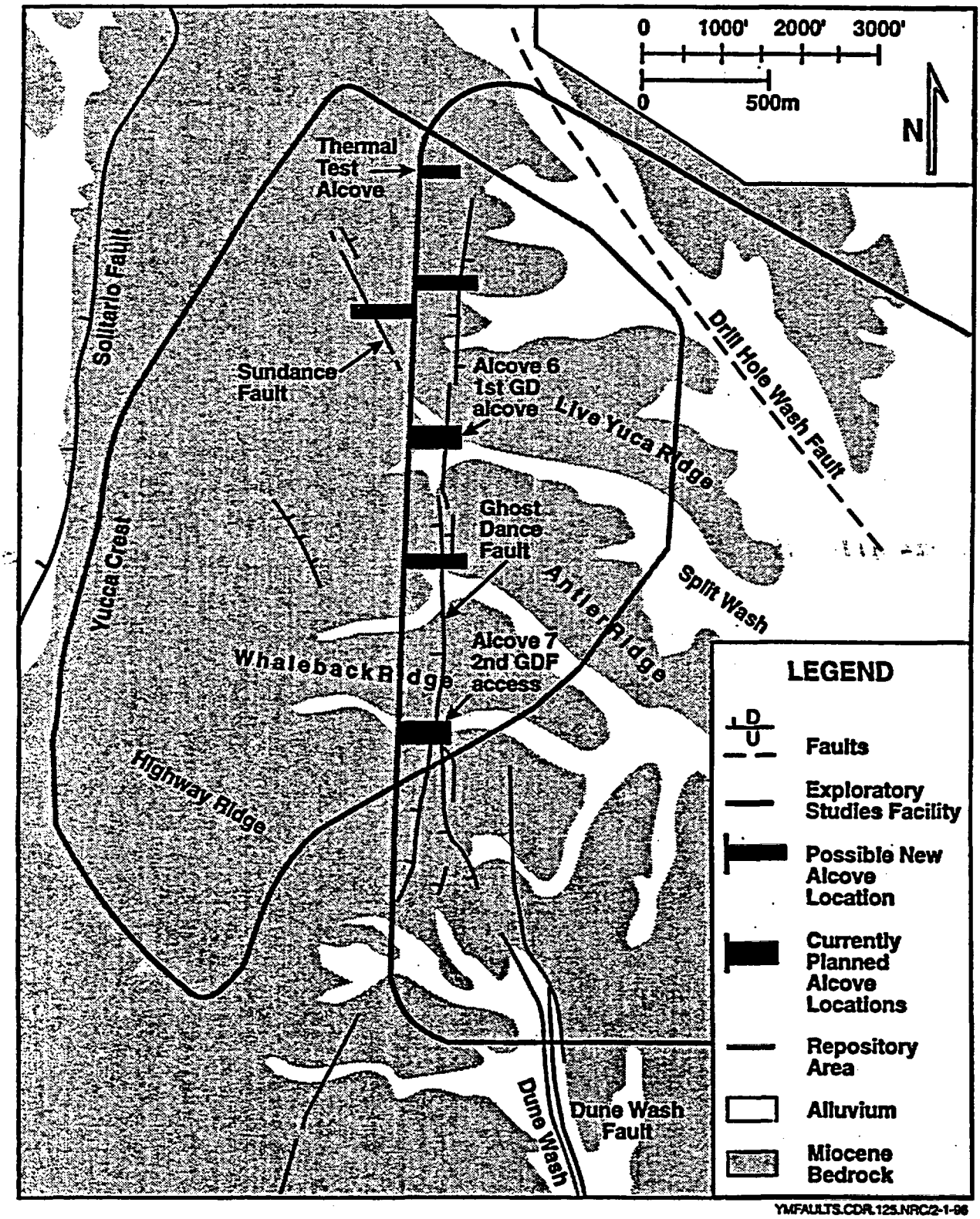
	METERS	FEET
Total Scheduled Progress in	2725.0	8940.2
Total Actual Progress in	4159.2	13,645.5
Data Posted on	02-12-96	



TUNNEL BORING MACHINE PROGRESS



Yucca Mountain Faults, Alcoves



YMFAULTS.CDR.125.NRC2-1-96

Purpose of ESF Alcoves

- Determine fault dip, strike, characteristics
  - Spatial (vertical, lateral) offset analysis
  - Refine understanding of temporal sequence of offset
  - Composition of fault zone
- Obtain fracture characteristics
- Refine structural model of faulting in YM area
  - "Growth fault" = pre Tiva activity
  - Horsetailing concepts = faults simpler at depth
- Obtain other supporting evidence
  - Natural resource: evidence of mineralization in fault zone
  - Volcanism programs: evidence of intrusions on fault planes
- Characterization of UZ rock and fault properties for UZ flow and transport models

Purpose of ESF Alcoves

- Hydrologic testing objectives
  - Pneumatic testing (flow properties)
  - Gas sampling (gas phase chemistry)
  - Pore water sampling (water chemistry)
  - Saturation data (fractures and matrix)
  - Moisture tension (capillary pressure)

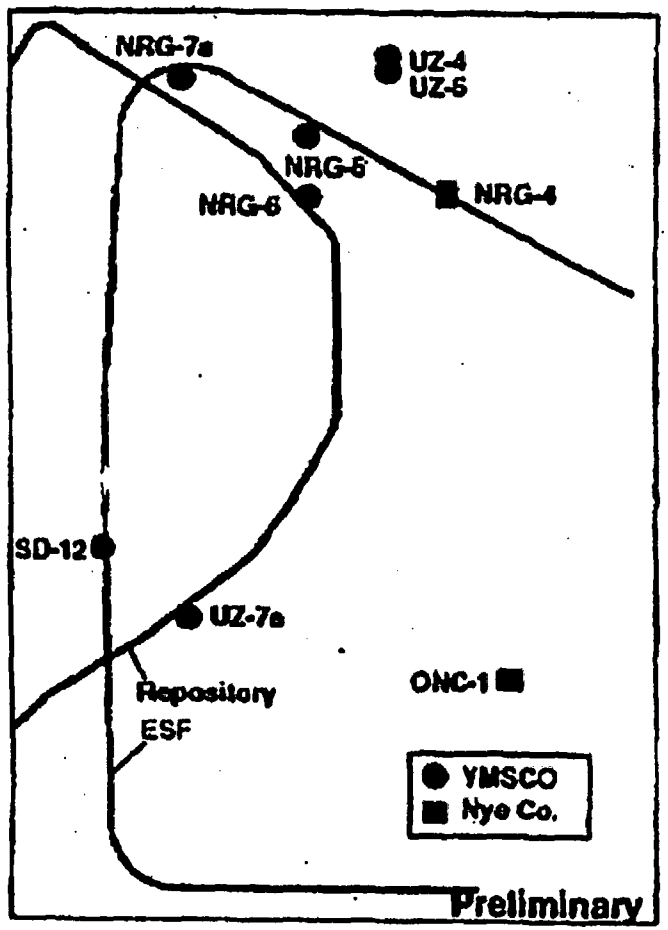
Sample Testing in Existing Alcoves

- 4 coreholes completed to date
- Measurement of core moisture content continues
- Temperature, video and caliper logs run

(OVERHEAD)

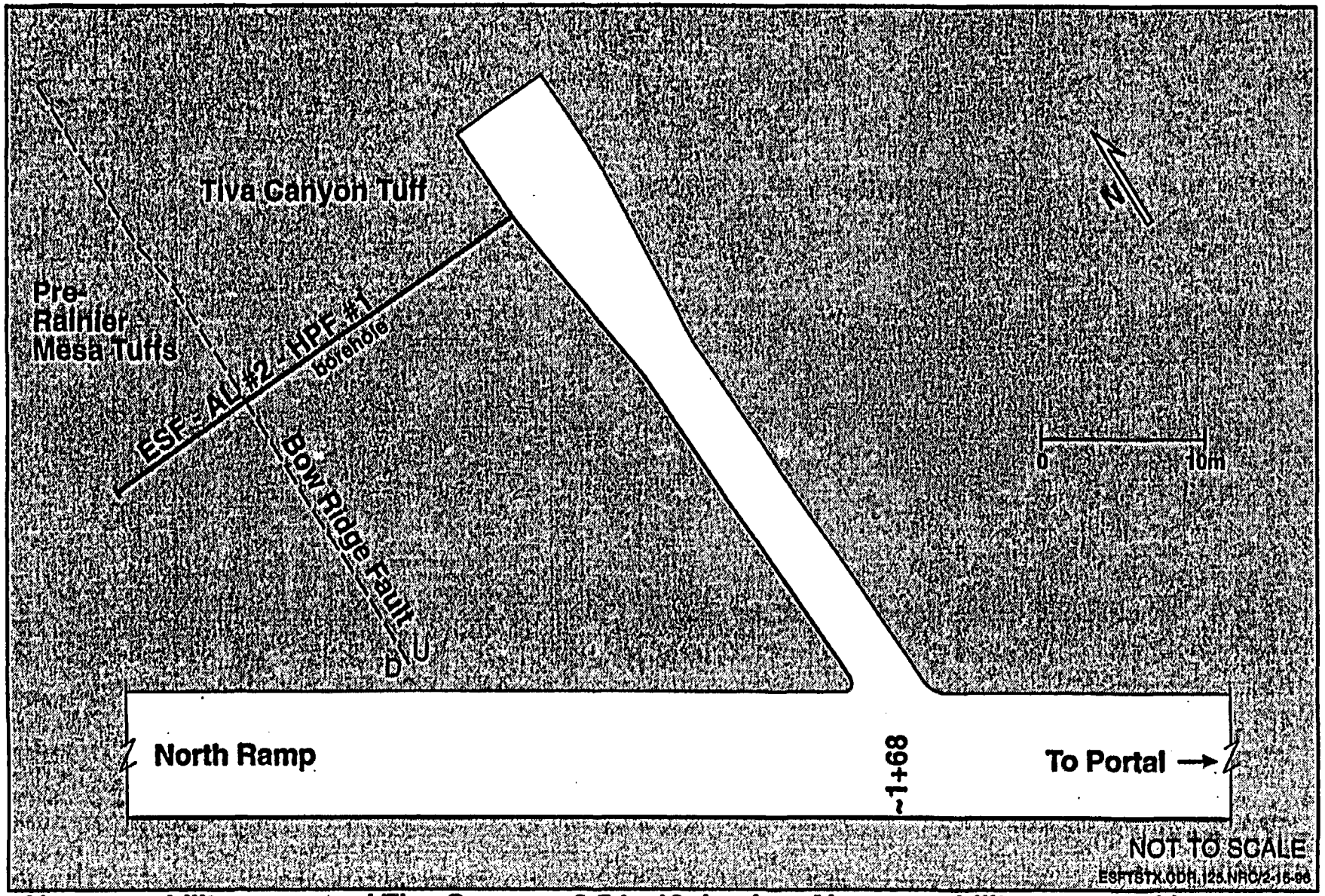
Pneumatic Testing/Monitoring

- DOE currently monitoring seven boreholes
- Nye County monitoring an additional two boreholes
- Response at depth to barometric pressure fluctuations recorded
- Pneumatic response to ESF penetrating PTn recorded
- Pressure response calculations made with UZ gas flow model



ESF Alcove 2

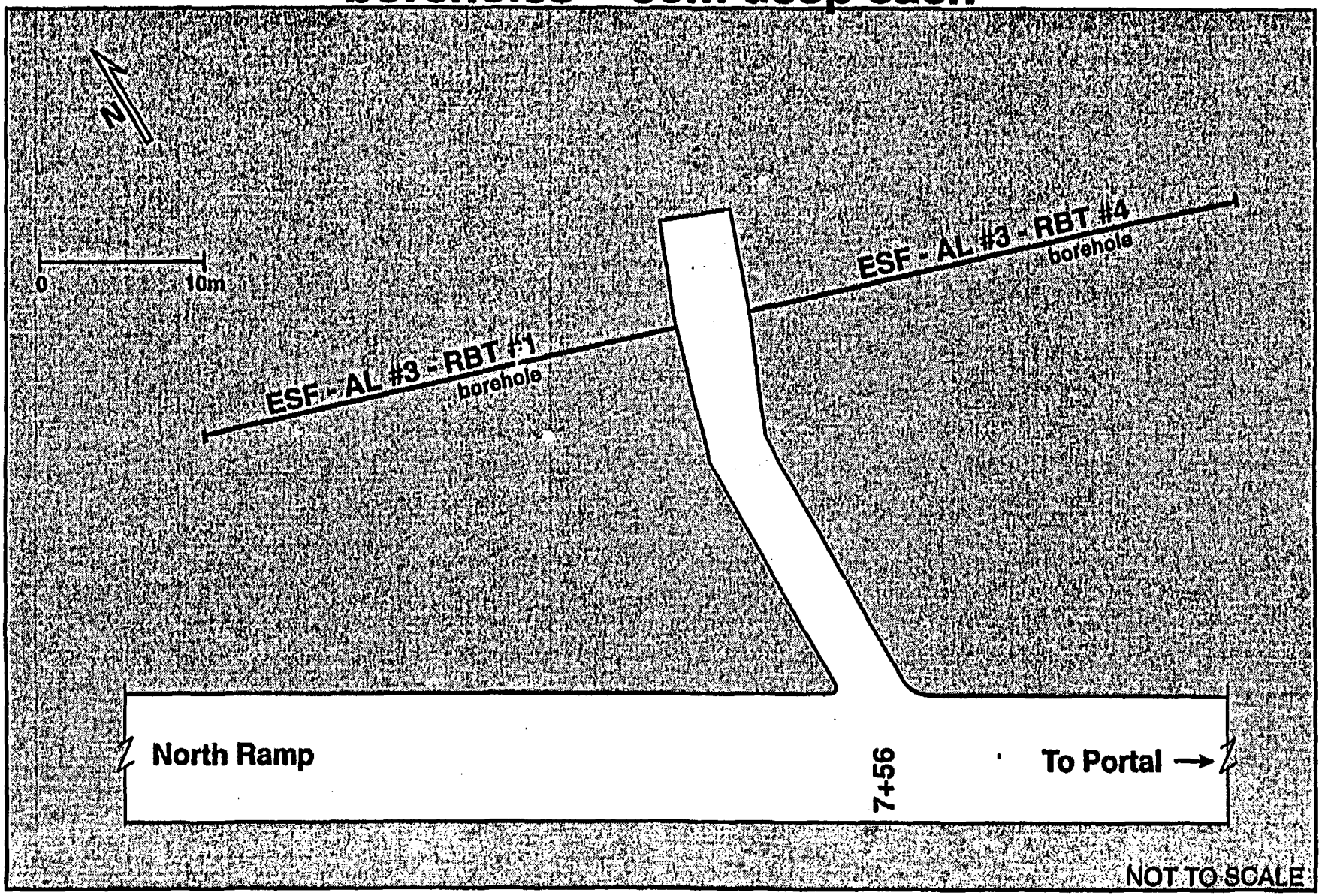
Bow Ridge Fault Test; one radial borehole ~30m deep



Air permeability measured Tiva Canyon ~0.5 to 13 darcies, Air permeability measured in Bow Ridge fault ~8 darcies, Air permeability measured Pre-Rainier ~14 to 27 darcies

ESF Alcove 3

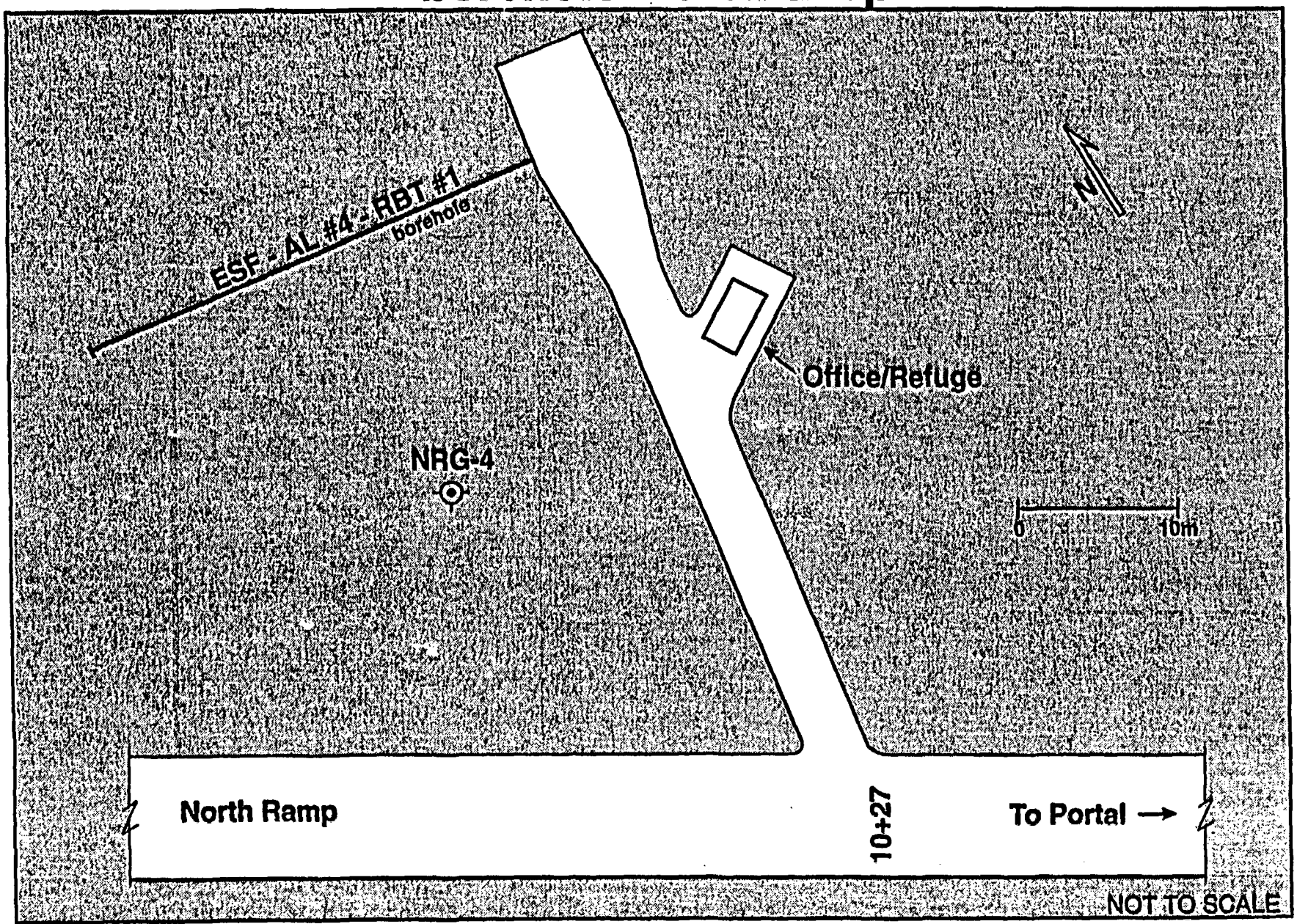
Test of Lower Tiva hydrostratigraphic unit; two radial boreholes ~ 30m deep each



Testing not yet initiated; boreholes recently completed

ESF Alcove 4

Test of PTn hydrostratigraphic unit; one radial borehole ~ 30m deep



Testing not yet initiated; boreholes recently completed

Planned Ghost Dance Fault Alcove Testing

Phase I

- Sub horizontal borehole
  - 30 to 60 meters (west of Ghost Dance through fault)
- Air K-testing, thermal temperature logs

Phase II

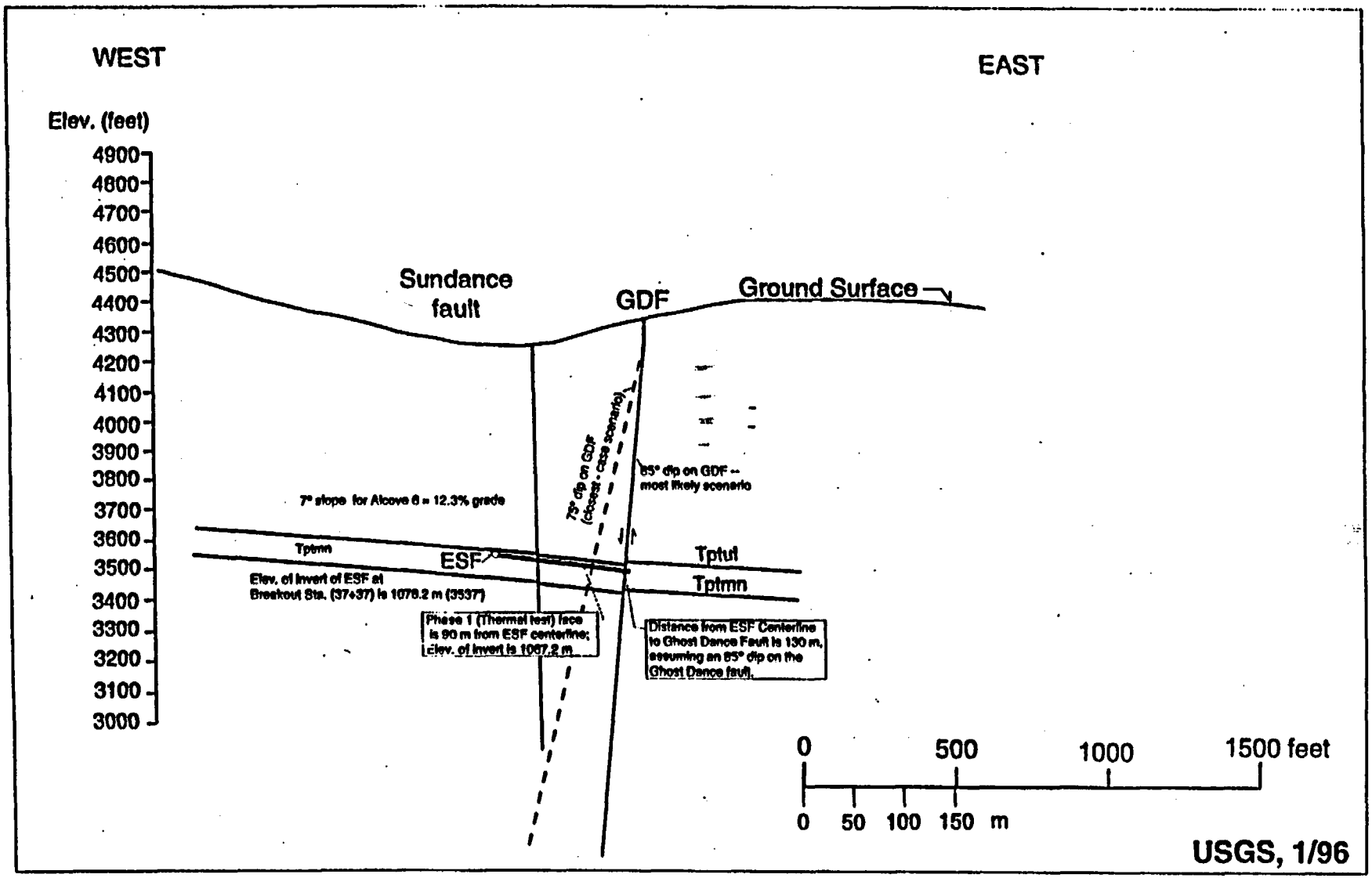
- Alcove construction
  - through Ghost Dance fault
  - Parallel to Ghost Dance fault on east side

Phase III

- Multiple (4) boreholes for hydrologic testing

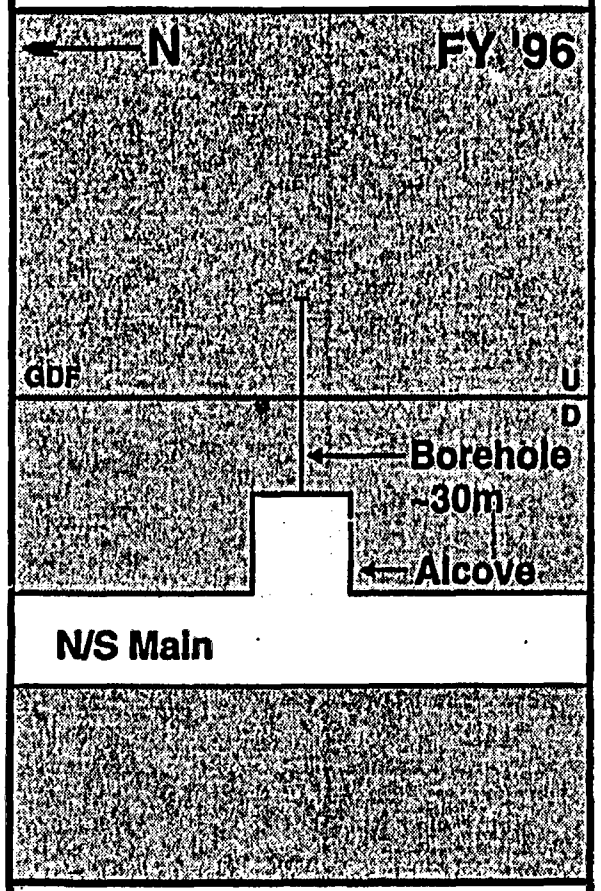
INFORMATION ONLY. PARTICIPANTS' USE ONLY.

GEOLOGIC DRAWING FOR ALCOVE 6, ASSUMING AN 85° WESTERLY DIP FOR THE GHOST DANCE FAULT AND AN 89° EASTERLY DIP FOR THE SUNDANCE FAULT (75° dip also shown for Ghost Dance).
ALCOVE (SHOWN IN GRAY BELOW) BREAKS OUT OF ESF AT 37+37, HEADS DUE EAST, AND HAS A 7° SLOPE.



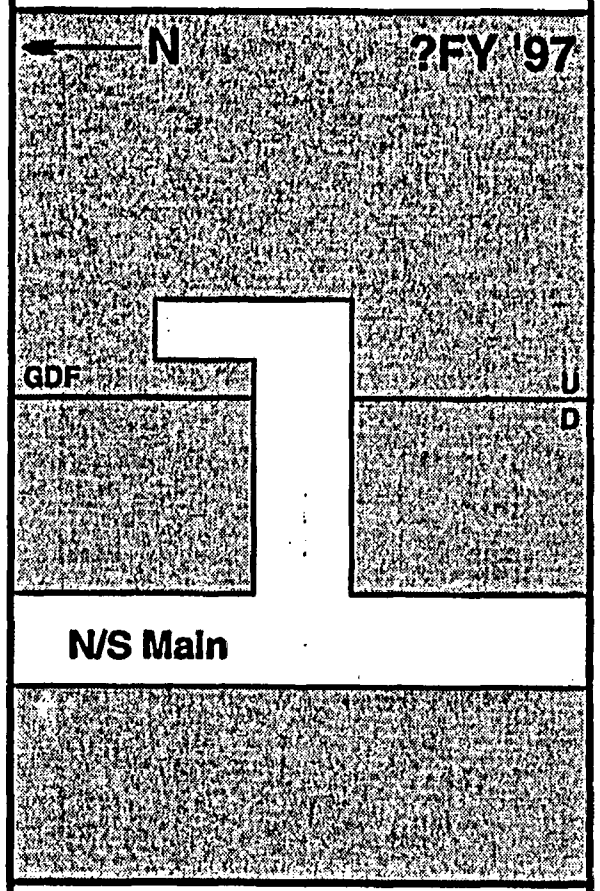
Planned GDF Alcove 6 Testing

Phase 1



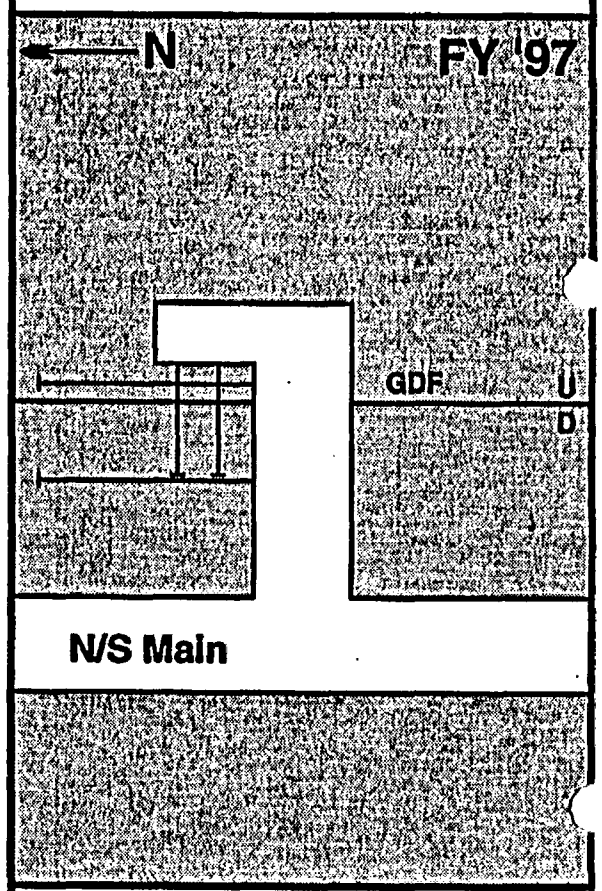
- Single Borehole
  - Thermal log
  - Hydro-chem/Air-K Tests

Phase 2



- Complete alcove excavation

Phase 3



- 4 Boreholes
  - 2 parallel GDF
  - 2 perpendicular GDF

Cross hole testing

PRELIMINARY

(Drawing Not to Scale)

Thermal Test Alcove: In-Situ Heater testing

Rationale

- Had to be in repository horizon
- Sooner is better than later; North rather than South
- Repository designers wanted alcove located East of main so as not to impact design
- Final location based on geology (in TSw2)

ESF Thermal Test Alcove Information Sought

- System Shakedown - Single Heater Test
  - Measure rock mass qualities from single heater test (thermal, mechanical, hydrologic)
  - Determine rock bolt performance under thermally perturbed conditions
  - Test instrumentation and workforce performance
  - Operations and logistics test for future work

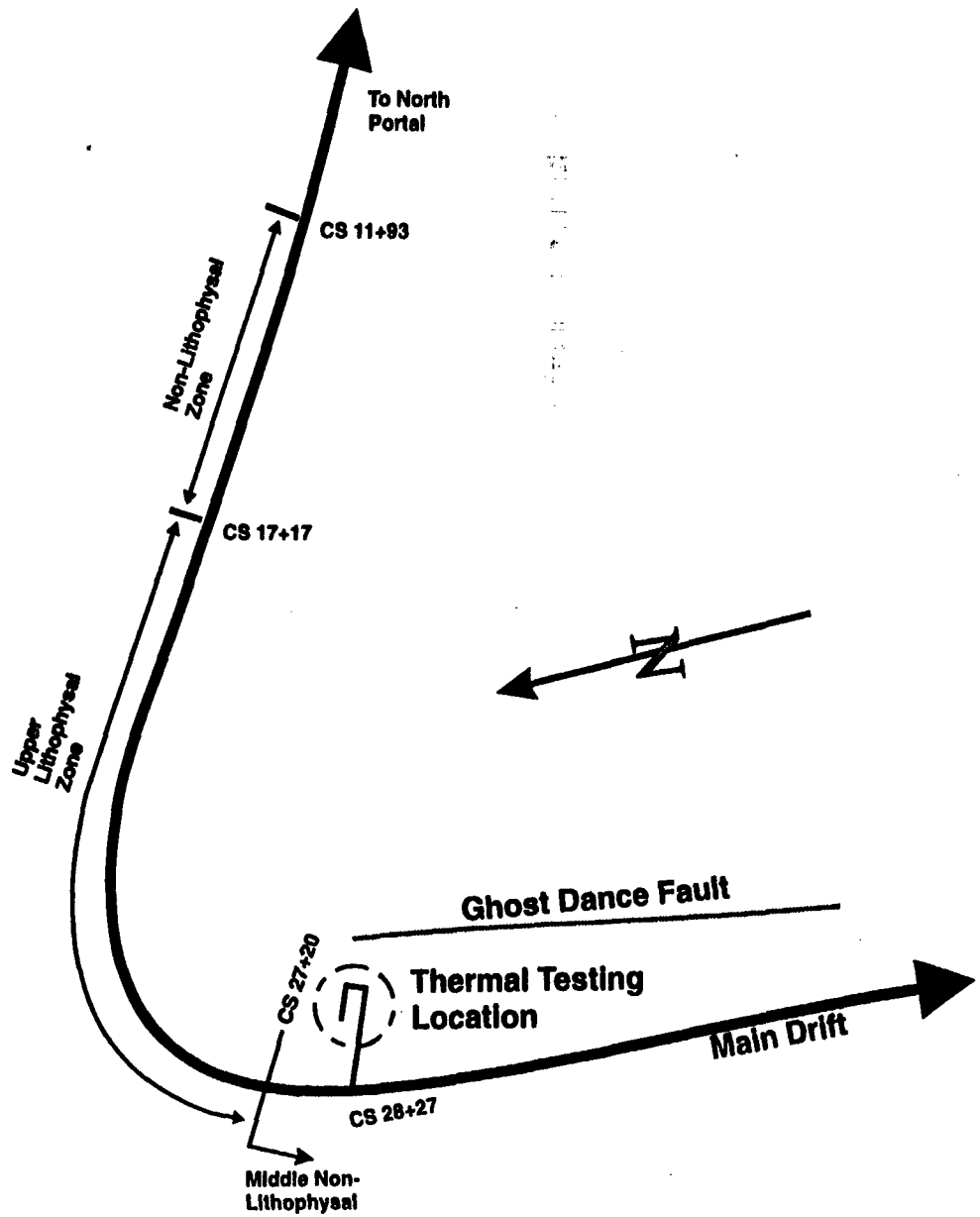
ESF Thermal Test Alcove Information Sought

- Examination of coupled processes
  - a) single heater test starting in FY'96, and
  - b) drift scale test in FY'97
- Processes and parameters to be examined
  - Thermal hydrologic
  - Thermal mechanical
  - Thermal chemical
- Derivation of critical data sets required to assess performance of the geologic and engineered barrier systems in thermally perturbed conditions; analog data permitting some measure of scaling in modeling of systems' performance

ESF Thermal Test Alcove Information Sought

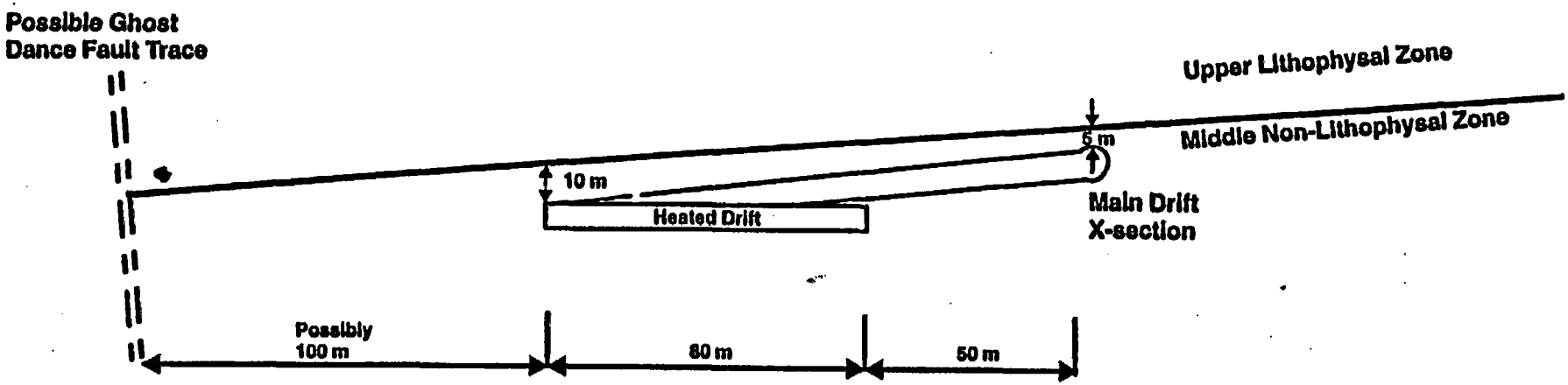
- Preclosure
  - Thermal properties
  - Deformation and strength
  - Near-field environment
- Postclosure
  - Heat driven processes
  - Near- and far-field environment

Plan View of Thermal Test Facility



PRELIMINARY
(Drawing Not to Scale)

Cross-Section of Thermal Test Facility



PRELIMINARY
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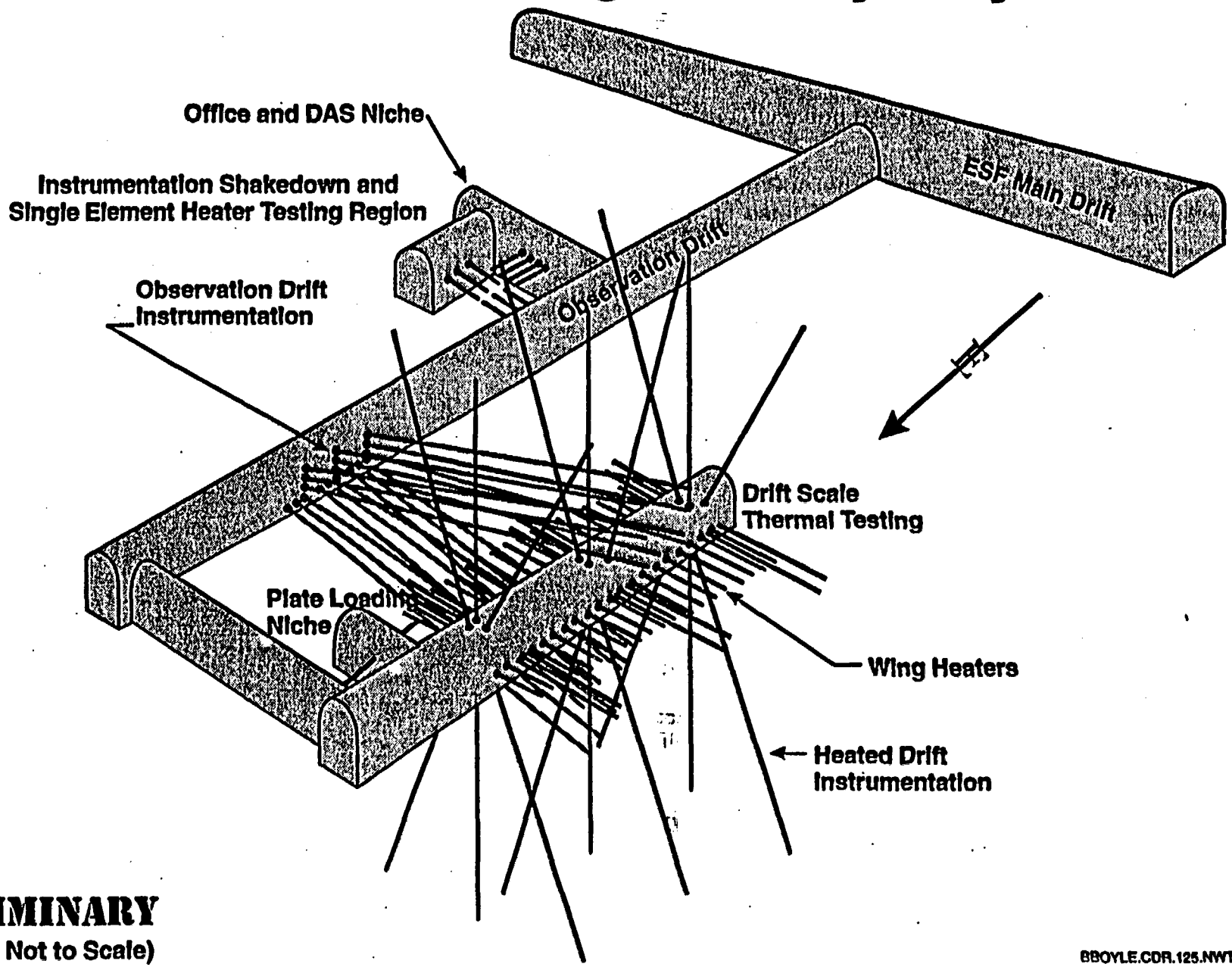
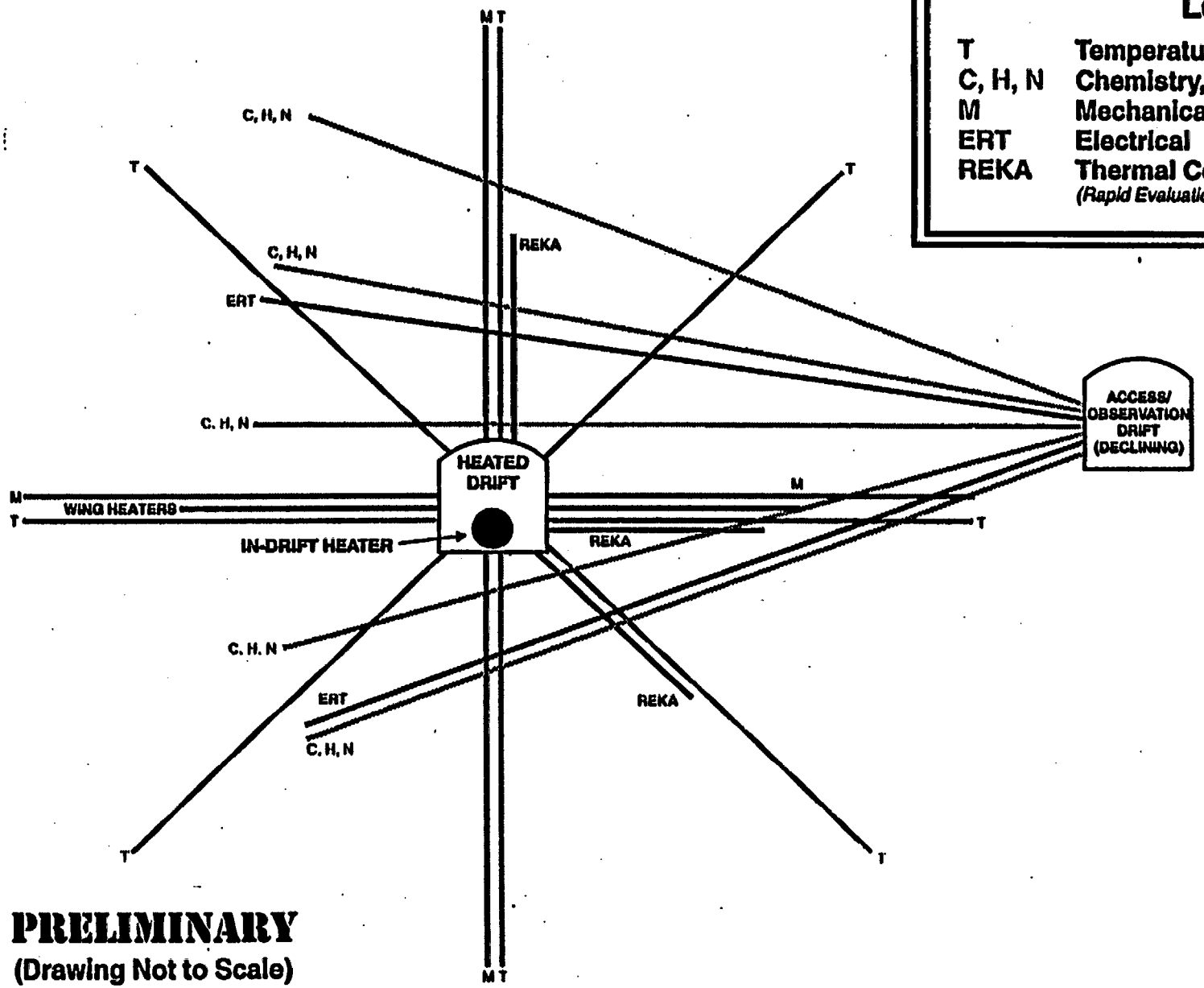
Schematic Illustration Of The Thermal Testing Facility Layout



PRELIMINARY
(Drawing Not to Scale)

Thermal Testing In The ESF - Phase 1

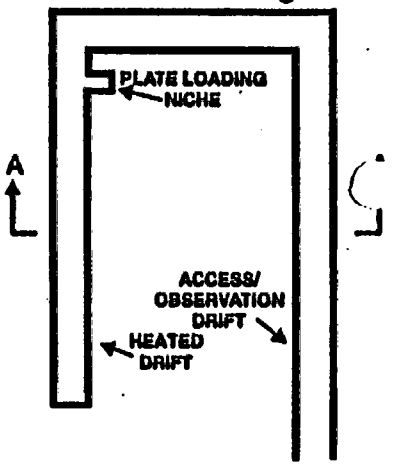
Heated Drift Stage - Borehole Arrangement and Typical Cross Section



Legend

T	Temperature Holes
C, H, N	Chemistry, Hydrology, Neutron Holes
M	Mechanical Holes
ERT	Electrical Resistivity Tomography
REKA	Thermal Conductivity and Diffusivity *(Rapid Evaluation of K and Alpha Thermal Probes)*

Cross-Section Legend

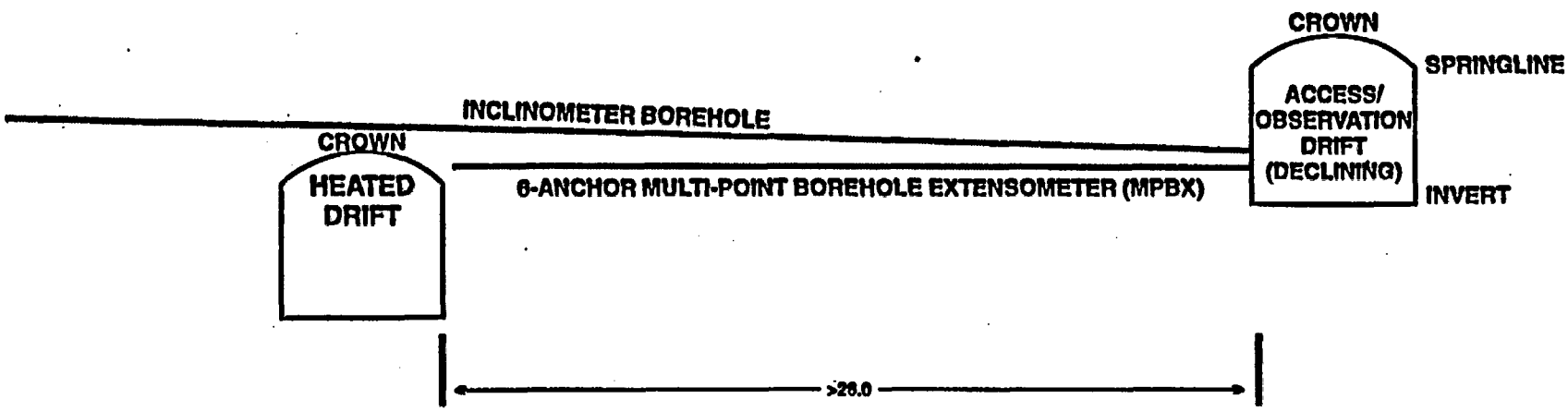


PRELIMINARY

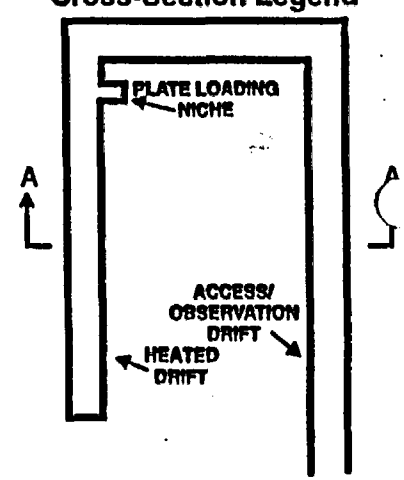
(Drawing Not to Scale)

Thermal Testing In The ESF - Phase 1

Sequential Drift Mining Stage - Borehole Arrangement and Typical Cross-Section



Cross-Section Legend



PRELIMINARY

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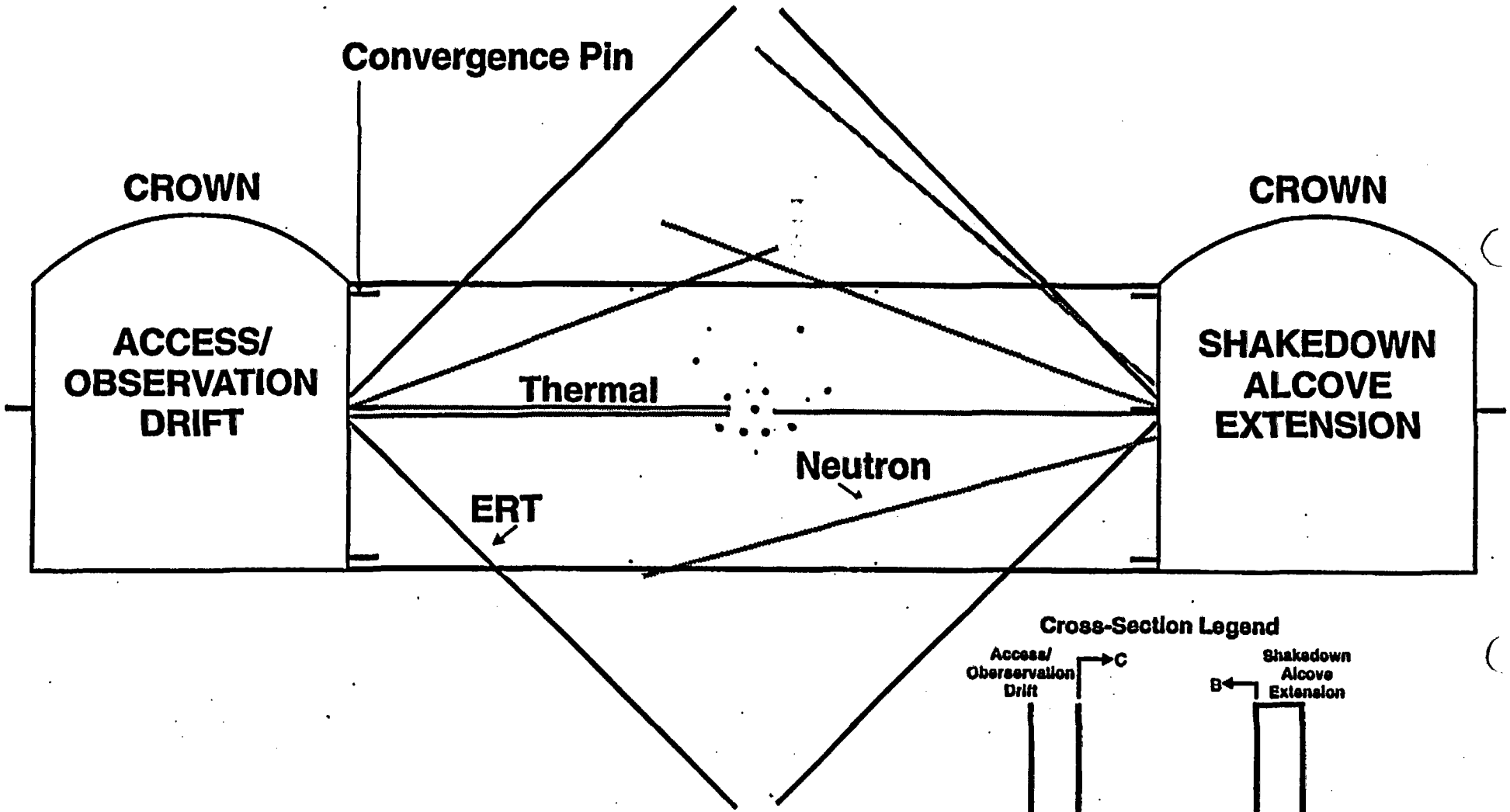
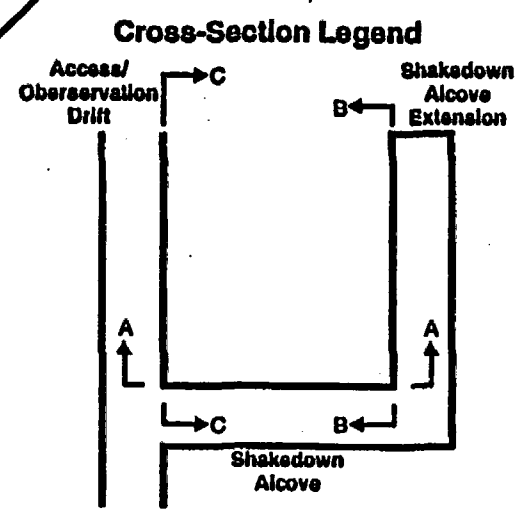
Thermal Testing In The ESF - Phase 1

Shakedown/Single Element Heater Stage - Administrative Borehole Arrangement



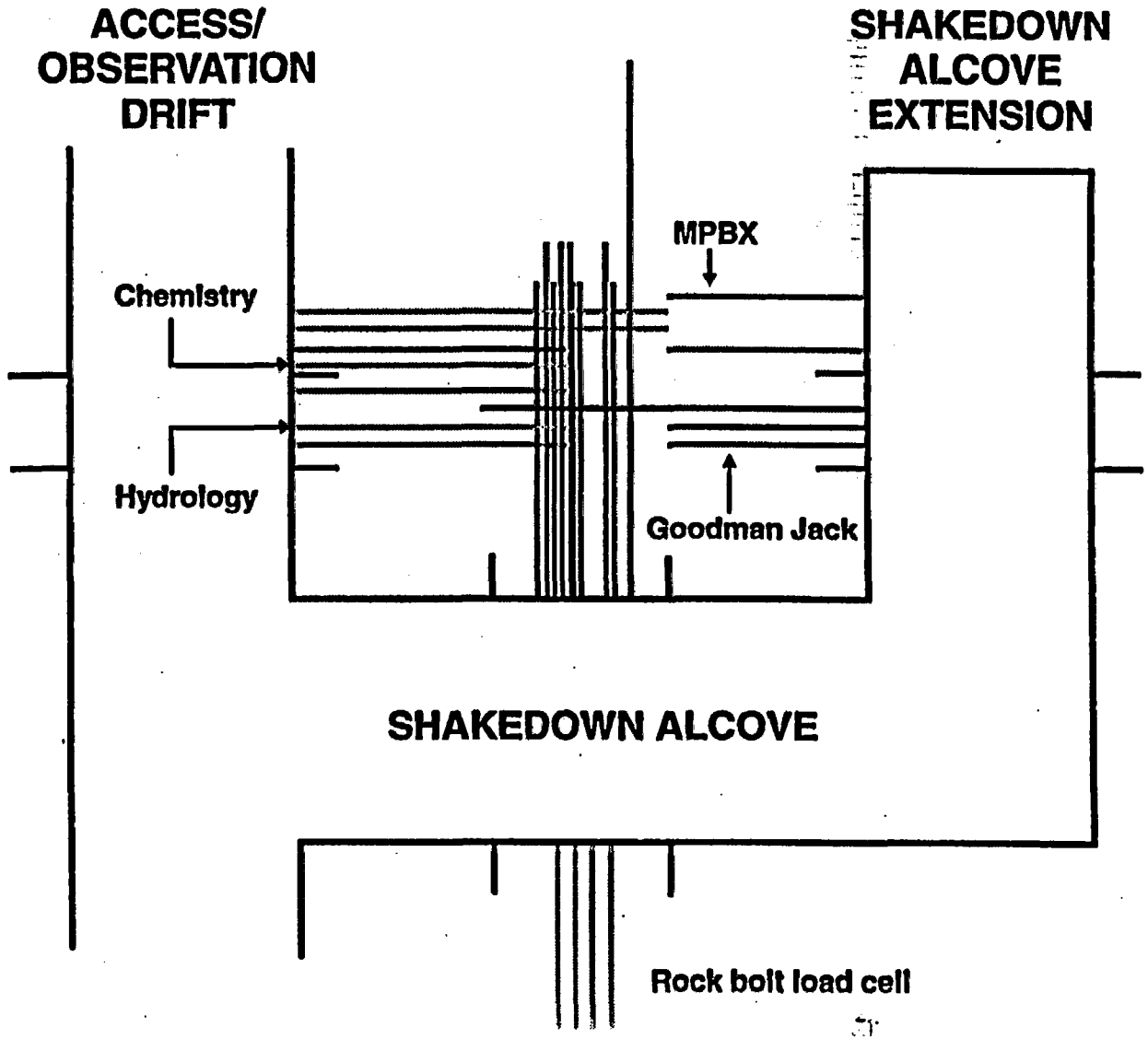


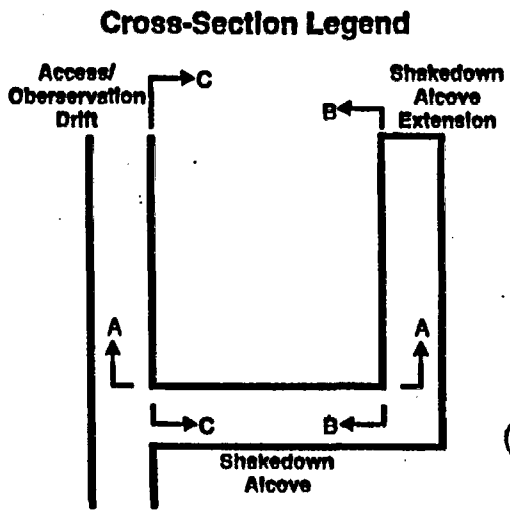
PRELIMINARY
(Drawing Not to Scale)

BBOYLE.CDR.125.NWTRB/2-1-98

Thermal Testing In The ESF - Phase 1

Shakedown/Single Element Heater Stage - Administrative Borehole Arrangement





PRELIMINARY

(Drawing Not to Scale)

ESF Thermal Test Schedule

Current FY96 Funding

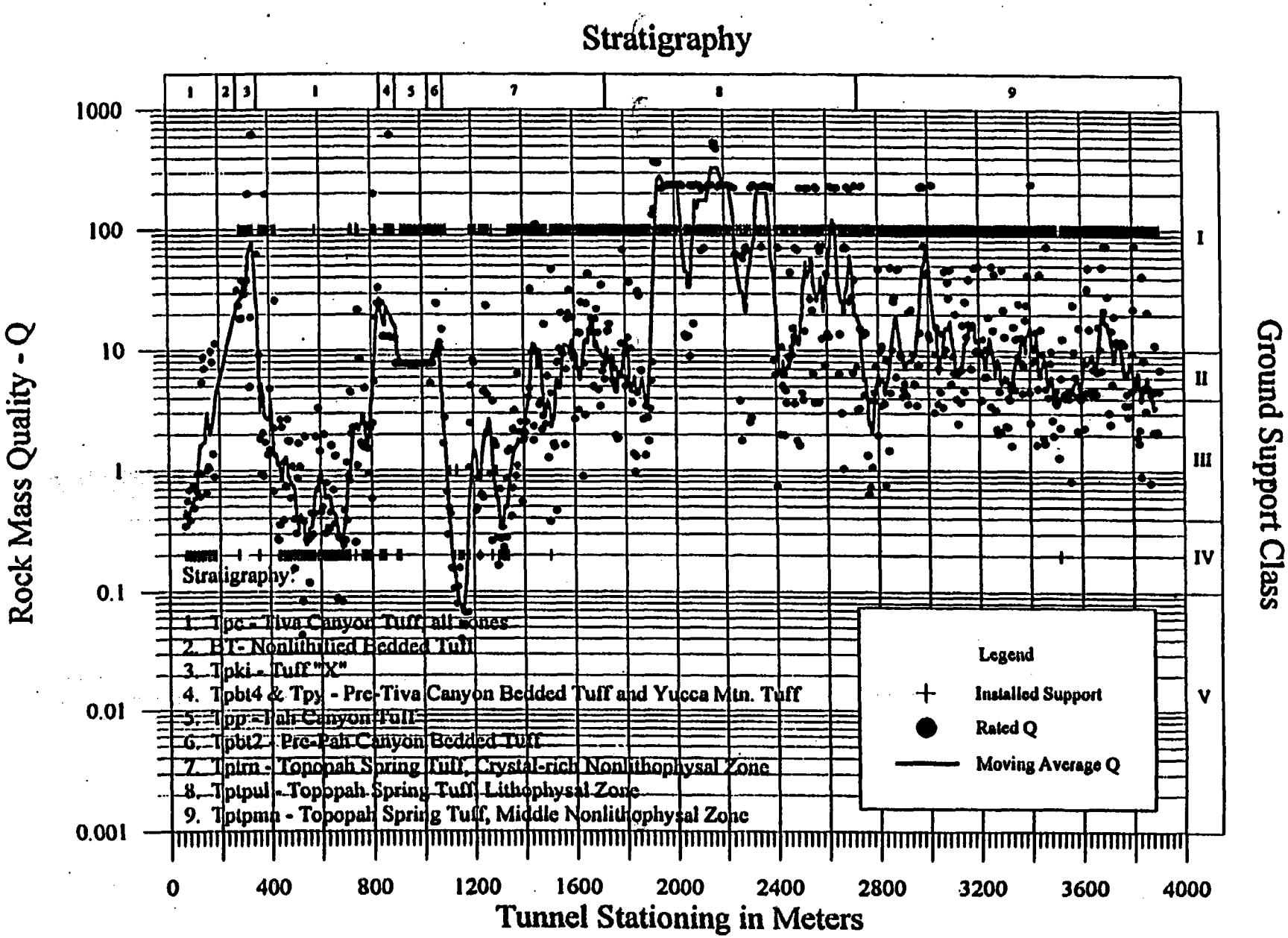
	Shakedown/Single Heater Element Phase	Drift Scale Phase
Heater on	December 1996	September 1997
Heater off	December 1997	March-September 1999
Test Complete	December 1998	September 2000 - March 2001

Accelerated Schedule

	Shakedown/Single Heater Element Phase	Drift Scale Phase
Heater on	August 1996	June 1997
Heater off	August 1997	December 1998 - June 1999
Test Complete	August 1998	March 2000 - September 2000

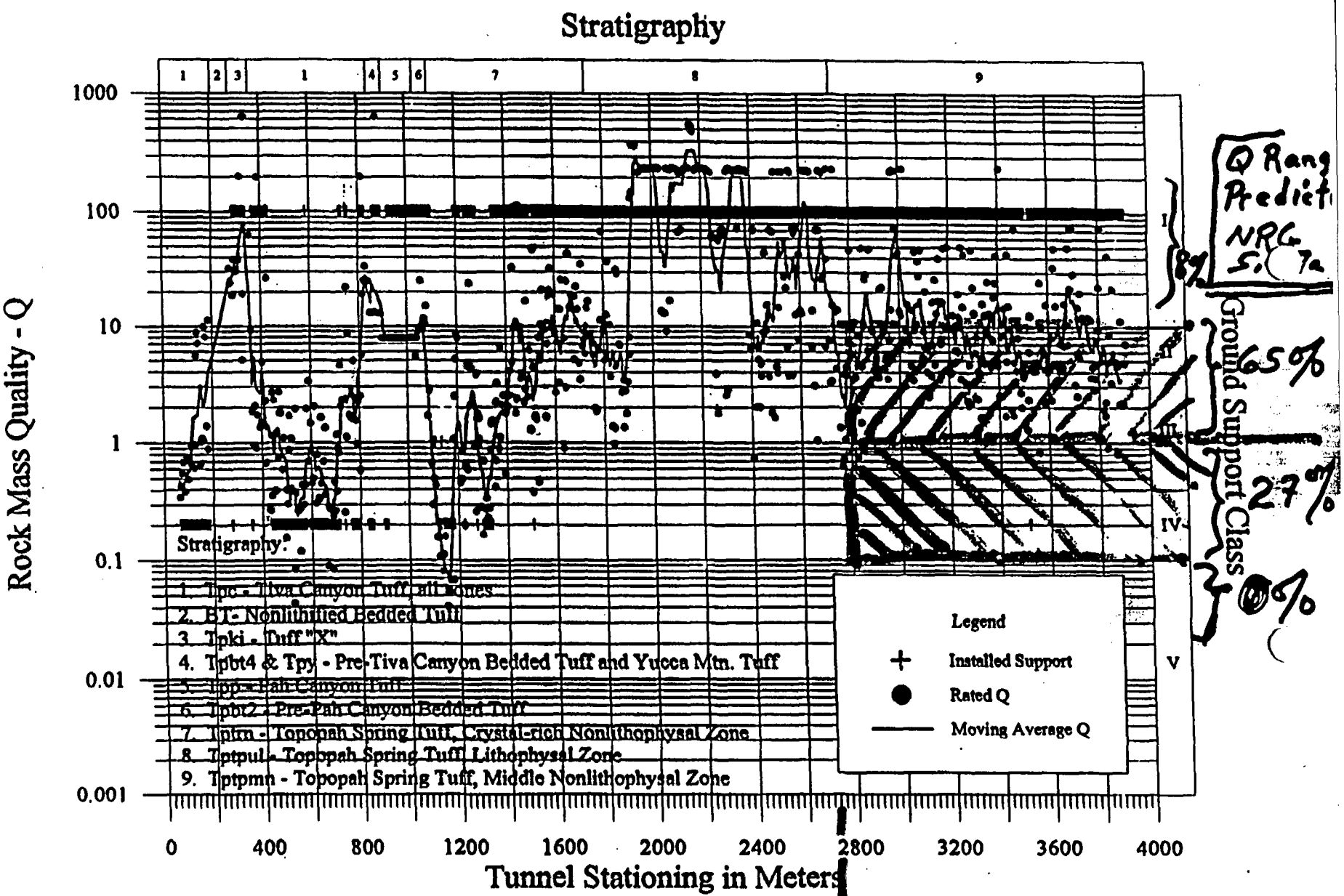
ESF Update:
Recent Ground Support Class - 4 vs 1

- Low angle joints encountered
- Impacts construction tunnel support for short distances;
  - Ground conditions observed to degrade/improve over short lateral/vertical distances
- Ground class support I, II, III, common along N/S main
- No significant or major known or unknown geologic feature(s) account for change in ground condition
- Construction wisely selects class 4 ground support for worker safety



PRELIMINARY DRAFT

"FLIP" – show without Flip



(OVERHEAD)

THERMAL/MECH UNIT	Q RANGE	CATEGORY	%CORE	CUM %
Tsw2	0.1-0.4	V. POOR	14	14
	0.4-1.0	V. POOR	13	27
	1.0-4.0	POOR	46	73
	4.0-5.5	FAIR	8	81
	5.5-10	FAIR	11	92
	10-26	GOOD	8	100

Source = page 7-45, North Ramp Report; Ground support indicated for Tsw2 units for the ESF

Tsw2	0.001-0.01	ext poor	0	0
	0.01-0.1	ext poor	0	0
	0.1-1.0	v poor	27	27
	1-4	poor	46	73
	4-10	fair	19	92
	10-40	good	8	100
	40-100	v good	0	100
	100+	extr good	0	100

Source = page 7-27, North Ramp Report; Ground support indicated for Tsw2. Compare with above; more detailed for intervals of interest related to support analysis.

*65% of Tsw2 for north ramp expected to fall within range of Q = (1.0 to 10), corresponding to ground class II/III

*27% of Tsw2 for north ramp expected to fall within range of Q = (0.1-1.0), corresponding to ground class III/IV

Predictions of ground support requirements based on Q calculation from coredata adequate, but tends to err to "poor" side for Yucca Mountain rocks; installed ground support required is less than indicated by measured or core estimated ground support requirements. Supports need for tunnel

We have no indications that we should encounter any poorer ground conditions than already found in the ESF. Suggests modification factor required for Q as estimator of required ground support for Tsw2 units.

Q system based on drill & blast tunnel, not necessarily applicable to TBM tunnel; expect as-constructed differences, borehole data & low Q expected; All lith physics counted as fractures in SNL tunnel Q estimates

(OVERHEAD)

SD Borehole data

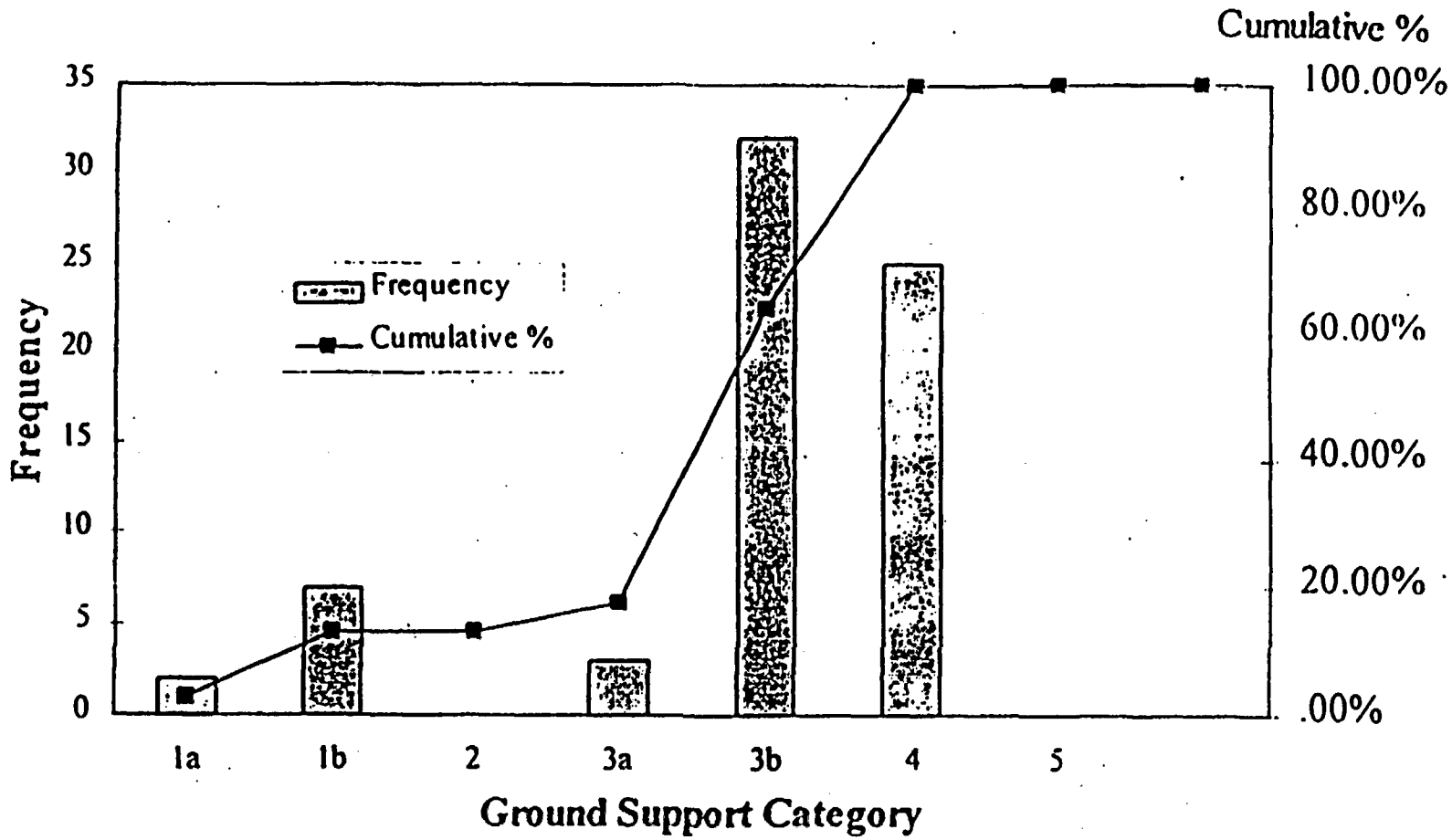


Figure 2-1. Projected distribution of ESF ground support category for the Tptpmn—Main Drift boreholes.

(OVERHEAD)

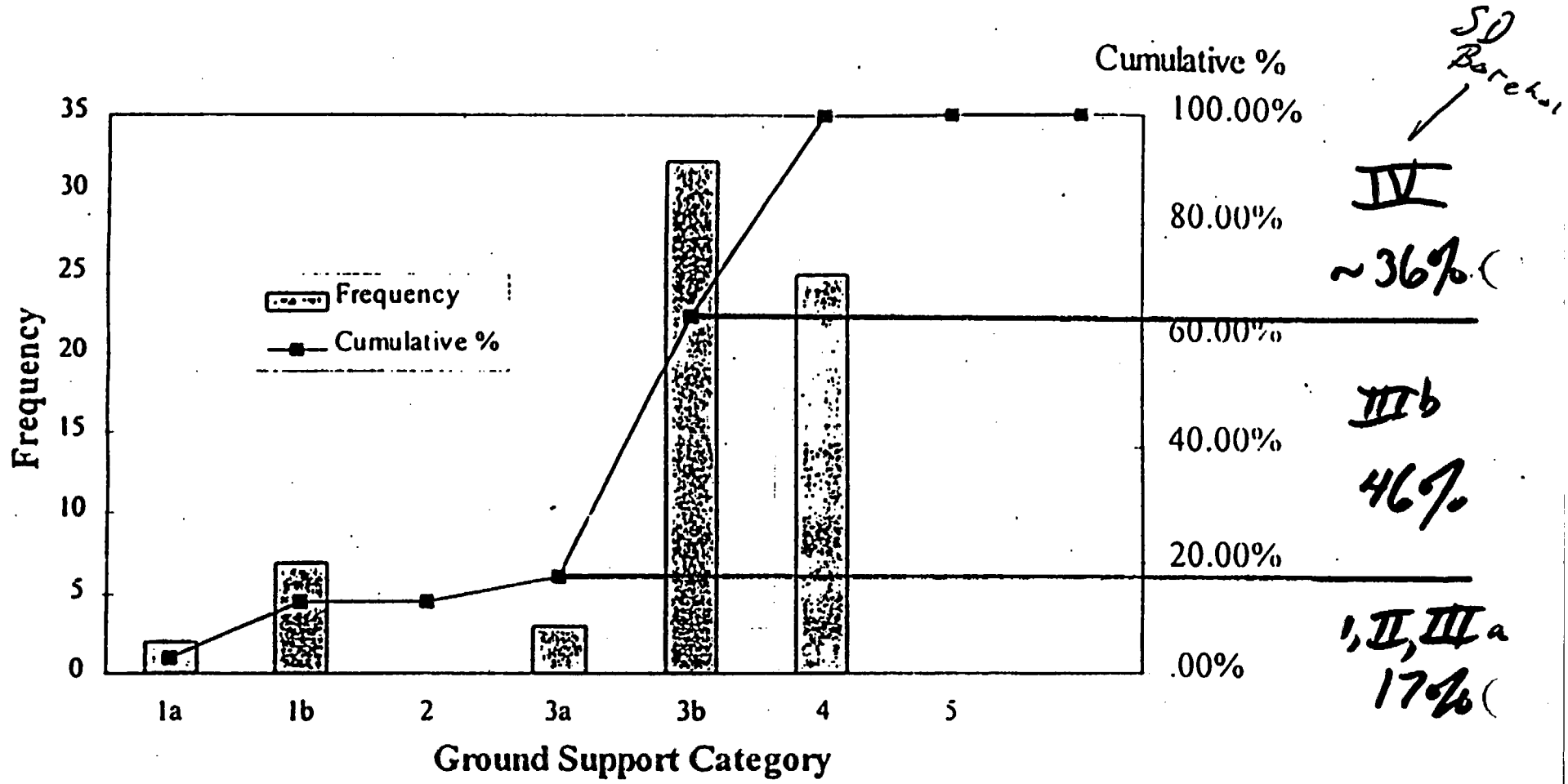


Figure 2-1. Projected distribution of ESF ground support category for the Tptpmn—Main Drift boreholes.

(OVERHEAD)

ESF Update: Scientific Programs Conclusion

- Enhanced confidence from predictive capabilities
- Ground conditions generally consistent with expectations
- Constructability generally better than expected
- Appropriate surface and subsurface testing continues
- Will provide required data for Structural, Tectonic, Hydrology, Resource and other Assessments

DOE 1.2.3 Deliverables Listing, FY'96

Key = definition of milestone level

- Level 2 = DOE product for headquarters
- Level 3 = Participant product delivered to DOE for review and acceptance
- Level 4 = Participant internal deliverable milestone not provided to DOE for acceptance or review