June 16, 1997

Mr. Ronald A. Milner, Director
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 MARCH 13, 1997, EXPLORATORY STUDIES FACILITY MEETING

Dear Mr. Milner:

Enclosed are the minutes of the March 13, 1997, 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 was held by three-way videoconference at DOE offices in Las Vegas, Nevada; NRC offices in Rockville, Maryland; and the Center for Nuclear Waste Regulatory Analyses (CNWRA) offices in San Antonio, Texas, as one of a continuing series of periodic ESF meetings.

Organizations other than NRC and DOE that were represented at the meeting were the CNWRA; DOE's Management and Operating Contractor (M&O), the U.S. Geological Society, the U.S. Nuclear Waste Technical Review Board, the State of Nevada's Nuclear Waste Project Office, and Clark and Nye Counties, Nevada.

The meeting again resulted in a good exchange of information and views between DOE and NRC. No response to this letter is required. If you have any questions regarding this letter or the enclosed meeting minutes, please contact Michael P. Lee of my staff. He can be reached at (301) 415-6677.

Sincerely,
[Original signed by]
Michael J. Bell, Acting Chief
Performance Assessment and High-Level
Waste Integration Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Y/
NH16

950125

Enclosure: As stated on the left WM-11 102.2
Same Sec # (Minutes of 3/13/97)

cc: See attached list

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R. Anderson, NEI

w/ D.W. letter dtd. 6/16/97

ENCLOSURE

MINUTES OF THE MARCH 13, 1997 U.S. NUCLEAR REGULATORY COMMISSION/U.S. DEPARTMENT OF ENERGY TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

On March 13, 1997, U.S. Nuclear Regulatory Commission staff met with staff from the U.S. Department of Energy (DOE) and DOE's contractor to discuss items of mutual interest regarding progress on the excavation of DOE's Exploratory Studies Facility (ESF) at Yucca Mountain, Nevada, and technical issues related to the design of the geologic repository. The items discussed included the status of ESF construction, an update on the status of scientific studies at the ESF — including alcove testing — and some preliminary discussion of the engineering design program plans for waste package retrievability. In addition, the two staffs discussed possible technical topics that might be included as part of an expanded scope of future meetings.

This meeting was another in a continuing series of periodic ESF technical meetings. The meeting was held via a three-way videoconference at the NRC office in Rockville (Maryland); the DOE office in Las Vegas (Nevada); and Center for Nuclear Waste Regulatory Analyses (CNWRA) office in San Antonio (Texas). Representatives from the State of Nevada; Clark County and Nye County, Nevada; the U.S. Geological Survey (USGS); and the U.S. Nuclear Waste Technical Review Board also attended. The agenda is in Attachment 1. Attachment 2 contains the list of attendees.

In the first series of presentations, DOE provided an update on the status of ESF tunnel and alcove construction. (The briefing materials reviewed are contained in Attachment 3.) The topics covered included: an update on ESF tunneling operations; a discussion of testing alcove excavation sequencing, including schedules and method of excavation; tunnel boring machine (TBM) progress; South Portal construction activities; and a discussion of Thermal Test Facility Heater Drift and Single Element Heater Test alcove excavation. With respect to TBM operations, DOE reported that the current date for daylighting the TBM was now sometime in early April 1997 owing to ground conditions. In anticipation of TBM daylighting, it was reported that the South Portal box-cut was completed on February 18, 1997, and completion of the South Portal construction is anticipated by March 15, 1997.

Regarding other ESF operations, DOE staff discussed the status of the North and South Ghost Dance Fault alcove excavations as well as the status of excavation of the Thermal Test Facility Heater Drift and the Single Element Heater Test in Alcove 5. DOE noted that excavation of the Thermal Test Facility Heater Drift had been completed and the placement of the final concrete liner will be completed by March 1997. The Single Element Heater (thermo-mechanical) Test was reported to be ongoing. The heater element was energized on August 26, 1996, and the planned heat-up cycle is scheduled to end in late May 1997.

In the second series of presentations, DOE provided an update of the scientific investigations within the ESF. The first presentation was an update on the thermal testing programs involving the Large Block Tests (LBT) above-ground, and the preliminary measurements and data from the Single Element Heater and Drift-Scale Heater Tests below-ground, in Alcove 5. (The briefing materials reviewed are contained in Attachment 4.) Although this information is considered preliminary, a comparison of the predicted and measured data to date for the

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Single Element Heater Test indicated good agreement. The following additional discussion points were noteworthy:

- *Large Block Tests:* The LBT heater was turned on February 28, 1997, and tests of the thermal-mechanical-hydrologic-chemical properties of the test block are in progress. The LBT status report deliverable is due the end of August 1997, and the final report deliverable is scheduled for April 2, 1998.

- *Drift Scale Heater Test*: The high range of temperatures and the heating time window for this test have been sources of concern to the NRC staff. The staff believes that an accelerated drift scale heater test at thermal loads much higher than those expected at the repository poses a risk of masking potentially important phenomena and not providing the information necessary to differentiate among alternative conceptual models. The NRC staff advocates a lower and more representative temperature at a slower rate to allow for observation of potential phenomena such as condensation and water dripping. DOE has noted that thermal tests are being changed to address this concern, and also in response to the January 23, 1997, NRC letter, and the NRC staff's comments regarding this subject. The details of these changes, which also include changes to the instrumentation, have not been completed, but are to be addressed in DOE's response to the NRC's January 23, 1996, letter.

  Several questions were raised by the NRC staff regarding the excavation method in the heater drift, plans for sealing of instrumentation boreholes, and rock permeability. DOE responded that excavation of the heater drift was done with an Alpine Miner except for the drift floor which was done by the drill and blast method. DOE noted that all instrumentation boreholes with the exception of the MPBX holes will be sealed to some degree. The test results have indicated that the rock for the Drift-Scale Test is more permeable than the rock for the Single Element Heater Test. The Drift-Scale Test heating will be initiated on December 8, 1997 and terminated on December 8, 1999.

- *Single Element Heater Test*: DOE reported that this test is proceeding as planned. However, the measured temperatures near the heater are somewhat hotter than the predicted temperatures. In response to a question by Nye County, DOE noted that it is too early to determine if the difference is due to fractures and permeability.

DOE's presentation of the Borehole 16 and the Single Element Heater Test geochemistry analyses was followed by several questions by Nye County and the NRC staff. Nye County noted that drilling water seems to have complicated interpretation of the water chemistry results and asked if DOE intends to continue using drilling water. DOE responded that the preliminary results indicate low Lithium-Bromide (tracer) concentrations; therefore, this is an indication that the water is not drilling water and DOE intends to continue using drilling water. Preliminary data also suggests that the water is condensate exposed to fracture-lined minerals. NRC asked that, given the problems associated with the chemical sensors in the single heater test, is DOE planning to use different sensors. DOE responded that the "SEAMIST" sampling pads and water samples are still available and are the primary sources for data.

Following the update on thermal test activities, DOE provided an overview of other testing

activities. The activities discussed were as follows: South Portal construction[1]; TBM progress[2]; ESF mapping status; status of work and testing in Test Alcoves[2] 5, 6, and 7 including a preliminary description of Ghost Dance Fault and related structures; ESF moisture monitoring and testing; three South Ramp breathing fractures; C-Well reactive tracer tests; hydrologic testing in general; and new site characterization boreholes to be included in the FY97-98 Program Enhancements. (The briefing materials that were relied on in this portion of the discussion are contained in Attachment 5.)

In this series of presentations, the following additional discussion points were noteworthy:

- *Test Alcove 6:* DOE also described the pneumatic monitoring, gas sampling, core water sampling, air injection sampling test and results, with emphasis on the Ghost Dance Fault zone and related structures in Alcove 6. The NRC asked if certain criteria were used for defining the fault zone as shown in a preliminary sketch (in one of the briefing slides). DOE responded that the sketch did not show a transition of the fault into breccia. The NRC staff's question was related to the issue of a specified "setback" to avoid potentially active fault zones. DOE responded that no criteria were used to determine a setback near potentially active faults or the thickness of fault zones. However, a planned DOE revision of the Seismic Design Topical Report II will address criteria for fault setback.

- *Test Alcove 7:* DOE reported that some additional testing would be conducted owing to the availability of monies from the $13 million FY97-98 Program Enhancement Package.

- *2nd and 3rd Quarter Deliverables:* DOE provided a list of studies/products due to the project in the next 4 to 5 months.

- *^{36}Cl Studies:* No bomb-pulse ^{36}Cl was detected beyond ESF station 45+00. However, no Carbon/Iodine analyses have been conducted, at this time, to corroborate this observation.

The third major presentation of the day concerned waste package retrievability. This discussion item was a follow-up discussion to an earlier February 1997 Appendix 7 meeting on design detail for a potential 10 CFR Part 60 license application. (As a prelude to the discussion, DOE acknowledged the need to keep the staff better informed of major design decisions when they take place and as a consequence would like to hold another Appendix 7 meeting in sometime in the Summer of 1997, to further explain the current overall repository design concept including the so-called "binning" of repository structures, systems, and components.) With respect to retrievability, DOE discussed the following: the Part 60 regulatory basis for the retrievability requirement; retrievability design impacts; a description of issues related to retrieval; the current design status; current repository design assumptions related to retrievability; design events such as ground support failure, failure of control

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[1] See earlier discussion in this meeting summary.

[2] No new developments/activities were reported in Test Alcoves 1 through 4.

systems; leaking waste packages that need to be evaluated; and off-normal scenarios that may necessitate retrieval. (The briefing materials pertinent to these discussions can be found in Attachment 6.)

As part of these discussions, DOE noted that the Fiscal Year 1997 scope of work includes an engineering study to develop a retrieval strategy as part of the Viability Assessment design. In addition, analyses will be performed to provide a preliminary design of the waste package transportation system, the mechanism for loading and unloading waste packages, the emplacement gantry — also used for retrieval — and the subsurface layout and facilities design. Other analyses will address ventilation and retrieval scenarios.

Finally, DOE noted that the current 100 years retrievability design requirement in the repository requirements document will be revised to corresponds to Part 60's regulatory requirements of 50 years. Seismic design Topical Report II and other DOE design documents state that the geologic repository will be operational for 100 years (or more).

At the end of the retrievability discussions, there was some follow-up discussion concerning the revised repository footprint. In response to a question regarding the need to rely on the lower repository block for waste emplacement, DOE's M&O contractor noted that the lower block may not be needed if the high-thermal-loads option is chosen, and that the lower block may be the only portion of the current repository design that is needed if the low-thermal-load option is chosen. However, the repository lower block is not removed from the repository design. A question related to the repository layout asked by Nye County was why is repository ventilation main located below the repository horizon. DOE indicated that it did not have the right staff in attendance at the meeting to answer this question but subsequently responded to Nye County with an explanation.

The last item on the agenda concerned the future focus of the quarterly ESF meeting (See Attachment 7.) With construction of the ESF essentially complete, both staffs recognize that the quarterly videoconferences provide a valuable opportunity to interact and remain informed of major program developments. DOE noted that it would like to see these meetings continue in the future but with broader DOE and NRC staff involvement. The proposed name of the future meetings would be *DOE/NRC Quarterly Technical Meeting*. Several ideas and recommendations for future discussion topics were made, as noted below:

- Status of DOE total-system performance assessment abstractions and hypothesis testing.

- General updates concerning new developments or changes to repository design and testing activities.

- Timely themes related to the so-called "key technical issues."

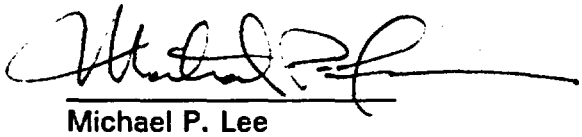
- Items that have some regulatory impact or for which DOE would need some timely regulatory (NRC) feedback.

- Respective staff efforts geared toward issue resolution. (In this regard, these meetings are an opportunity to discuss about the status of issue resolution, and to start

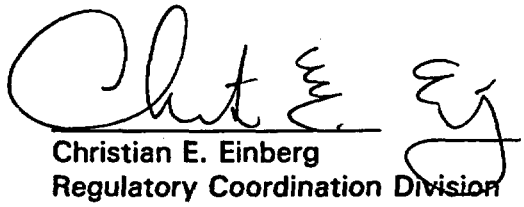
evaluating some of the issue resolution concepts.)

At the close of these discussions, the staff representing the State of Nevada and Clark County , Nevada, were invited to make some closing comments. Both participants declined to make comments.

Finally, scheduling for the next meeting in the series was discussed. A date in mid-June was proposed. It was also suggested that the meeting be held in Las Vegas thereby affording DOE the opportunity to discuss its repository design binning concept and in doing so, present some preliminary material on the subject, if available. Although videoconferencing is convenient and economical, it was noted that a face-to-face meeting would be a more effective way of interacting on this particular technical subject.



Michael P. Lee
Division of Waste Management
Office of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission



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

AGENDA FOR THE
DOE-NRC VIDEO CONFERENCE
ON THE STATUS OF THE
EXPLORATORY STUDIES FACILITY

March 13, 1997
12:30 — 4:00 p.m. (EST)

NRC:
Two White Flint North, 11555 Rockville Pike, Room T2B5
Rockville, Maryland

DOE:
Summerlin I Facility
1551 Hillshire Drive, Atrium Room
Las Vegas, Nevada

Time	*Subject*	*Lead(s)*
12:30 p.m.	**Opening Remarks**	DOE, NRC, State, AUG
12:40	**ESF Construction Update** - Status of Tunnel and Alcove Construction - South Portal Construction	DOE
1:30	**Scientific Studies Update** - Status of Tunnel Mapping - Update on Thermal Test Results	DOE
2:30 — 2:45	**BREAK**	
2:45	**Engineering Design Program** - Feedback on Level of Detail Appendix 7 Meeting - Retrievability	DOE, NRC
3:15	**Future Focus of this Quarterly Meeting** - Topics Related to the Current Project's Activities - Ideas for Improving the Utility of this Interaction	DOE, NRC State, AUG
3:45	**Closing Remarks and Additional Discussion**	DOE, NRC
4:00	**Adjourn**	

ATTACHMENT 1

LIST OF ATTENDEES FOR THE DOE-NRC VIDEO CONFERENCE ON THE STATUS OF THE EXPLORATORY STUDIES FACILITY

March 13, 1997

DOE
A. Gil
C. Einberg
W. Boyle
D. Bryan
P. Harrington
T. Hawe
J. Herrington
V. Iori
J. Replogle
M. Tynan

State of Nevada
J. Grubb
S. Frishman
J. Treichel

DOE M&O
K. Ashe
J. Bailey
A. Chakrabarti
K. Lobo
A. Haghi
A. Stohl

Nuclear Energy Institute
C. Henkle

Center for Nuclear Waste Regulatory Analyses
R. Green
L. McKague
J. Russell

NRC
J. Austin
B. Ibrahim
P. Justus
B. Leslie
M. Lee
M. Nataraja
J. Pohle
S. Wastler
R. Weller

NRC (Las Vegas)
W. Belke
C. Glenn

Clark County, Nevada
E.V. Tiesenhausen

Nye County, Nevada
N. Stellavato

U.S. Geological Survey
R. Wallace

U.S. Nuclear Waste Technical Review Board
R. McFarland

ATTACHMENT 2

ATTACHMENT 3

YUCCA MOUNTAIN PROJECT

Studies

ESF Construction Update

Presented to:
NRC-DOE ESF Technical Meeting, Video Conference

Presented by:
Richard L. Craun
Manager for Viability Assessment
Yucca Mountain Site Characterization Office

March 13, 1997

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

ESF Tunneling Operations Update

- ESF tunneling is currently at Station 76+46.4m as of 3/10/97
  - Approximately 232m remain to daylight at south portal
  - Current ground conditions are good (bolts/mesh)
  - Ground conditions will determine estimated holeout in April 97, although scheduled holeout date at the South Portal is 3/27/97
- Phase I excavation on North Ghost Dance Fault Alcove (#6) access drift completed to Station 1+34m on 11/23/96
  - Fault was located at Station 1+54 (fault zone from 1+43 to 1+55)
  - Phase I (single borehole testing) was completed on 3/3/97
  - Phase II excavation of nearly 65 meters (alcove across fault) has commenced (current location 1+39.2) and is scheduled for completion by 4/30/97

2ESF.ppt

ESF Tunneling Operations Update (continued)

- Excavation of Phase I access drift in the South Ghost Dance Fault Alcove (#7) has been completed to Station 1+ 34 meters, i.e., 84% complete. Schedule completion date is 4/18/97. Projected station completion 2+25 (end of Phase 2)
  - Horizontal (fault contact) and vertical (stratigraphic contact) drilling began on 3/3/97
  - Testing is schedule to commence late March (4 month duration)
  - Four months of testing will follow Phase I excavation completion
  - Phase II excavation (65 meters) completion date is 10/31/97

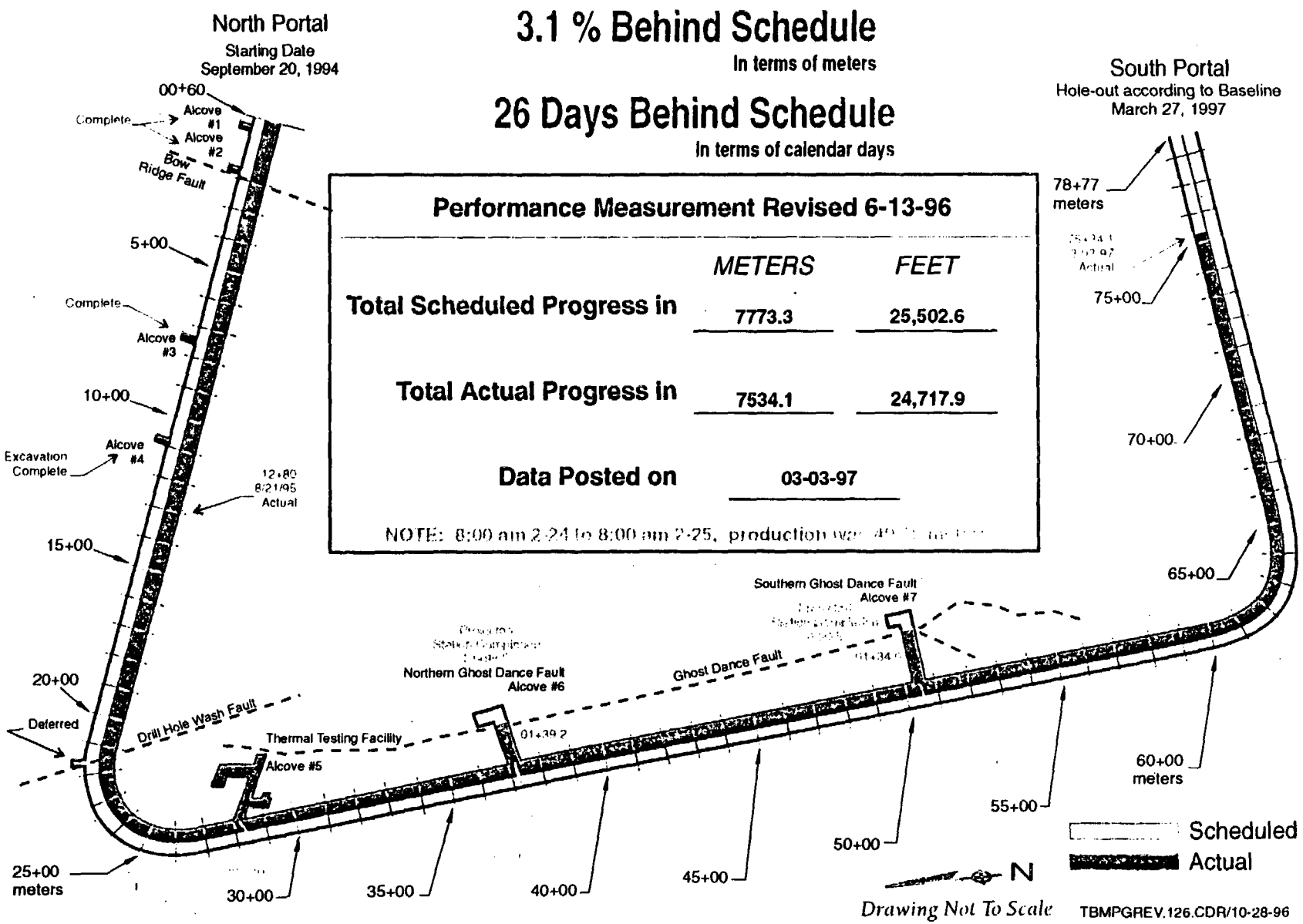
ESF Tunneling Operations Update (Continued)

- Excavation of Thermal Test Facility Heater Drift was completed mid-February; all excavation now complete
  - Cast-in-place forms are on site; final invert and liner concrete placements will be performed during March 97
  - Restart of drilling test boreholes in heater drift and Access Observation Drift (AOD) will begin late March 97
- Single Element Heater Test (Thermo-Mechanical Alcove) is ongoing. Heater energized on 8/26/96 (planned heat-up cycle is scheduled to end late May 97)

ESF Tunneling Operations Update (Continued)

- ESF South Portal Box Cut was completed on 2/18/97
  - South Portal Pad and TBM demobilization and disassembly ramp and runway is 60% complete
  - Completion of highwall and sidewall shotcrete applications in progress
  - Completion is anticipated by 3/15/97

TUNNEL BORING MACHINE [illegible]

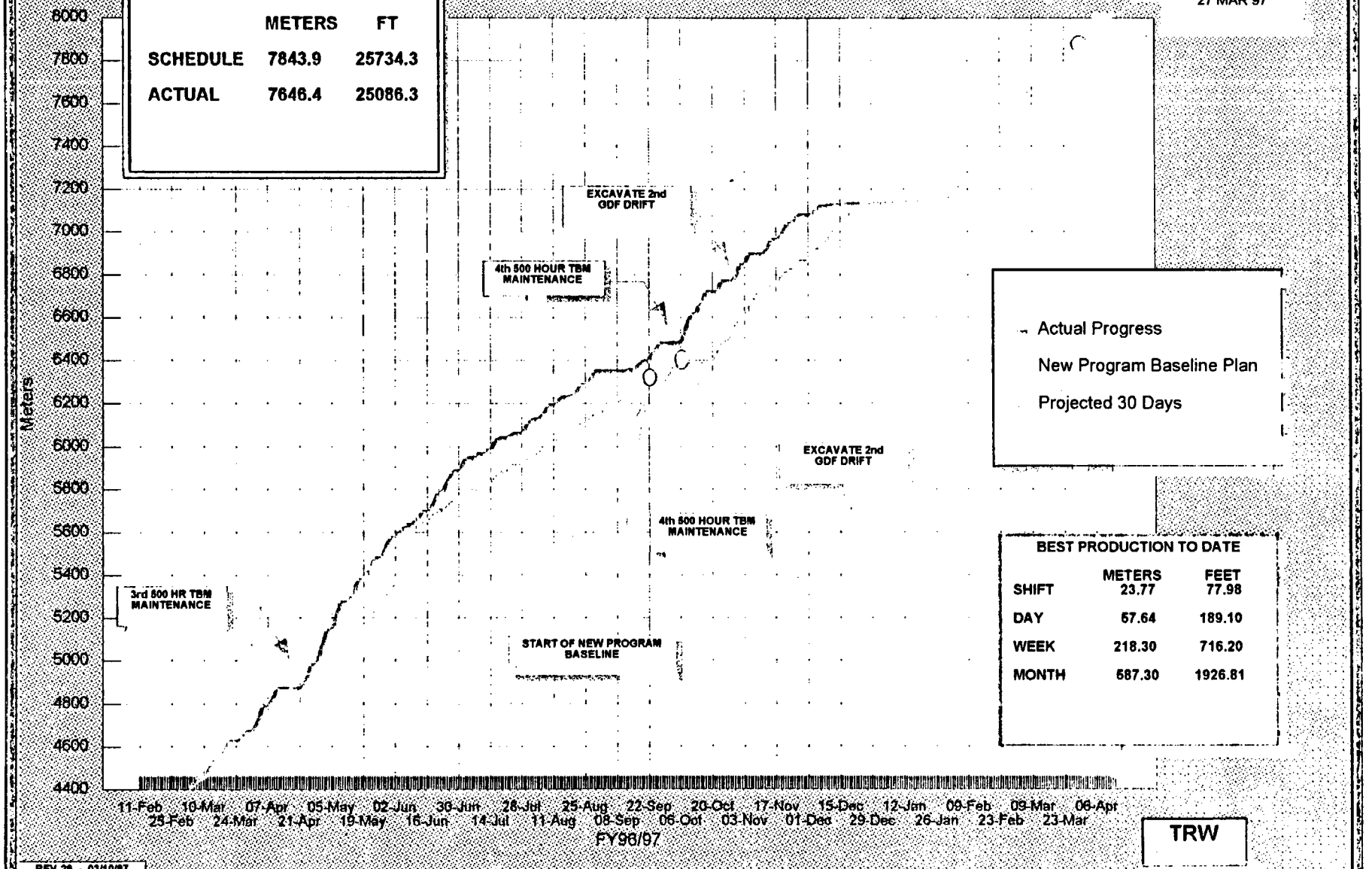


TBM Progress

New Baseline vs Actual

STATION @ 0800 HRS 03-10-97	METERS	FT
SCHEDULE	7843.9	25734.3
ACTUAL	7646.4	25086.3

TBM HOLE OUT
27 MAR 97



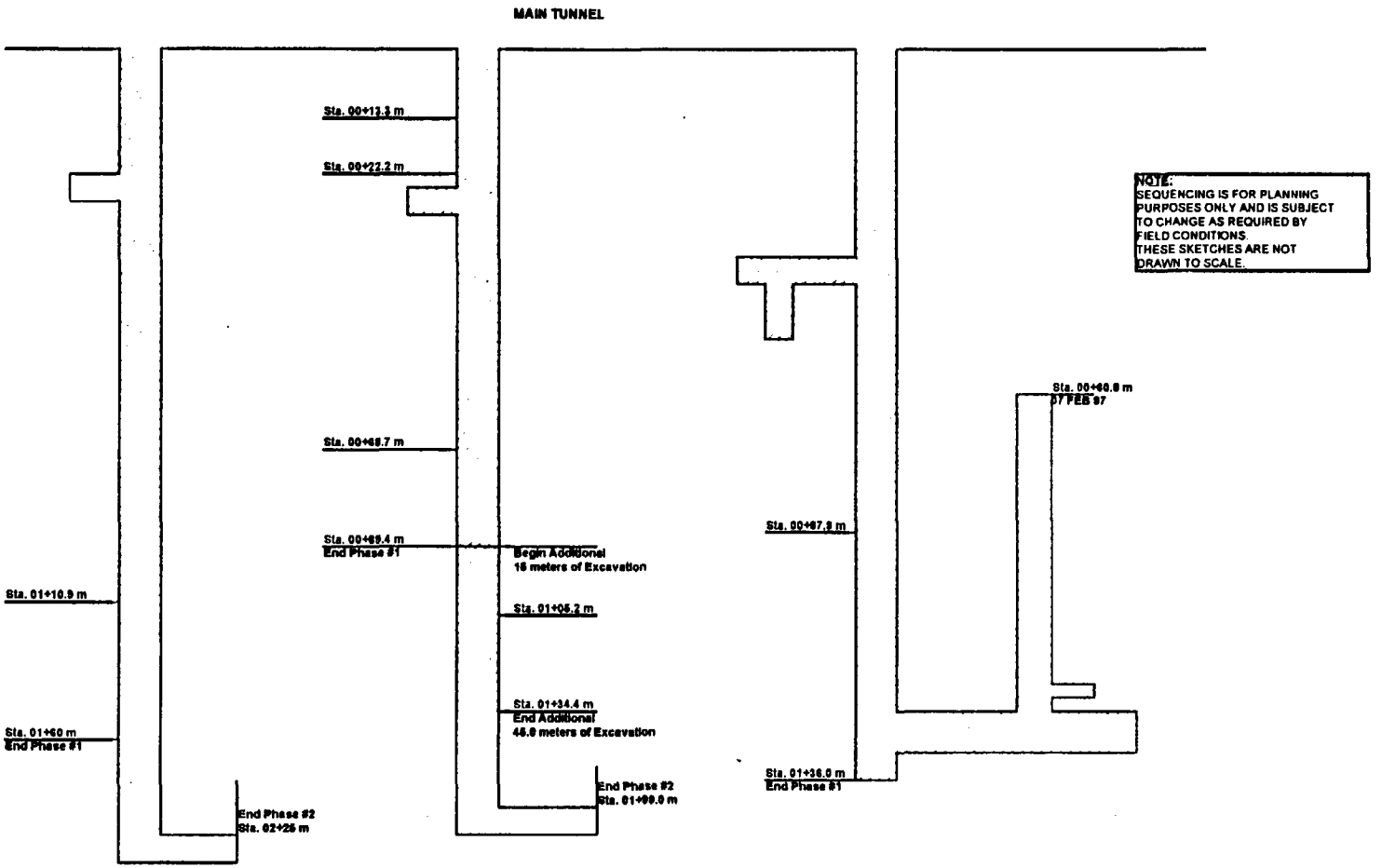
- Actual Progress
- New Program Baseline Plan
- Projected 30 Days

BEST PRODUCTION TO DATE	METERS	FEET
SHIFT	23.77	77.98
DAY	57.64	189.10
WEEK	218.30	716.20
MONTH	587.30	1926.81

TRW

REV 29 - 03/10/97

ALCOVE EXCAVATION SEQUENCING



SOUTH GHOST DANCE FAULT ALCOVE

SCHEDULED COMPLETION - 31 OCT 97
MILESTONE COMPLETION - 31 OCT 97

NORTH GHOST DANCE FAULT ALCOVE

SCHEDULED COMPLETION - 30 APR 97
MILESTONE COMPLETION - 30 APR 97

HEATER TEST ALCOVE #1

ACTUAL COMPLETION - 07 FEB 97
MILESTONE COMPLETION - 26 MAR 97

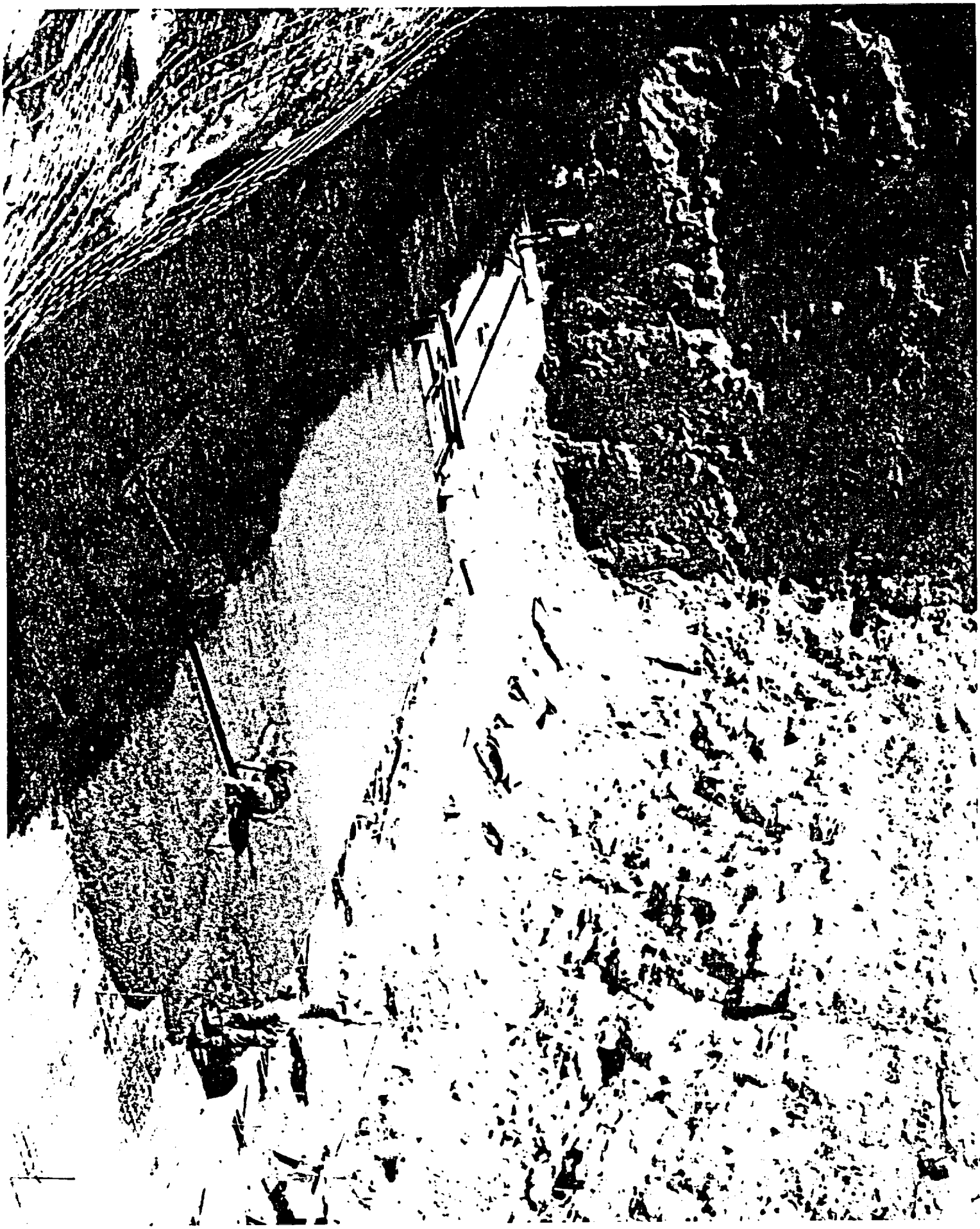
ALPINE MINER

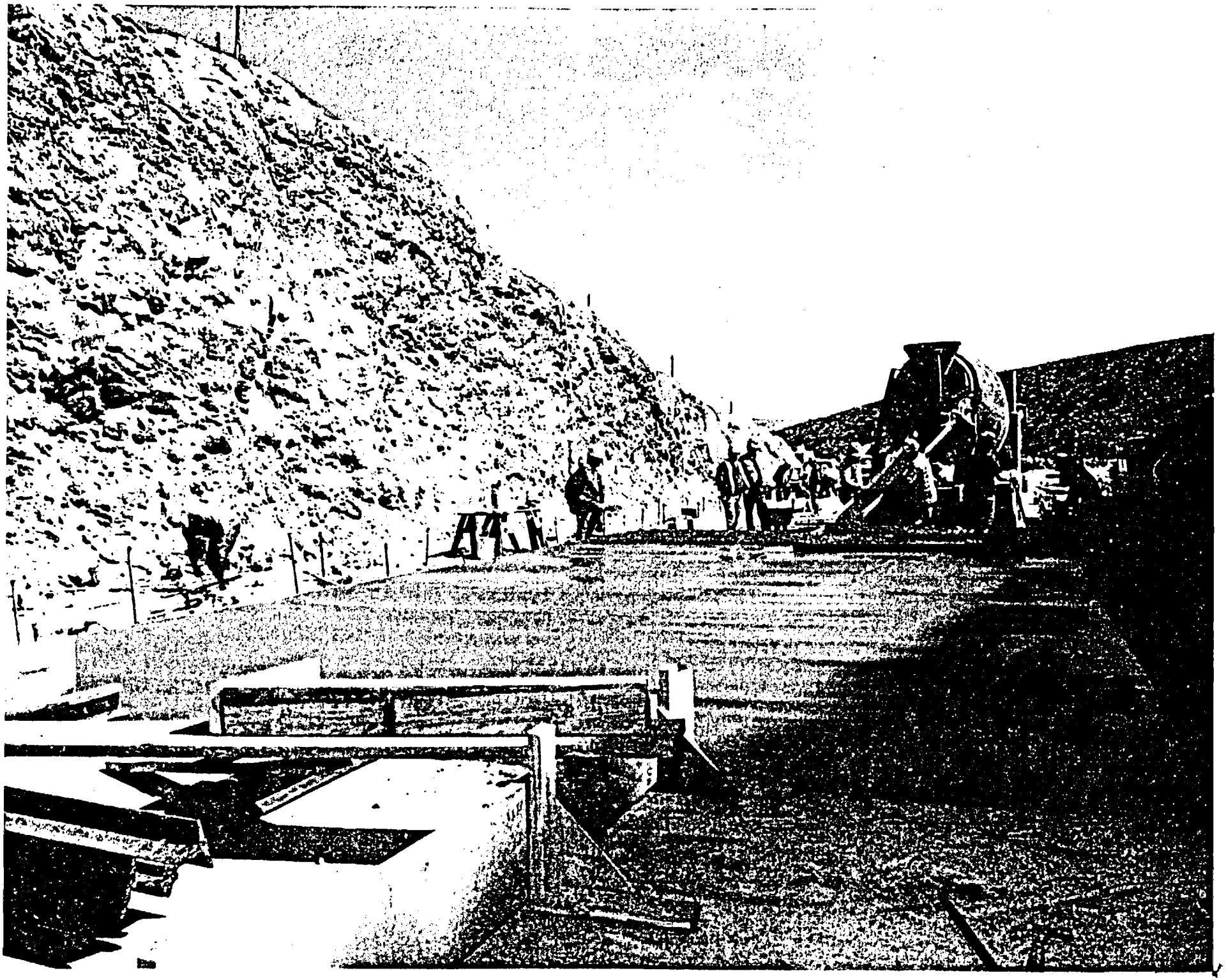
DRILL & BLAST

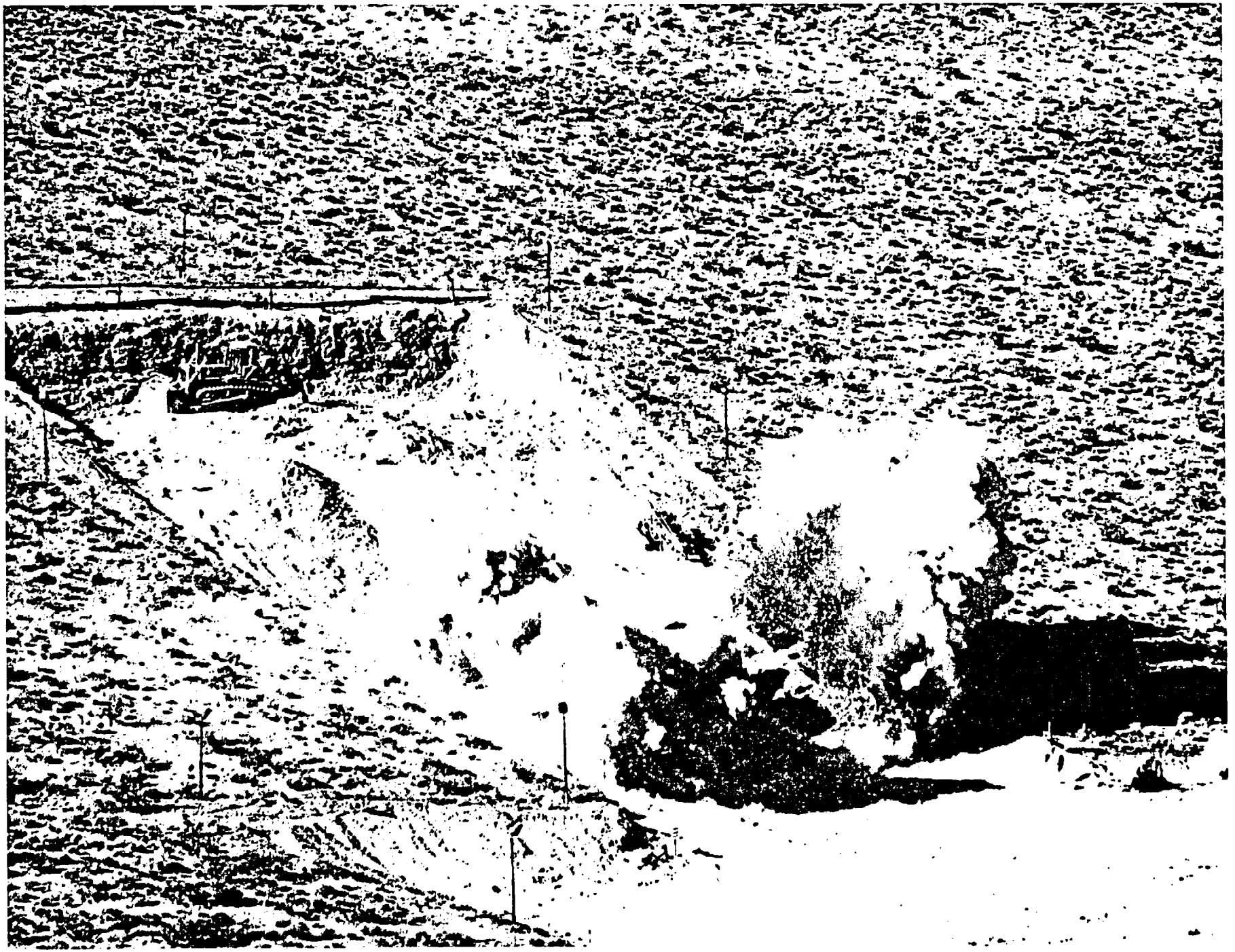
COMPLETED EXCAVATION

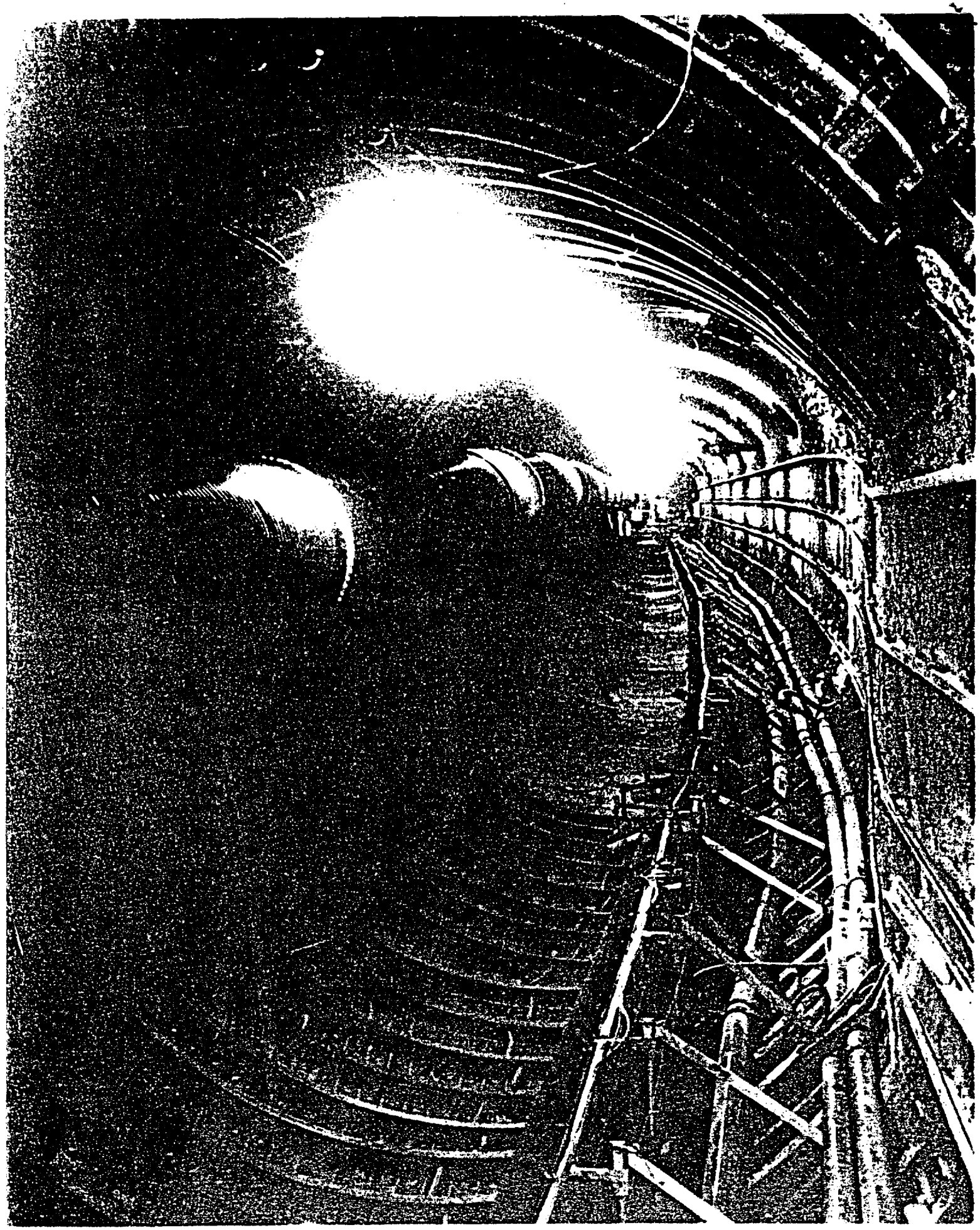
UP DATED 2-24-96

03 05 97









ATTACHMENT 4

YUCCA MOUNTAIN PROJECT

Studies

YMP Thermal Test Activities

Presented to:

NRC-DOE Technical Exchange, Video Conference

Presented by:

William J. Boyle
DOE Team Leader for Performance Confirmation

March 13, 1997

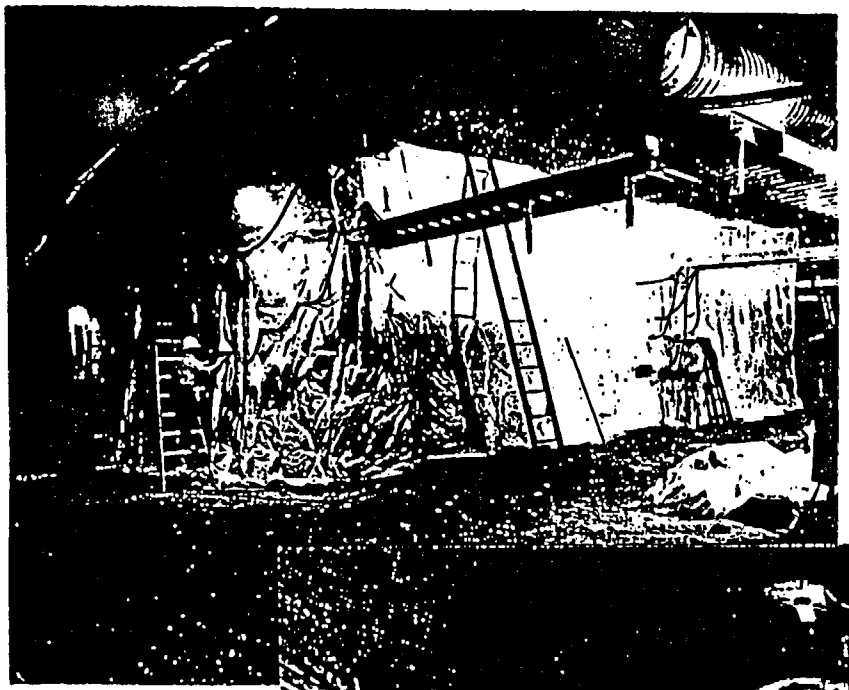
U.S. Department of Energy
Office of Civilian Radioactive
Waste Management

YMP Thermal Activities Update

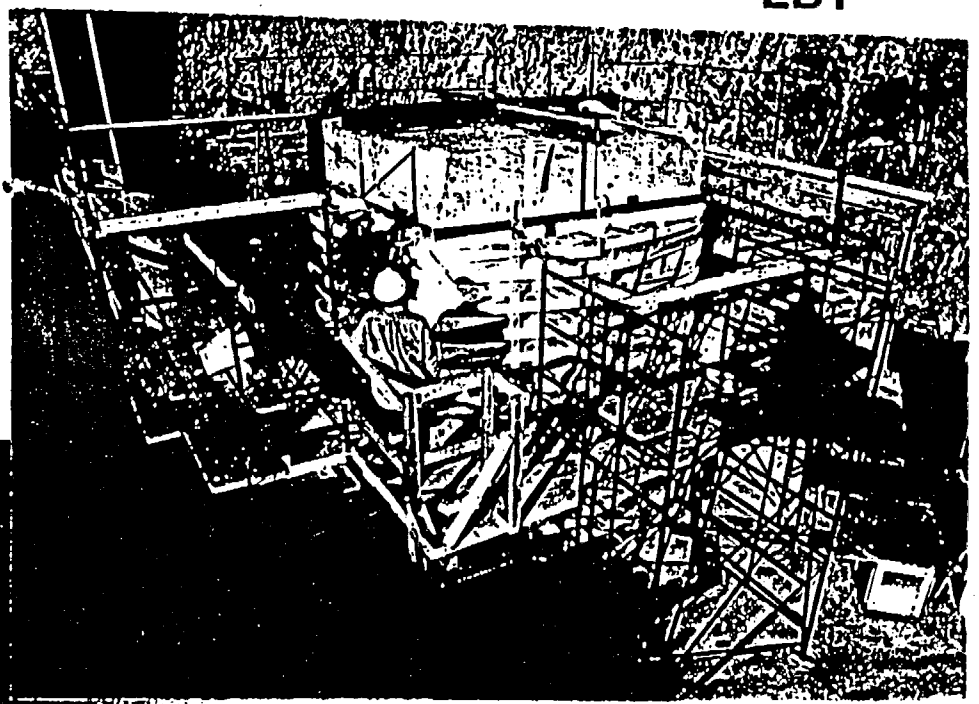
- Large Block Test
- ESF Thermal Tests
  - Drift-Scale Test
  - Single Heater Test

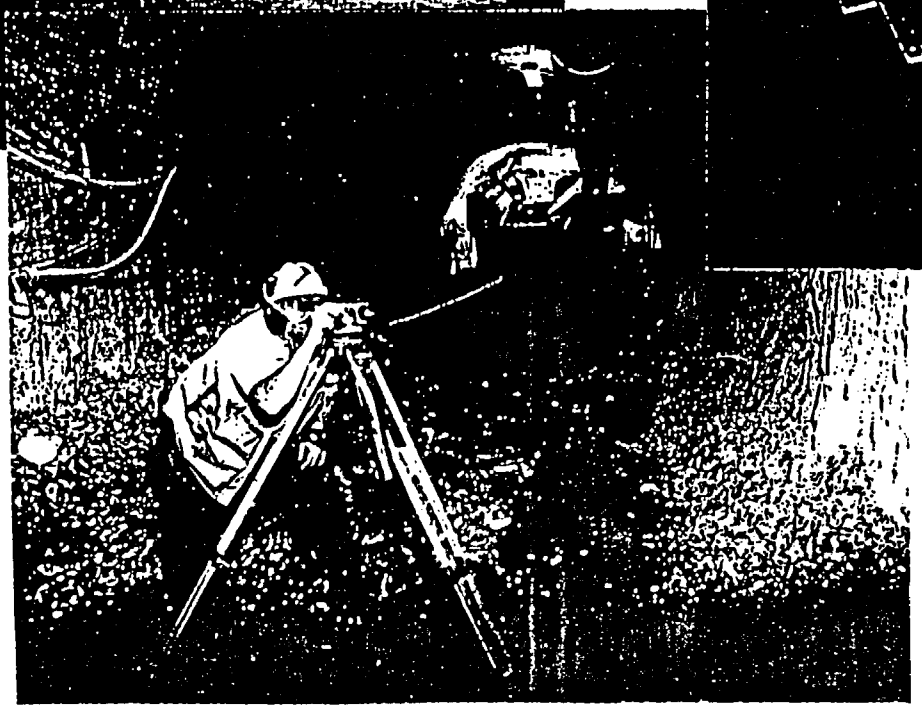
Yucca Mountain Project
Thermal Tests

SHT



LBT

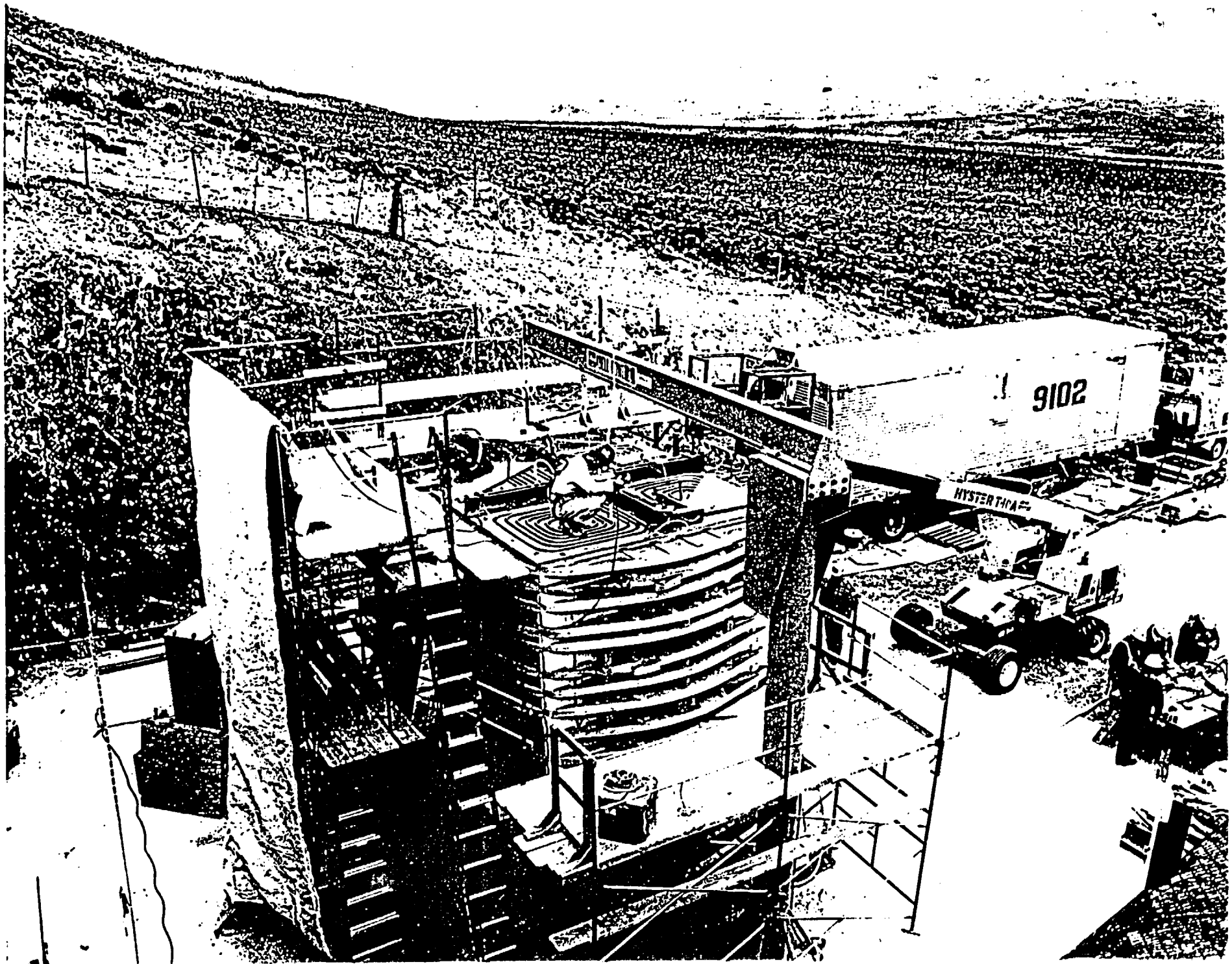




DST

Large Block Test

- To study the coupled TMHC processes in a medium of
  - controlled thermal boundary
  - controlled moisture boundary
  - large scale
  - multiple fractures and inhomogeneities
  - well pre- and post-test characterizations
- To test instrumentation in a quasi in situ environment
- To test waste package materials in a quasi in situ environment
- To investigate microbial activity


9102

Large Block Test

(Continued)

- Completed characterization of ambient hydrological characteristics

  Measurements include:

  - Air permeability tracer test
  - Neutron probe moisture content
  - Electrical resistance--moisture distribution indicator
  - Completed mapping of fractures

- Heater was turned on at ~10:00 AM PDT on February 28, 1997
  - TMHC Tests are in progress

Large Block Test

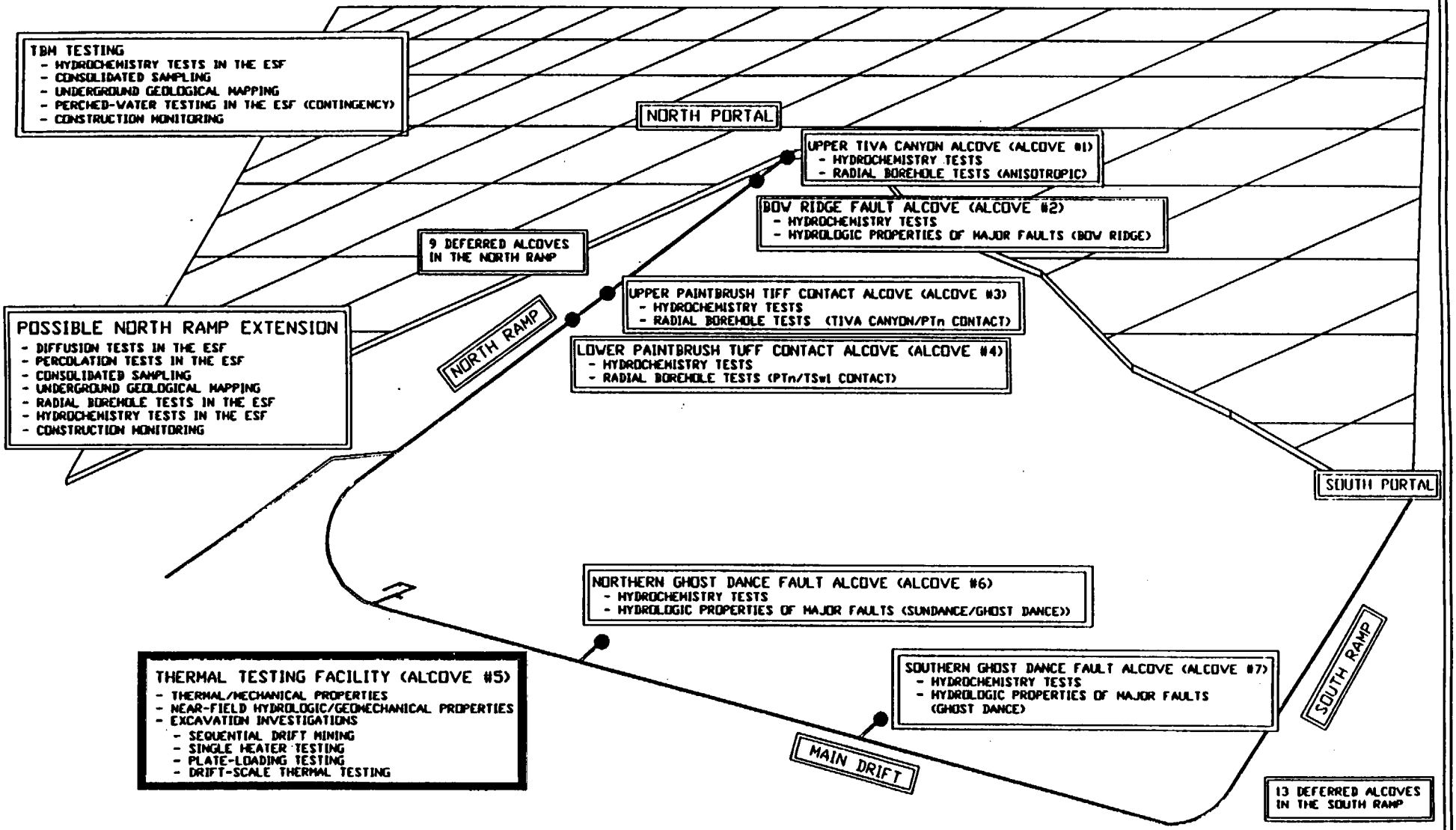
(Continued)

- Schedules and deliverables
  - Report to start heating: completed 1/27/97
  - LBT status report : due 8/29/97
  - LBT Final Report 4/2/98

Exploratory Shaft Facility Thermal Test

- Drift Scale Test
- Single Heater Test

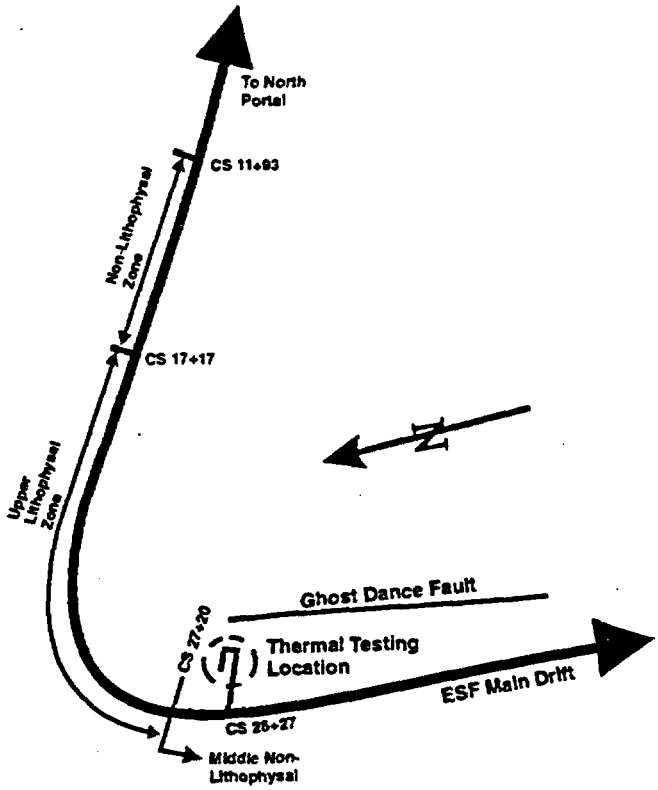
EXPLORATORY STUDIES FACILITY - TEST LOCATIONS



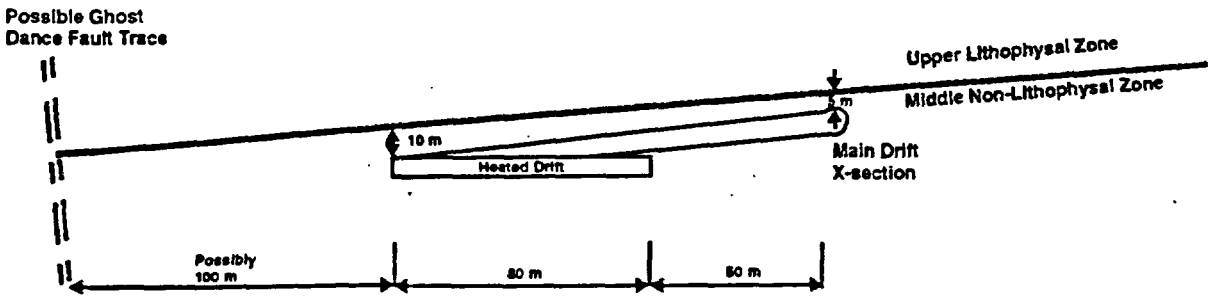
LOS ALAMOS NATIONAL LABORATORY ESF TEST COORDINATION OFFICE

NRC4 BWG
WEAVER 11/17/95

General Location of the ESF Thermal Test



(a) Plan View

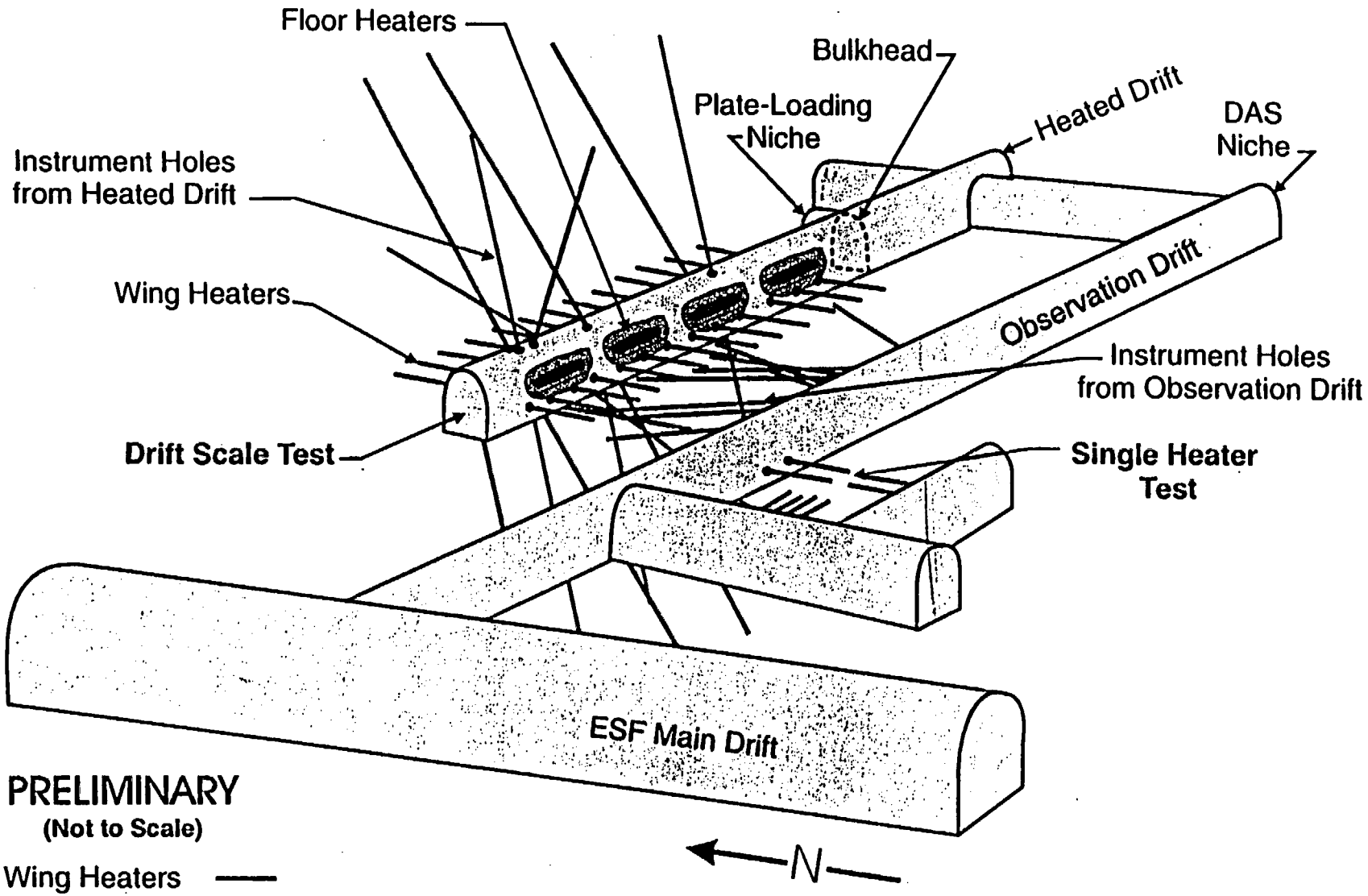


(b) Profile View

REFERENCE ONLY
(Not to Scale)

ESF72 CDR 12/07-30-96

Schematic of ESF Thermal Test Facility

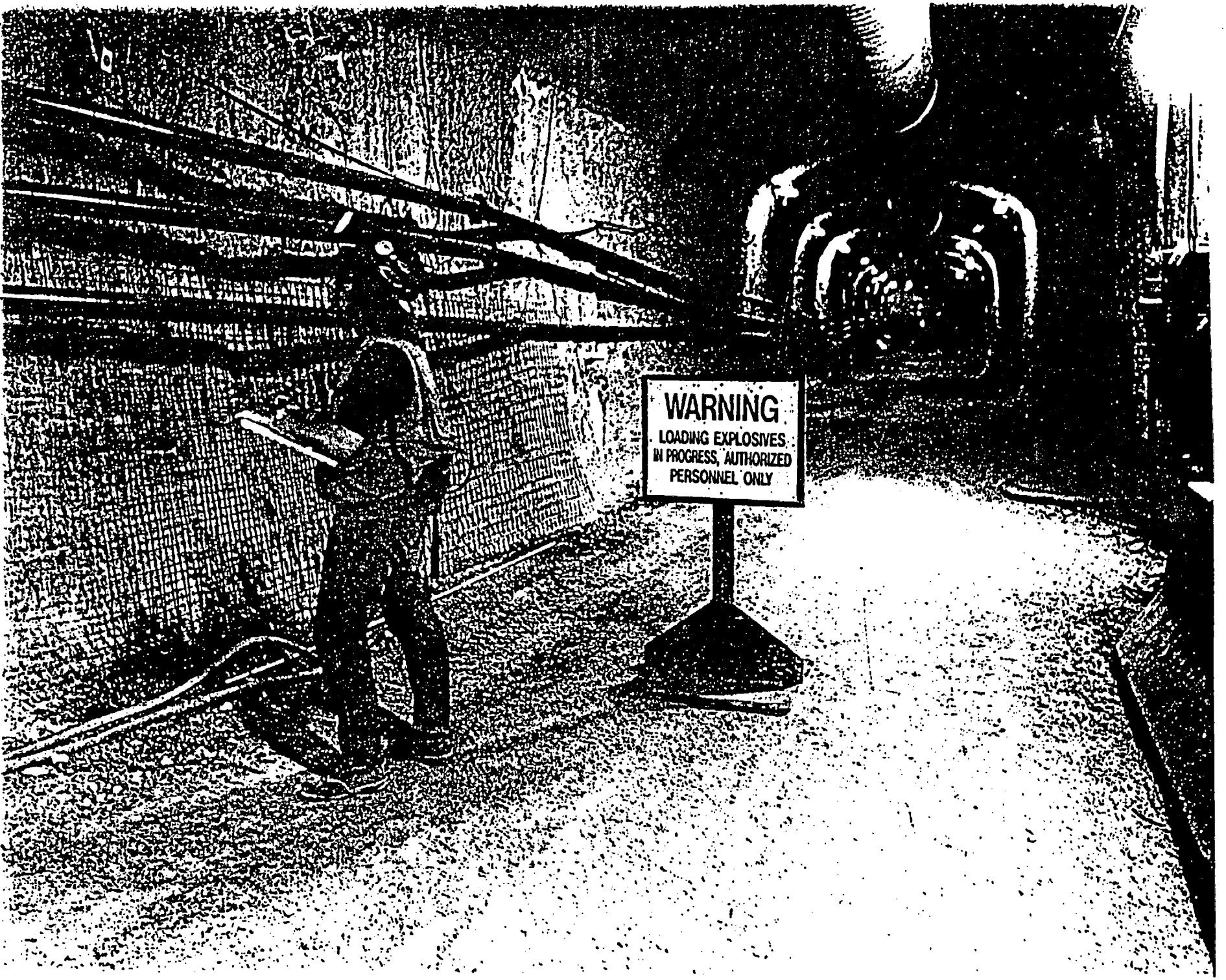


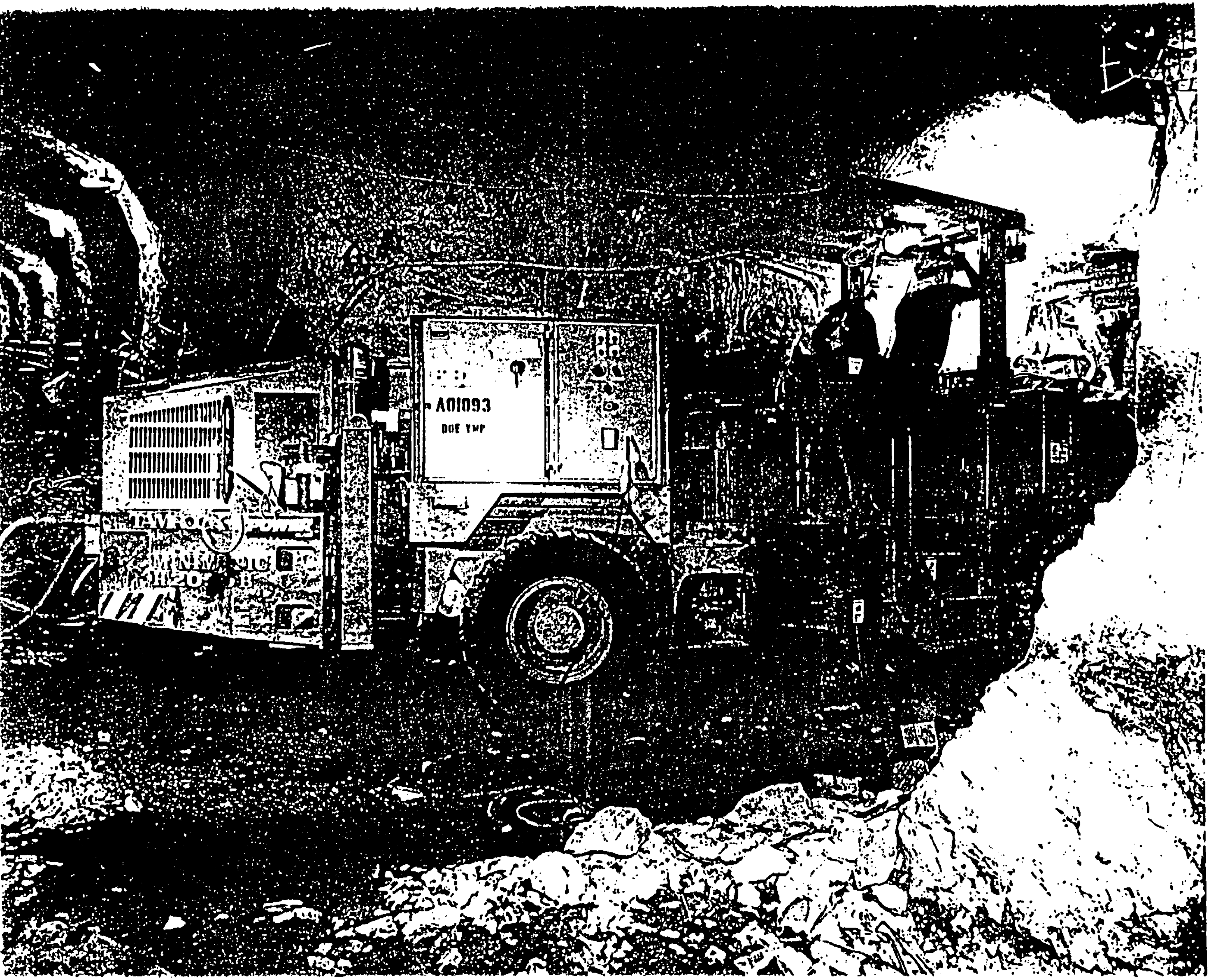
ESFTST.CDR.123

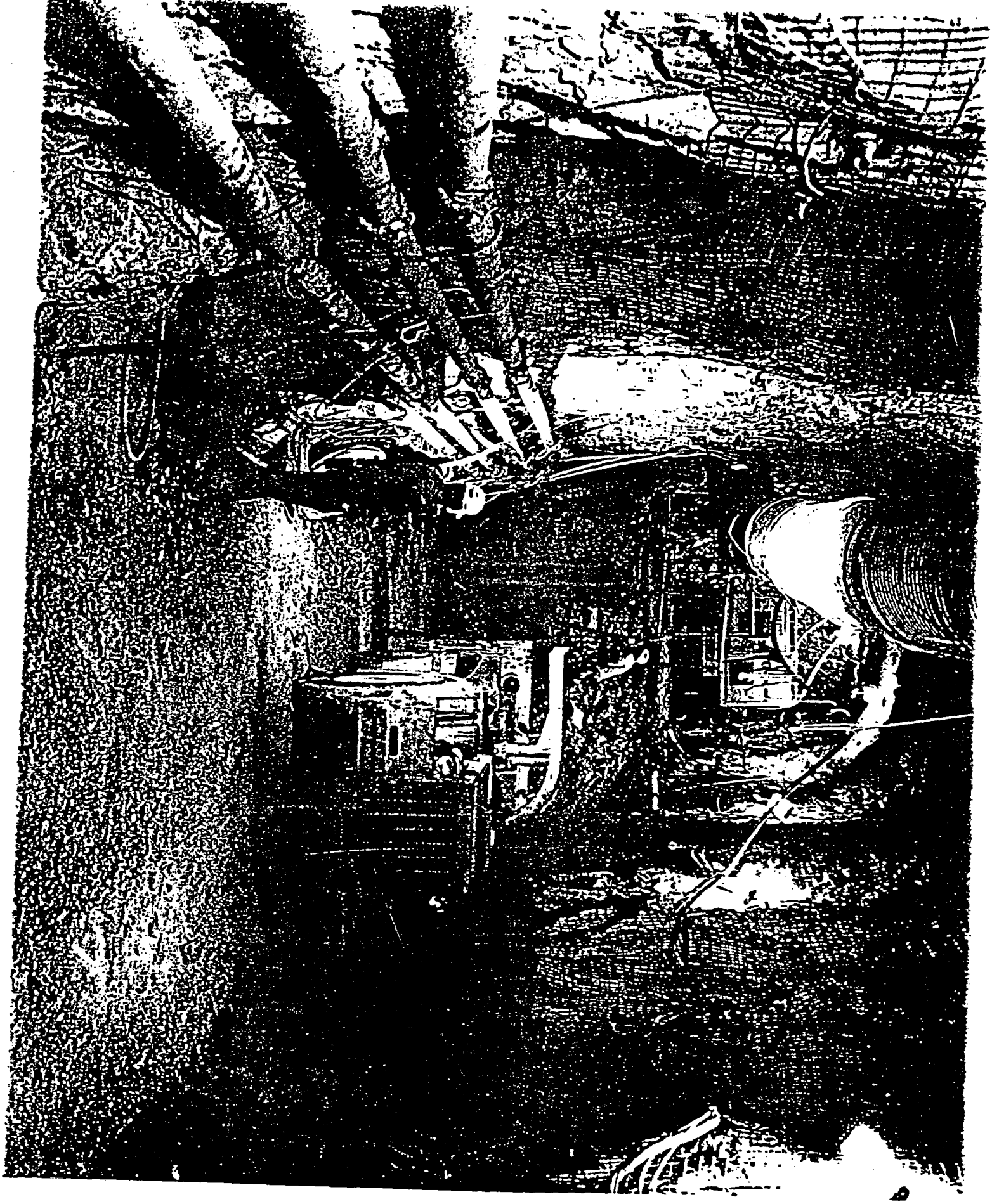
Why the Drift Scale Test?

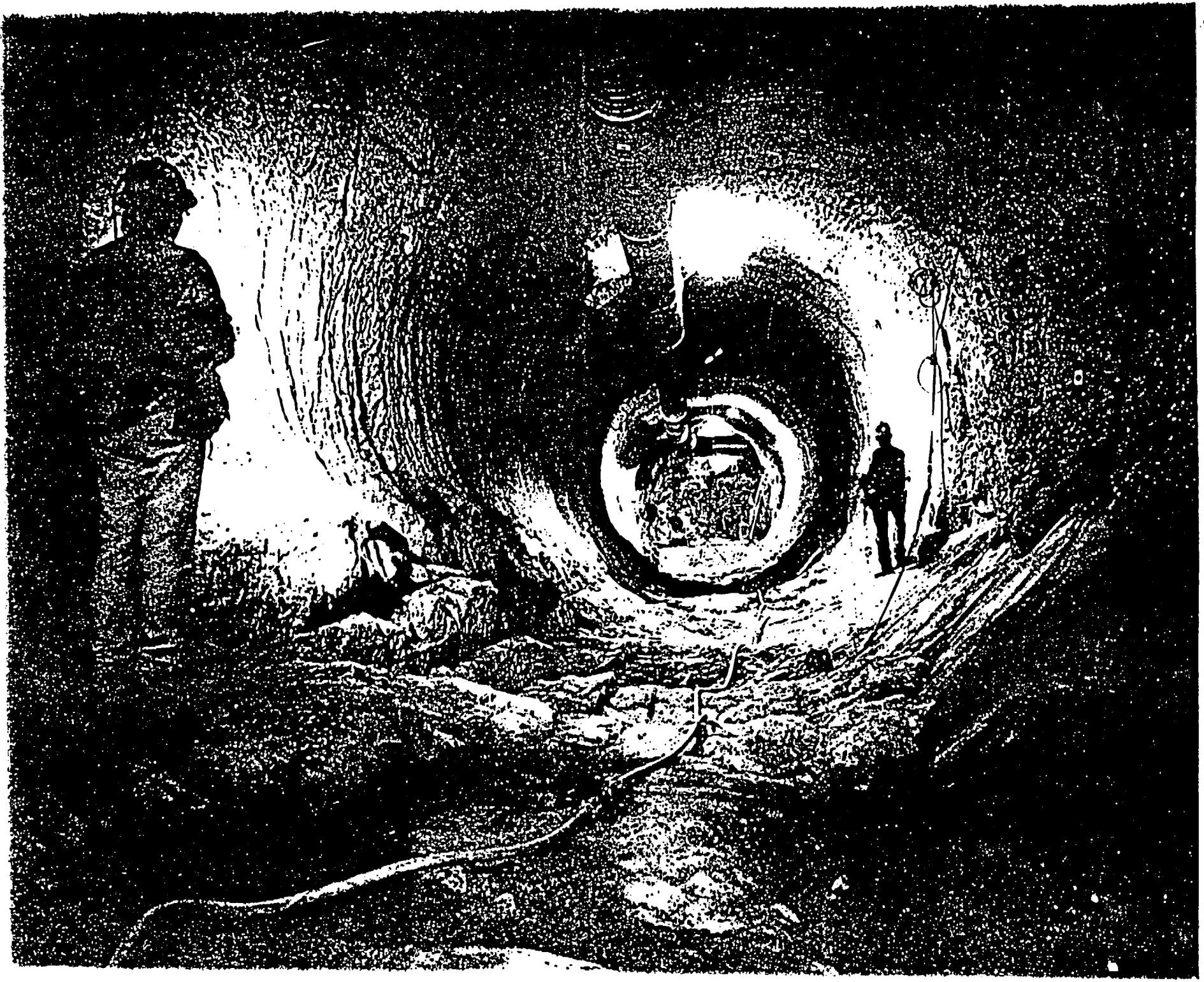
Predict and measure coupled T-M-H-C processes at an appropriate scale

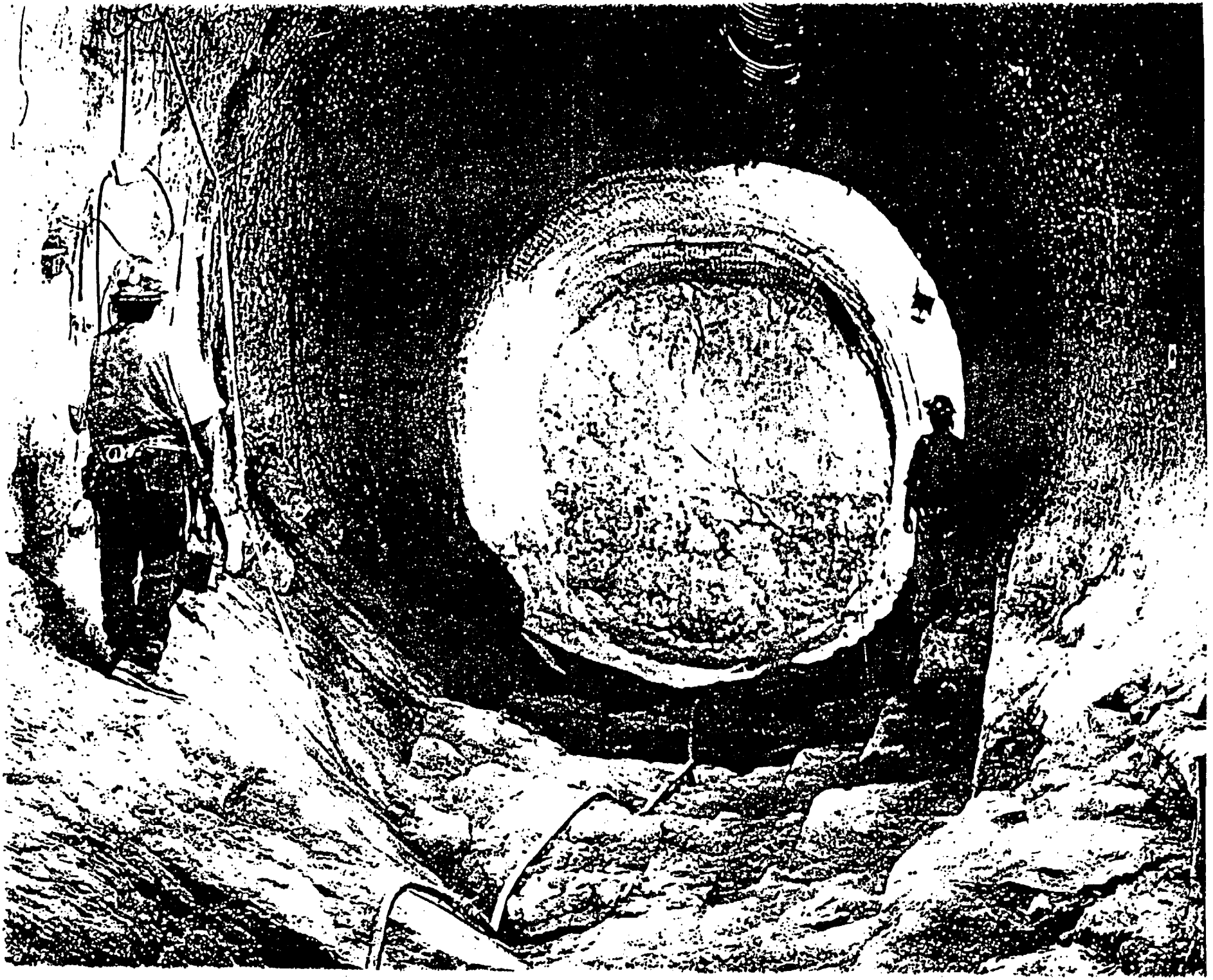
- Temperature distribution and heat transfer modes
- Propagation of the drying and re-wetting regions
- Changes in water chemistry and mineralogy
- Thermal expansion and deformation modulus


WARNING
LOADING EXPLOSIVES
IN PROGRESS, AUTHORIZED
PERSONNEL ONLY


A01093

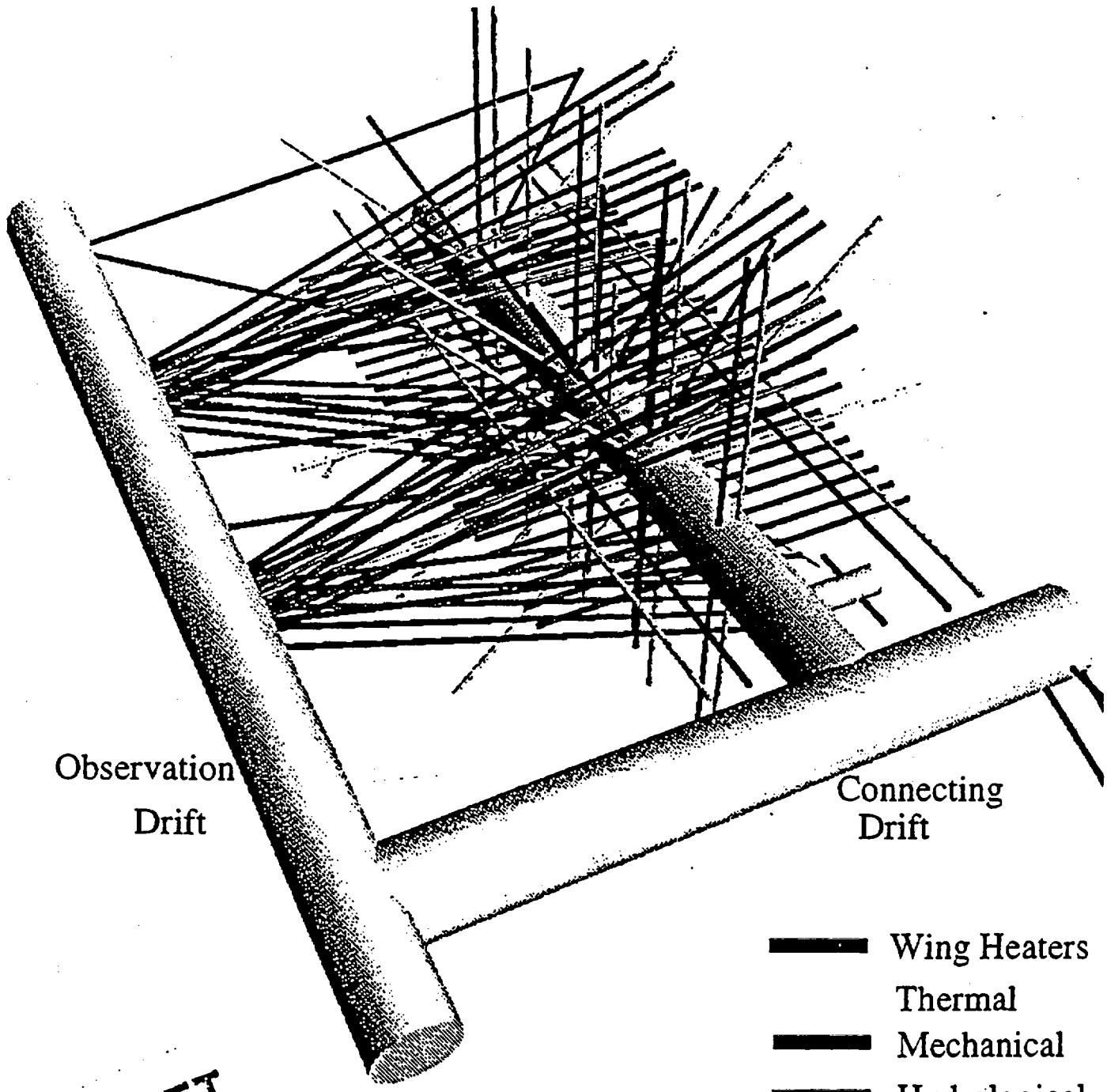






Drift Scale Test

Borehole Perspective



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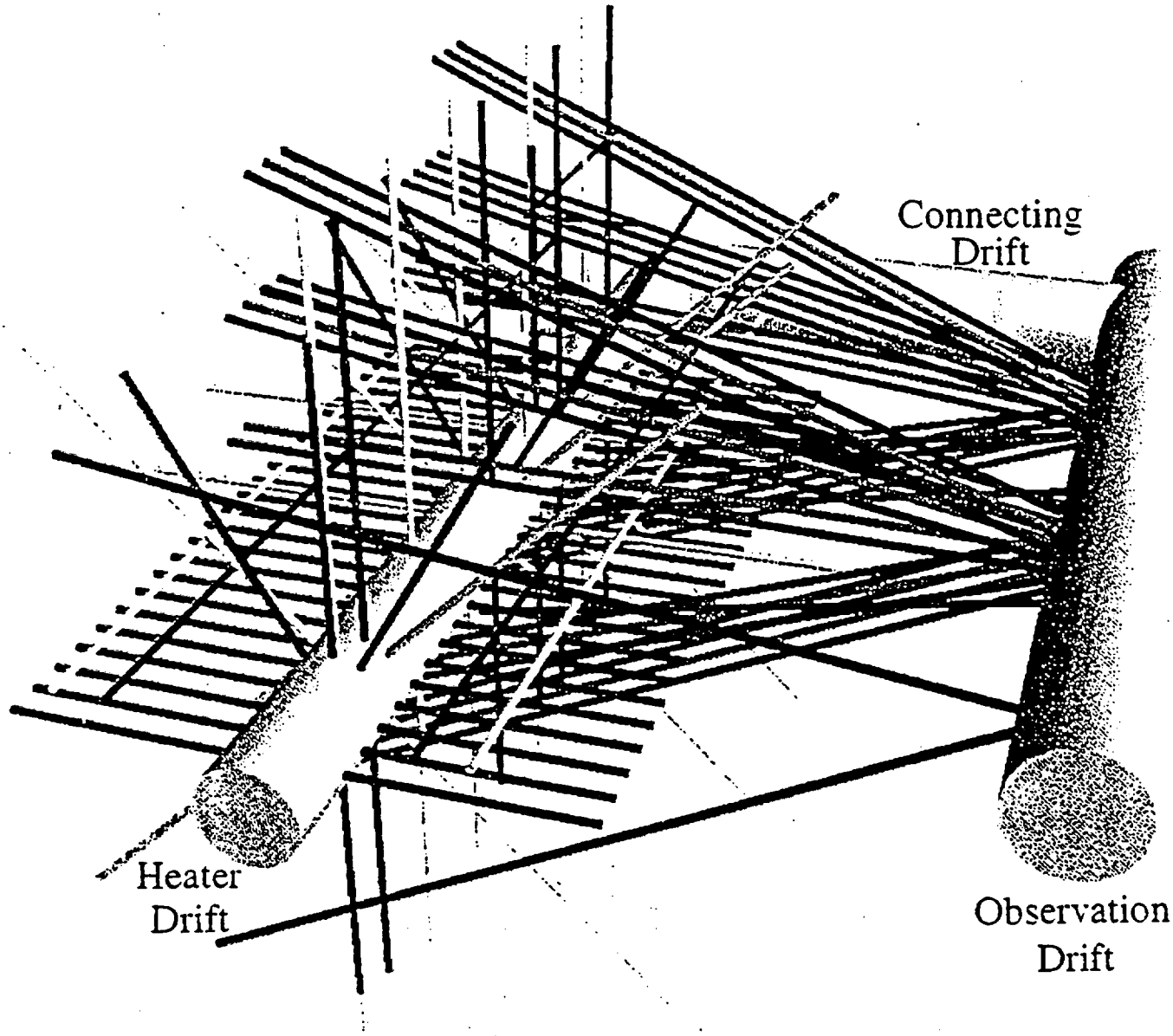
Drift Scale Test

Borehole Perspective



Wing Heaters

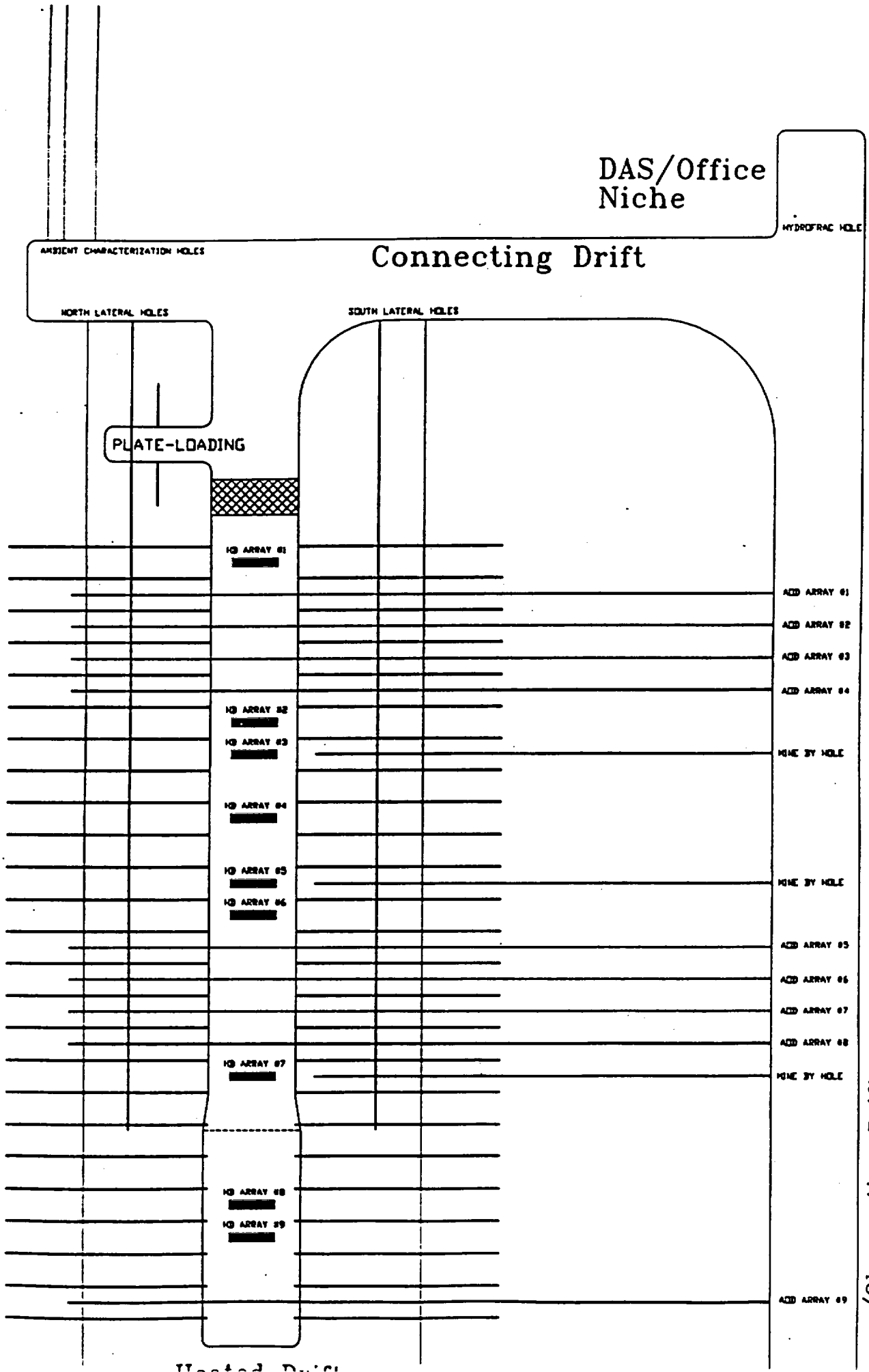
Thermal

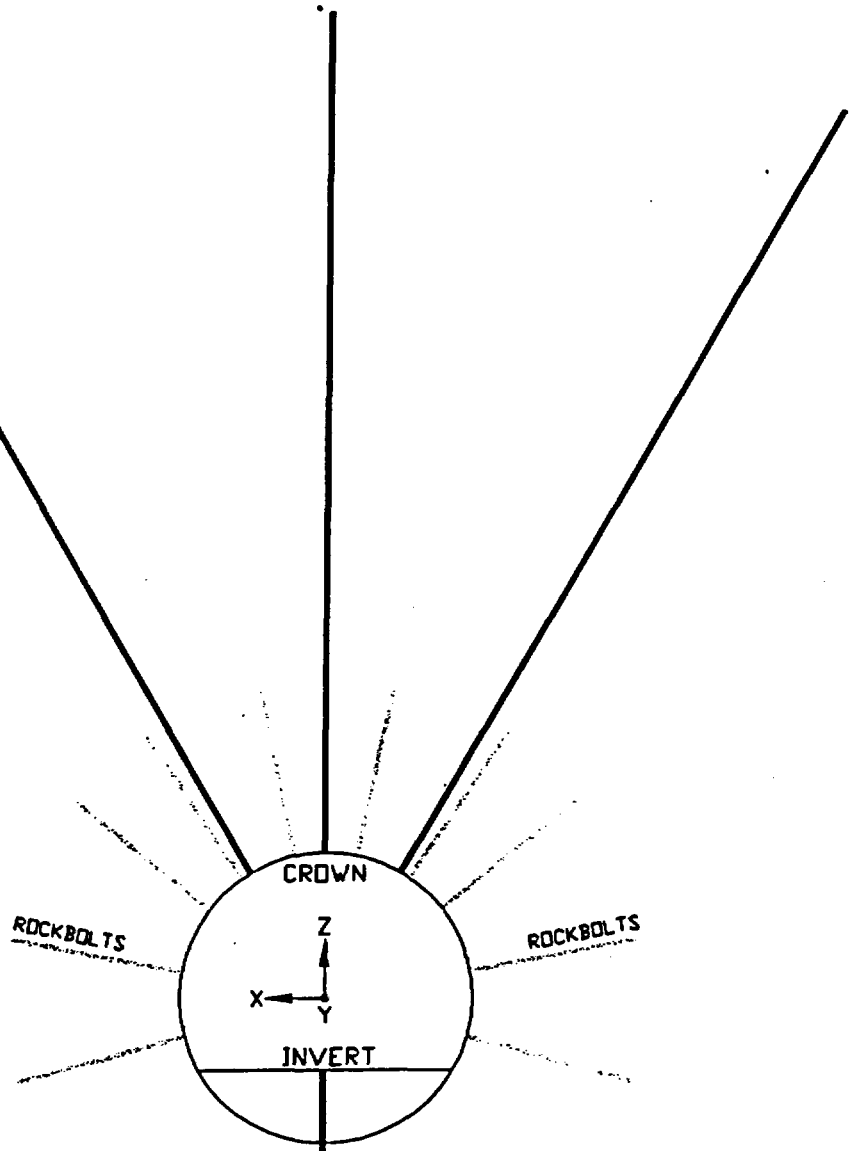
Mechanical

Hydrological

Chemical

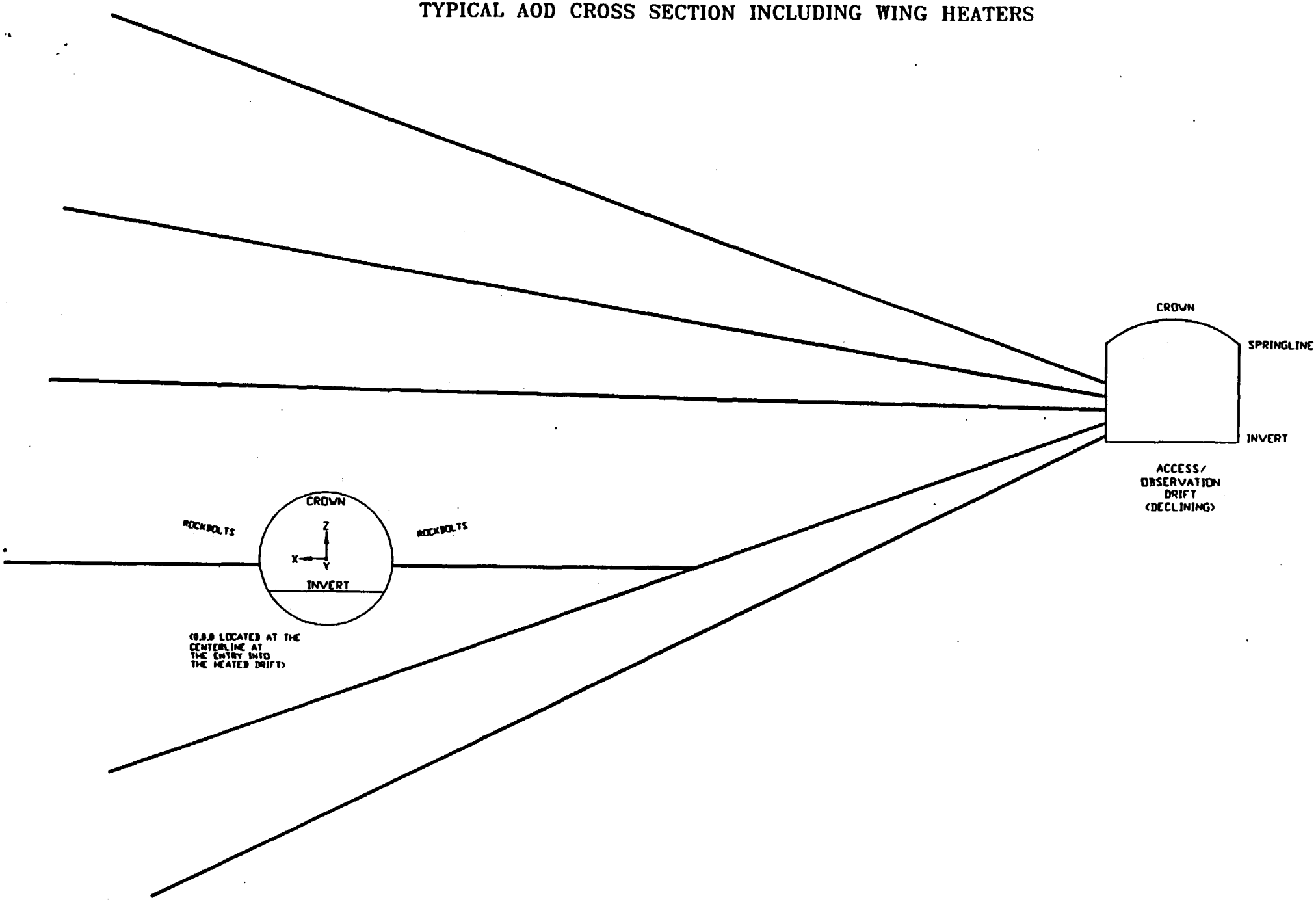
DRAFT


DAS/Office Niche
HYDROFRAC HOLE
AMBIENT CHARACTERIZATION HOLES
Connecting Drift
NORTH LATERAL HOLES
SOUTH LATERAL HOLES
PLATE-LOADING
HB ARRAY #1
HB ARRAY #2
HB ARRAY #3
HB ARRAY #4
HB ARRAY #5
HB ARRAY #6
HB ARRAY #7
HB ARRAY #8
HB ARRAY #9
ACID ARRAY #1
ACID ARRAY #2
ACID ARRAY #3
ACID ARRAY #4
MINE BY HOLE
MINE BY HOLE
ACID ARRAY #5
ACID ARRAY #6
ACID ARRAY #7
ACID ARRAY #8
MINE BY HOLE
ACID ARRAY #9
Heated Drift
Access/Observation Drift

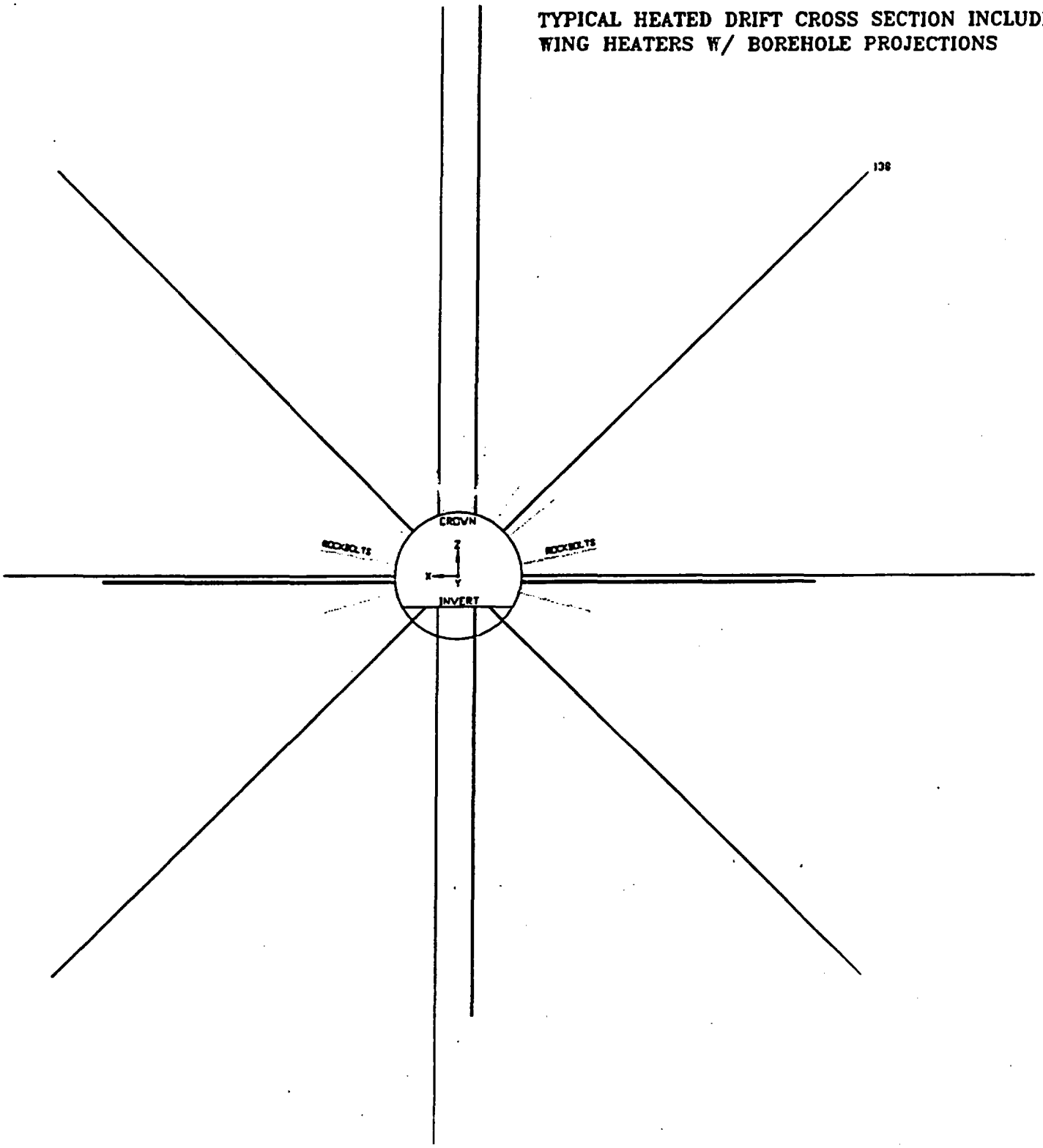


TYPICAL MPBX CROSS SECTION INCLUDING WING HEATERS W/ BOREHOLE PROJECTIONS

TYPICAL AOD CROSS SECTION INCLUDING WING HEATERS



TYPICAL HEATED DRIFT CROSS SECTION INCLUDING WING HEATERS W/ BOREHOLE PROJECTIONS



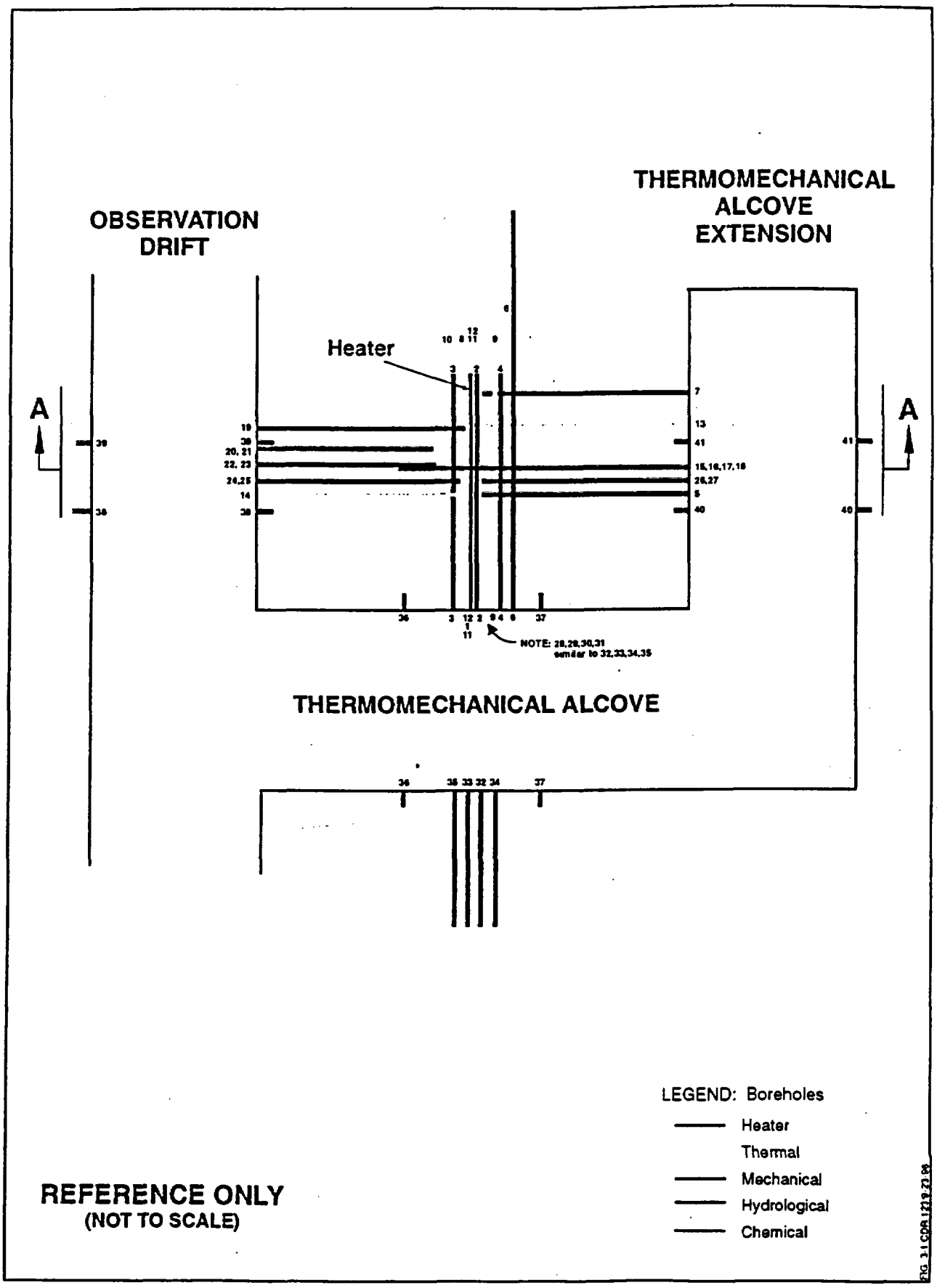
Schedule for the Drift Scale Test

• Final Test Design and Forecast Report Initiate Heating	July 16, 1997
• Characterization of Thermal Test Area Report	August 4,1997
• Initiate Heating	December 8, 1997
• DST Early Results Report	February 2, 1998
• DST Progress Report	September 1,1998
• Terminate Heating (min.)	December 8, 1999
• Terminate Cooling	December 8, 2001
• Submit Final Report	July 1, 2002

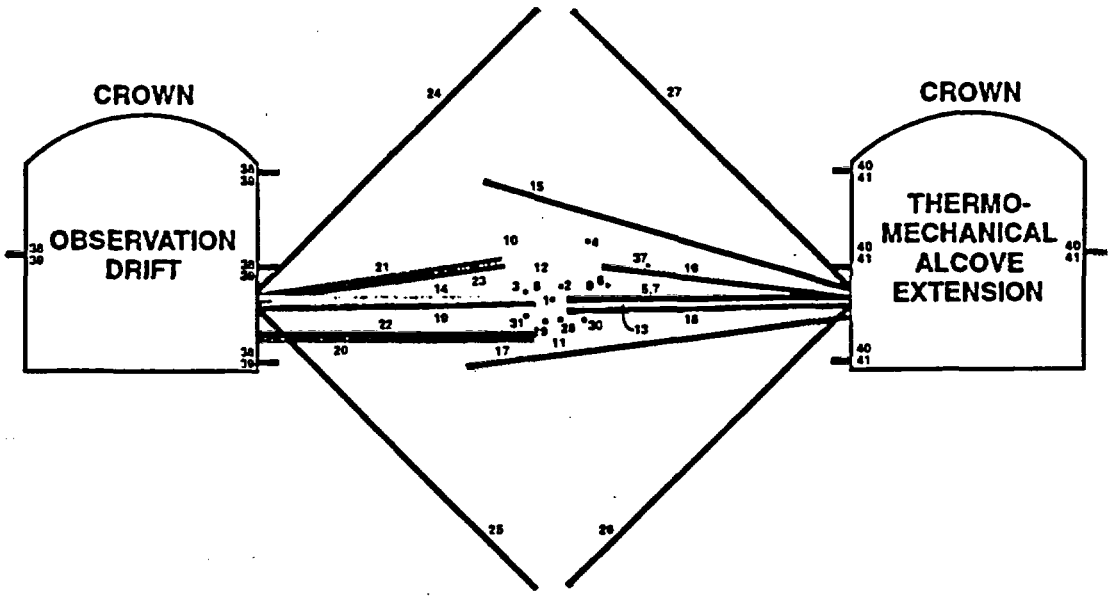
Why the Single Heater Test?

- Shakedown
- Simpler-Smaller-Shorter

Layout of Single Heater Test



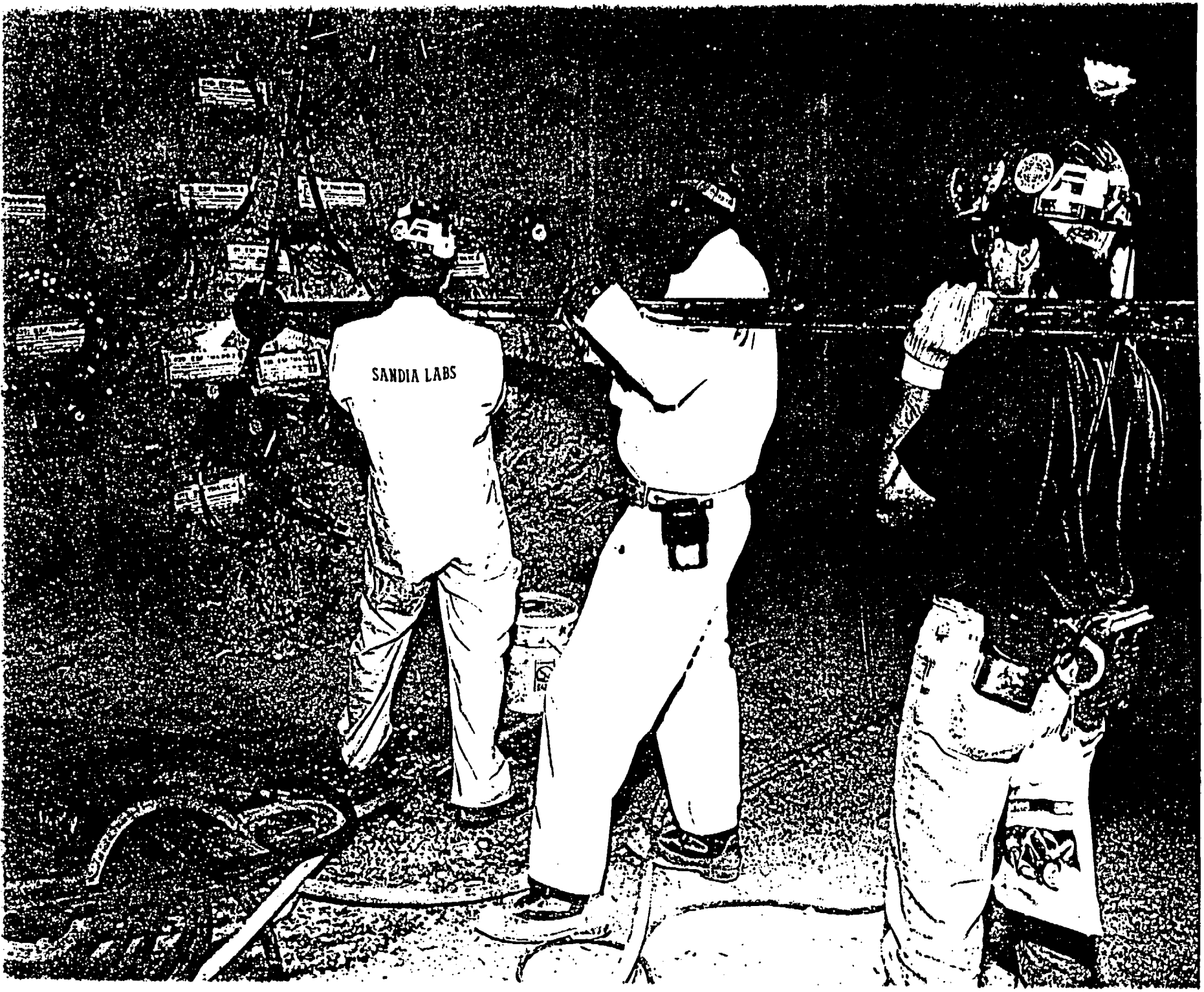
Cross-Section of Single Heater Test



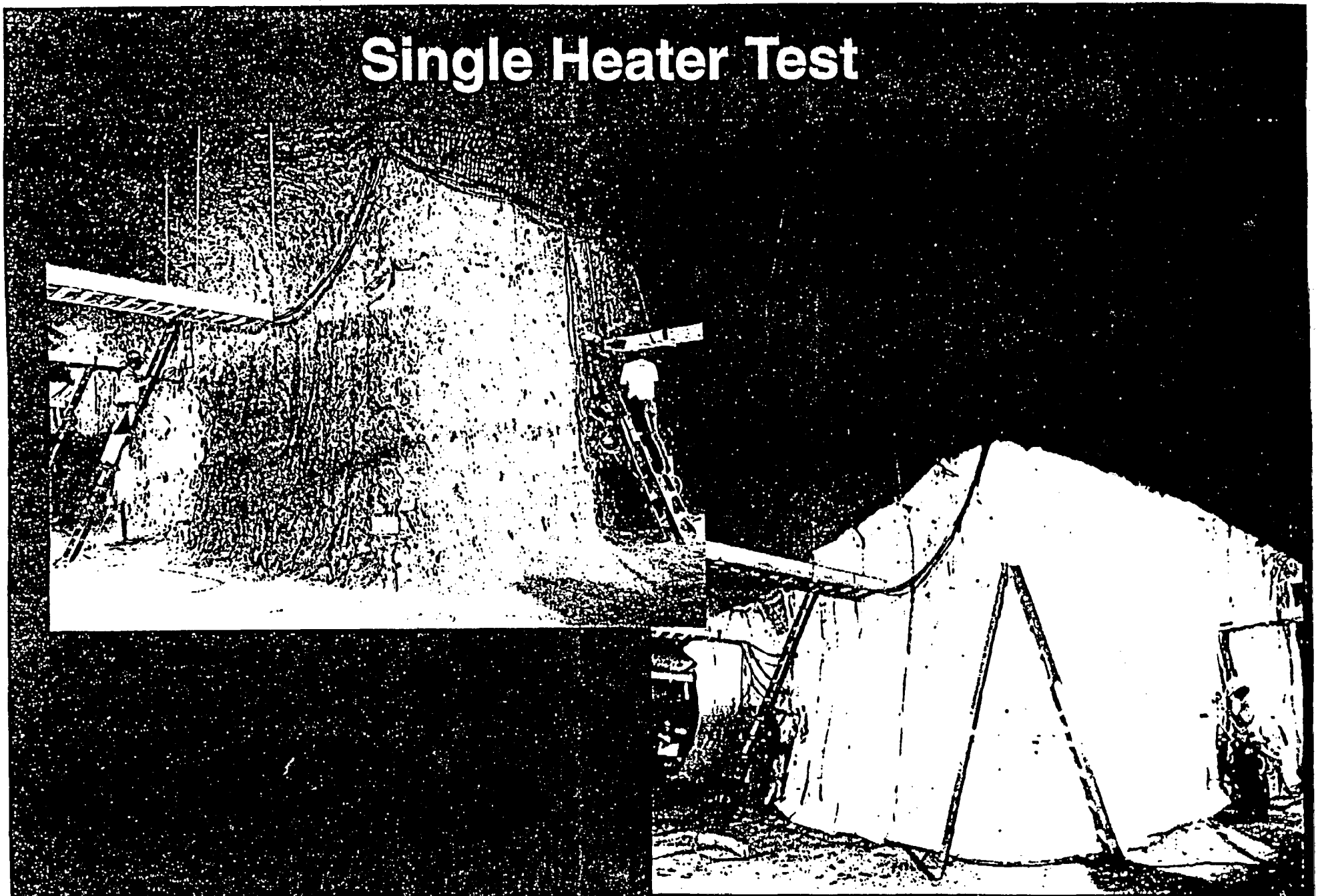
CROSS-SECTION A-A

LEGEND: Boreholes
- Heater
- Thermal
- Mechanical
- Hydrological
- Chemical

REFERENCE ONLY
(NOT TO SCALE)


SANDIA LABS

Single Heater Test

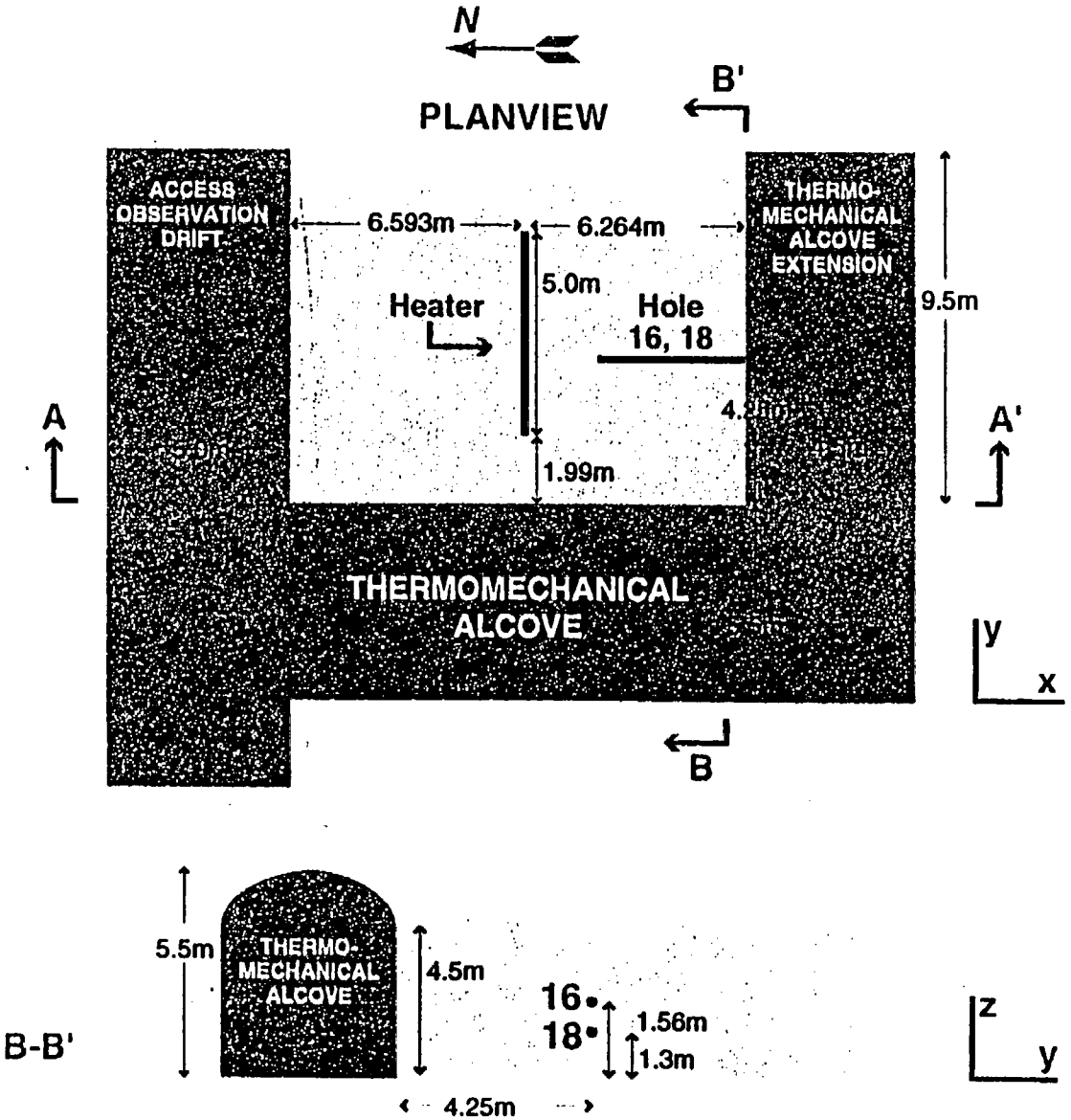


THE THERMOMECHANICAL TEST BLOCK WAS COVERED WITH INSULATION IN LATE AUGUST IN PREPARATION FOR AN AUGUST 26, 1996 HEATER TURN ON.

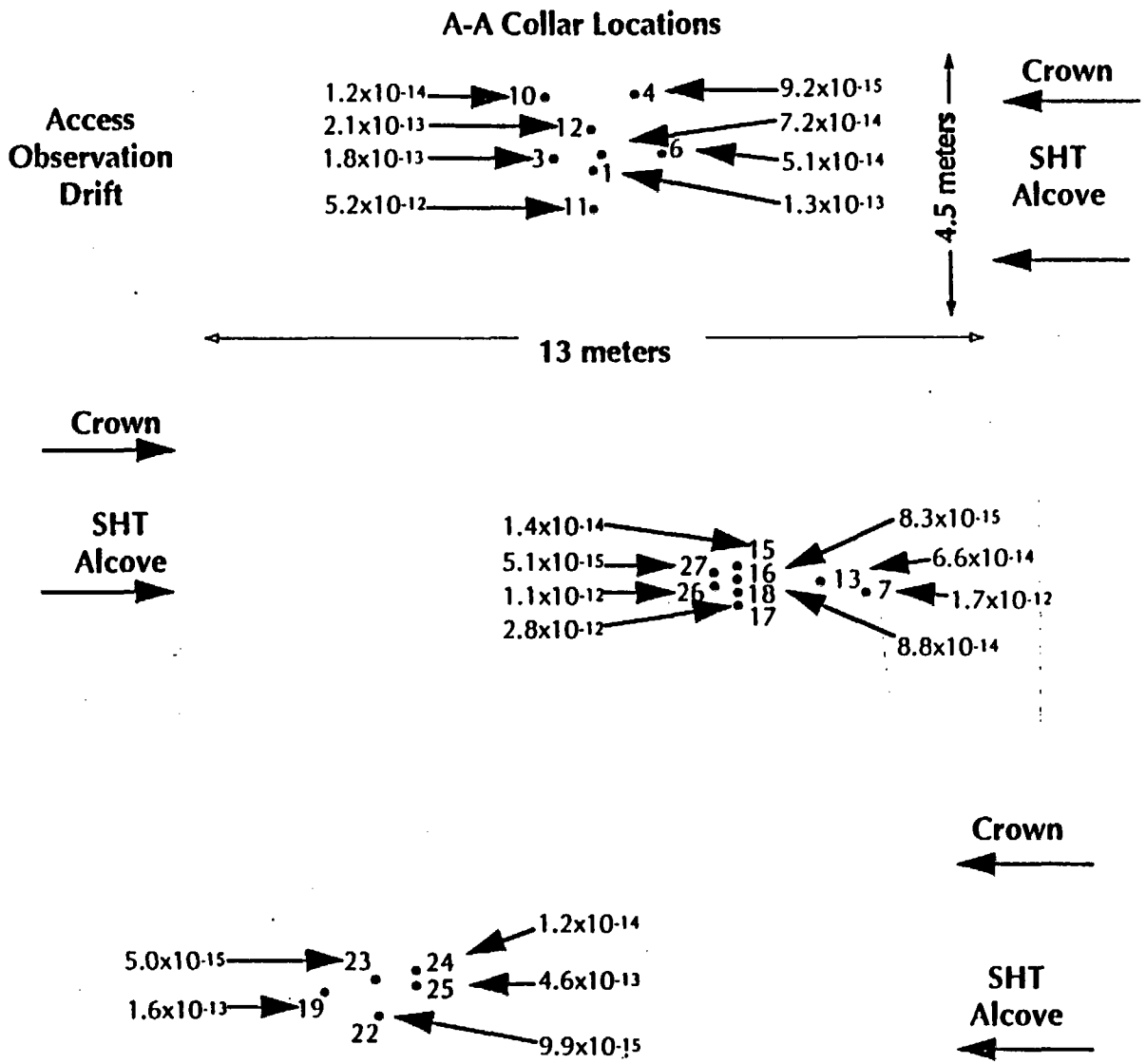
Results to Date
Single Heater Test

- Test Proceeding as Planned

Configuration of the Single Heater Test



Permeability Values From Test Conducted in May 1996
Single Heater Test

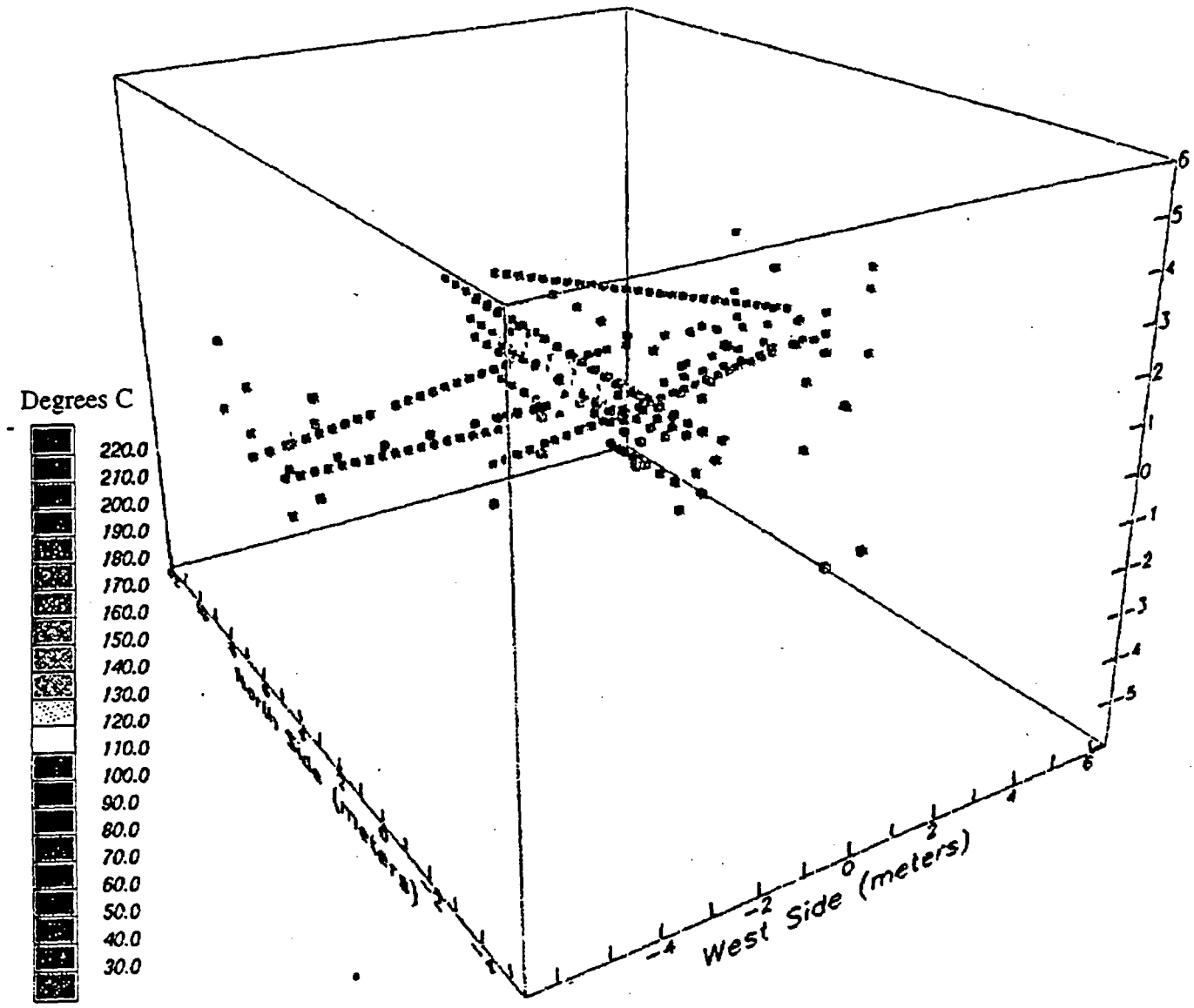


Single Heater Test: Measurements

Perspective Isotherms

Input Sensor Locations

February 17, 1997 (Day 175)



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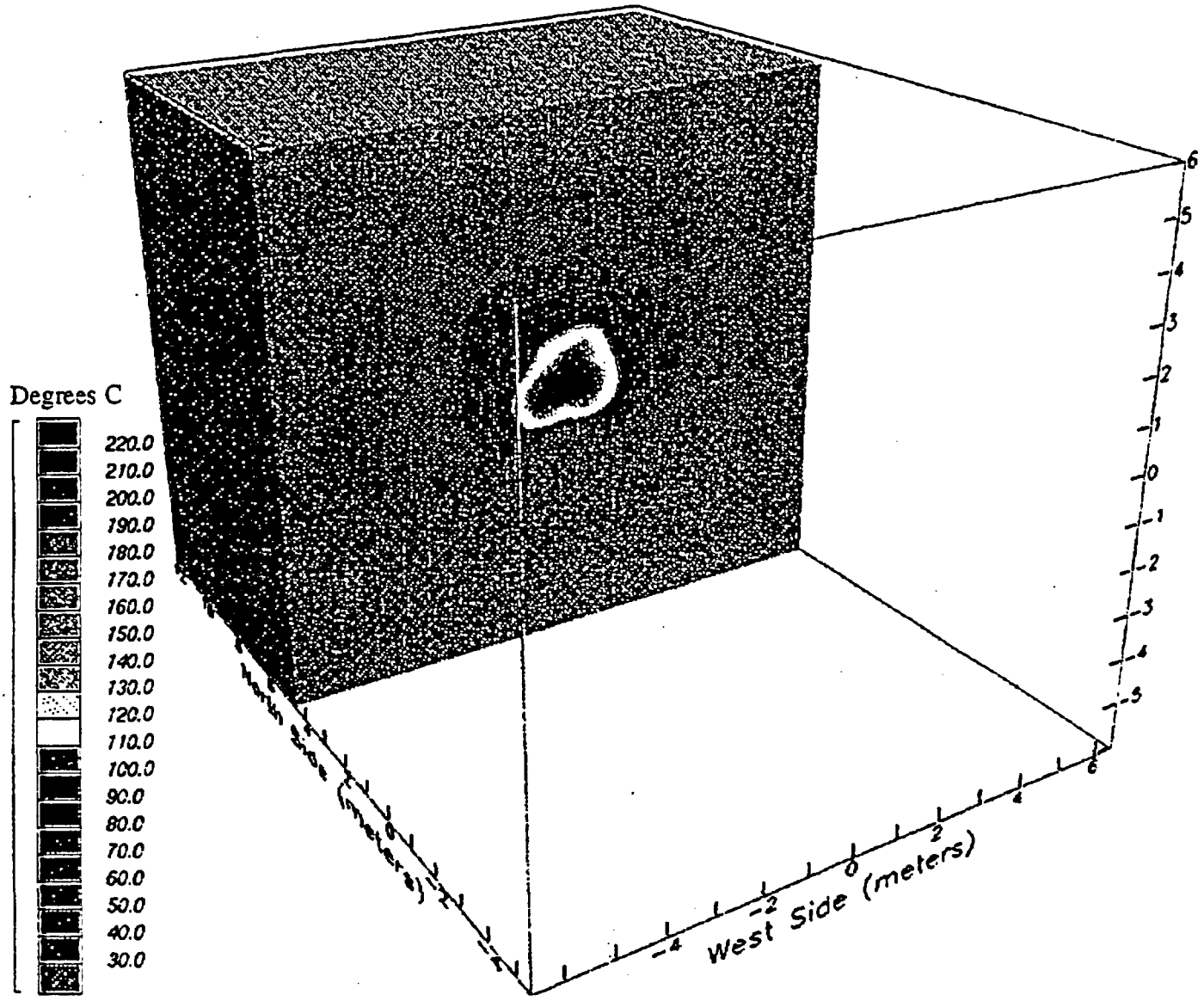
Single Heater Test: Measurements

Perspective Isotherms

Vertical Slice at Heater Midlength

February 17, 1997 (Day 175)



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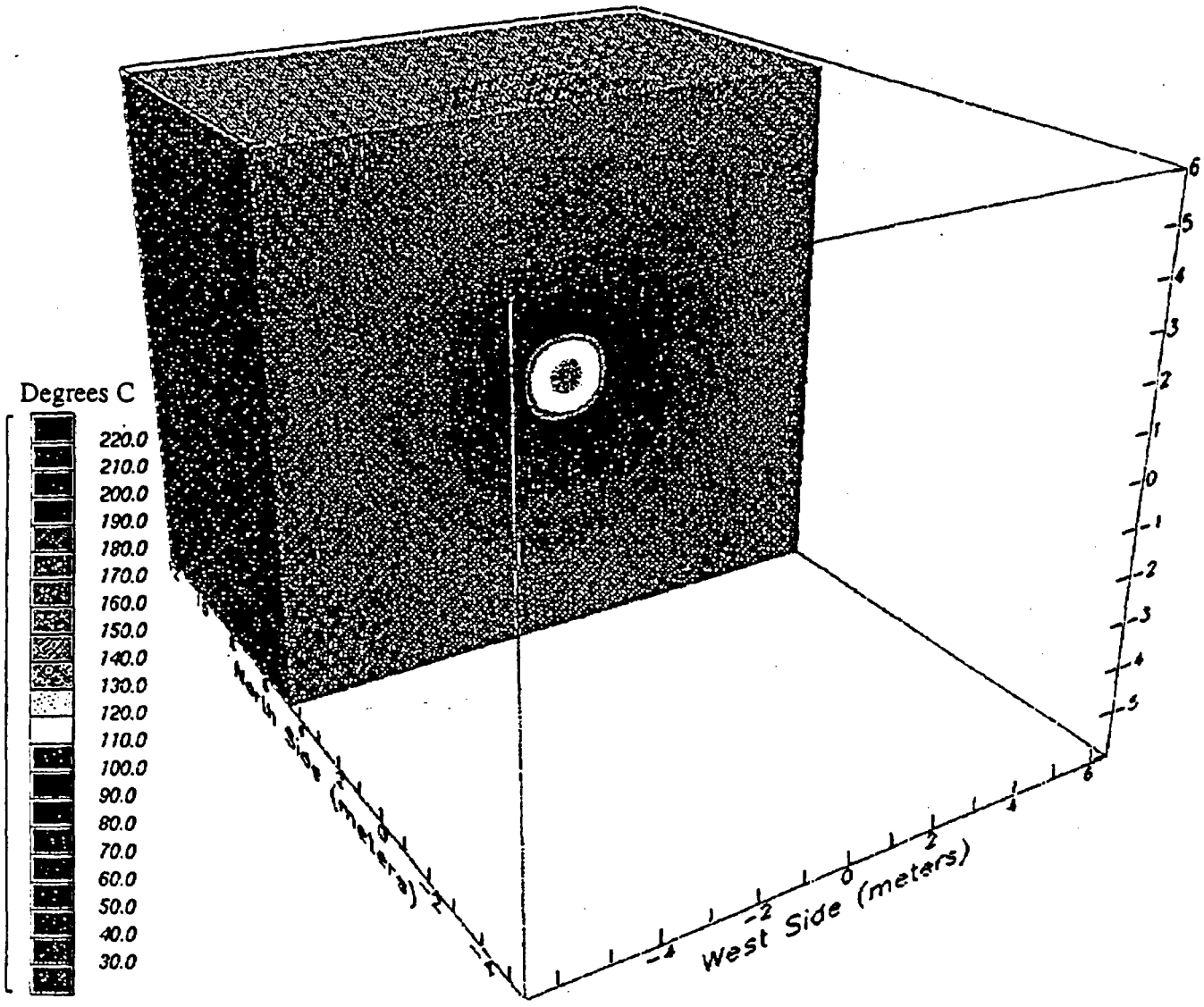
Single Heater Test: Predictions

Perspective Isotherms

Vertical Slice at Heater Midlength

February 17, 1997 (Day 175)



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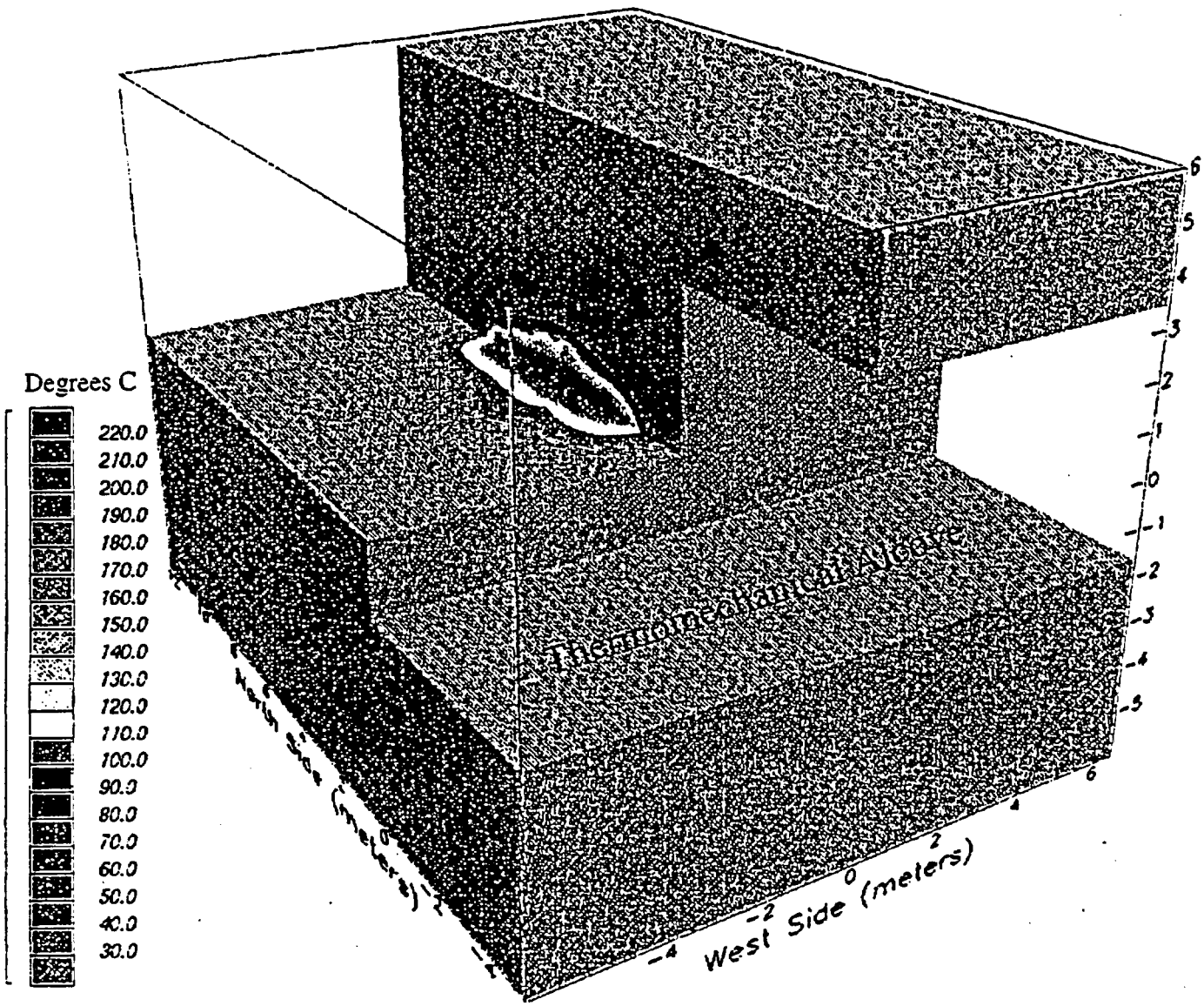
Single Heater Test: Measurements

Perspective Isotherms

Cutaway Along Heater

February 17, 1997 (Day 175)



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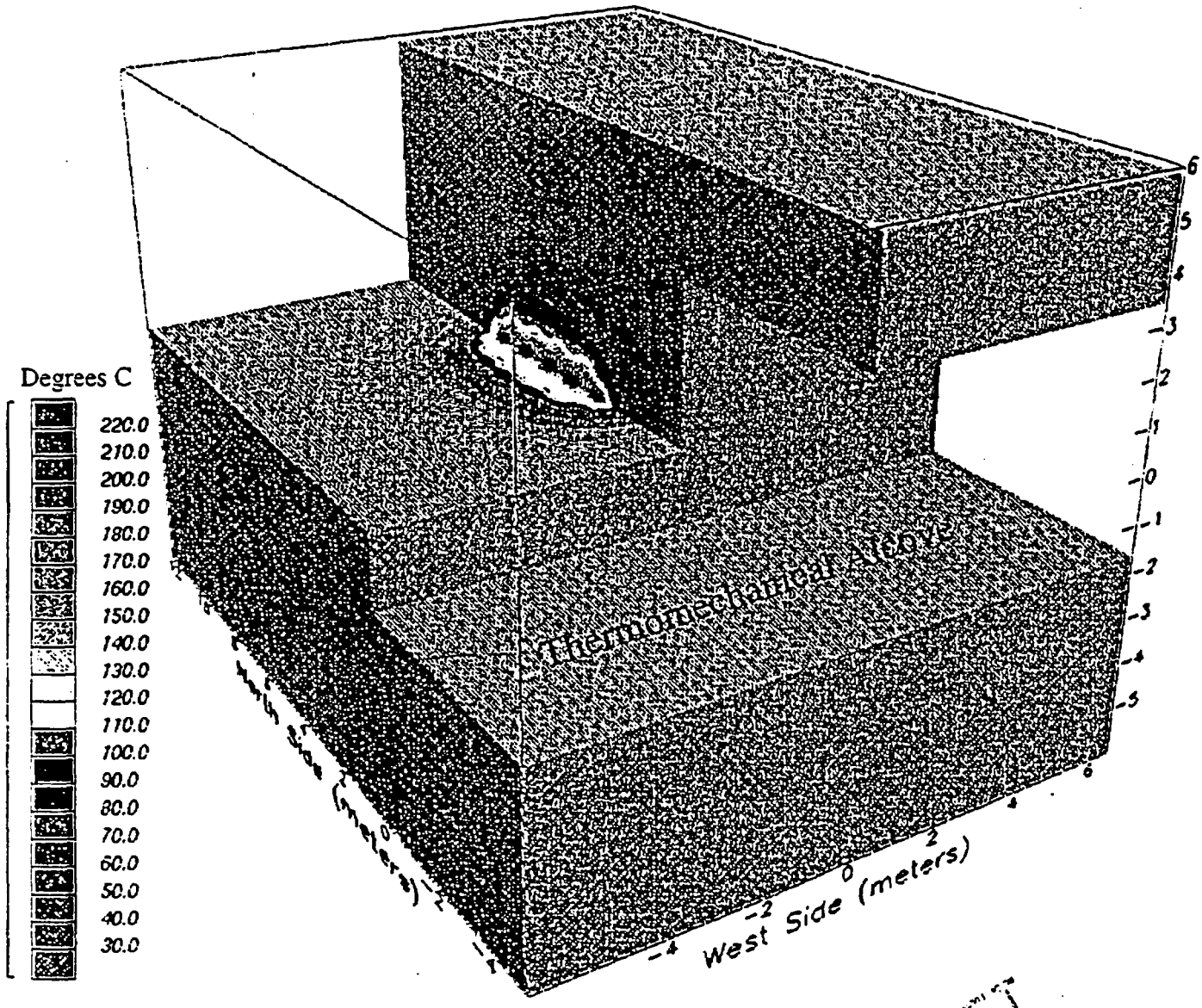
Single Heater Test: Predictions

Perspective Isotherms

Cutaway Along Heater

February 17, 1997 (Day 175)

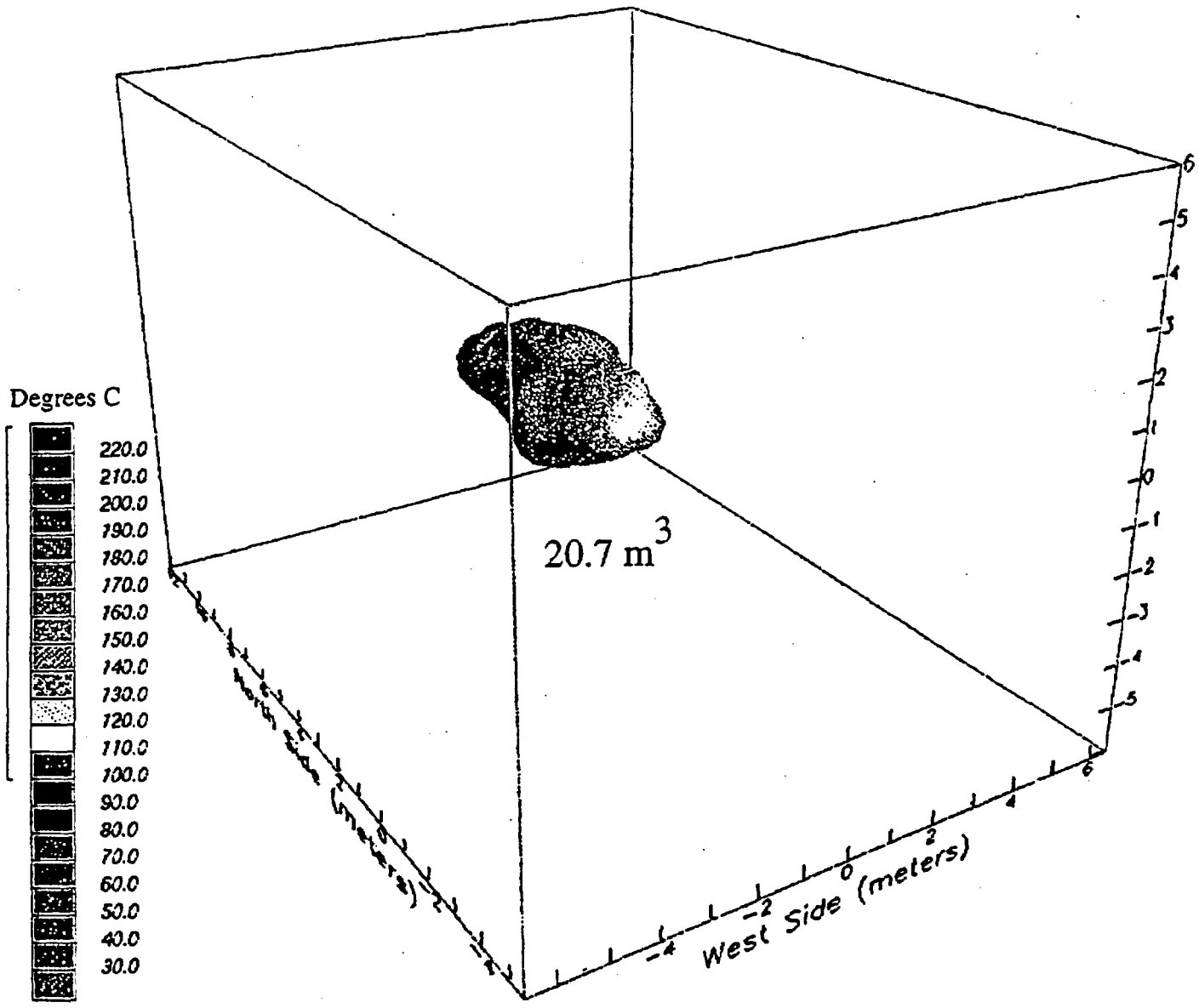


Single Heater Test: Measurements

Perspective Isotherms

100 Degree C Isotherm

February 17, 1997 (Day 175)



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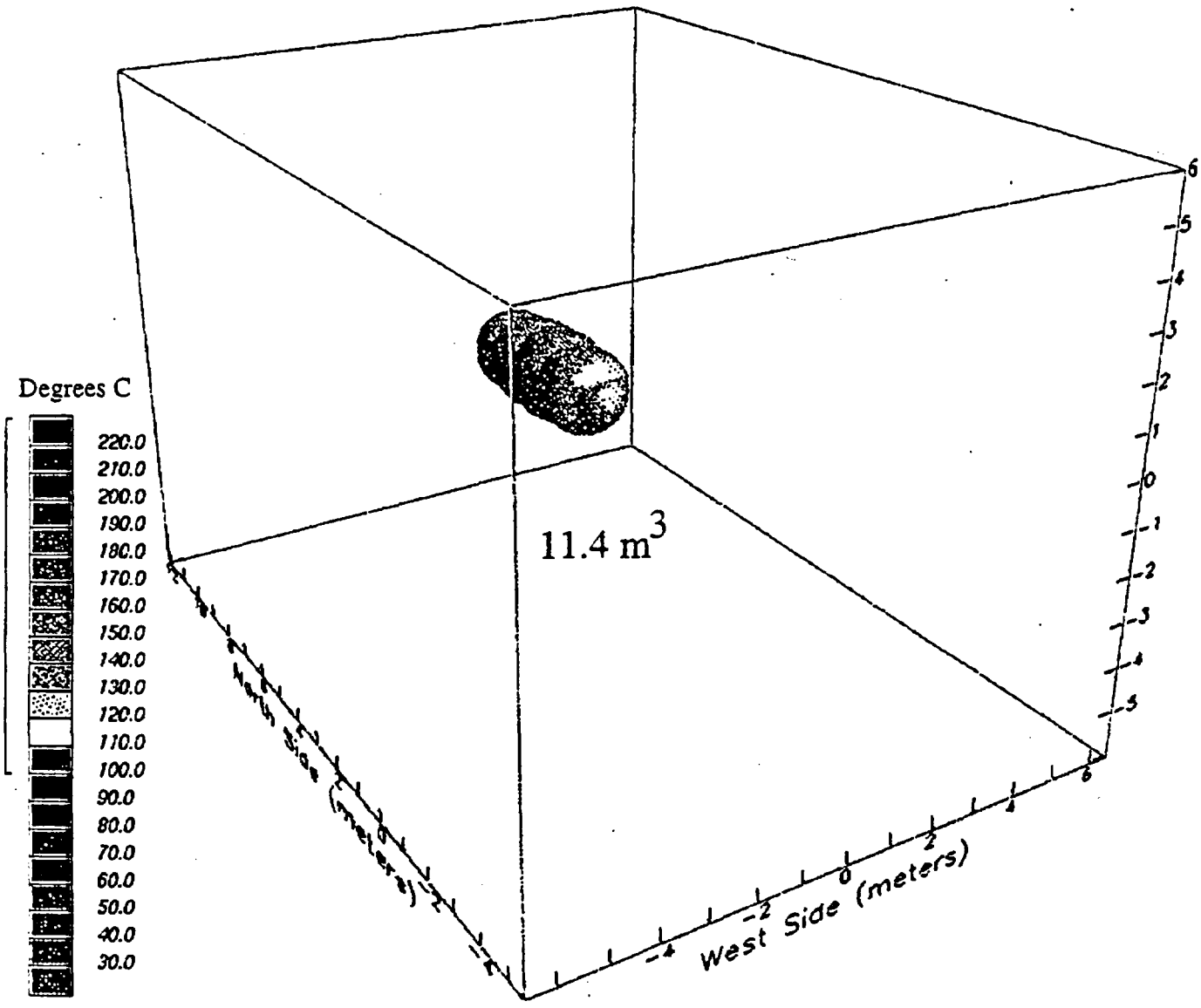
Single Heater Test: Predictions

Perspective Isotherms

100 Degree C Isotherm

February 17, 1997 (Day 175)



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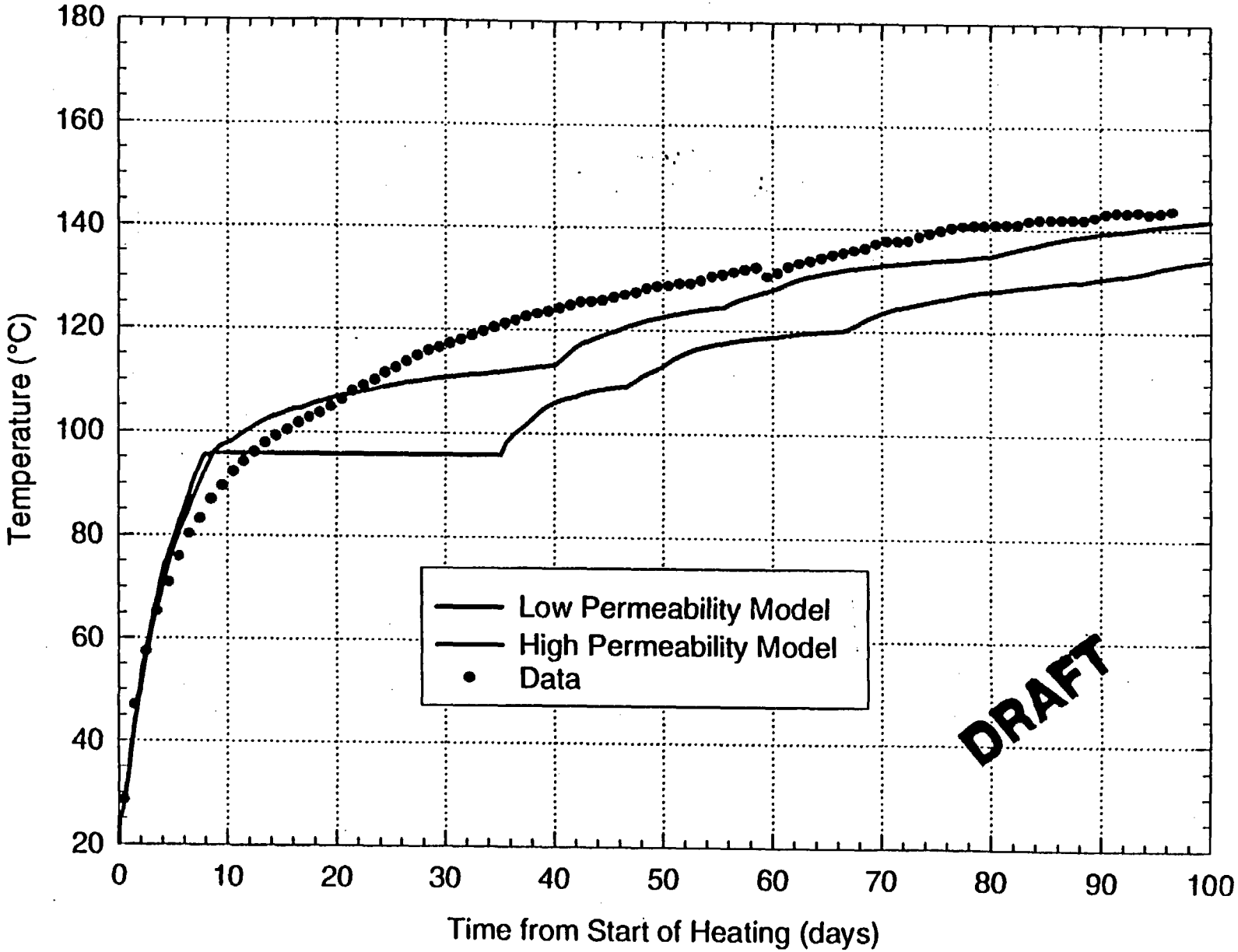
TMA-TC-1A-7
Single Heater Test



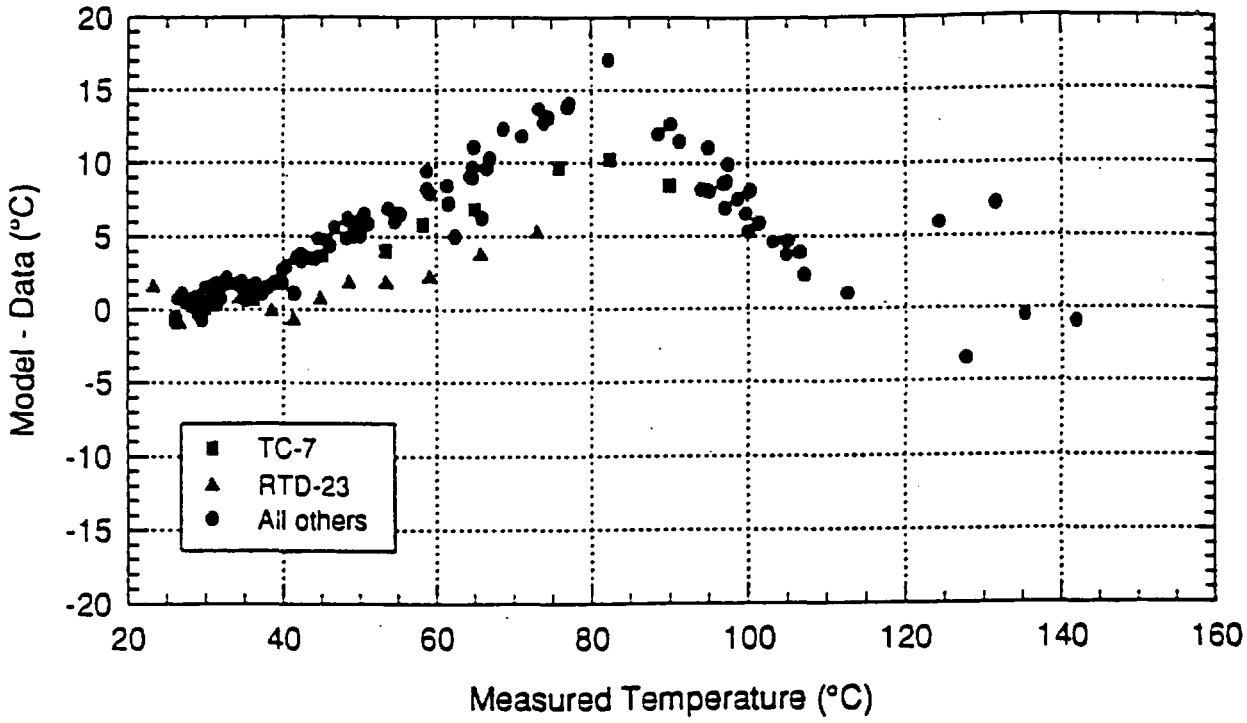


Figure 4-18. Comparison of Predicted and Measured Temperatures Along the Heater Axis (Kwet = 1.671 W/m-K)

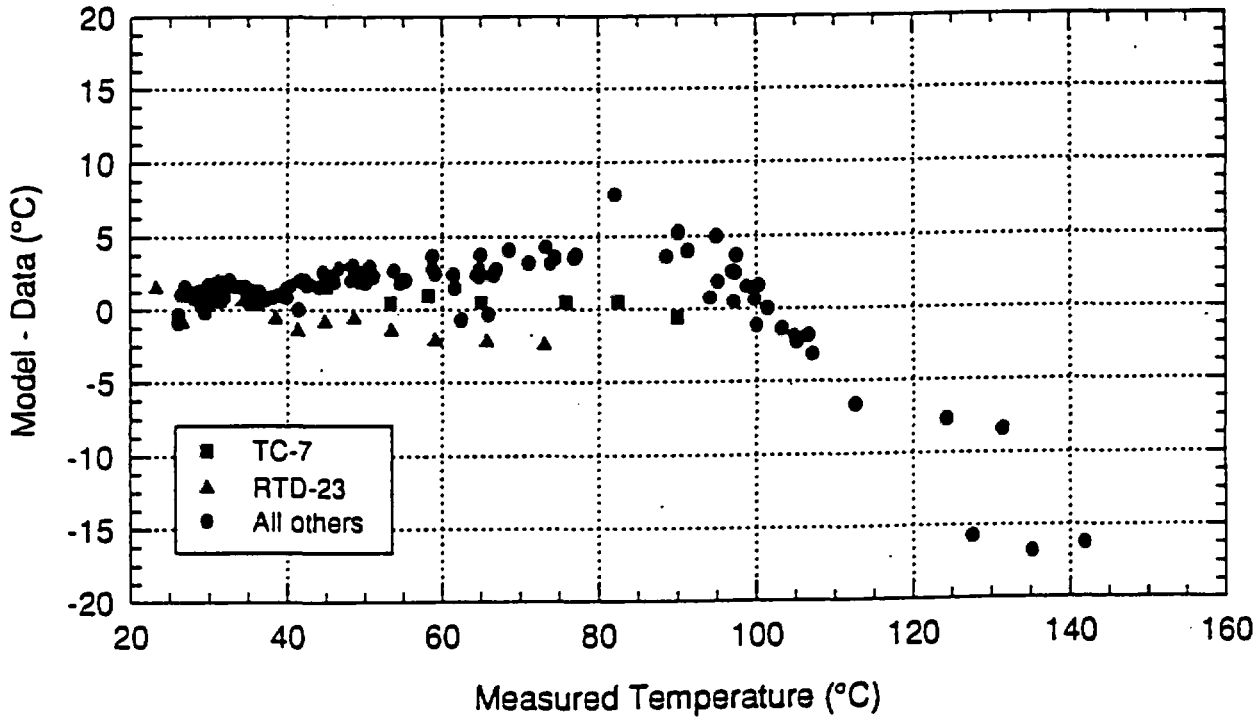
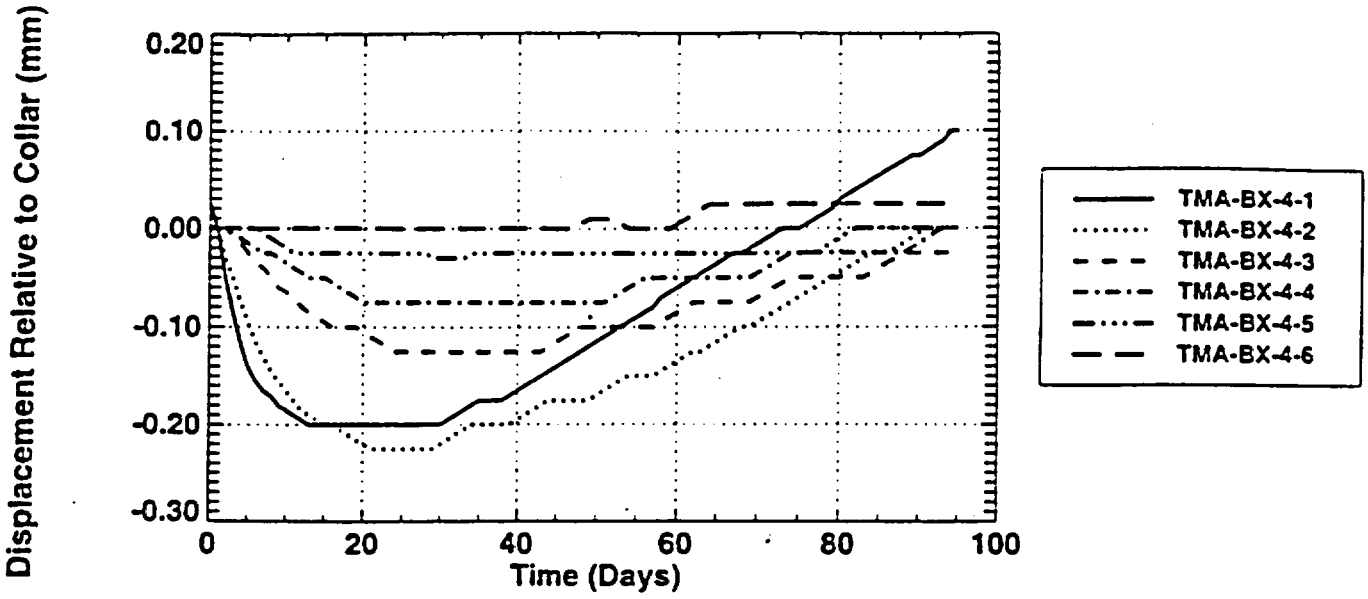
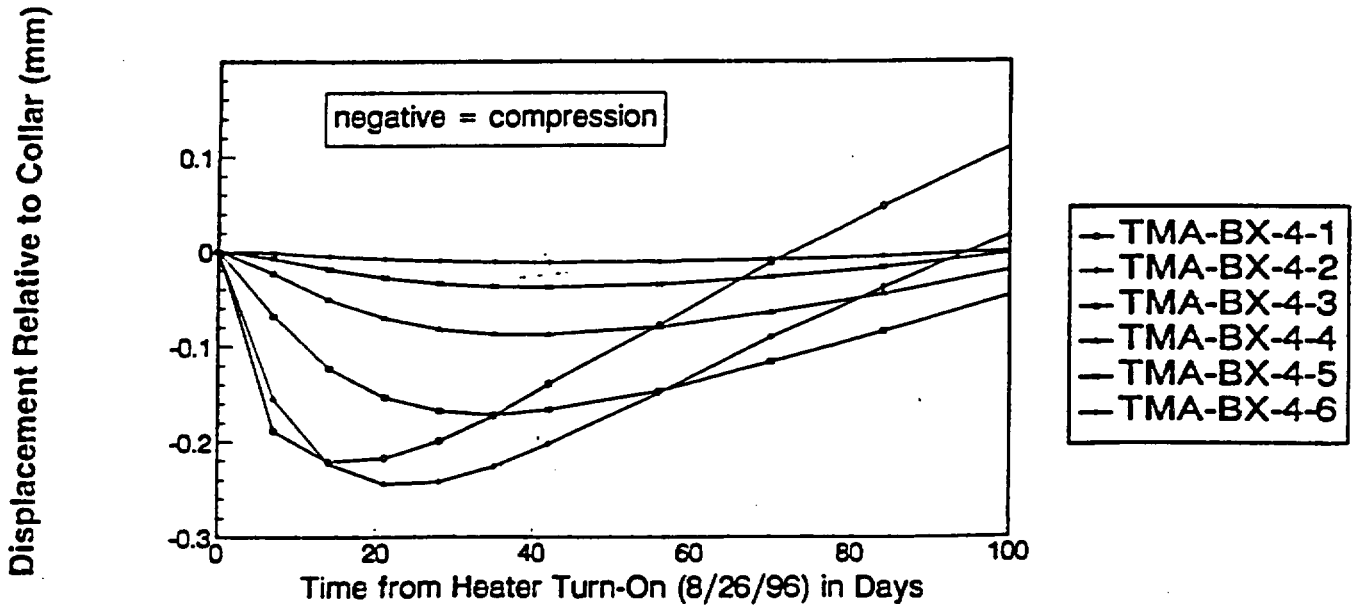


Figure 4-20. Comparison of Predicted and Measured Temperatures Along the Heater Axis (Kwet = 2.1 W/m-K)



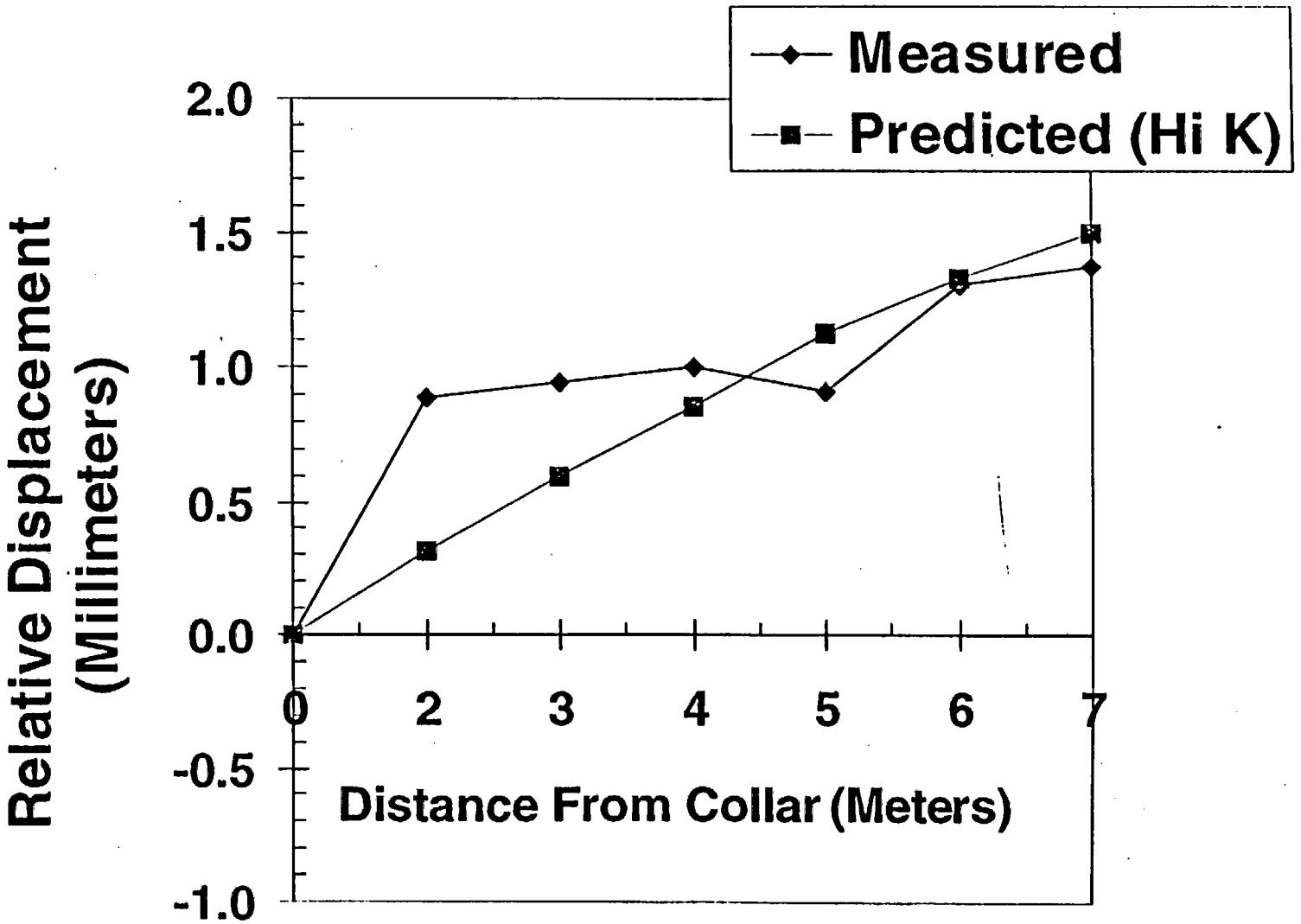
Measured Displacements for TMA-MPBX-4 (uncorrected for thermal expansion of rods; extension being positive)

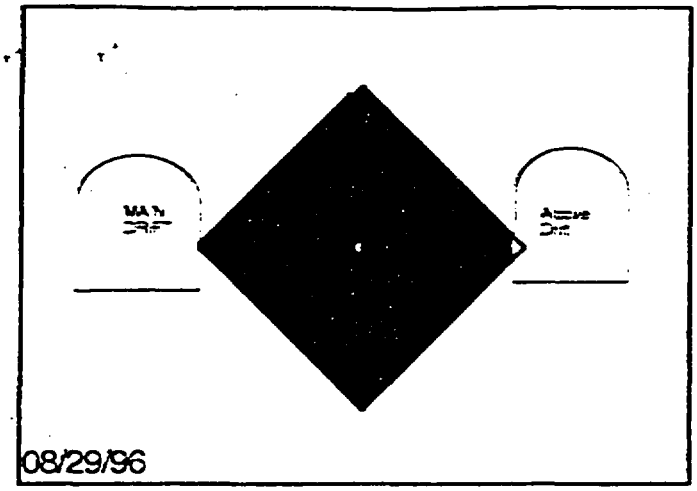


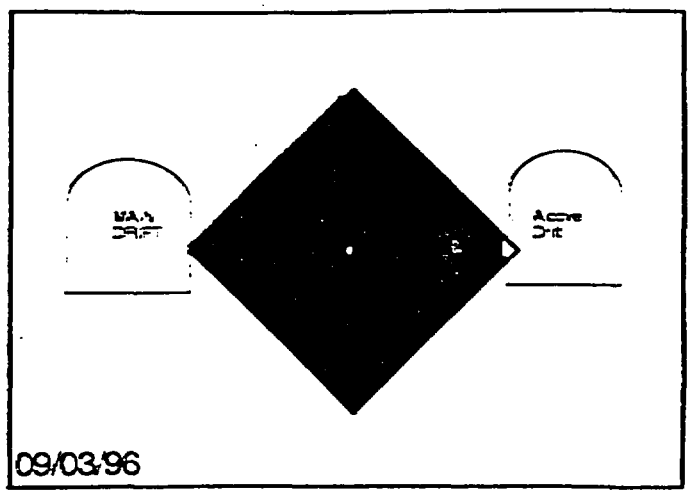
Predicted Displacements for TMA-MPBX-4 (High Permability Case)

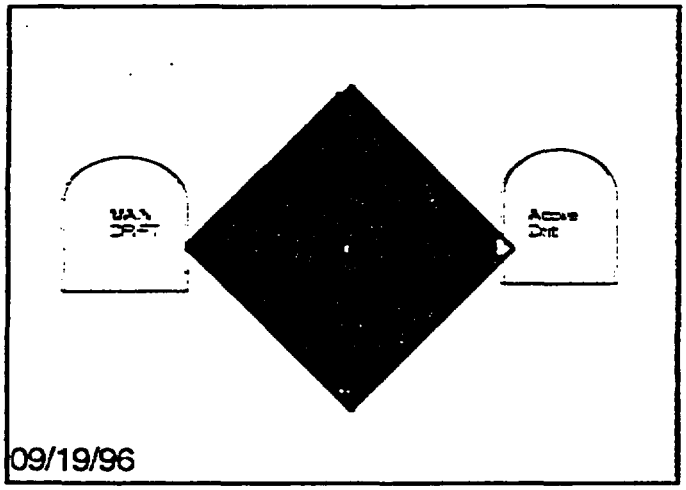
Single Heater Test: Displacement Comparison

for MPBX-3 on November 30, 1996 (Day 96)




08/29/96


09/03/96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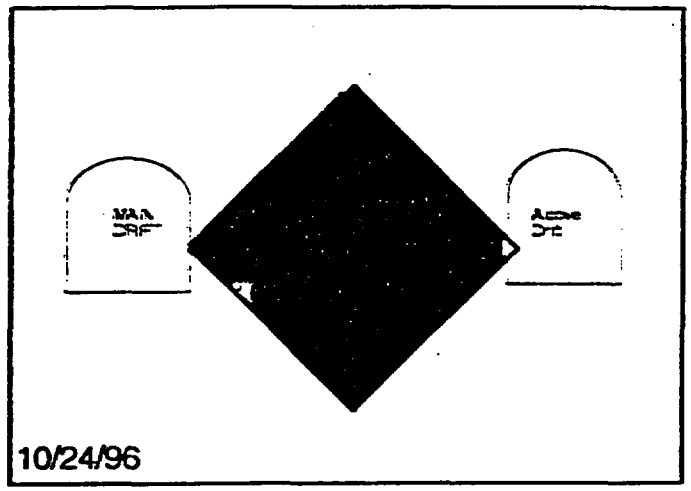
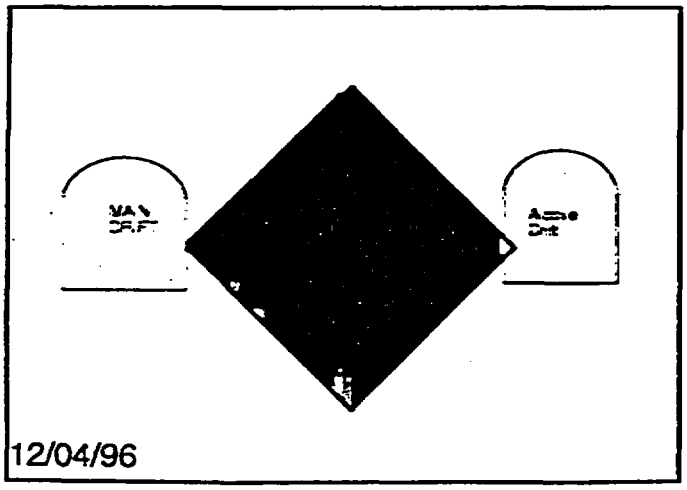

10/24/96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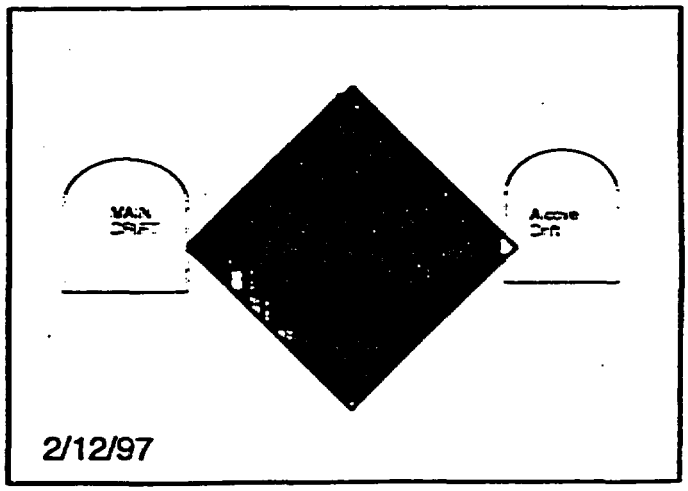
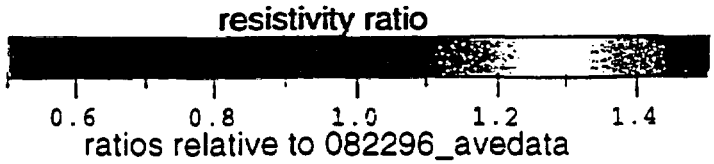
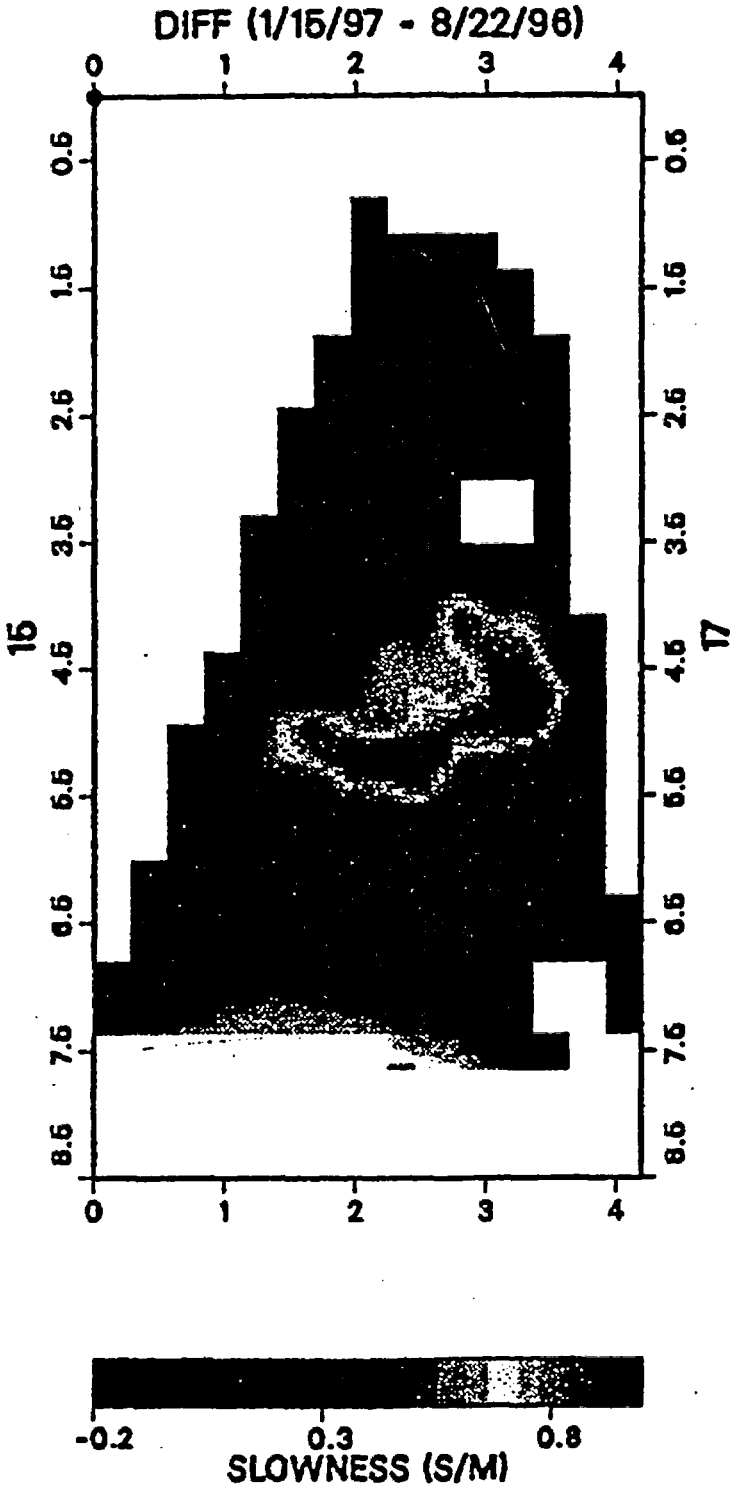
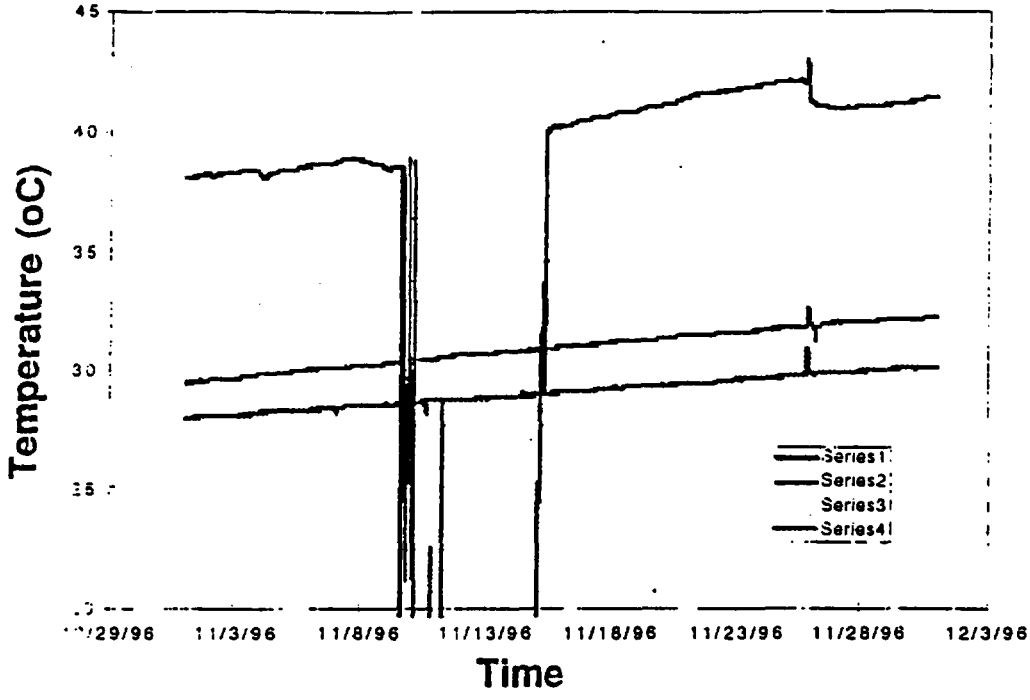

2/12/97


resistivity ratio
0.6
0.8
1.0
1.2
1.4
ratios relative to 082296_avedata

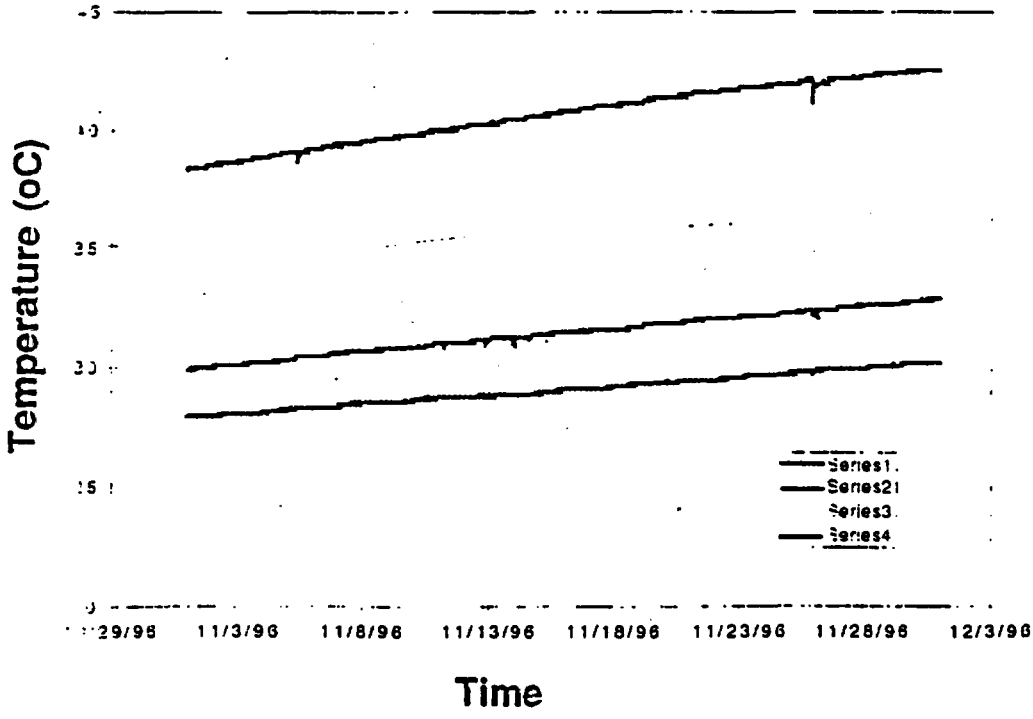
YUCCA MTN HEATER TEST (GPR RESULTS)



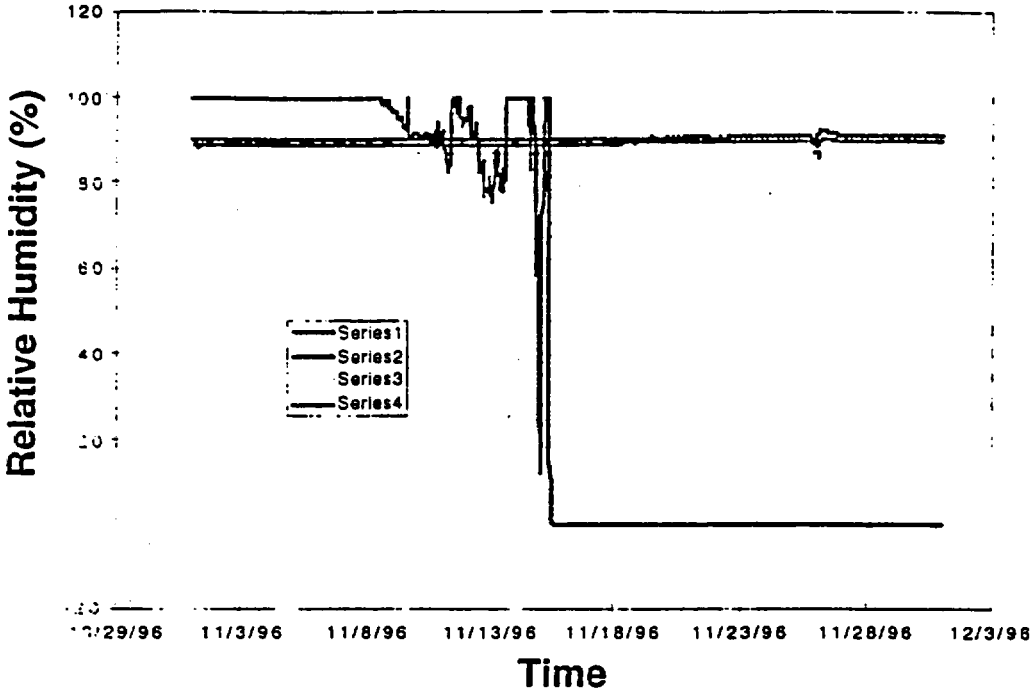
Borehole 16



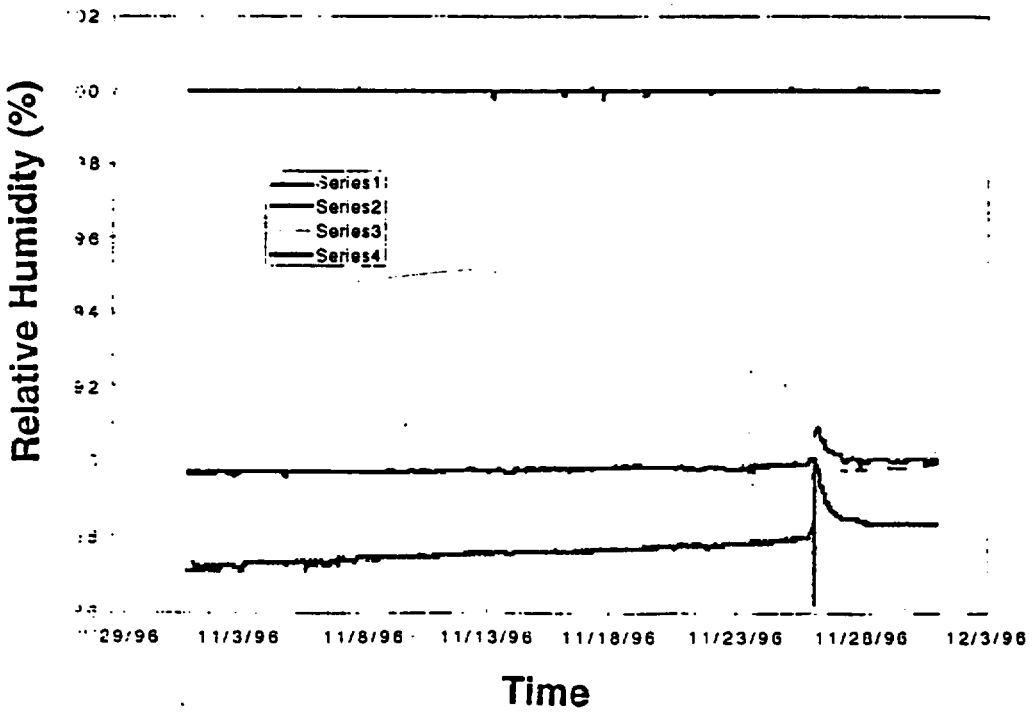
Borehole 18



Borehole 16



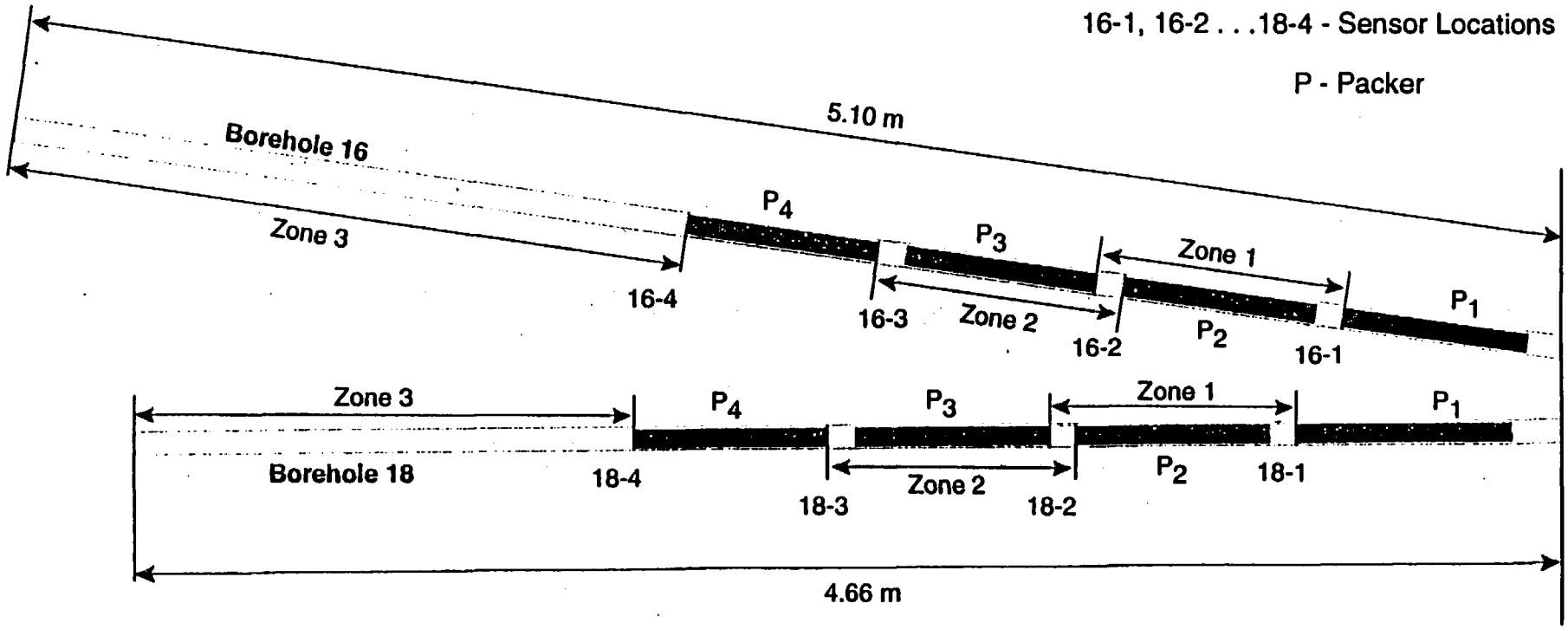
Borehole 18



Borehole 16 Observations

- The following volumes of water collected in zone 4:
  - 5.5 Liters on November 25, 1996
  - 5.5 Liters on February 4, 1997
  - 1.5 Liters on February 27, 1997
- Zone 4 (before test)
  - Relatively low air permeability
  - Fracture at low angle lined with white mineral(s)
- Zone 4 (during test)
  - Temperature and relative humidity dropped significantly before water collection
  - Air permeability was lower after water collection

Geometry of the Air Injection Test in Boreholes 16 and 18



Borehole 16 Observations

(Continued)

- Comprehensive suite of chemical and isotopic analyses are ongoing
  - Preliminary data suggests water is not drilling fluid
  - Preliminary data suggests water is condensate exposed to fracture-lined minerals
  - Confirms anticipated water mobilization

Chemistry: Single Heater Test

- Chemical sensors are faulty
- "SEAMIST" sampling pads and water samples are primary sources

Chemical Analysis of 16-4 water

Parameter	SHT Hole 16 LLNL Data (mg/L)	SHT Hole 16 LANL Data (mg/L)	EQ3/6 2nd Attempt (mg/L)	J-13 (mg/L)	G4 (mg/L)	Rainer Mesa Fracture Water (mg/L)
Na	16		n.e.	45.8	57	35
Si	16.8		18.8	28.5	21	25
Ca	13		12.3	13	13	8.4
K	2.5		n.e.	5	2.1	4.7
Mg	1.63		n.e.	20.1	0.2	1.5
~ pH	6.2		6.44	7.4	7.7	7.5
HCO^3	84.4			129	139	98
F	0.44			2.18	2.5	0.25
Cl	2.54	2.1		7.1	5.9	8.5
S	0.71					
SO^4_3	1.83	1.5		18.4	19	15
PO4	<0.03			<10		
Nitrate	<0.01					
NO_3	1.1			8.8		
Li	<0.03			0.048	0.067	
B	0.37			0.134		
Al	<0.06			0.02		
Fe	0.74					
Sr	0.2			0.04		
Br	<0.02	0.008				
~del D	-98.2			.98	-103	
~del O	-13			-13	-13.8	

Schedule for the Single Heater Test

• Initiate Heating (on time)	August 26, 1996
• SHT Interim Report	February, 1997
• Terminate Heating (min.)	May 26, 1997
• Final Test Design and Forecast Report	July, 1997
• Characterization of Thermal Test Area Report	August, 1997
• Heating Phase Results Status Report	September, 1997
• Terminate Cooling	February 26, 1998
• Submit Final Report	June 30, 1998
• SHT Final Report	August, 1998

ATTACHMENT 5

YUCCA MOUNTAIN PROJECT

Studies

Overview of Testing Activities

Presented to:

NRC-DOE ESF Technical Meeting, Video Conference

Presented by:

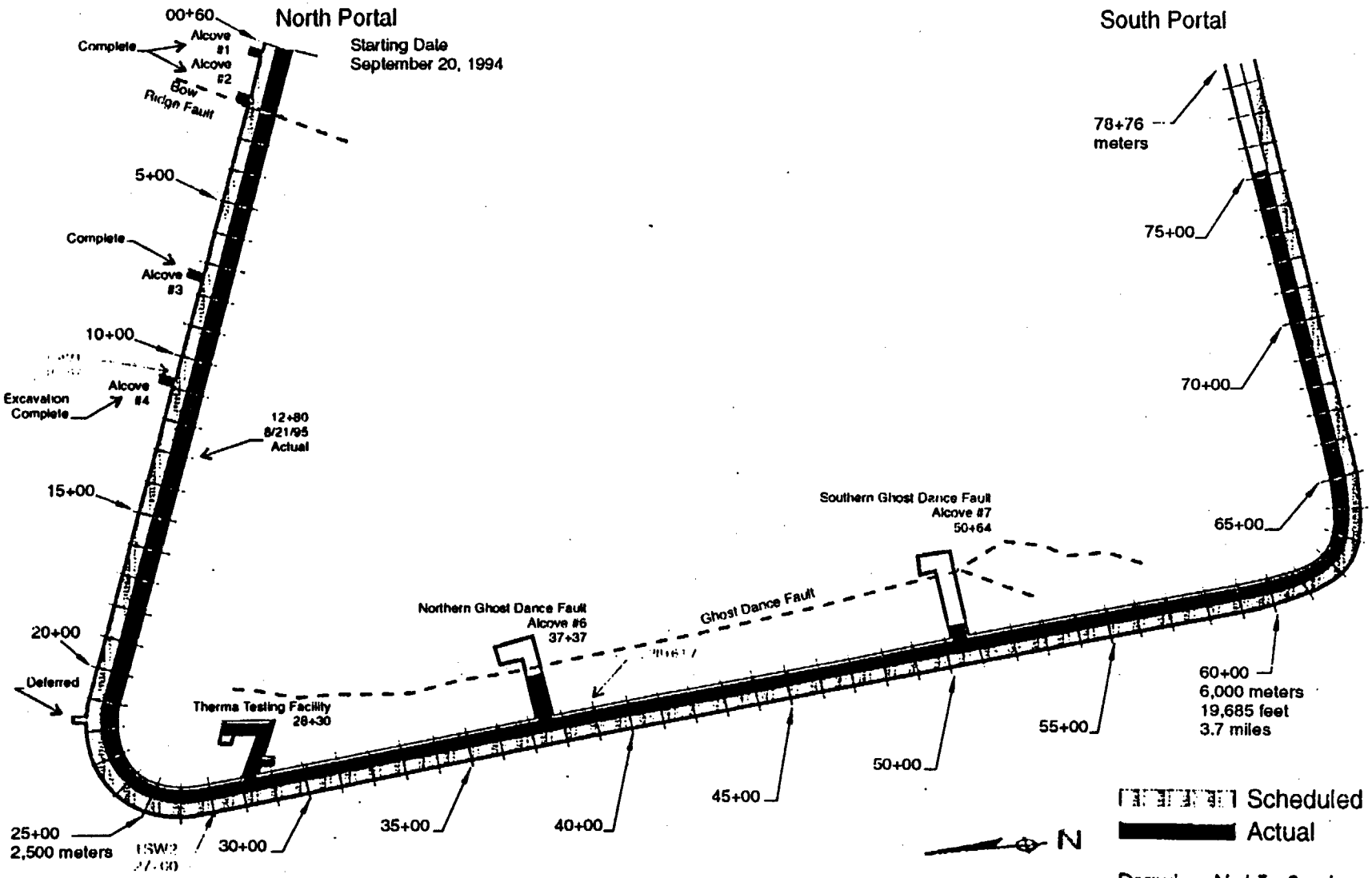
Mark C. Tynan
DOE Staff, Assistant Manager for Licensing
Yucca Mountain Site Characterization Office

March 13, 1997

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

YM 13740 View of Calico Hills from Alice Ridge

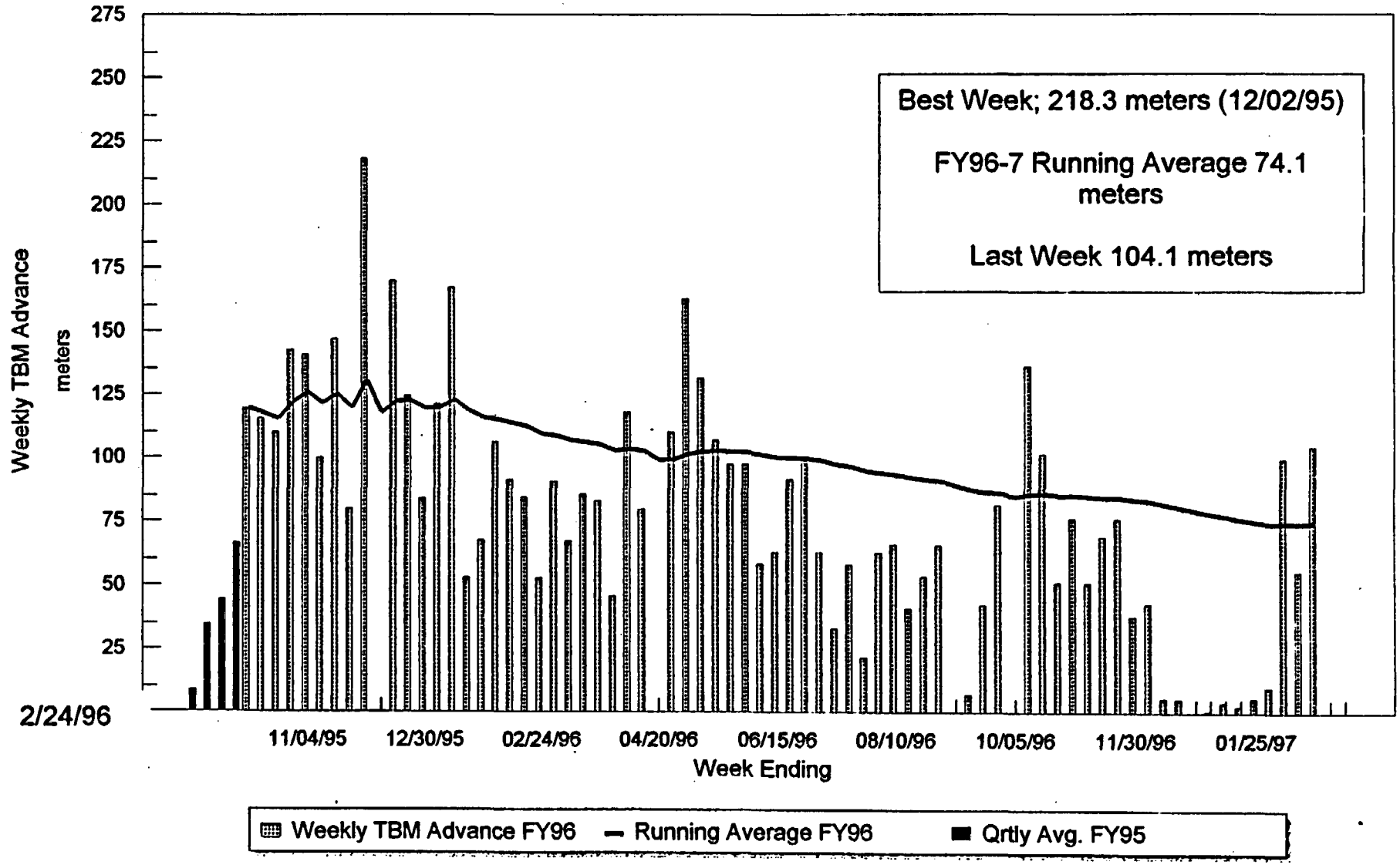
Tunnel Boring Machine Progress

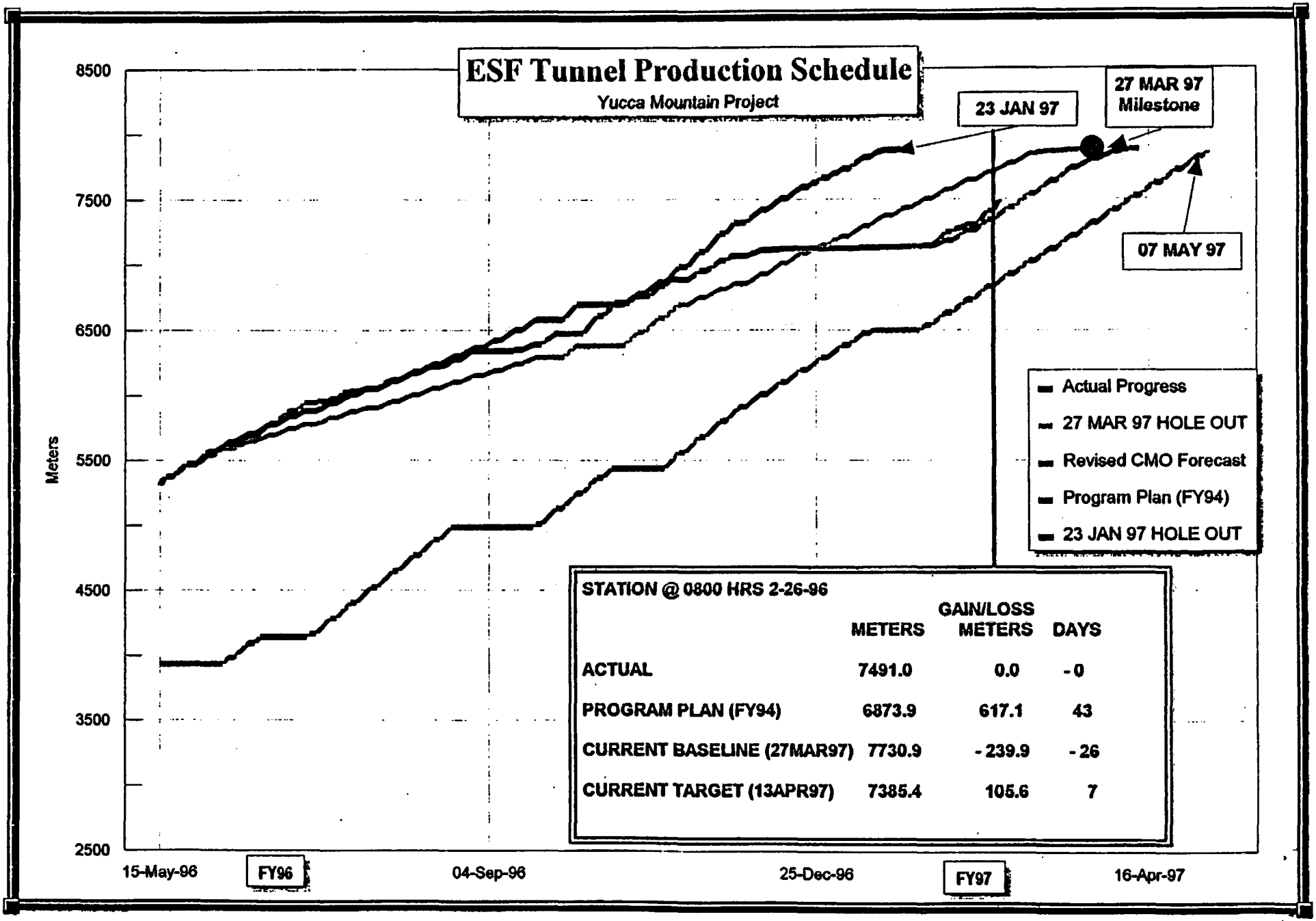


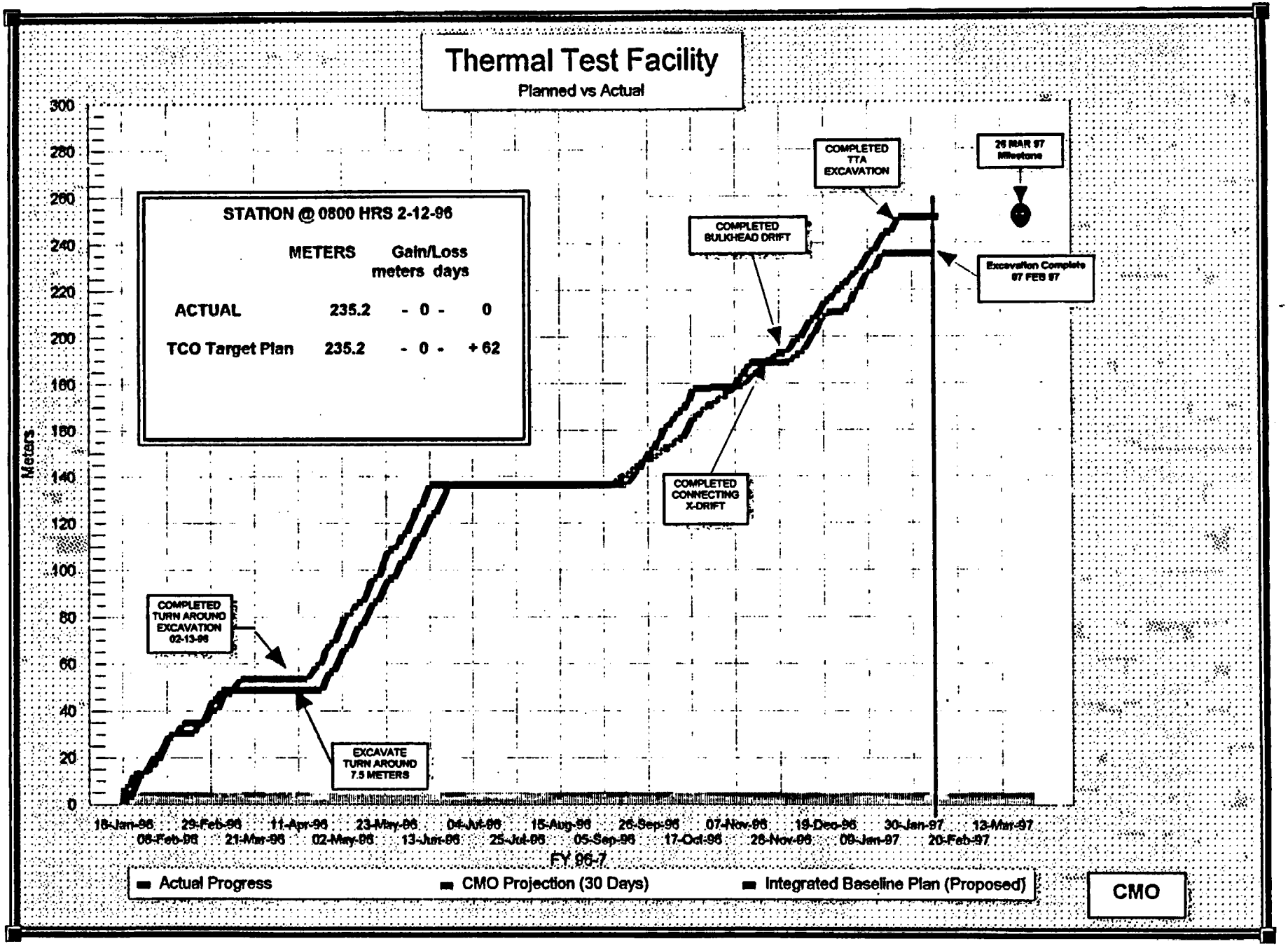
NRCTYNAN.PPT.123.3-13 972

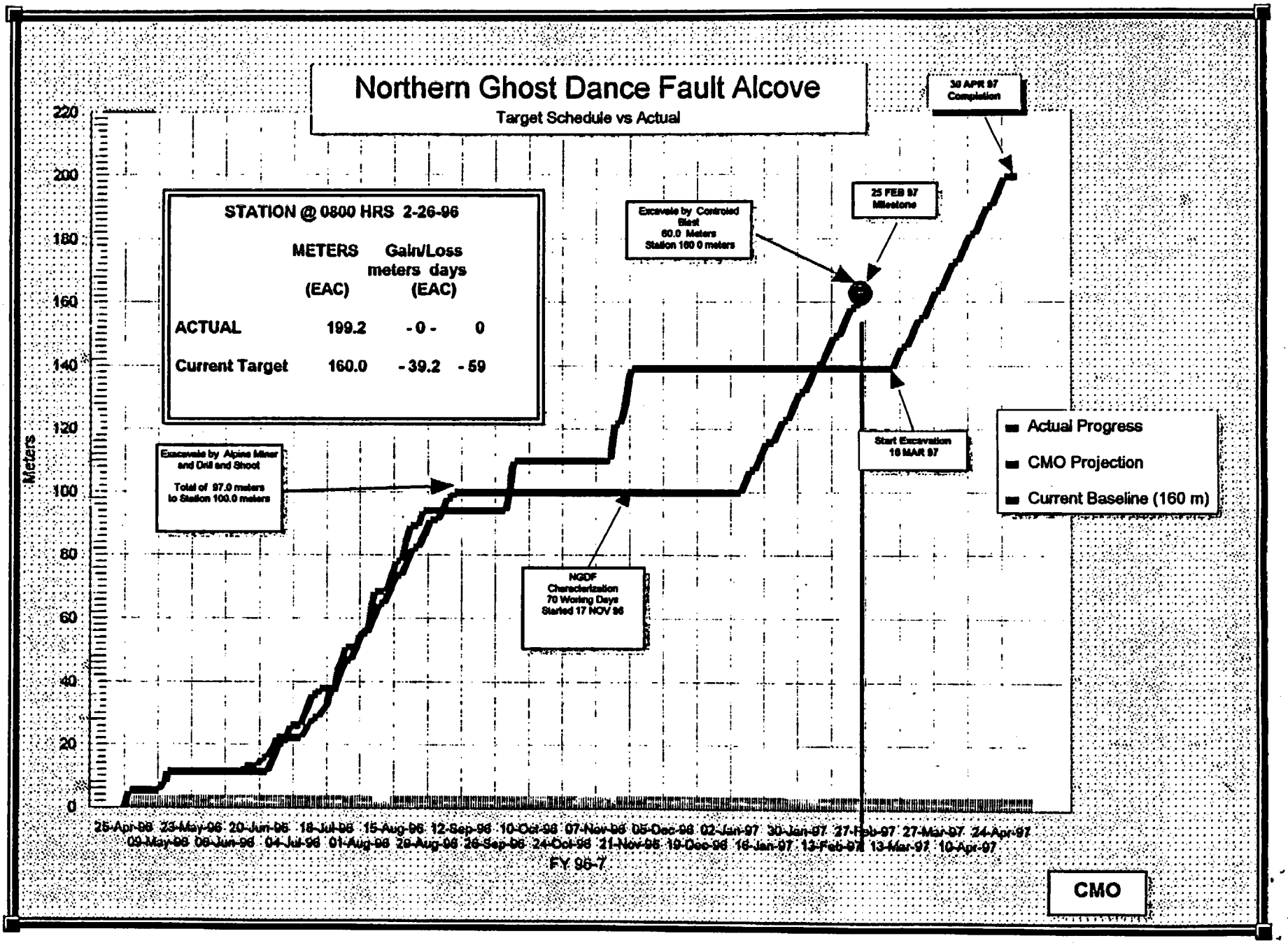
Weekly TBM Advance Rate FY96/7

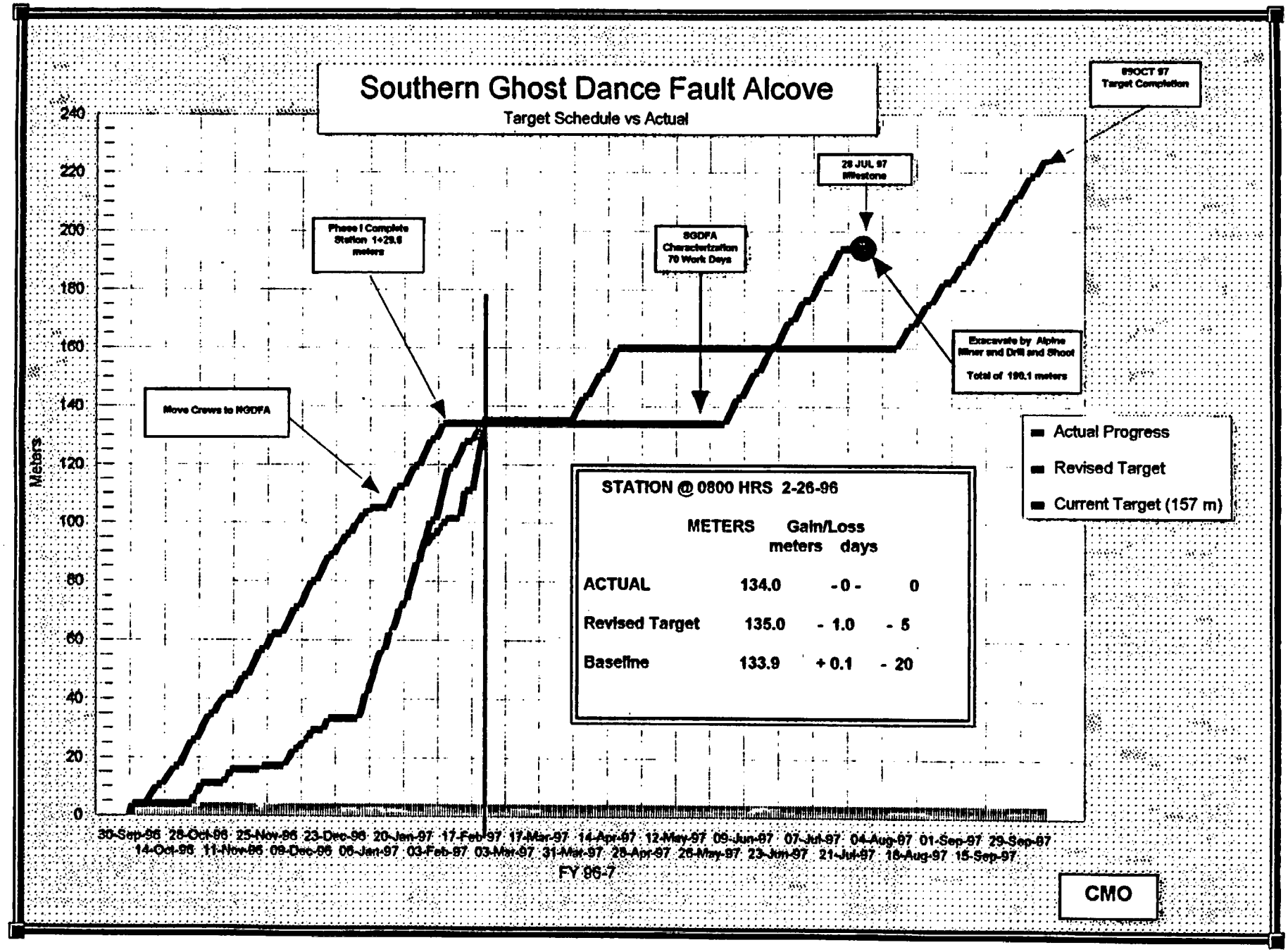
plus the running average



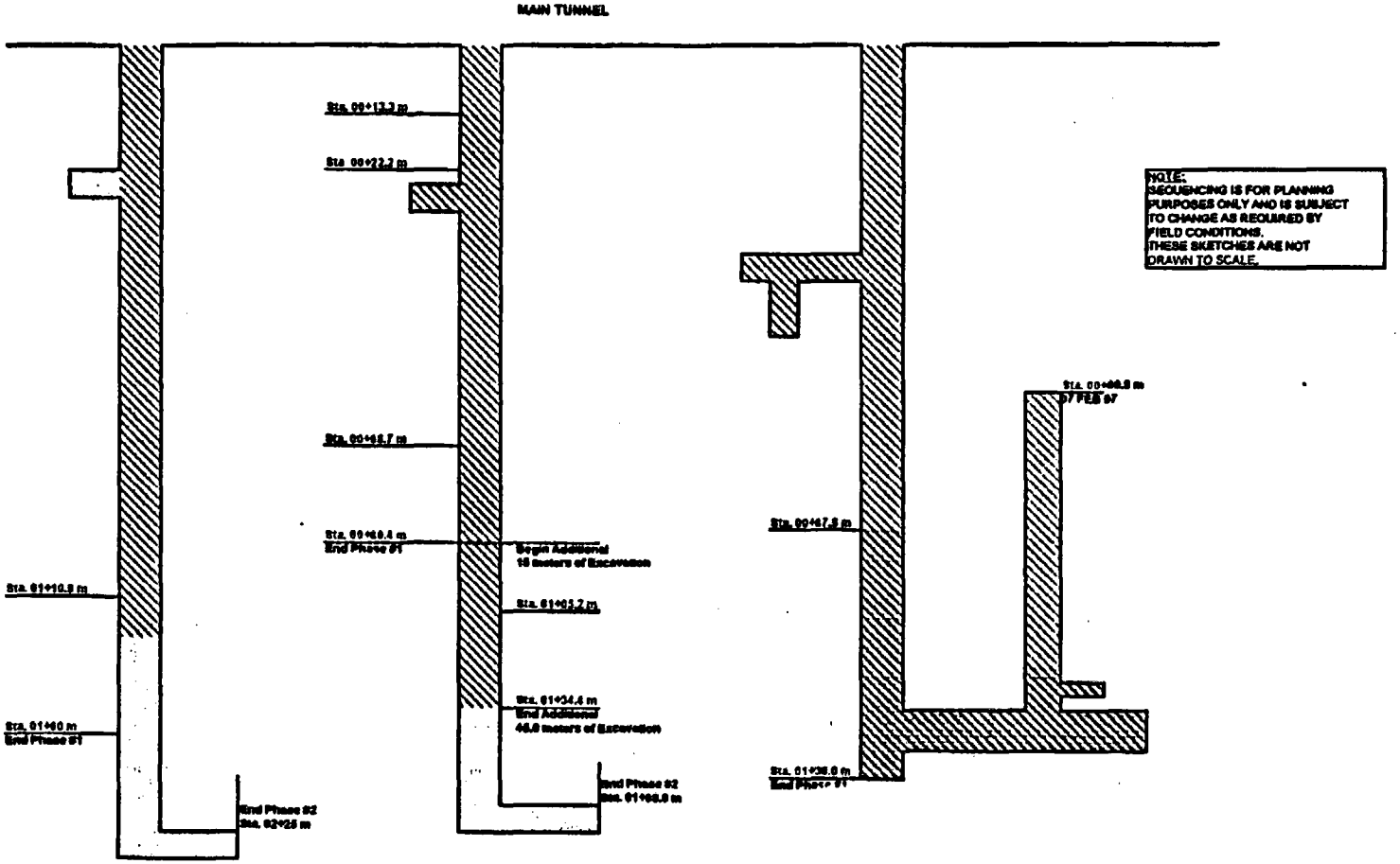

ESF Tunnel Production Schedule
Yucca Mountain Project
23 JAN 97
27 MAR 97 Milestone
07 MAY 97
8500
7500
6500
5500
4500
3500
2500
Meters
15-May-96
FY96
04-Sep-96
25-Dec-96
FY97
16-Apr-97
Actual Progress
27 MAR 97 HOLE OUT
Revised CMO Forecast
Program Plan (FY94)
23 JAN 97 HOLE OUT
STATION @ 0800 HRS 2-26-96
METERS
GAIN/LOSS METERS
DAYS
ACTUAL 7491.0 0.0 - 0
PROGRAM PLAN (FY94) 6873.9 617.1 43
CURRENT BASELINE (27MAR97) 7730.9 - 239.9 - 26
CURRENT TARGET (13APR97) 7385.4 105.6 7


Thermal Test Facility
Planned vs Actual
STATION @ 0800 HRS 2-12-96
METERS Gain/Loss meters days
ACTUAL 235.2 - 0 - 0
TCO Target Plan 235.2 - 0 - +62
COMPLETED TTA EXCAVATION
26 MAR 97 Milestone
COMPLETED BULKHEAD DRIFT
Excavation Complete 07 FEB 97
COMPLETED CONNECTING X-DRIFT
COMPLETED TURN AROUND EXCAVATION 02-13-96
EXCAVATE TURN AROUND 7.5 METERS
Meters
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
18-Jan-96
29-Feb-96
11-Apr-96
23-May-96
04-Jul-96
15-Aug-96
26-Sep-96
07-Nov-96
19-Dec-96
30-Jan-97
13-Mar-97
08-Feb-96
21-Mar-96
02-May-96
13-Jun-96
25-Jul-96
05-Sep-96
17-Oct-96
28-Nov-96
09-Jan-97
20-Feb-97
FY 96-7
Actual Progress
CMO Projection (30 Days)
Integrated Baseline Plan (Proposed)
CMO


Northern Ghost Dance Fault Alcove
Target Schedule vs Actual
STATION @ 0800 HRS 2-26-96
METERS (EAC)
Gain/Loss meters (EAC)
days
ACTUAL 199.2 - 0 - 0
Current Target 160.0 - 39.2 - 59
Excavate by Alpine Miner and Drill and Shoot
Total of 97.0 meters to Station 100.0 meters
Excavate by Controled Blast
60.0 Meters
Station 160.0 meters
NGDF Characterization
70 Working Days
Started 17 NOV 96
Start Excavation
18 MAR 97
25 FEB 97 Milestone
30 APR 97 Completion
Actual Progress
CMO Projection
Current Baseline (160 m)
Meters
0
20
40
60
80
100
120
140
160
180
200
220
25-Apr-96 23-May-96 20-Jun-96 18-Jul-96 15-Aug-96 12-Sep-96 10-Oct-96 07-Nov-96 05-Dec-96 02-Jan-97 30-Jan-97 27-Feb-97 27-Mar-97 24-Apr-97
09-May-96 06-Jun-96 04-Jul-96 01-Aug-96 29-Aug-96 26-Sep-96 24-Oct-96 21-Nov-96 19-Dec-96 16-Jan-97 13-Feb-97 13-Mar-97 10-Apr-97
FY 96-7
CMO


Southern Ghost Dance Fault Alcove
Target Schedule vs Actual
Meters
240
220
200
180
160
140
120
100
80
60
40
20
0
30-Sep-96 28-Oct-96 25-Nov-96 23-Dec-96 20-Jan-97 17-Feb-97 17-Mar-97 14-Apr-97 12-May-97 09-Jun-97 07-Jul-97 04-Aug-97 01-Sep-97 29-Sep-97
14-Oct-96 11-Nov-96 09-Dec-96 06-Jan-97 03-Feb-97 03-Mar-97 31-Mar-97 28-Apr-97 26-May-97 23-Jun-97 21-Jul-97 18-Aug-97 15-Sep-97
FY 96-7
Move Crews to NGDFA
Phase I Complete Station 1+29.6 meters
NGDFA Characterization 70 Work Days
28 JUL 97 Milestone
89OCT 97 Target Completion
Excavate by Alpine Miner and Drill and Shoot
Total of 190.1 meters
Actual Progress
Revised Target
Current Target (157 m)
STATION @ 0800 HRS 2-26-96
METERS
Gain/Loss
meters
days
ACTUAL 134.0 - 0 - 0
Revised Target 135.0 - 1.0 - 5
Baseline 133.9 + 0.1 - 20
CMO

ALCOVE EXCAVATION SEQUENCING



SOUTH GHOST DANCE FAULT ALCOVE

SCHEDULED COMPLETION - 31 OCT 97
MILESTONE COMPLETION - 31 OCT 97

NORTH GHOST DANCE FAULT ALCOVE

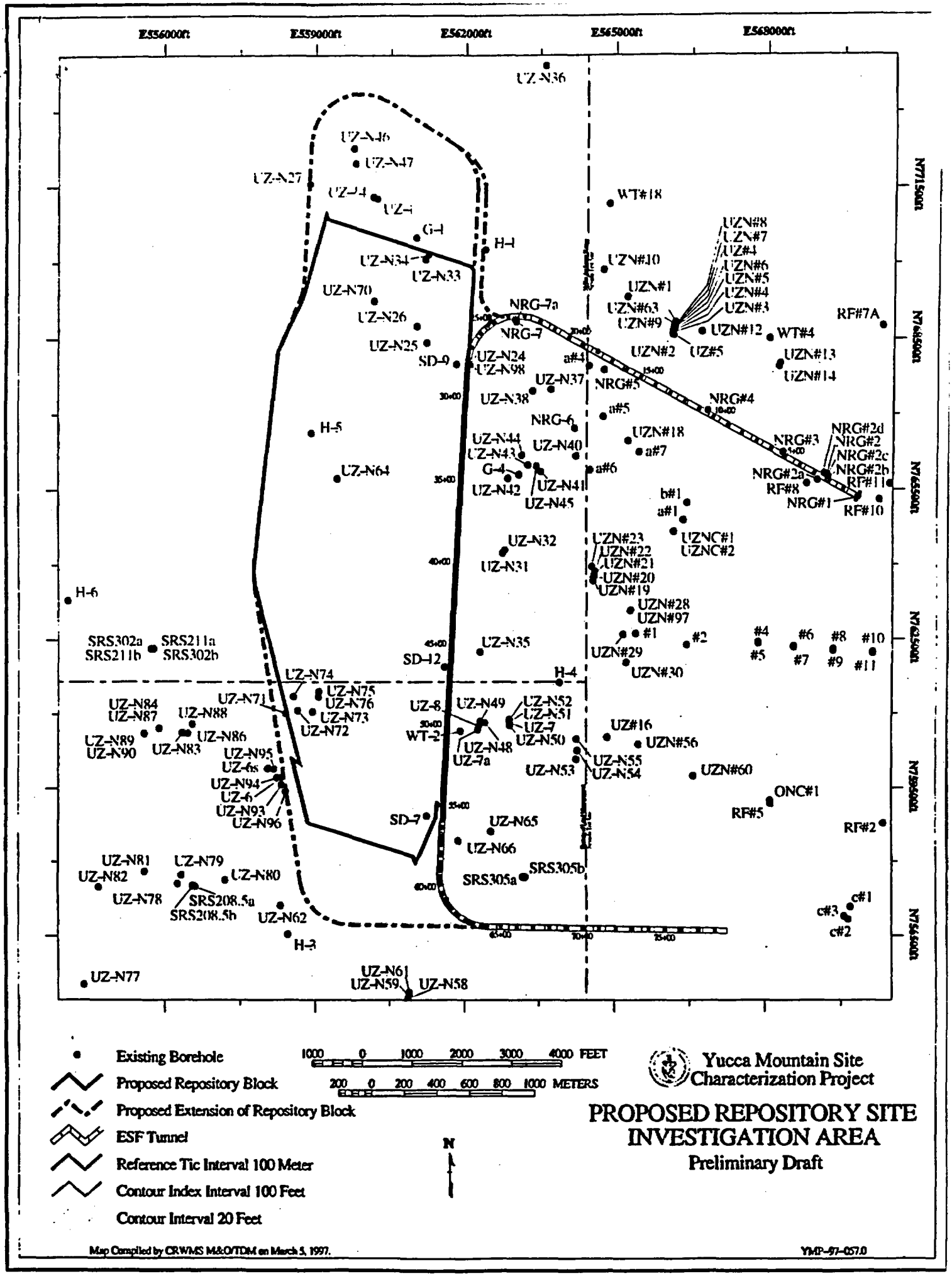
SCHEDULED COMPLETION - 30 APR 97
MILESTONE COMPLETION - 30 APR 97

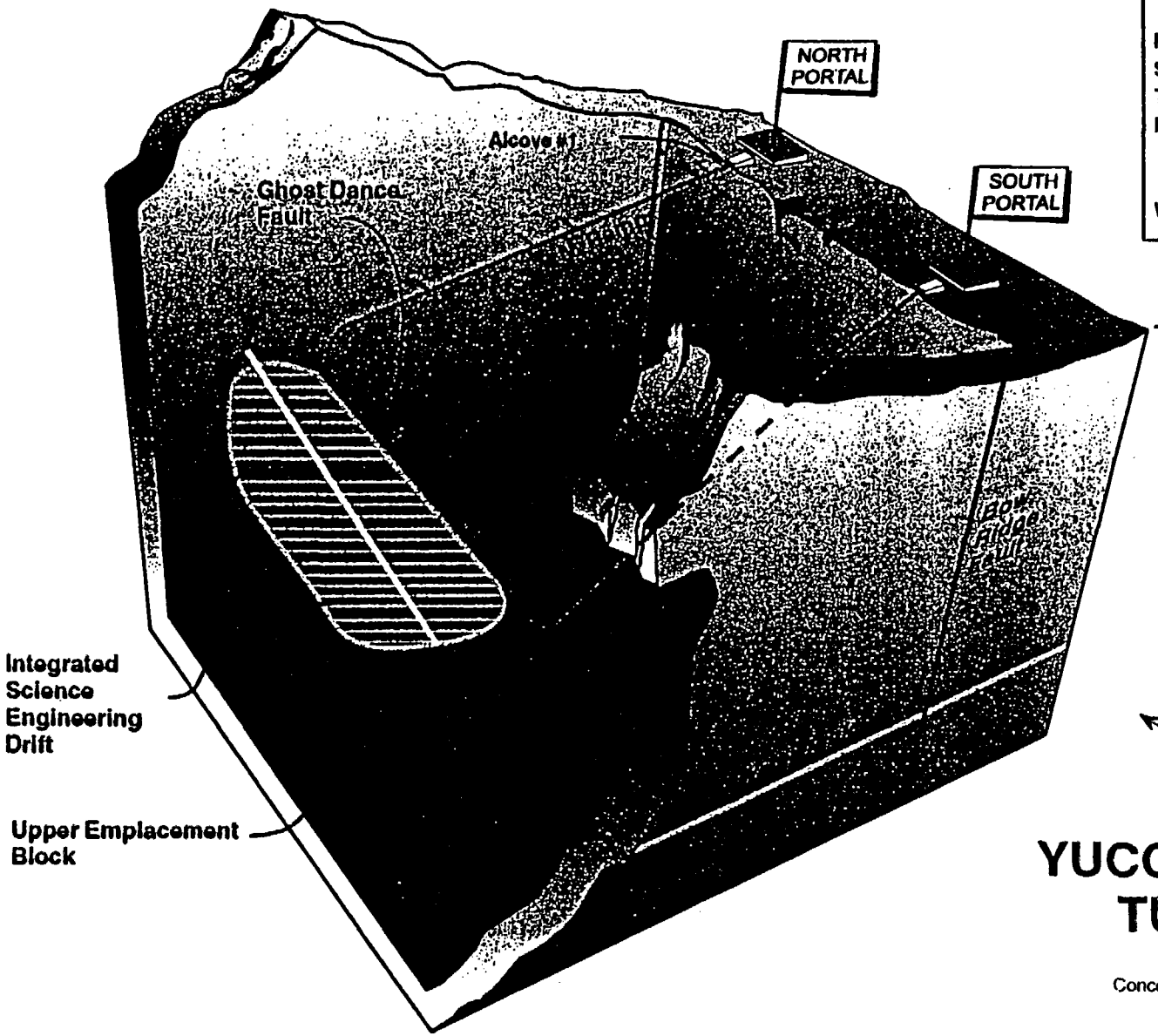
HEATER TEST ALCOVE #1

ACTUAL COMPLETION - 07 FEB 97
MILESTONE COMPLETION - 26 MAR 97

ALPINE MINER
DRILL & BLAST
COMPLETED EXCAVATION

UP DATED 2-24-98


E556000ft
E559000ft
E562000ft
E565000ft
E568000ft
N771500ft
N768500ft
N765500ft
N762500ft
N759500ft
N756500ft
UZ-N36
UZ-N46
UZ-N47
UZ-N27
UZ-4
UZ-4
G-4
H-4
UZ-N34
UZ-N33
UZ-N70
UZ-N26
UZ-N25
SD-9
UZ-N24
UZ-N98
UZ-N37
UZ-N38
H-5
UZ-N64
UZ-N44
UZ-N43
G-4
UZ-N42
UZ-N40
UZ-N41
UZ-N45
UZ-N32
UZ-N31
H-6
SRS302a
SRS211a
SRS211b
SRS302b
UZ-N35
SD-12
H-4
UZ-N74
UZ-N75
UZ-N76
UZ-N71
UZ-N73
UZ-N72
UZ-N84
UZ-N87
UZ-N88
UZ-N89
UZ-N90
UZ-N83
UZ-N86
UZ-N95
UZ-6s
UZ-N94
UZ-6
UZ-N93
UZ-N96
UZ-8
UZ-N49
UZ-N52
UZ-N51
UZ-7
WT-2
UZ-N48
UZ-7a
UZ-N50
UZ-N53
UZ-N55
UZ-N54
SD-7
UZ-N65
UZ-N66
SRS305a
SRS305b
UZ-N81
UZ-N79
UZ-N82
UZ-N80
UZ-N78
SRS208.5a
SRS208.5b
UZ-N62
H-3
UZ-N77
UZ-N61
UZ-N59
UZ-N58
WT#18
UZN#10
UZN#1
UZN#63
UZN#9
UZN#8
UZN#7
UZ#4
UZN#6
UZN#5
UZN#4
UZN#3
UZN#12
WT#4
UZN#2
UZ#5
UZN#13
UZN#14
RF#7A
NRG-7a
NRG-7
a#4
NRG#5
NRG#4
a#5
NRG-6
UZN#18
a#7
NRG#3
NRG#2d
NRG#2
NRG#2c
NRG#2b
NRG#2a
RF#8
RF#11
NRG#1
RF#10
a#6
b#1
a#1
UZN#23
UZN#22
UZN#21
UZN#20
UZN#19
UZNC#1
UZNC#2
UZN#28
UZN#97
UZN#29
#1
#2
#4
#5
#6
#7
#8
#9
#10
#11
UZN#30
UZ#16
UZN#56
UZN#60
ONC#1
RF#5
RF#2
c#1
c#3
c#2
Existing Borehole
Proposed Repository Block
Proposed Extension of Repository Block
ESF Tunnel
Reference Tic Interval 100 Meter
Contour Index Interval 100 Feet
Contour Interval 20 Feet
1000 0 1000 2000 3000 4000 FEET
200 0 200 400 600 800 1000 METERS
N
Yucca Mountain Site Characterization Project
PROPOSED REPOSITORY SITE INVESTIGATION AREA
Preliminary Draft
Map Compiled by CRWMS M&O/TDM on March 5, 1997.
YMP-97-057.0



ELEVATIONS (Above Sea Level)	
North Portal	3,684 ft.
South Portal	3,790 ft.
Top of Mountain	5,000 ft. at Crest
Repository	
North End	3,494 ft.
South End	3,634 ft.
Water Table	2,400 ft.

YUCCA MOUNTAIN TUNNELING

Conceptual Illustration: Not to scale
VANDESFC.CDR.121/3-7-97

ESF - Mapping Status

As of 3/3/97 with TBM at 75-29

- Full -periphery geologic mapping completed to station 75+26
- Detailed line survey at the heading completed to station 75+32
- Stereophotography completed at the heading to station 75+46
- Completed Q & RMR to station 72+75
- Completed RQD to station 75+14

Prelimary Draft

STATUS OF WORK IN ALCOVES 5, 6, AND 7*

Alcove 5	Heading Station	FPGM	DLS	Photo	RQD	Q/RMR
AOD	1+30	1+30	1+30	1+30	1+30	1+30
Connecting drift	0+40	NS	0+15	NS	NS	NS
Heated drift	0+60	0+39-0+60	0+22-0+60	0+60	0+40-0+60	0+40-0+60
Alcove 6	1+34	0+90	1+34	1+34	1+34	1+34
Alcove 7	1+34	NS	NS	NS	NS	NS

* As of 3-3-97

NS= Not Started
Heading Station

Detailed Line Survey = DLS
Full-Periphery Geologic = FPGM

Photography = Ph
RQD Assessment = RQD

AOD = Access Observation Drift
Q & RMR Assessment = Q/RMR

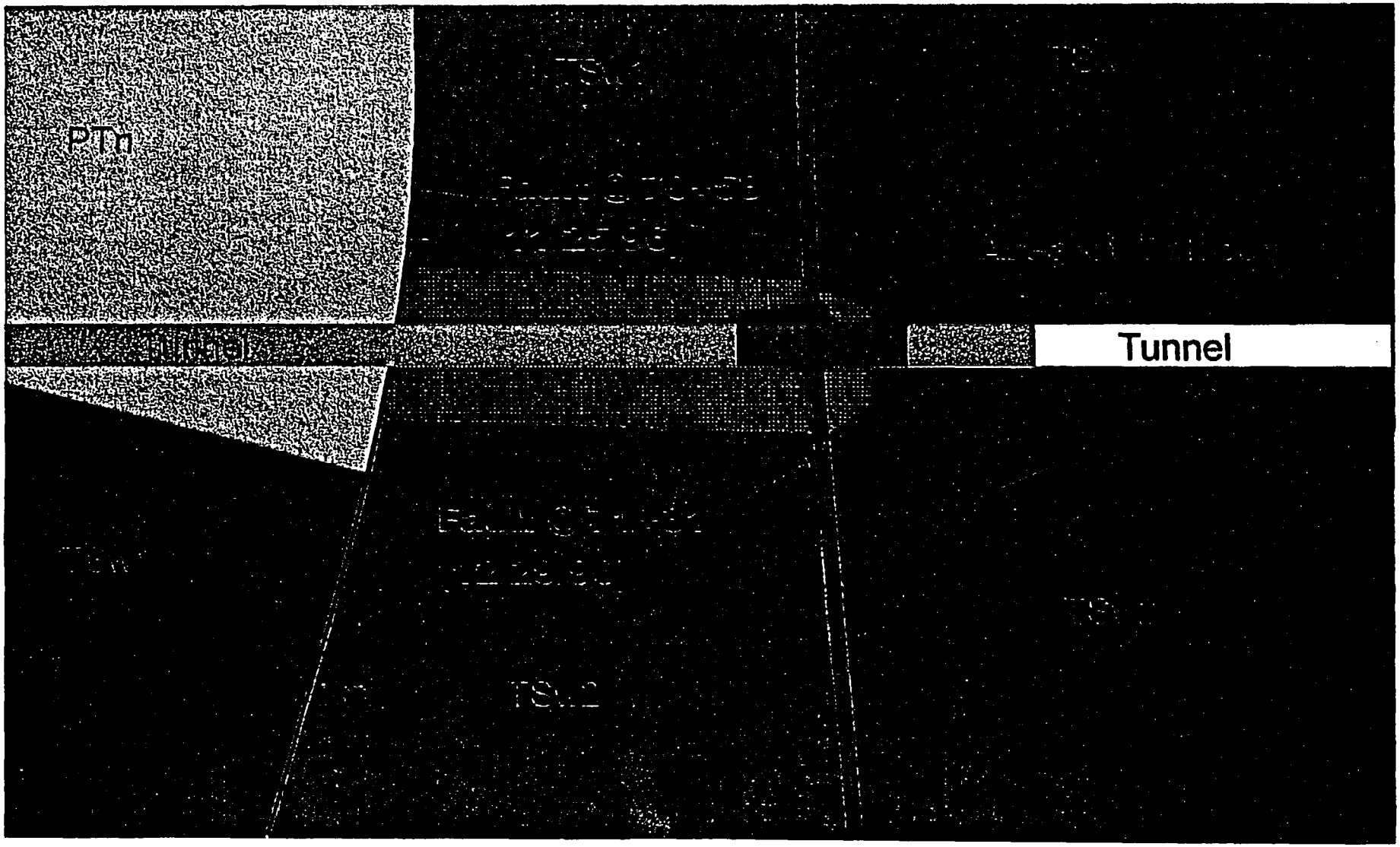
Fault at Station 70+58

- Consists of a narrow, discrete zone of uncemented fault breccia composed primarily of clayey gouge up to 20 cm thick
- Oriented 170°/60° to 209°/81°
- Hanging wall composed of bedded tuff unit 2 (Tpb2)
- Footwall composed Topopah Spring, crystal-poor, middle non-lithophysal zone (Tptpmn)

Fault at Station 71+31

- Fault zone is completed obscured by tunnel and shotcrete
- Consists of a 2-m wide zone of uncemented fault breccia composed primarily of gravelly sand and silt
- Oriented roughly due North, dipping near vertical
- Hanging wall composed of Topopah Spring, crystal-poor, middle non-lithophysal zone (Tptpmn), and Topopah Spring, crystal-poor, upper lithophysal (Tptpul)
- Footwall composed of intensely fractured Topopah Spring, crystal-poor, middle non-lithophysal zone (Tptpmn)

Generalized Cross-Section from Station 69+50 to 72+20 (approx.)



Class 1

Class 3a

Class 4

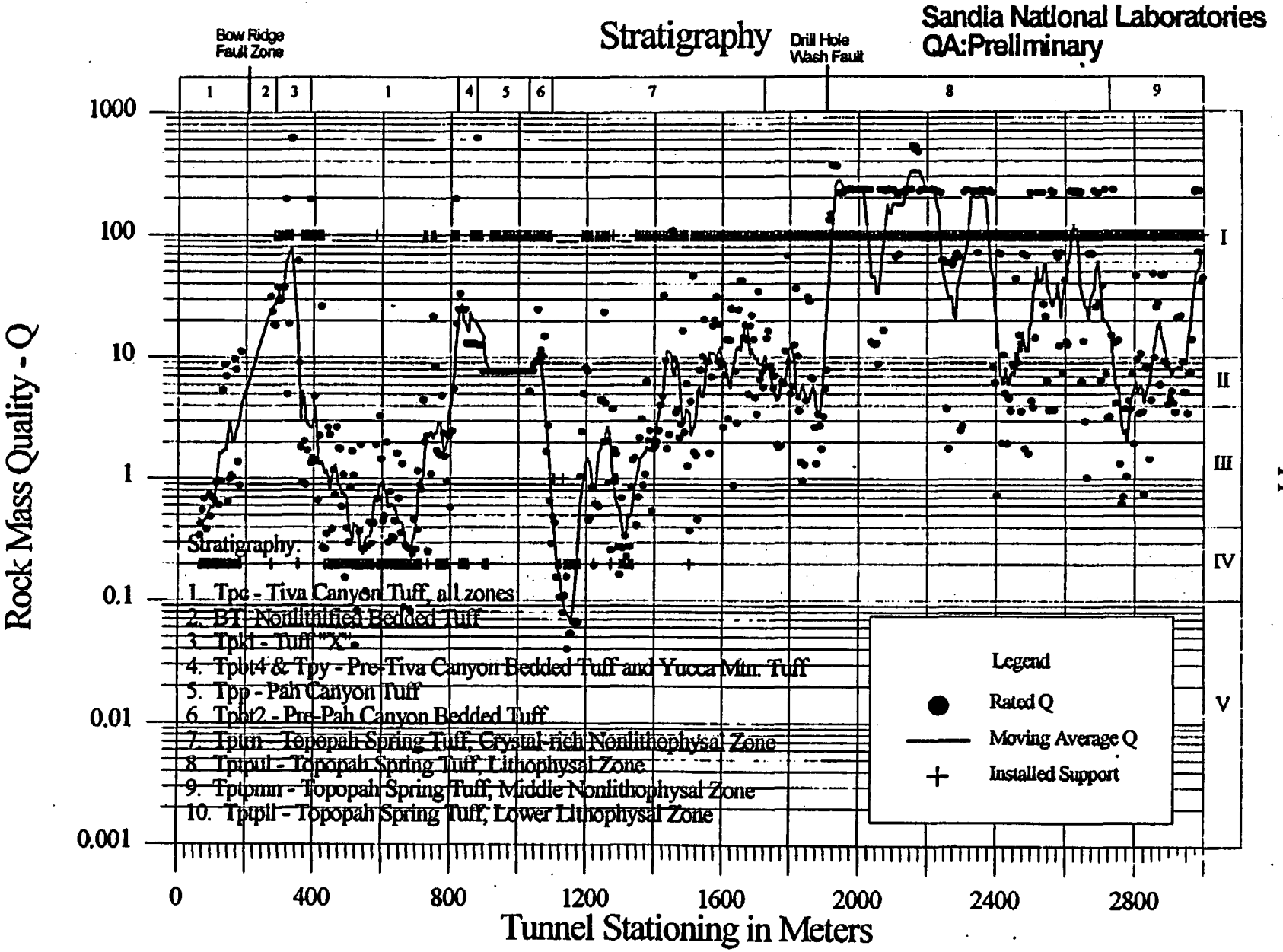
Blocky Ground

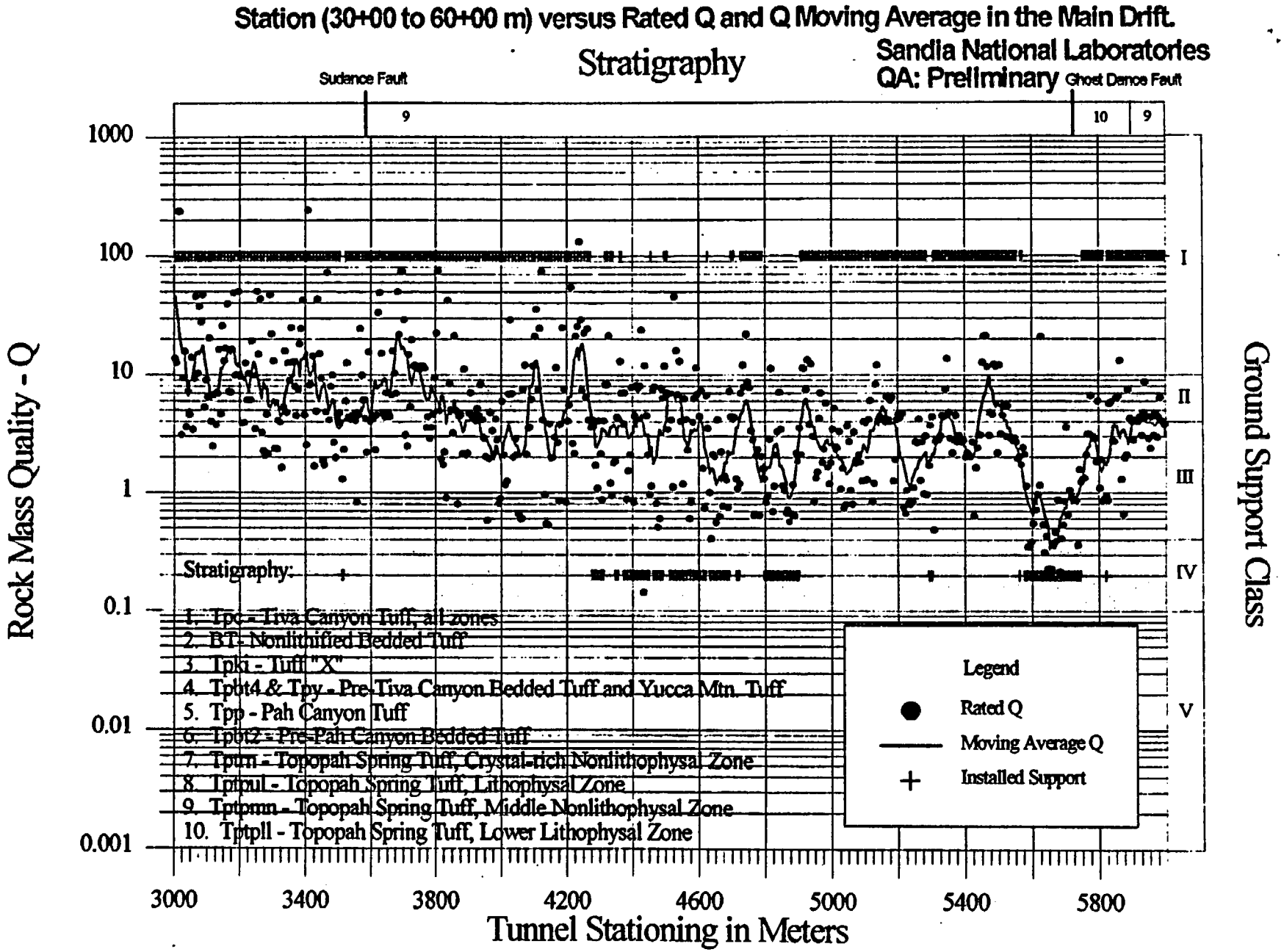
PTn - Paintbrush Tuff, nonwelded

TSw1 - Topopah Spring, welded, lithophysal-rich

TSw2 - Topopah Spring, welded, lithophysal-poor

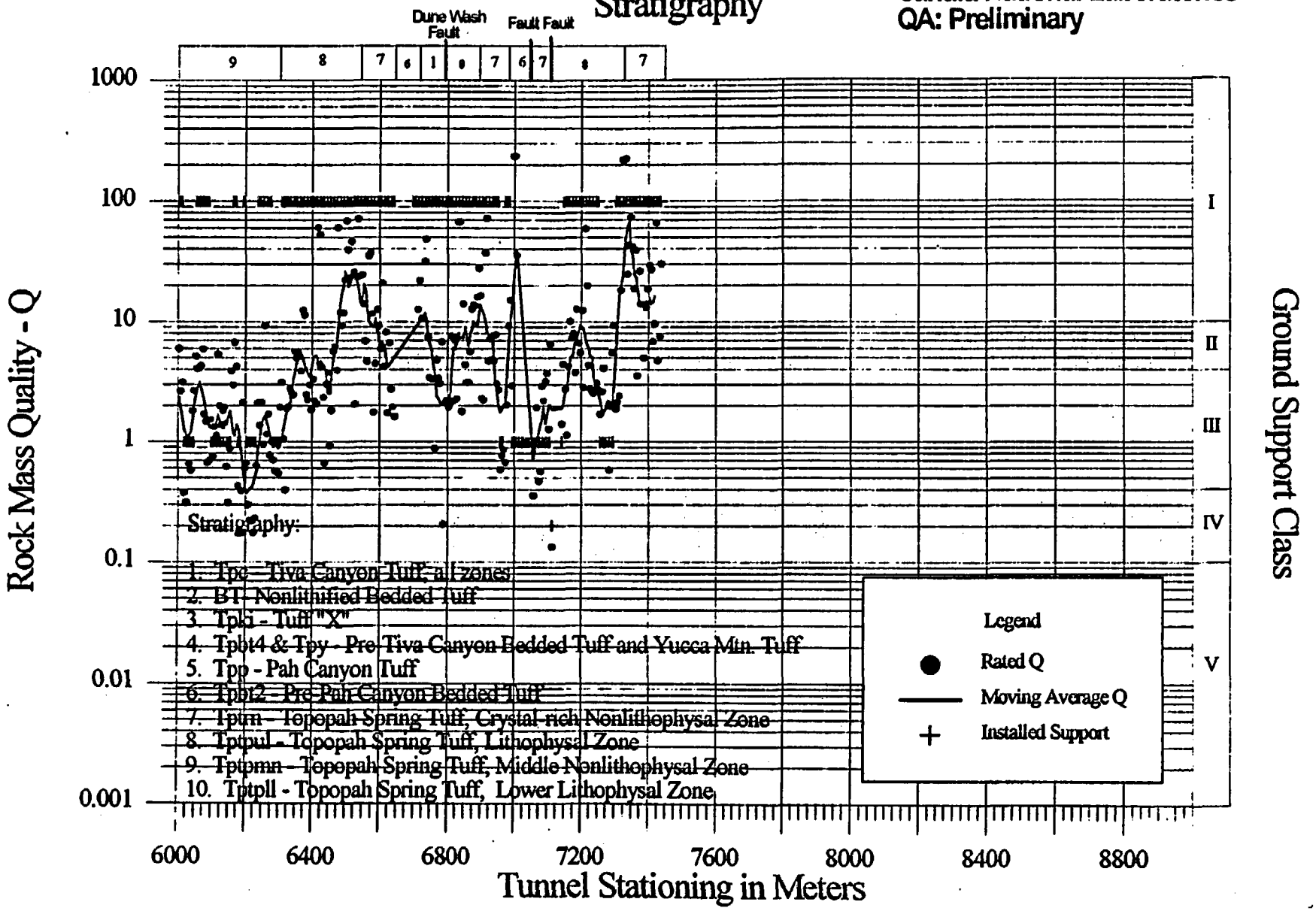
Station (00+60 to 30+00 m) versus Rated Q and Q Moving Average in the Main Drift.




Station (30+00 to 60+00 m) versus Rated Q and Q Moving Average in the Main Drift.
Stratigraphy
Sandia National Laboratories
QA: Preliminary
Sudance Fault
Ghost Dance Fault
9
10
9
1000
100
10
1
0.1
0.01
0.001
I
II
III
IV
V
Rock Mass Quality - Q
Ground Support Class
Stratigraphy:
1. Tpc - Tiva Canyon Tuff, all zones
2. BT - Nonlithified Bedded Tuff
3. Tpki - Tuff "X"
4. Tpbt4 & Tpy - Pre-Tiva Canyon Bedded Tuff and Yucca Mtn. Tuff
5. Tpp - Pah Canyon Tuff
6. Tpbt2 - Pre-Pah Canyon Bedded Tuff
7. Tptm - Topopah Spring Tuff, Crystal-rich Nonlithophysal Zone
8. Tptpul - Topopah Spring Tuff, Lithophysal Zone
9. Tptpmn - Topopah Spring Tuff, Middle Nonlithophysal Zone
10. Tptpll - Topopah Spring Tuff, Lower Lithophysal Zone
Legend
Rated Q
Moving Average Q
Installed Support
3000
3400
3800
4200
4600
5000
5400
5800
Tunnel Stationing in Meters

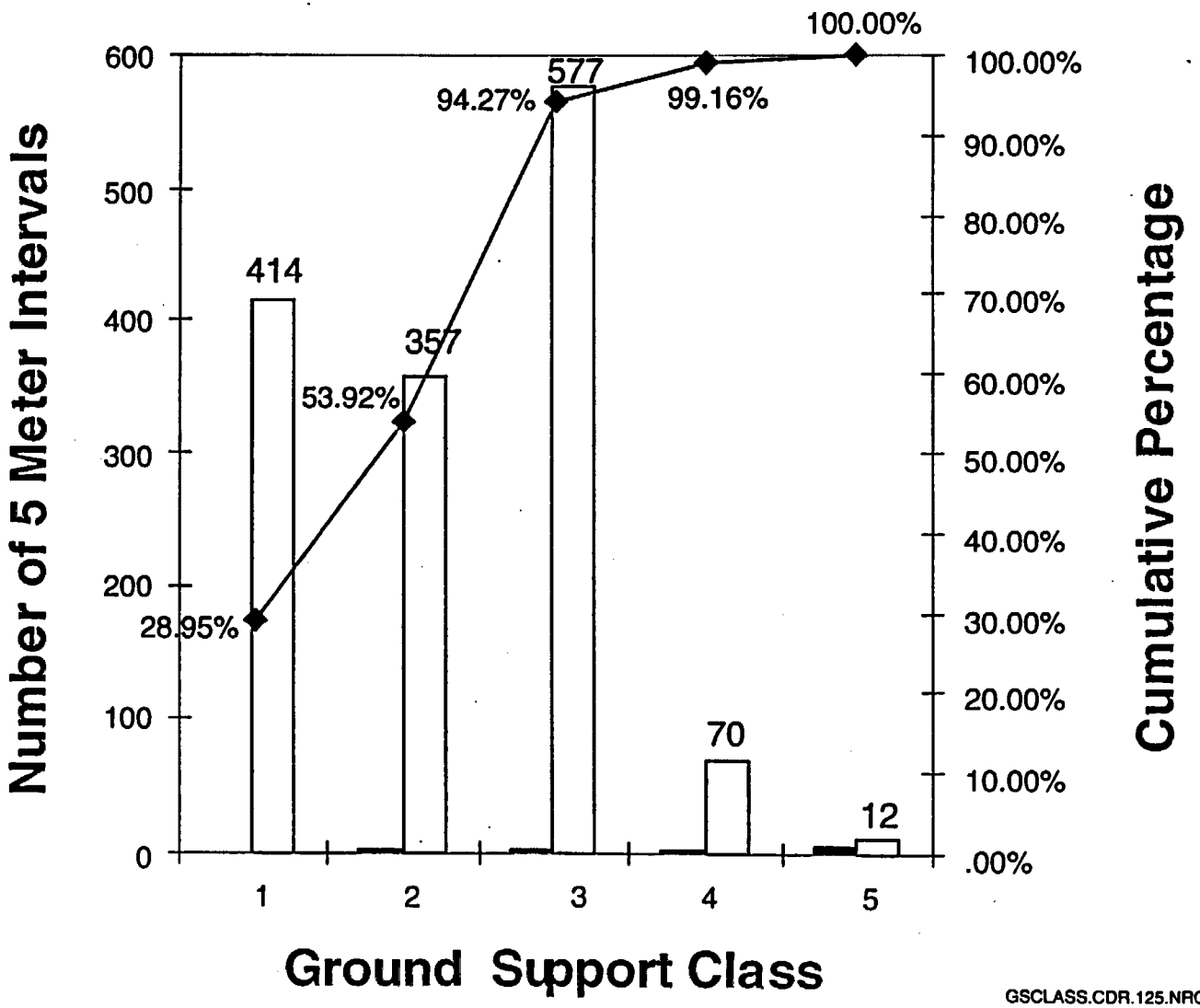
Station (60+00 to 74+40 m) versus Rated Q and Q Moving Average in the Main Drift.

Sandia National Laboratories
QA: Preliminary



Calculated Ground Support Class

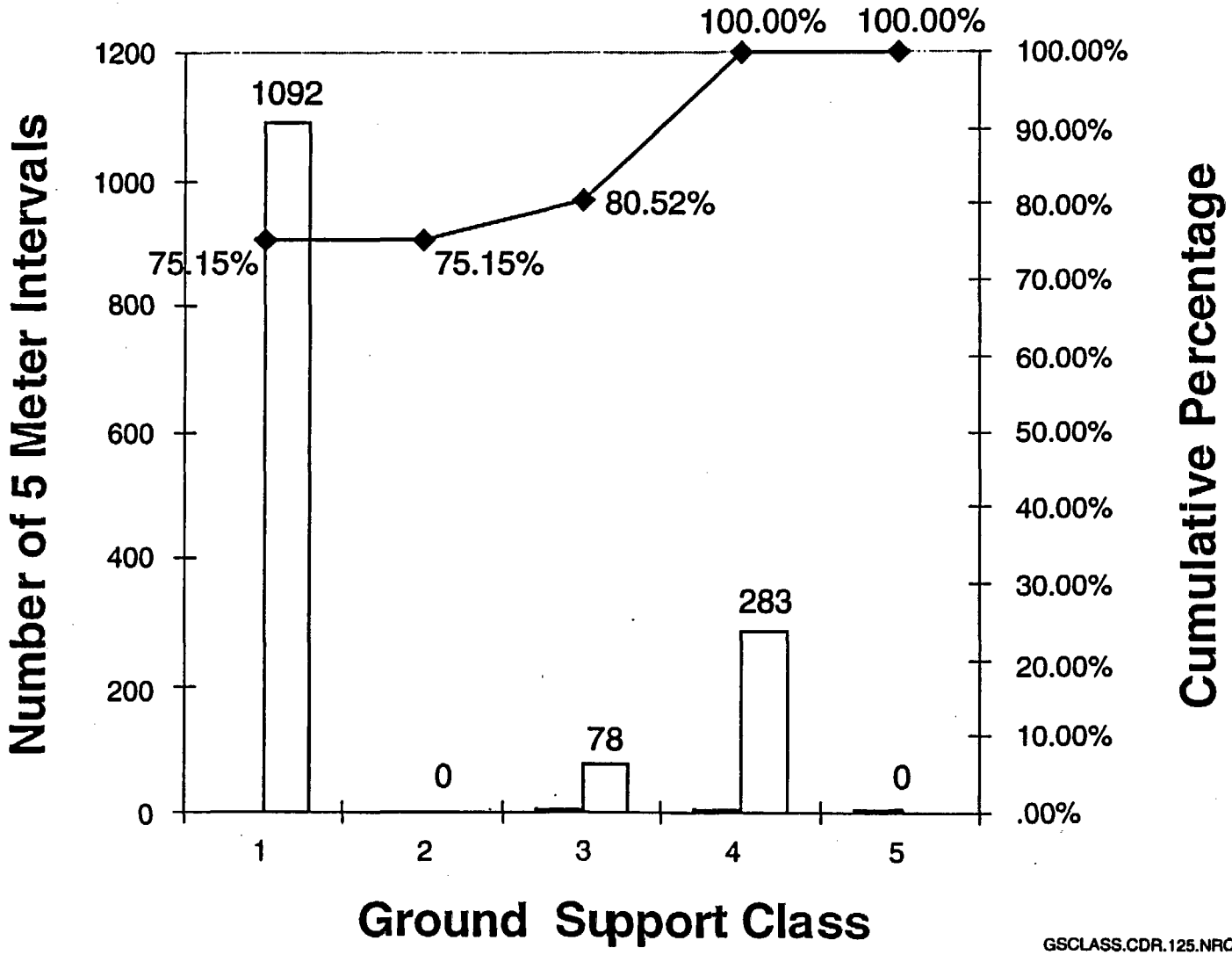
Station 00+60 to 74+40



GSCLASS.CDR.125.NRC/3-3-9719

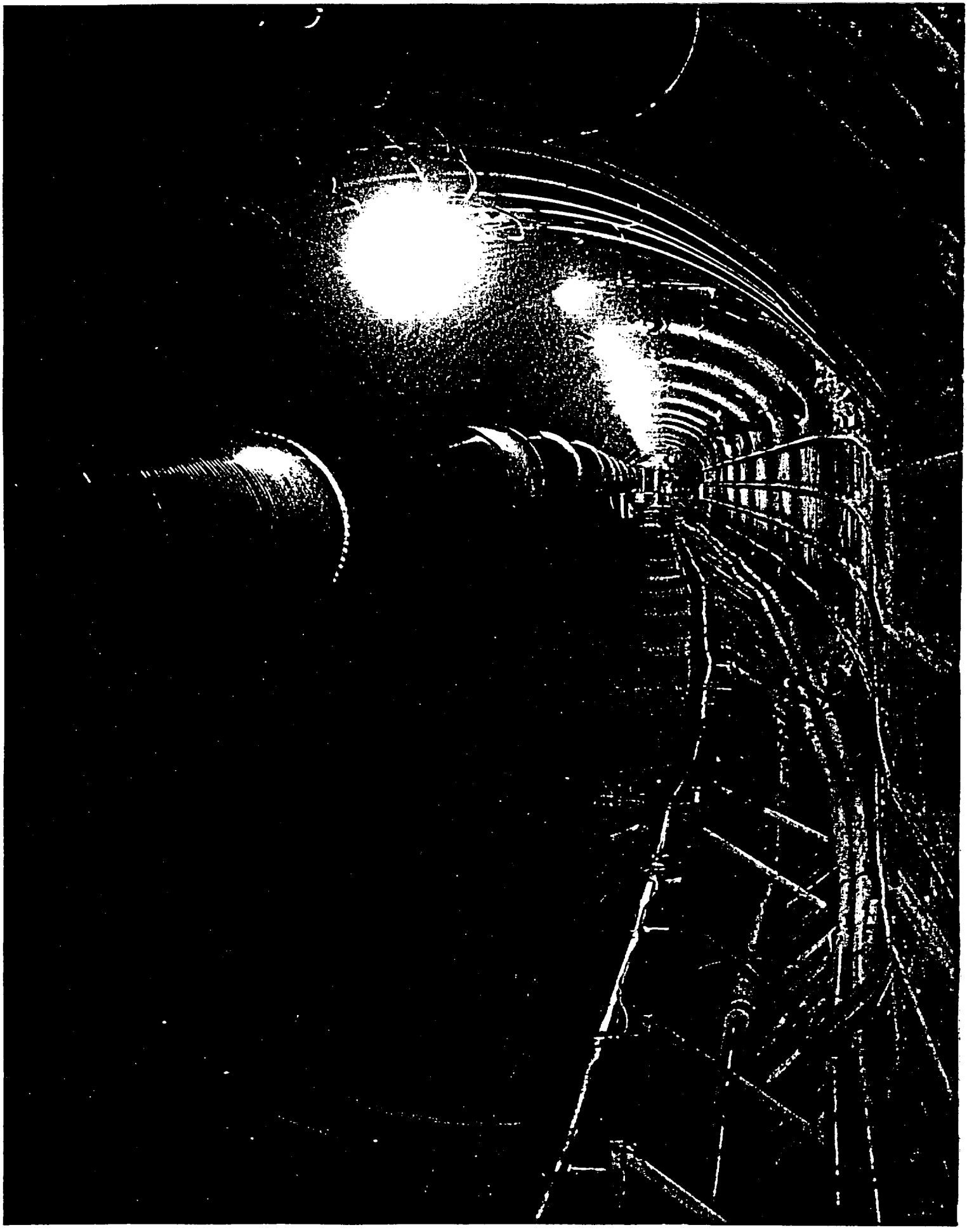
Installed Ground Support Class

Station 00+60 to 74+40

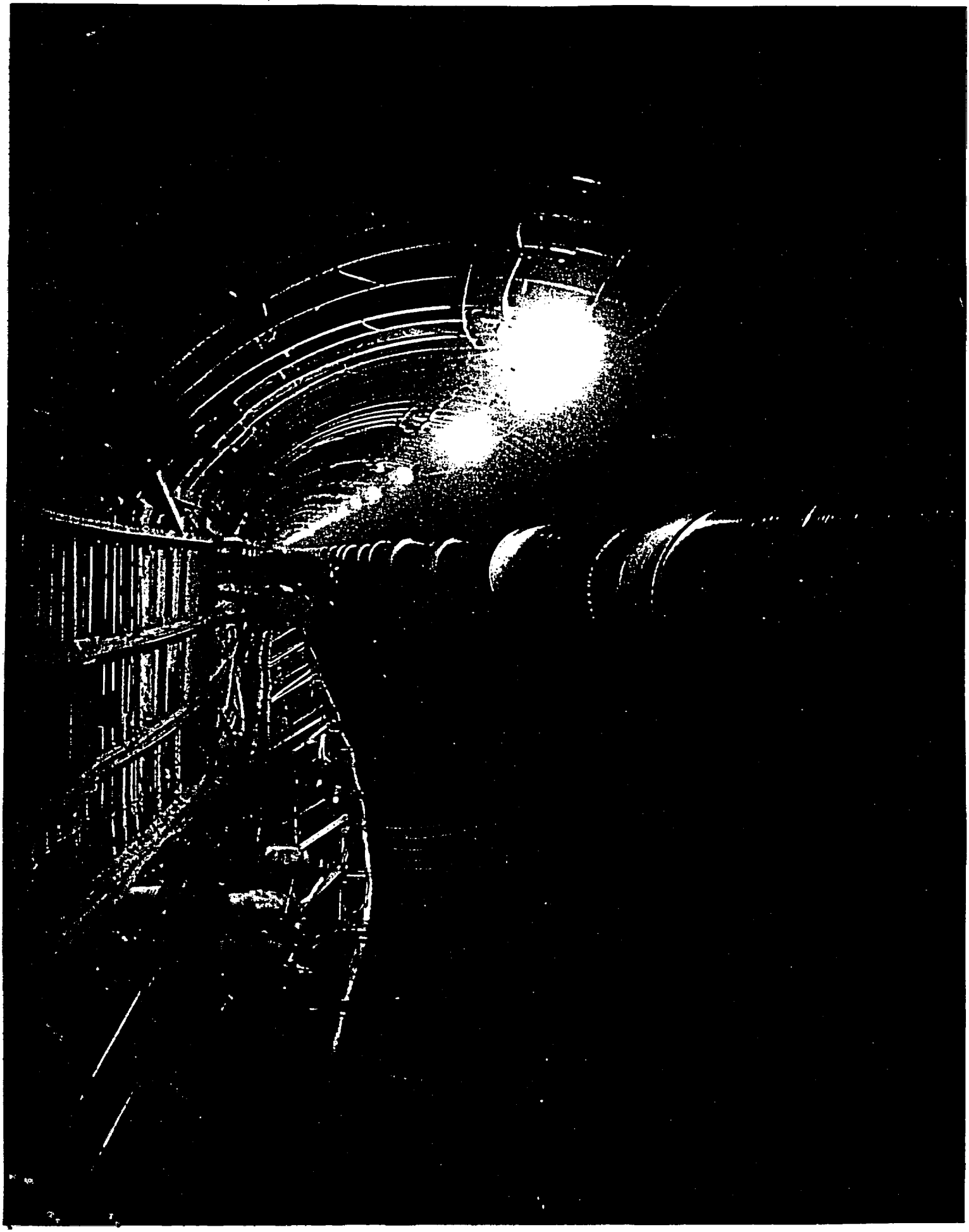


YM 13814 2/11/97 Examples of Ground Support

YM 13876 2/26/97 Views of the "Dip" Area in ESF Main at Station 71+30 to 71+40M after Reconstruction

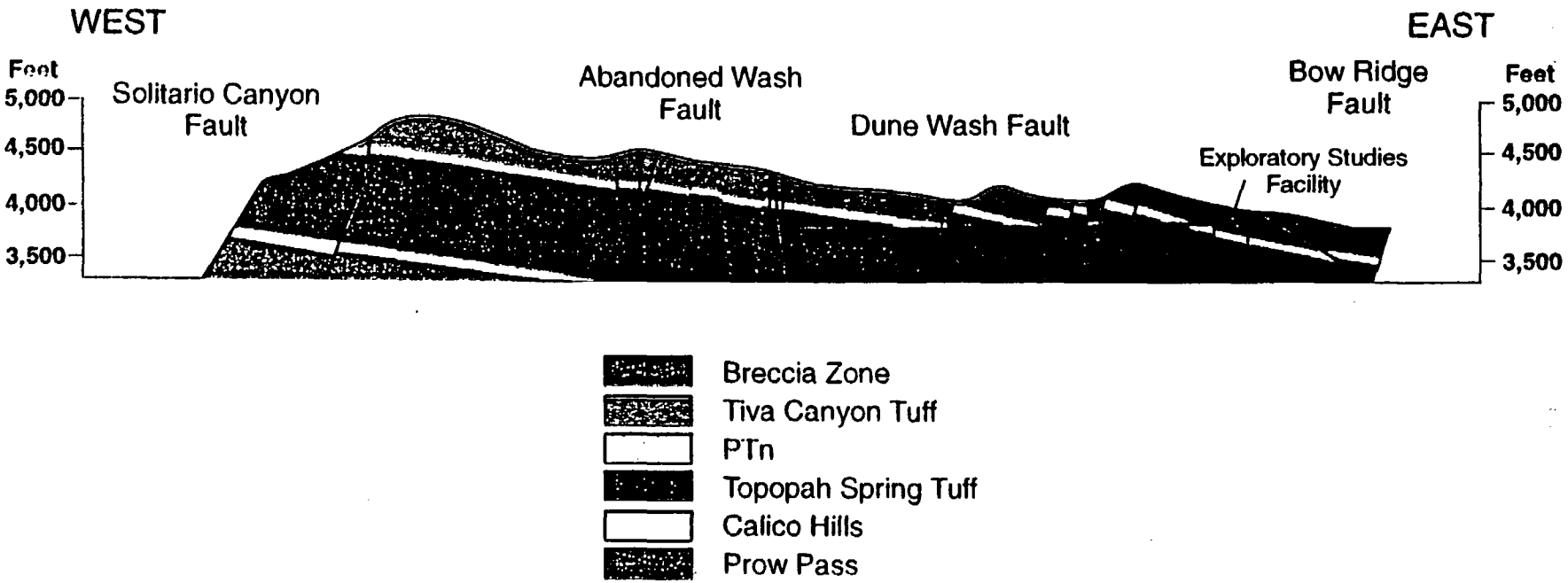


YM 13849 2/18/97 Views of the TBM Ahead of the Misalignment Area at 71+36.2M



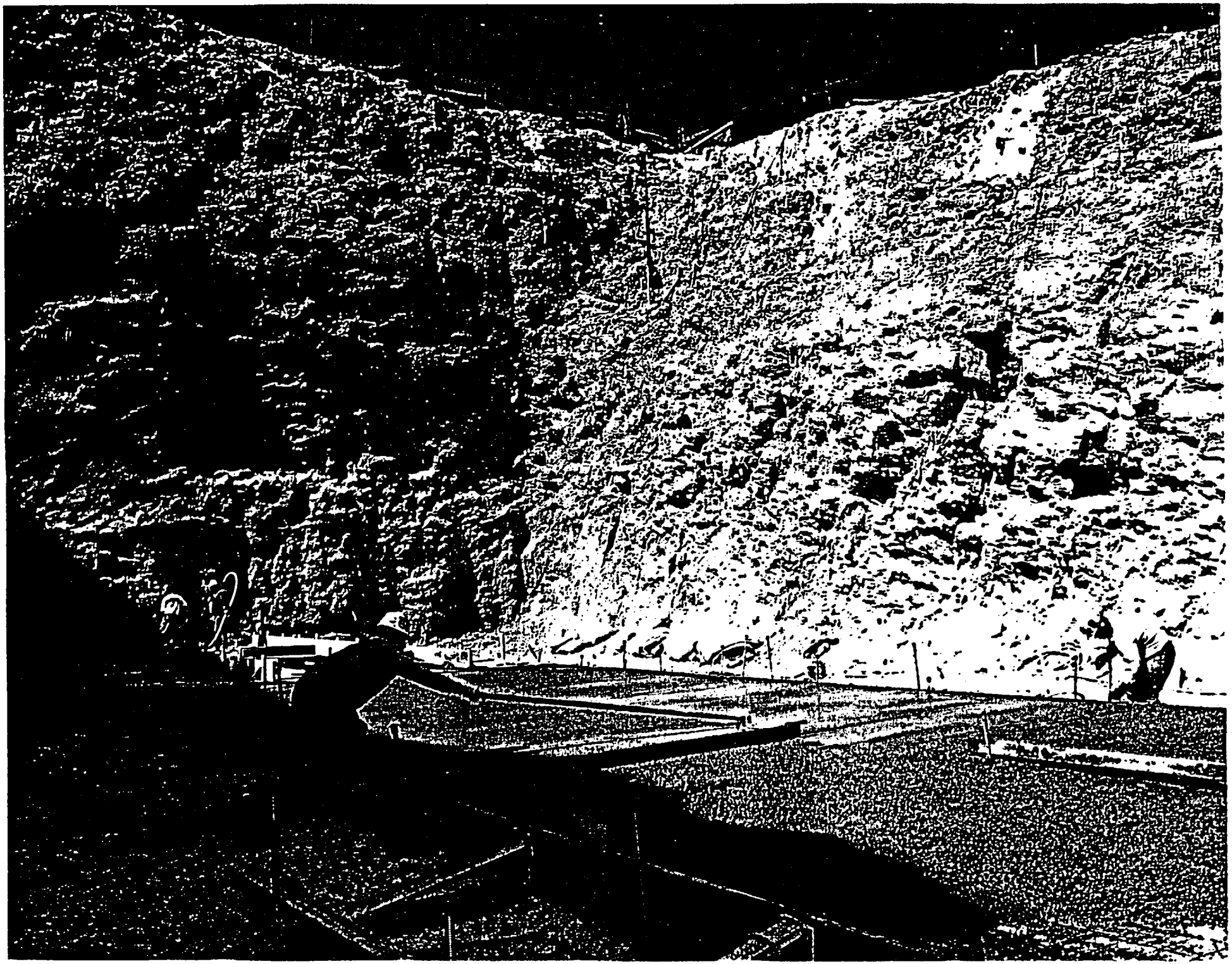
YM 13809 2/11/97 Examples of Ground Support

Cross Section From New Bedrock Geologic Map



YM 13884 2/26/97 Construction Activities at the ESF South Portal

NRCTYNAN.PPT.123.3-13-9726



DOE/NRC Technical Meeting

March 13, 1997

Alcove 1 - Upper Tiva Canyon Alcove

DOE/NRC Technical Meeting

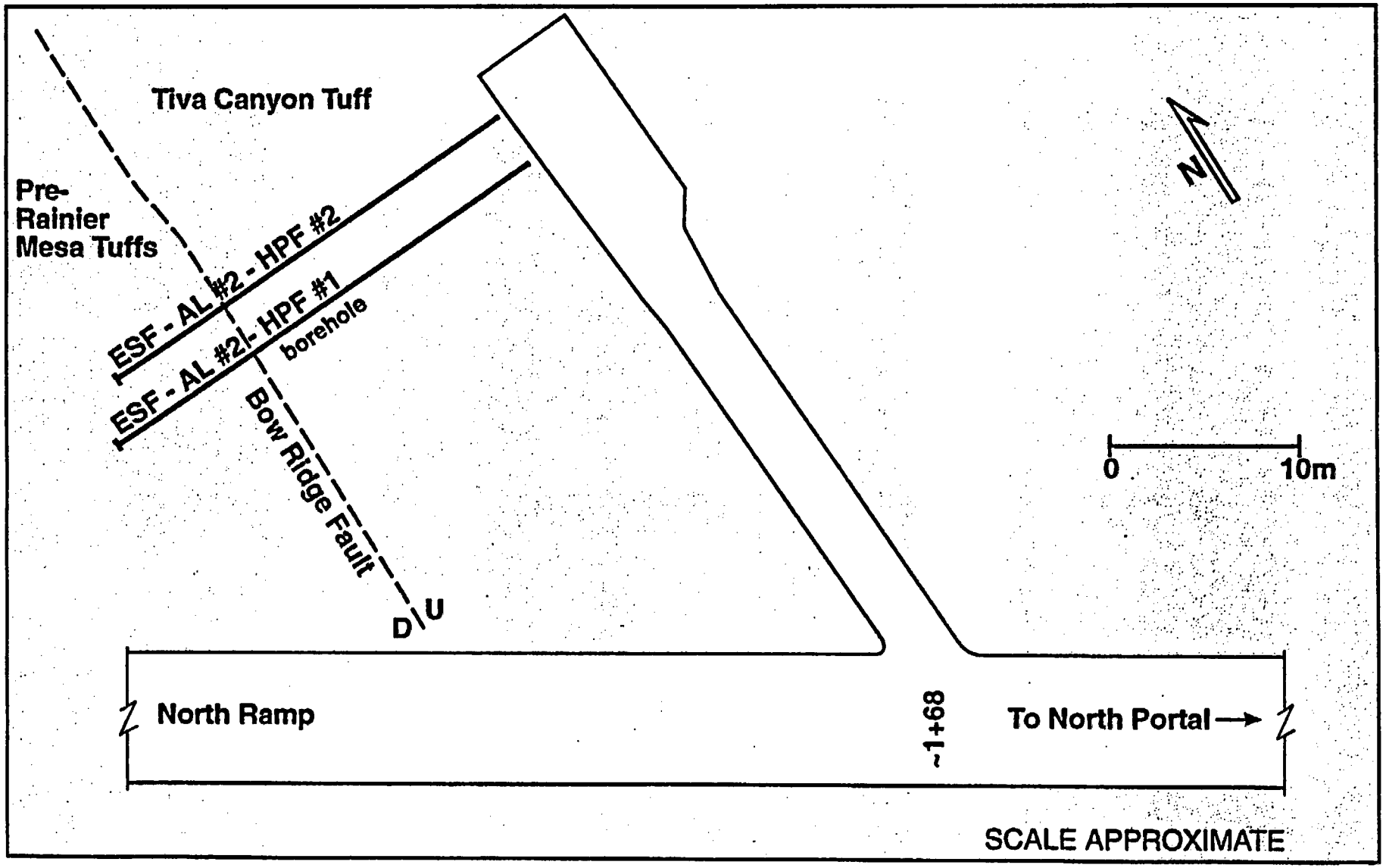
March 13, 1997

Alcove 2

No additional significant testing results to report since last update

ESF Alcove 2

Bow Ridge Fault Test; two radial boreholes ~30m deep



125.nrc.tynan.cdr - 12/6/96 29

DOE/NRC Technical Meeting

March 13, 1997

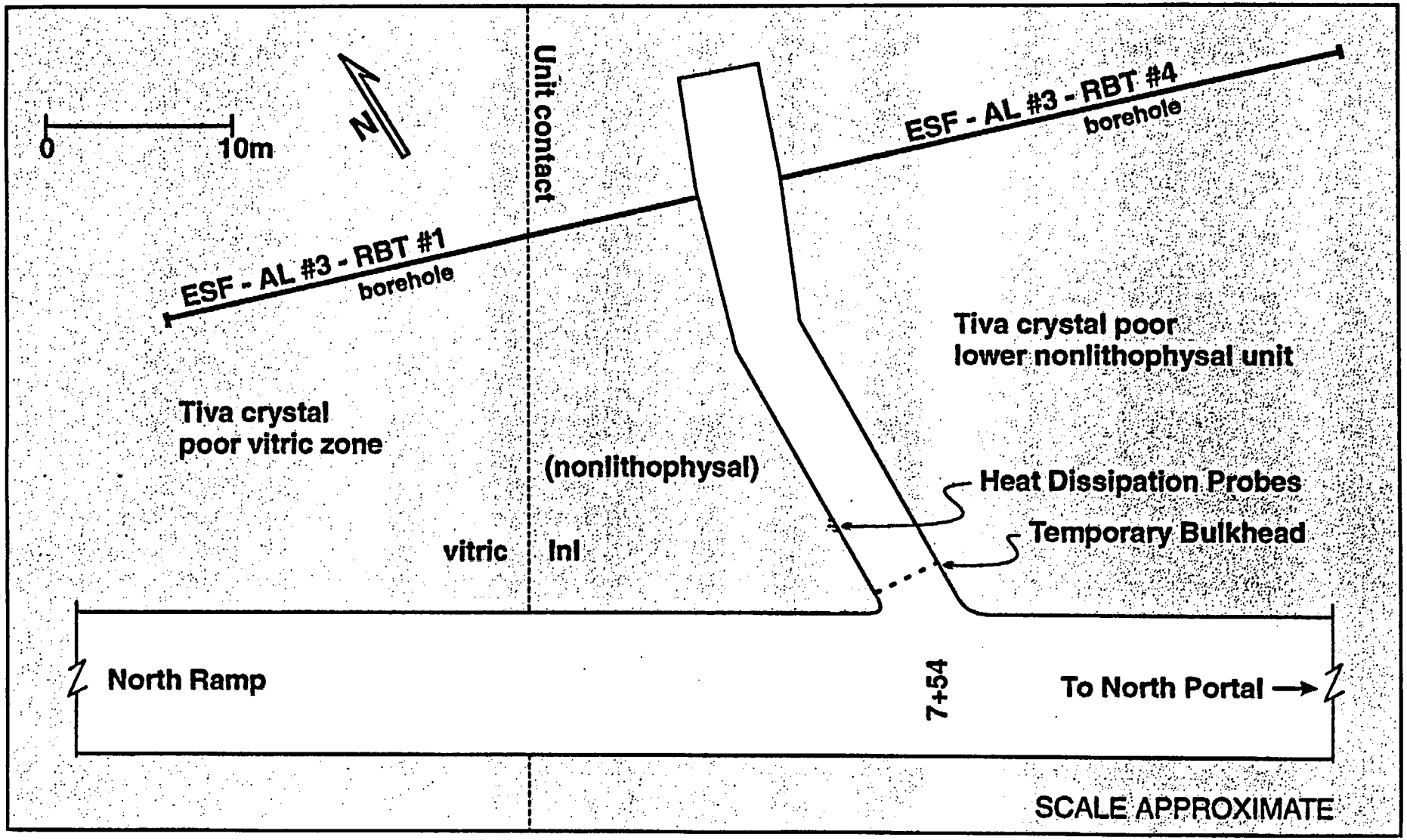
Alcove 3 = Upper PTn Contact Alcove

No additional significant testing results to report since last update

ESF Alcove 3:

Upper Paintbrush Tuff Non-Welded Contact

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



DOE/NRC Technical Meeting

March 13, 1997

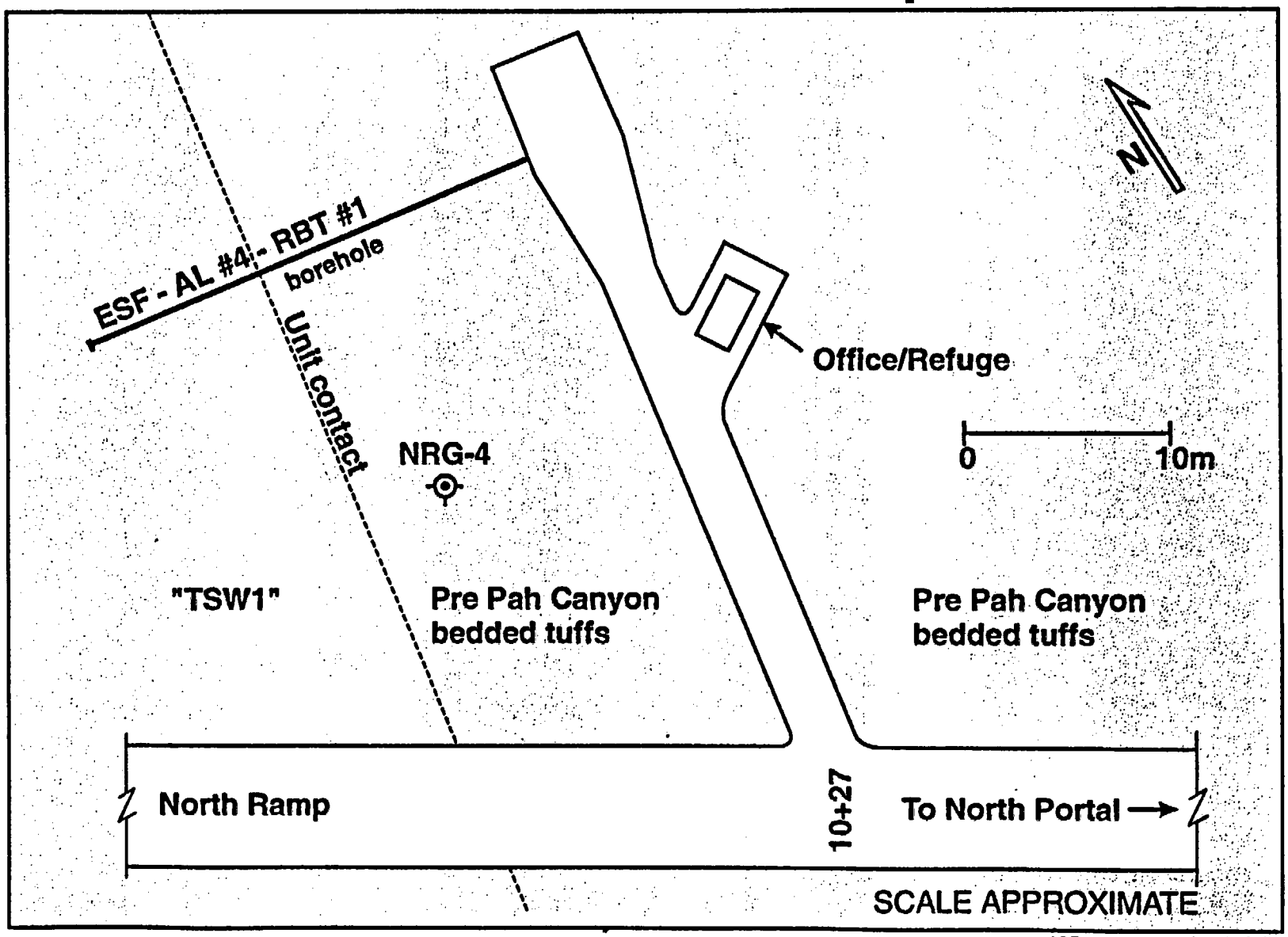
Alcove 4

No additional significant testing results to report since last update

ESF Alcove 4

Lower Paintbrush Non-welded Contact

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



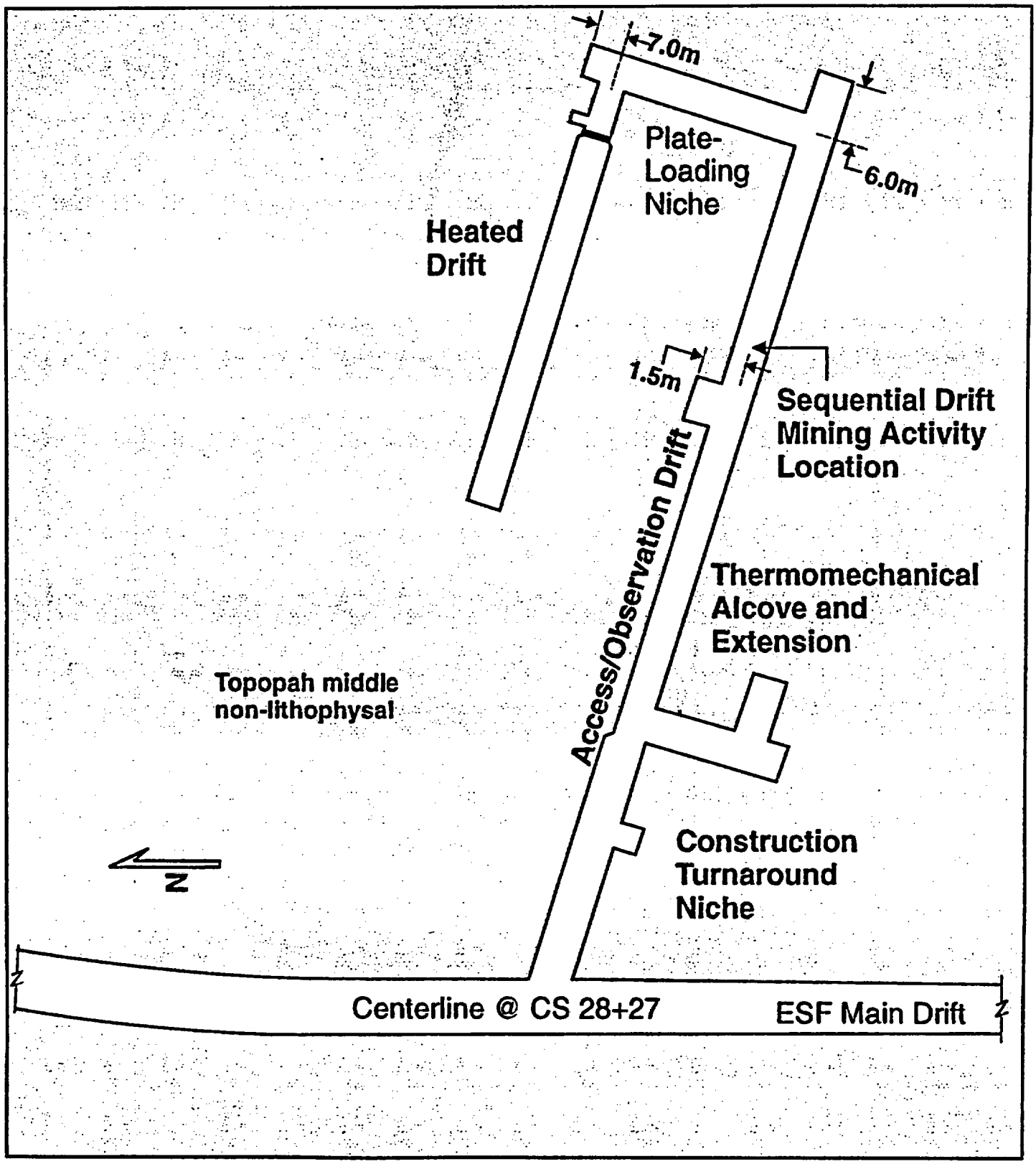
DOE/NRC Technical Meeting

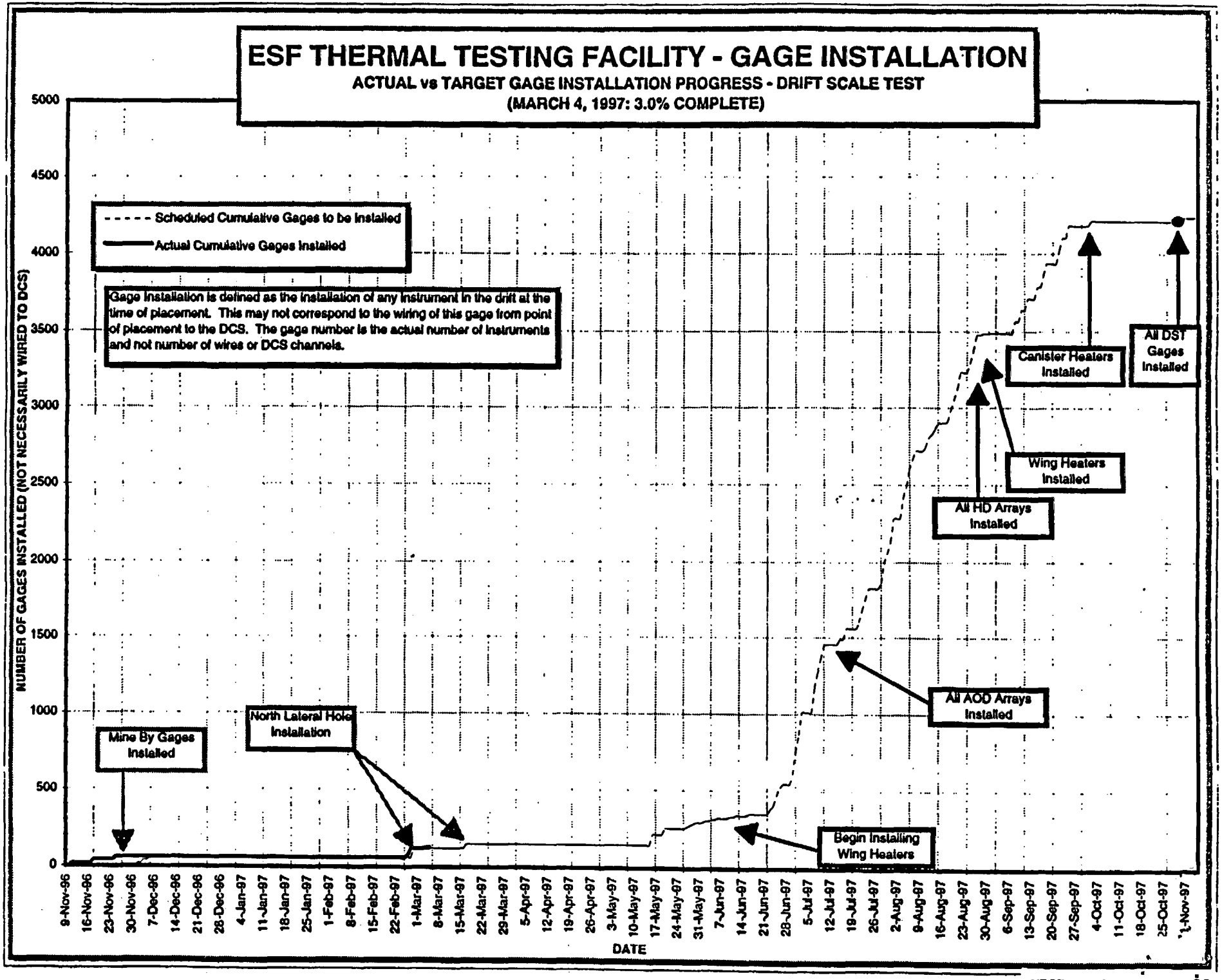
March 13, 1997

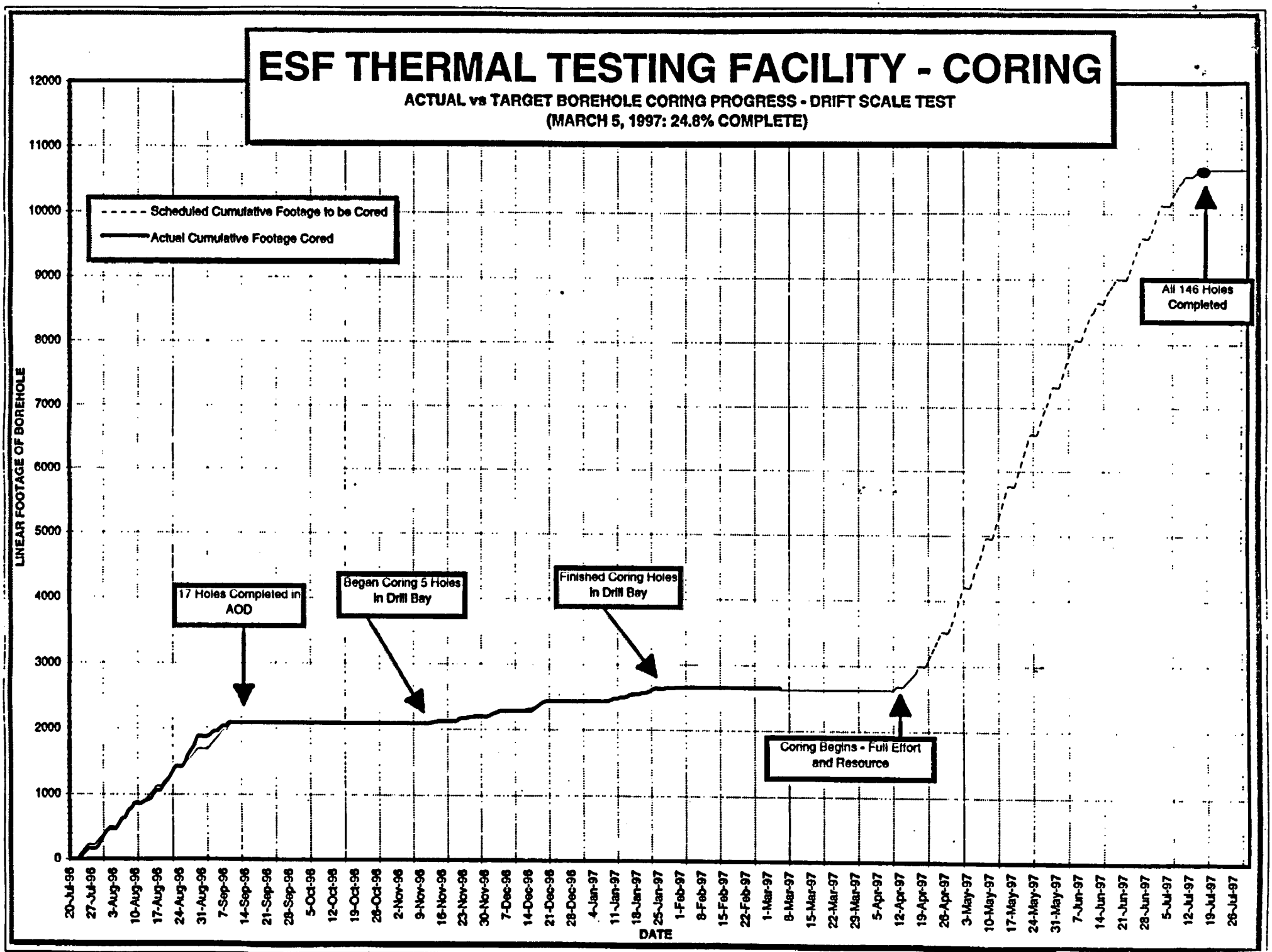
Alcove 5

Bill Boyle is presenting status and results testing in thermal alcove

ESF Alcove 5
Thermal Test Facility




ESF THERMAL TESTING FACILITY - GAGE INSTALLATION
ACTUAL vs TARGET GAGE INSTALLATION PROGRESS - DRIFT SCALE TEST
(MARCH 4, 1997: 3.0% COMPLETE)
Scheduled Cumulative Gages to be Installed
Actual Cumulative Gages Installed
Gage Installation is defined as the installation of any instrument in the drift at the time of placement. This may not correspond to the wiring of this gage from point of placement to the DCS. The gage number is the actual number of instruments and not number of wires or DCS channels.
NUMBER OF GAGES INSTALLED (NOT NECESSARILY WIRED TO DCS)
DATE
Mine By Gages Installed
North Lateral Hole Installation
All HD Arrays Installed
Wing Heaters Installed
Canister Heaters Installed
All DST Gages Installed
All AOD Arrays Installed
Begin Installing Wing Heaters


ESF THERMAL TESTING FACILITY - CORING
ACTUAL vs TARGET BOREHOLE CORING PROGRESS - DRIFT SCALE TEST
(MARCH 5, 1997: 24.8% COMPLETE)
Scheduled Cumulative Footage to be Cored
Actual Cumulative Footage Cored
17 Holes Completed in AOD
Began Coring 5 Holes In Drill Bay
Finished Coring Holes In Drill Bay
Coring Begins - Full Effort and Resource
All 146 Holes Completed
LINEAR FOOTAGE OF BOREHOLE
DATE

YM 13823 2/12/97 Face of Heater Test Drift at Completion of Excavation Alcove 5

DOE/NRC Technical Meeting

March 13, 1997

Alcove 6 = North Ghost Dance Alcove Testing:

- Core Water Sampling
  - No statistically significant tritium concentrations were found

– Prelimary Draft

DOE/NRC Technical Meeting

March 13, 1997

Alcove 6 = North Ghost Dance Alcove Testing:

- Air Injection Testing
  - Permeabilities measured in fault range 1.3 to 11.1 darcies
  - Permeabilities outside fault measured range 0.06 to 0.63 darcies
  - Fault zone permeabilities one order of magnitude > rock
  - Rock is dryer near main trace

- Prelimary Draft

DOE/NRC Technical Meeting

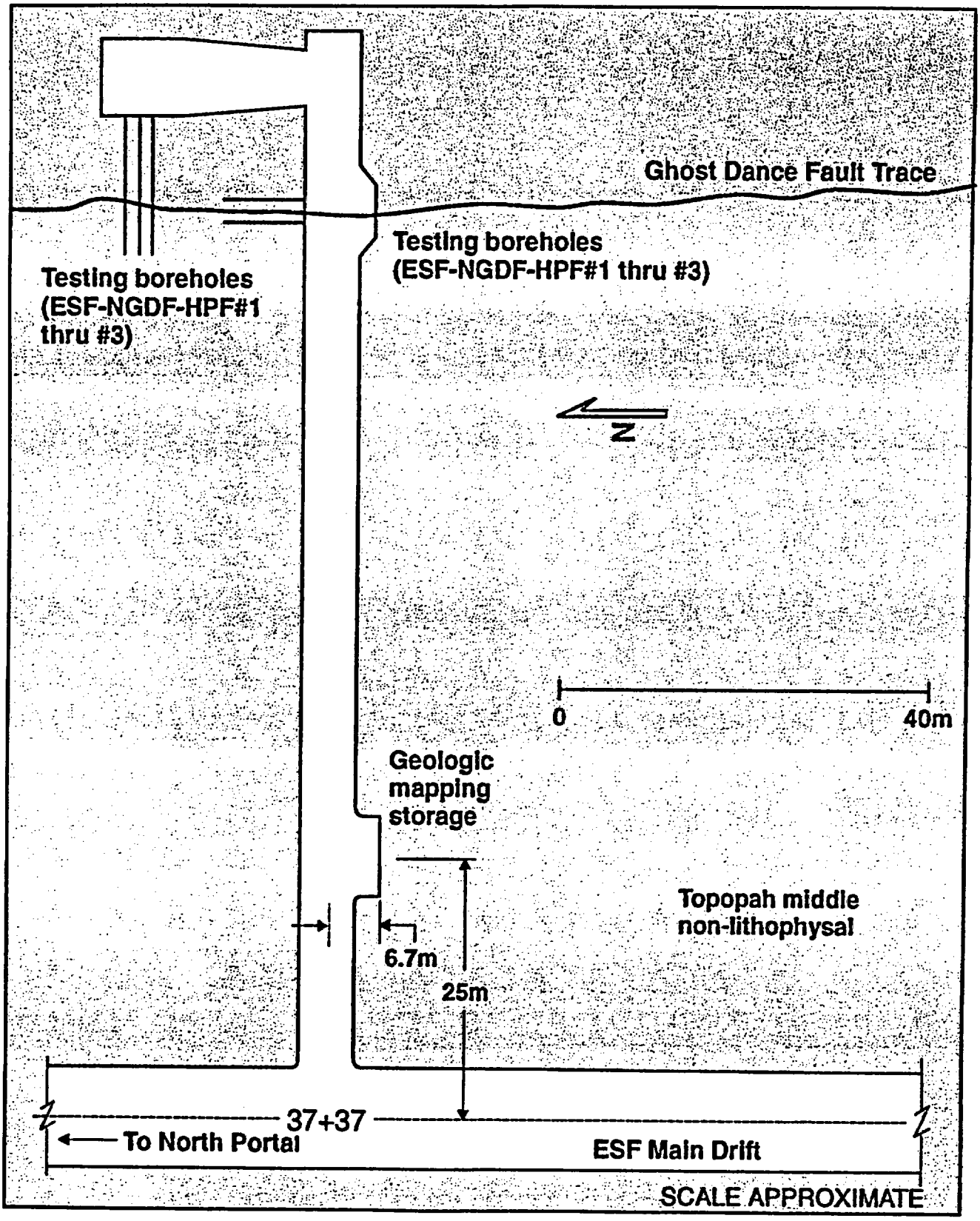
March 13, 1997

Alcove 6 = North Ghost Dance Alcove Testing:

- Future Testing Plans
  - Excavate through fault to construct testing chamber
  - Geothermal logging
  - Pneumatic monitoring and gas sampling
  - New drill hole series
  - Perform 3-d air injection and tracer tests

– Prelimary Draft

ESF Alcove 6
Northern Ghost Dance Fault Alcove: Phase II



125.nrc.lynan.cdr/12-6-96 50

DOE/NRC Technical Meeting

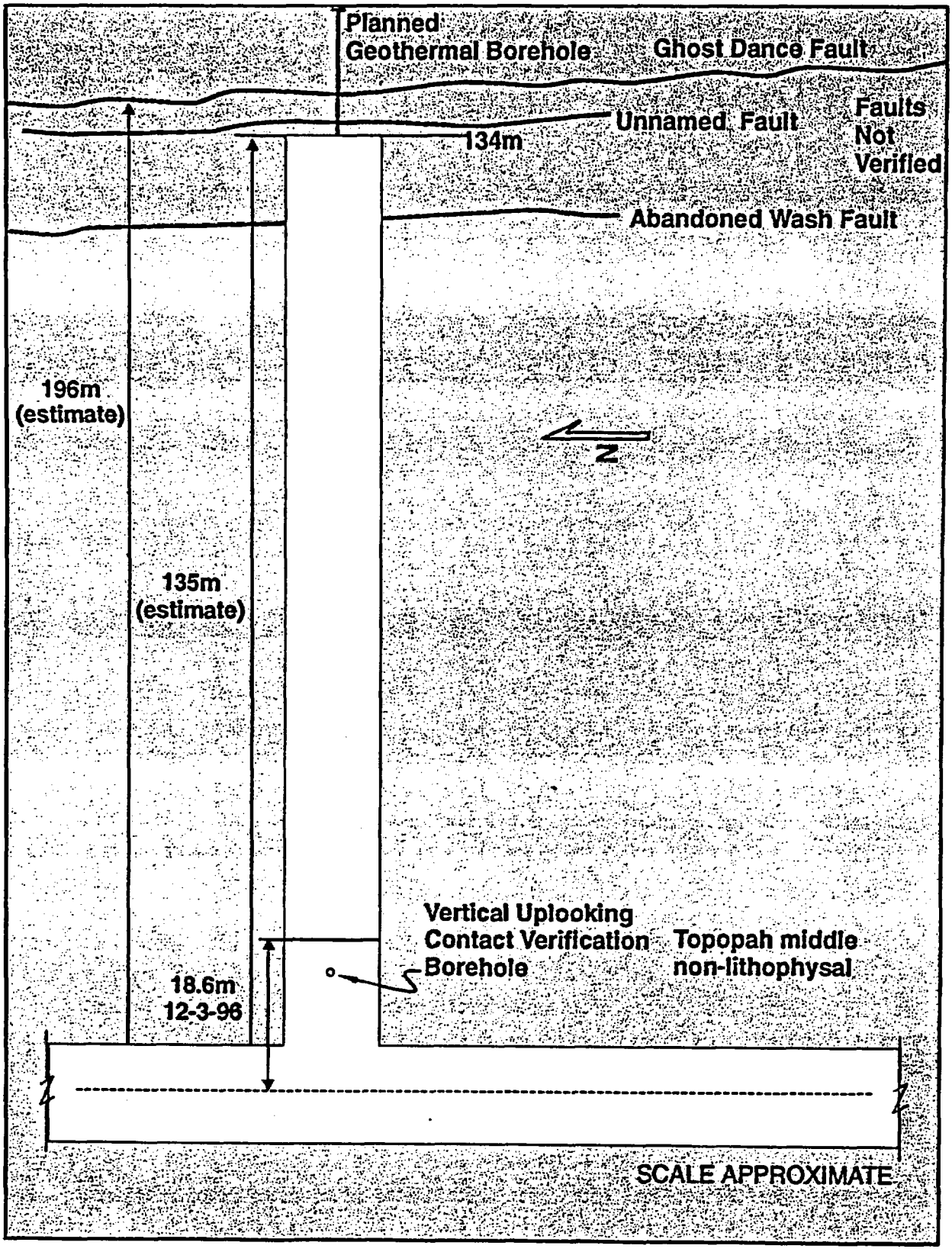
March 13, 1997

Alcove 7

- Phase I Construction completed to 1+34m
- Thermal probe hole drilling (60m deep); planned to cross Ghost Dance Fault;
- To initiate gas pressure and temperature data acquisition in early March
- Core to be sampled for saturation and water potential determination
- Alcove mapping and structural assessment progressing

- Prelimary Draft

ESF Alcove 7
Southern Ghost Dance Fault test alcove:



125.nrc.tyman.cdr - 12-4-96

DOE/NRC Technical Meeting

March 13, 1997

ESF Moisture Monitoring/Testing (USGS)

Purpose = Monitor water use, rock dryout, wetting effects of exposure and ventilation

Objective = Determine net changes in moisture to use for modeling

Instrumentation = Temperature, humidity, wind velocity, heat dissipation, evaporation pans, tensiometers

Calculate = Net moisture flux using water balance equation, rock water potential, water content *(in situ)*, water sorption / desorption curves; unsaturated hydraulic conductivities

- Prelimary Draft

DOE/NRC Technical Meeting

March 13, 1997

ESF Moisture Monitoring/Testing (USGS)

- '97/98 Program Enhancements
  - Lateral diversion of water in the PTn, Phase 1
  - South Ramp hydrology characteristics of rock prior to dryout
  - Percolation flux and niche studies: characterize conditions leading to fracture flow via transient infiltration experiments

– Prelimary Draft

DOE/NRC Technical Meeting

March 13, 1997

ESF Moisture Monitoring/Testing (USGS):

Results:

- Estimated water loss, 0.5mm/day due to ventilation effects
- 30% porosity rock would dry at 2m/yr
- Water balance studies in progress
- Wetting in Alcove 3: moisture increased after alcove enclosed, but neither total saturation nor drips have been observed during testing period; basal Tiva
- No dripping or running water observed to date to Sta 65+00;
- South ramp wet spot likely not fully saturated. Niche studies are to characterize conditions required to induce dripping from fractures

- Prelimary Draft

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March 13, 1997

C-Wells Reactive Tracer Tests (LANL):

- Multiple paths observed
- Matrix diffusion observed in all paths
- All pathways with matrix sorption of Li^+
- Li^+ sorption field and lab studies in agreement
- SZ transport conceptual model validated for Bullfrog (dual porosity, matrix diffusion, sorption in matrix and fractures)
- Diffusion and sorption are effective retardation and dilution mechanisms

– Prelimary Draft

YM 13775 1/24/97 Tracer Injection System at C-wells

DOE/NRC Technical Meeting

March 13, 1997

C-Wells Hydrologic Testing (USGS):

- Hydraulic testing conducted 95 to present, short and long term pump testing in Bullfrog - Tram units
- Tracer testing in 96 to present; Bullfrog - Tram testing progresses, Prow Pass test planned for 1997/98

Results

Fracture porosity 8.6% to 0.6%

Matrix porosity ~3% to 19%

Longitudinal dispersivity 8.68' to 20.75'

(~10:1 to 20:1 longitudinal to latitudinal dispersion, i.e.., a 5 km plume down gradient would have dispersed only 500m laterally, but based on 30m separation of test wells)

Drawdown observed in farfield wells

Prelimary Draft

DOE/NRC Technical Meeting

March 13, 1997

- **Breathing Fracture:**
  - Station 74+37; right spring line
  - Located statigraphically at very top of Topopah
  - Aperture of 10cm
  - Breeze strong enough to blow out a match during onset of atmospheric high pressure
  - Tunnel cover/overburden ,100m
- **Testing Program**
  - UZ hydrology team has instrumented fracture and surface; monitoring (P,T, humidity) both locals

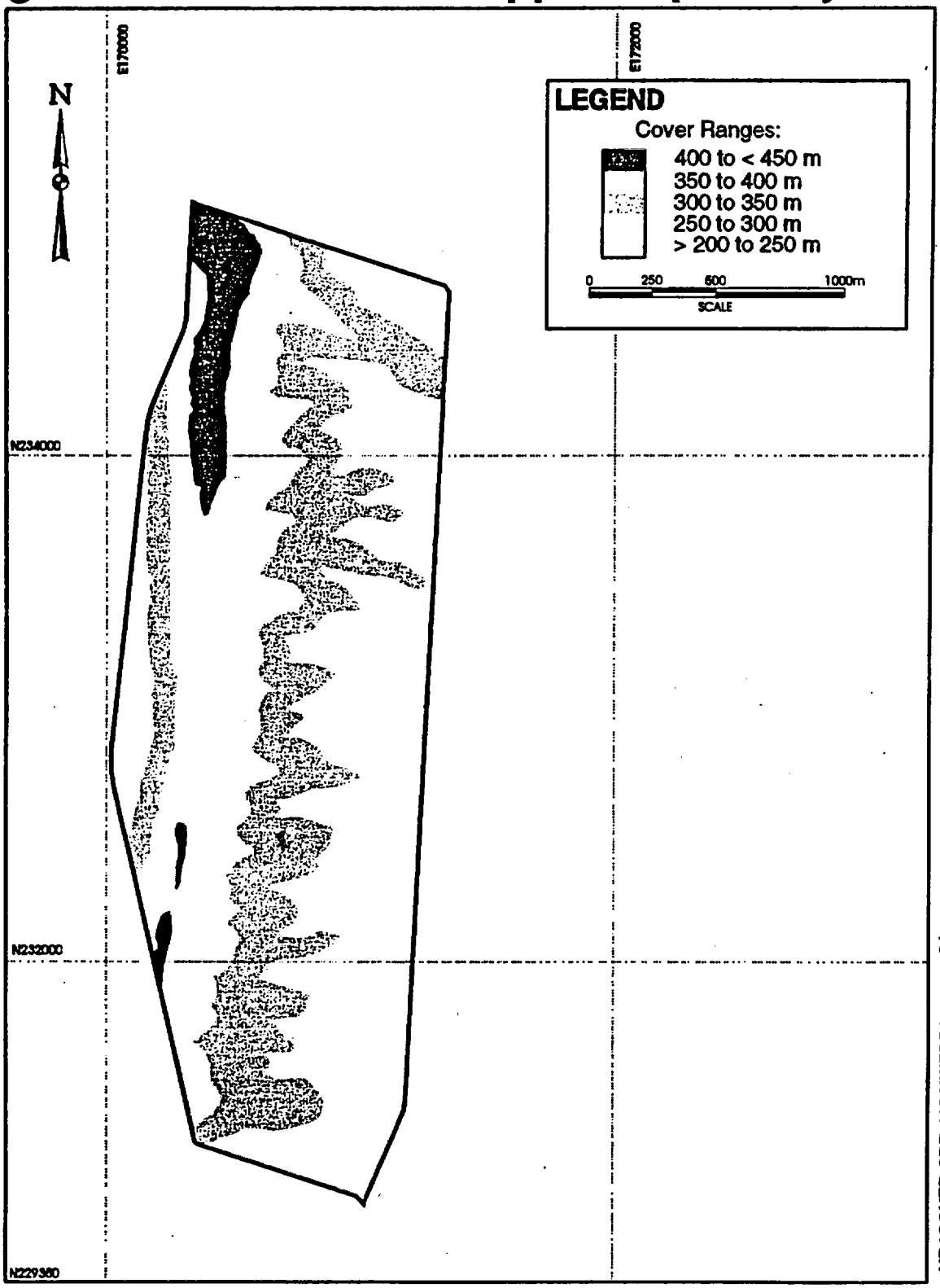
– Prelimary Draft

Three South Ramp "Breathing" Fractures

Station	Strike	Dip	Trace Length	Infilling	Aperture
74+20.78	206	82	1.69m	none	25mm
74+36.60	200	78	2.18m	Calcite-2mm	30mm
74+36.86	170	64	0.52m	Calcite-2mm	25mm

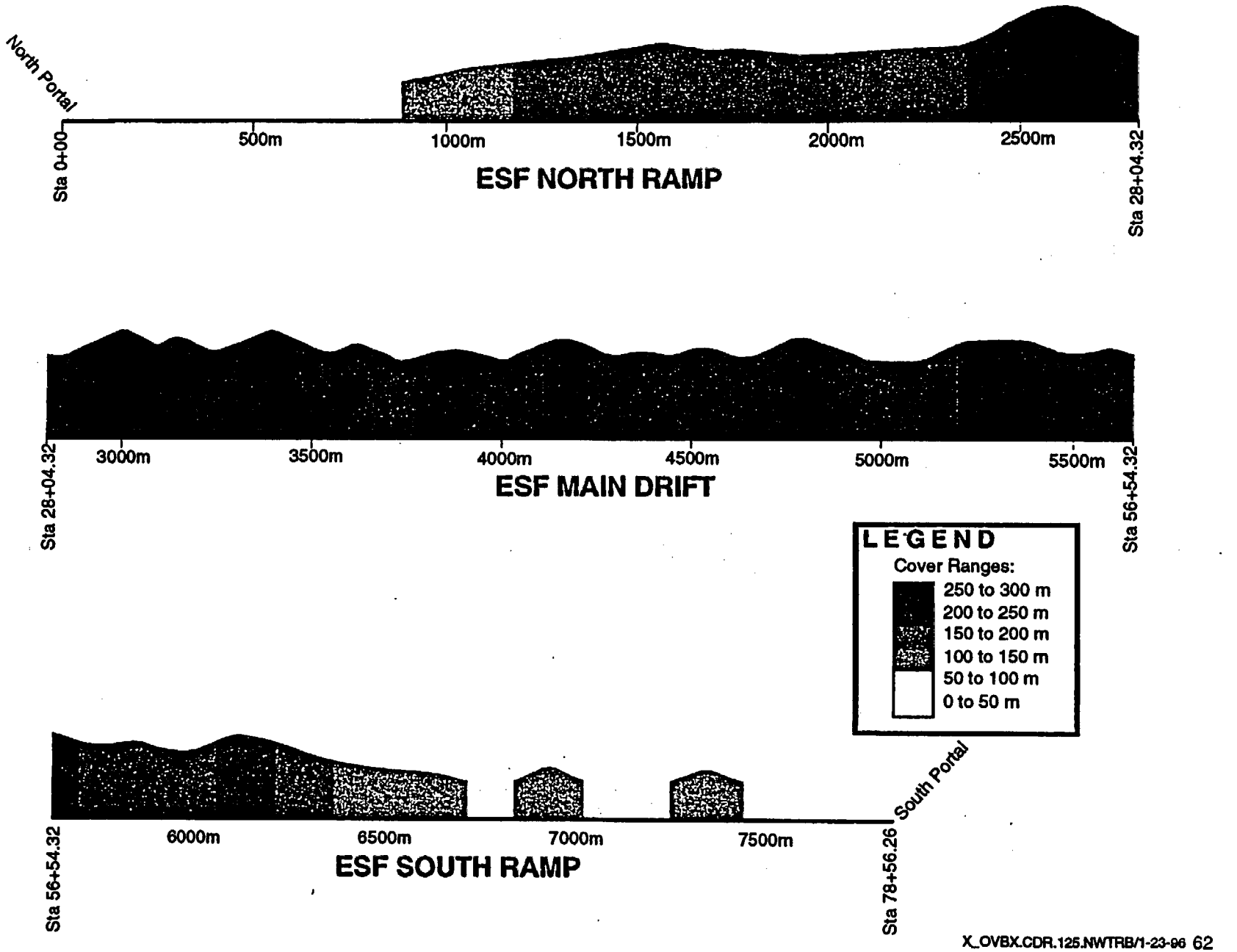
All are in the top of the densely welded Topopah Spring, Specifically the crystal-rich, vitric zone (Tptrv), just below the PTn.

Ranges of Cover Over the Upper Repository Block



UB4COVER.CDR.125.NWTRB/1-23-97 61

Ranges of Cover Over The ESF



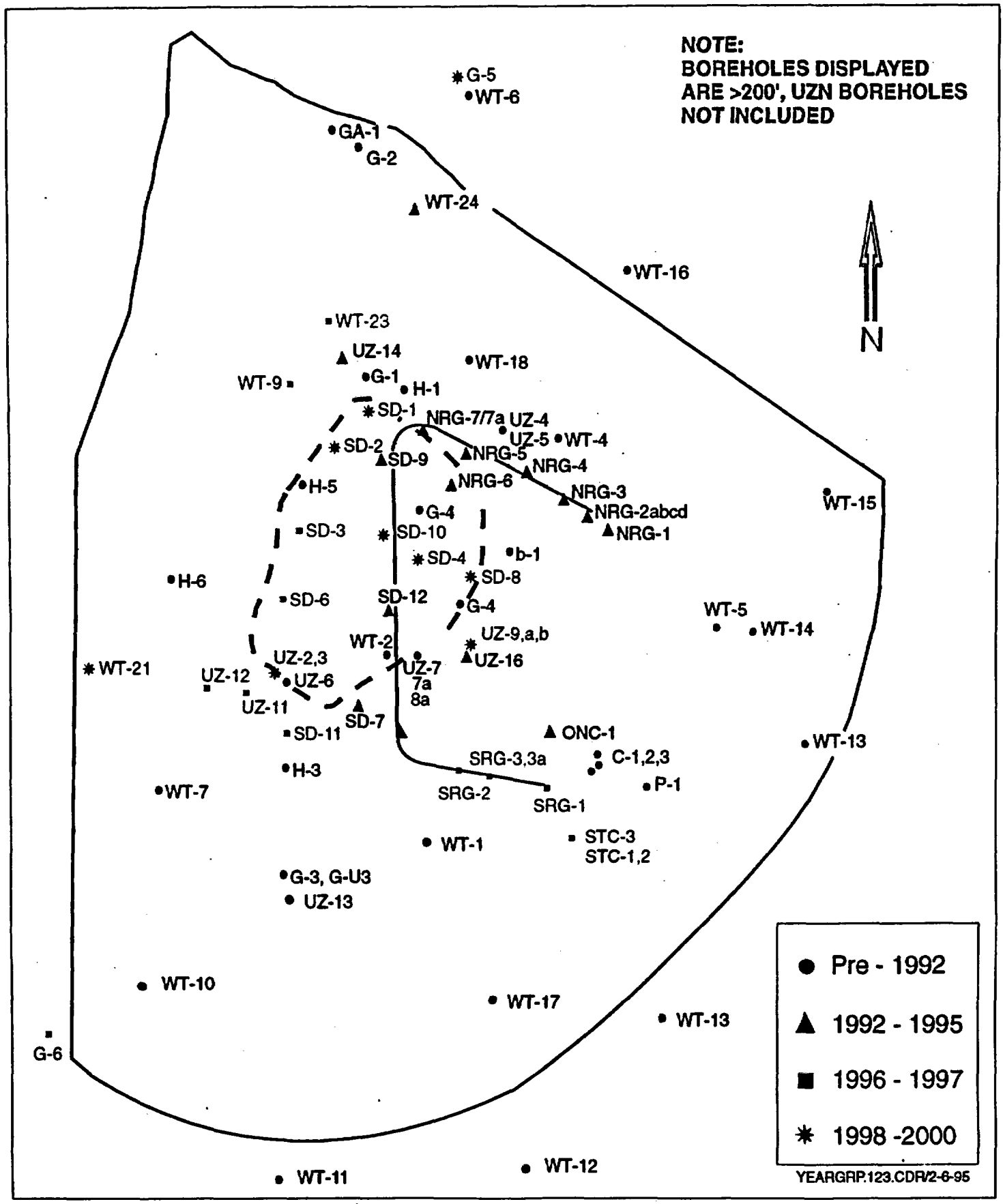
DOE/NRC Technical Meeting

March 13, 1997

- SD6 Borehole
  - Located on crest of Yucca Mountain at previously proposed site for SD6/H7 borehole
  - Drill to total depth taking only cuttings and sidewall samples; no core
  - Geophysical loging suite, UZ and SZ runs

  See prognosis and location map
- Purposes/Objectives
  - Obtain stratigraphic, hydrologic, rock properties data
  - Permits model validation

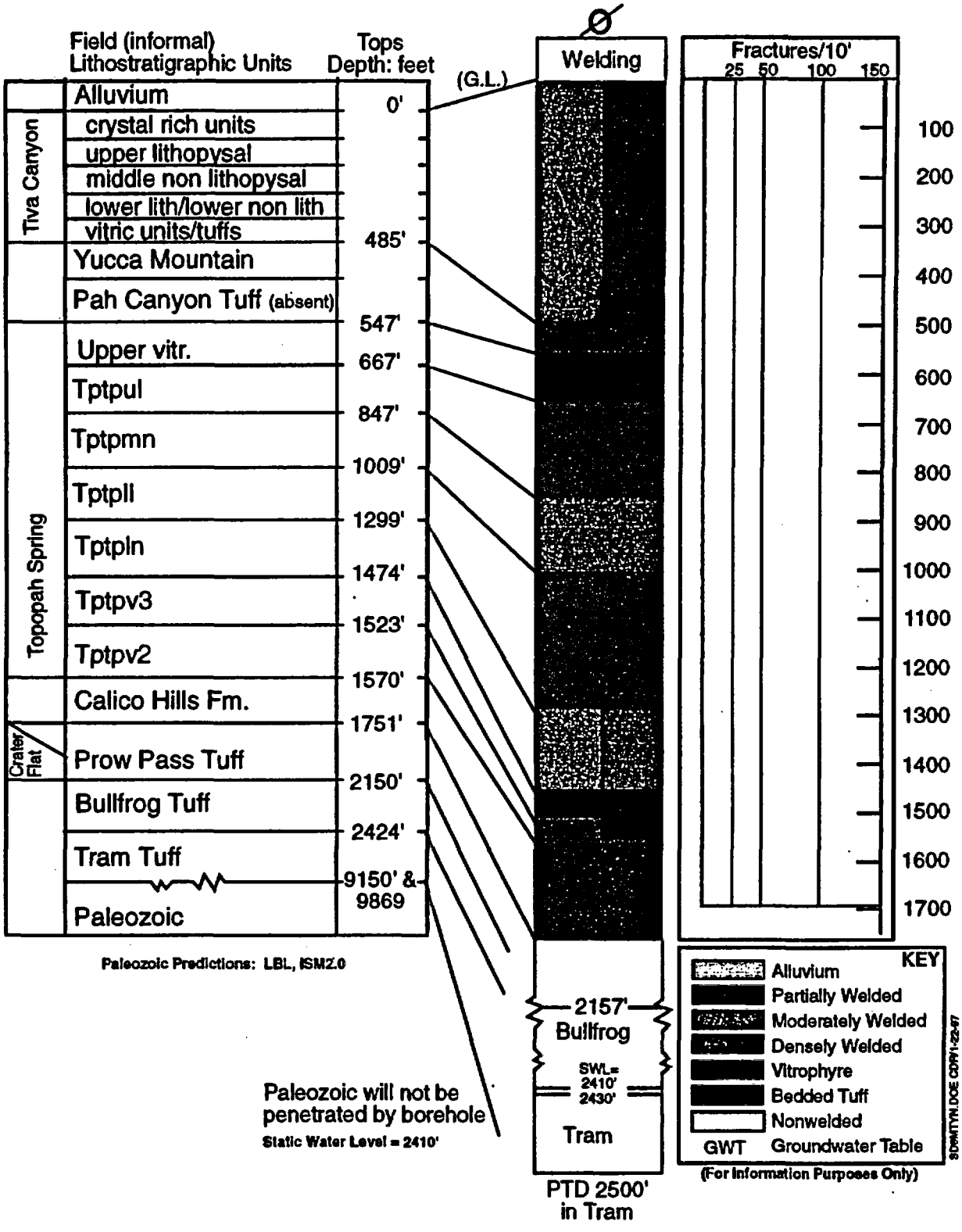
Availability of Site Characterization Boreholes



Prognosis: USW - SD6

GL = TBD
PTD ≅ 2500' + TBD

spud 1997 TBD
T.D. 1997 TBD



DOE/NRC Technical Meeting

March 13, 1997

Natural Resource Update

NRCTYNAN.PPT.123.3-13-9766

Resources Issue	report title	author	current status of review	publication plans
Geothermal	Geothermal Resource Assessment of the Yucca Mountain Area, Nye County, Nevada	Thomas Flynn, Paul Buchanan, Dennis Trexler, Lisa Shevenell, and Larry Garside	1995. Accepted by DOE review.	Nevada Bureau of Mines and Geology, Open-file Report 97-?, chap. 2.
Industrial Rocks and Minerals	Assessment of Industrial Minerals and Rocks in the Controlled Area, Yucca Mountain Site Characterization Project	Stephen B. Castor, and David E. Lock	1995. Accepted by DOE review.	Nevada Bureau of Mines and Geology, Open-file Report 97-?, chap. 3.
Metallic	Assessment of Metallic and Mined Energy Resources in the Yucca Mountain Controlled Area, YuccaMountain, Nye County, Nevada	Stephen B. Castor, Larry J. Garside, Joseph V. Tingley, Daphne D. La Pointe, Mario O. Desilets, Liang-Chi Hsu, Patrick M. Goldstrand, Thomas P. Lugaski, and Howard P. Ross	due 3/28/97 as Level 4 deliverable.	Nevada Bureau of Mines and Geology, Open-file Report 97-?, chap. 4.
Mined Energy	as above	as above	as above	as above
Hydrocarbon	Hydrocarbon Assessment of the Yucca Mountain Vicinity, Nye County, Nevada	Don E. French	due 4/11/97 as Level 4 deliverable	Nevada Bureau of Mines and Geology, Open-file Report 97-?, chap. 5.
Water	Assessment of the Water Resources of Yucca Mountain, Nye County, Nevada	Chuan Mian Zhang, Robert Young, James Booker, Garth Taylor, and Keith Little	due 3/28/97 as Level 4 deliverable	Nevada Bureau of Mines and Geology, Open-file Report 97-?, chap. 6.
Synthesis	Natural Resources Final Report	Jan C. Rasmussen	due 6/2/97 as Level 3 deliverable	Nevada Bureau of Mines and Geology, Open-file Report 97-?, chap. 7.
Surface Markers	Feasibility Assessment for Permanent Surface Marker Systems at Yucca Mountain	Gregory Fehr, Thomas Flynn, and William Andrews	finished 9/30/96, 59 pages accepted by DOE review	none

DOE/NRC Technical Meeting

March 13, 1997

Deliverables

(2nd & 3rd Quarter)

LEVEL 3 DELIVERABLES DUE 12/1/96 - 3/1/97
WBS Elements 1.2.1 thru 1.2.5
Sorted by Baseline Due Date

WBS	Del #	Deliverable Description	Baseline	TPM Rcvd
1.2.2.3.3	WP233735	EBS/WP Parts List	12/13/96	12/12/96
1.2.4.2	RP120MG1	VA Design & Review Plan	12/31/96	12/20/96
1.2.4.6	RP242CM	Operations Staffing Letter Report	1/2/97	12/31/96
1.2.5.2.4	PR15M3	Submit Semi Annual Progress Rpt 15 for Review	1/8/97	1/8/97
1.2.2.5.1	WP61607	Init of Rel Humidity Chamber Corr Tests	1/13/97	1/16/97
1.2.5.2.1	SL21M3B	2nd Quarterly Regulatory Interaction Summary Rpt	1/15/97	1/14/97
1.2.5.2.1	SL21M3C	Semi-Annual S/C Activities Open Item Status Rpt	1/15/97	1/14/97
1.2.2.5.1	WP26708	Init of Abiotic & Biotic MIC Tests	1/16/97	1/16/97
1.2.2.5.1	WP60703A	Initiation of Crack Growth Rate Testing	1/16/97	12/18/96
1.2.3.14.1	SP9901C3	Ltr to Recomm Initiation of Heat-Up Cycle of LBT	1/27/97	1/24/97
1.2.4.6	RP243AMA	Waste Handling Systems Config.	1/30/97	1/30/97
1.2.2.5.1	WP26402	Init of LT Controlled Electrochem Pot Tests	2/10/97	2/11/97
1.2.5.4.4	SLX03D1	Submit SZ Flow Model Wkshop Documentation	2/19/97	NA
1.2.5.4.2	SL208DM	Submit WP Degrad Abs/Test Wkshop Results	2/24/97	NA
1.2.5.4.4	SLX01DM	Submit VA UZ Flow Model Abstr/Test Wkshop Doc.	2/27/97	NA
1.2.3.2.2.1.2	SPG42AM3	Rpt Geo North/South Main Drft Sta 28+00 to55+00	2/28/97	NA
1.2.3.2.2.1.2	SPG42BM3	Ltr Rpt: Geo S.R. Sta 55+00 to STA 63+47	2/28/97	NA
1.2.3.9.5	SP23BM3	Updated Integrated Site 3-D Geo Framework Model	2/28/97	NA
1.2.2.5.1	WP015A3	Engr. Matls. Char. Rpt. Rev 1	2/28/97	NA
1.2.5.10	BMA05A	New version of MANICURE w/assoc doc and demo of total system	3/1/97	NA

LEVEL 3 DELIVERABLES DUE 3/1/97 - 6/1/97
WBS Elements 1.2.1 thru 1.2.5
Sorted by Baseline Due Date

WBS	Del #	Deliverable Description	Baseline	TPM Rcvd
1.2.5.10	BMA05A	New version of MANICURE w/assoc doc and demo of total system	3/1/97	NA
1.2.1.2	SE422M3	MGDS Requirements Document	3/3/97	NA
1.2.3.3.1.2.4	SP3505M3	Initiate South GDF Testing Geothermal Borehole	3/3/97	NA
1.2.3.3.1.2.3	SPH223M3	Main Drift Hydrology Report	3/14/97	NA
1.2.5.10.2	BM141M3	Identify Records Reprocessing Location	3/14/97	NA
1.2.5.4.3	SLX09M	Submit Thermohydrolog Mdl Abstr/Test Wkshop Doc.	3/18/97	NA
1.2.3.3.1.2.4	SP3500M3	Initiate North GDF Alcove Testing	3/19/97	NA
1.2.3.9.5	SPT22M3	(YAR) Updated 3-D Integrated Site Model (ISM2.0)	3/28/97	NA
1.2.5.3.6	SLTDM3	Submit Geographic Information CD to YMSCO	3/31/97	NA
1.2.1.5	SE200M3	Complete Throughput Study	3/31/97	NA
1.2.4.7	RP120M3E	Subsurface EBS Design	3/31/97	NA
1.2.1.5	SE440M3	Waste Isolation Req'mt Study Report	4/1/97	NA
1.2.4.7	RP120M3F	Performance Confirmation Design	4/1/97	NA
1.2.2.4.1	WP0035A3	Waste Form Char. Rpt. Rev.I	4/8/97	NA
1.2.5.2.1	SL21M3D	3rd Quarterly Regulatory Interaction Summary Rpt	4/15/97	NA
1.2.1.5	SE456M3	Rail Corridor Evaluation Report	4/30/97	NA
1.2.1.5	SE602M3	Retrievability Study - VA Rpt.	4/30/97	NA
1.2.4.6	RP247M3	Engineering File for NEPA	4/30/97	NA
1.2.5.4.4	SLX05D1A	Submit Transp. Model Wkshop Documentation	4/30/97	NA
1.2.3.2.2.1.2	SPG32M3	Rpt: Lithostrat Q'd Frac Data, UZ Hydro Flow Mdl	4/30/97	NA
1.2.1.10	PD121D7303	Approach to Incorp.Plut.Waste into FWMS	4/30/97	NA
1.2.5.10.2	BMA05B	Develop semiautomatic tools for increasing percentage of pages in the greater than 99	5/1/97	NA
1.2.5.4.2	SL210DM	Submit WF Mobil. Abstr/Testing Workshop Doc.	5/15/97	NA

LEVEL 3 DELIVERABLES DUE 3/1/97 - 6/1/97
WBS Elements 1.2.1 thru 1.2.5
Sorted by Baseline Due Date

WBS	Del #	Deliverable Description	Baseline	TPM Rcvd
1.2.3.14.2	SP9200M3	Ltr Rpt: Recomm Ending Date of Single Htr Test	5/23/97	NA
1.2.1.5	SE506M3	Seals Study Report	5/30/97	NA
1.2.4.6	RP243AMB	Waste Handling & Cask Maint.	5/30/97	NA
1.2.5.7	SL5X4B1M	Submit UZ Flux Uncertainty Characterization Rpt	5/30/97	NA

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+53	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+53 to 65+13	Topopah Spring crystal rich lithophysal zone
65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
69+84 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+68?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+68 to 73+46?	Topopah Spring crystal poor upper lithophysal zone
73+46 to ?	Topopah Spring crystal rich lithophysal zone
? to ?	Topopah spring crystal rich nonlithophysal zone
? to 74+30?	Topopah Spring vitric zone
74+30 to face	bedded tuffs

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

DOE/NRC Technical Meeting

March 13, 1997

^{36}Cl Studies

No bomb pulse chlorine has been detected in any of the 53 samples collected and analyzed beyond ESF station 45+00. The Study seems to document that fast paths exist; they are associated spacially with fault features, but not coincident with faults in all cases.

ATTACHMENT 6

YUCCA MOUNTAIN PROJECT

Studies

Retrieval

Presented to:
DOE-NRC ESF Technical Meeting

Presented by:
Paul Harrington
DOE Team Lead for License Application

March 13, 1997

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

Regulatory Requirement

10CFR 60.111(b)

- **GROA Design must preserve option for waste retrieval during waste emplacement period and completion of performance confirmation program**
- **Any or all waste could be retrieved on a reasonable schedule starting at any time up to 50 years after waste emplacement begins.**

Retrievability Design Impacts

- Subsurface Layout
- Emplacement Mode
- Emplacement & Retrieval Equipment
- Remote Systems Design
- Ground Support Systems

Retrieval Issue Description

- Development of a retrievability strategy to 10CFR60.111b
- Credible off-normal scenarios are currently being considered as part of waste package movement design
- The proof-of-principle aspects of retrievability must be addressed
- The emplacement drift environment of high heat and radiation, and the size and weight of the waste packages and the long retrievability period add to the complexity of the retrievability issue.

Current Status

- The FY97 scope of work includes an engineering study to develop a retrieval strategy.
- As part of the VA design, equipment concepts are being developed to meet various waste package movement off-normal scenarios. The DBE study will provide further input in this area of design.
- The remote system control and communications systems for retrieval equipment are also being analyzed.

Current Status (continued)

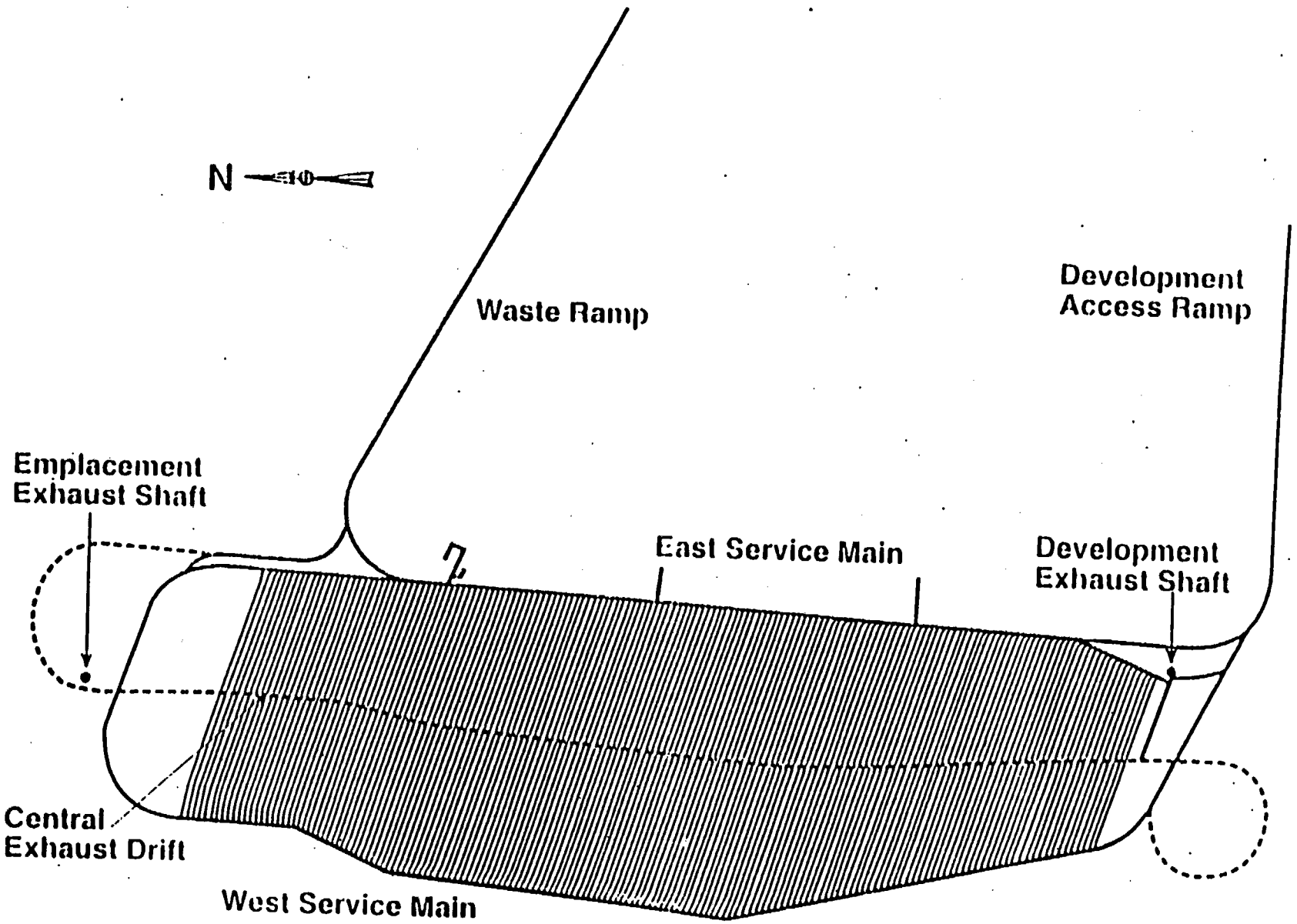
VA design changes to the ACD repository layout and emplacement method that make retrievability more credible include:

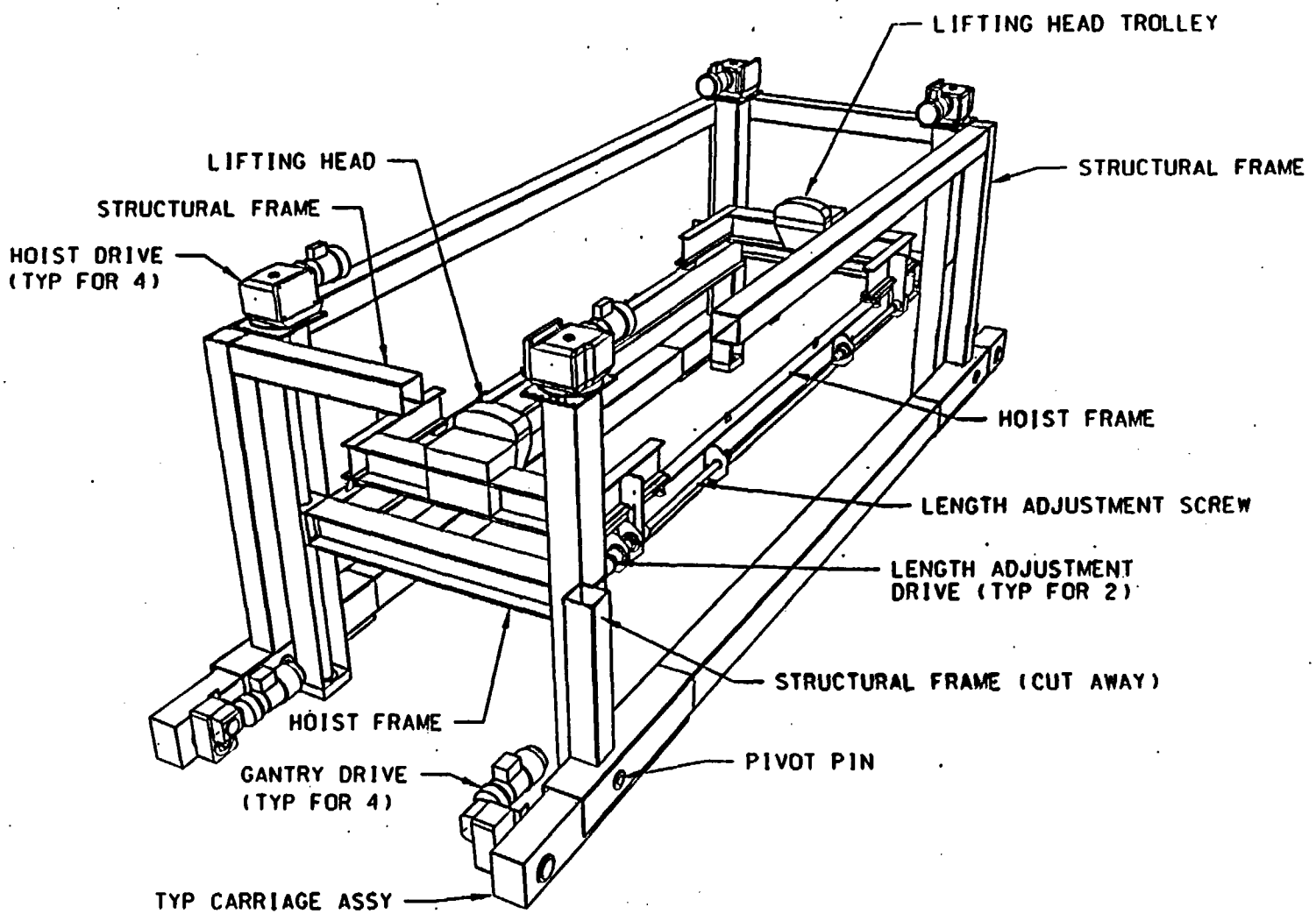
- **retrieval from both ends of the emplacement drifts, enhanced ventilation system with a central exhaust air main**
- **gantry emplacement of the waste packages onto pedestals.**

Current Status (continued)

- The current VA design for gantry emplacement supports retrieval on a when and as needed basis.
- The need for monitoring requires periodic access into the emplacement drift and to maintain a continuous retrieval option requires an intact access system (such as gantry rail, power, control systems, and gantry) and a stable drift ground support.
- The same equipment can be used for both emplacement and retrieval, for normal conditions retrieval is essentially the reverse process of emplacement.

Conceptual Repository Layout



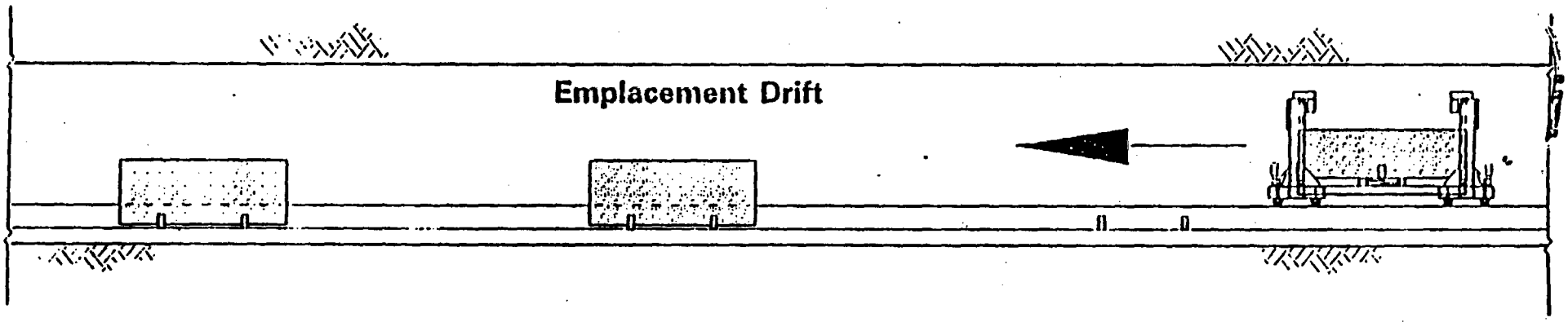


PERSPECTIVE VIEW

NO SCALE

HOIST FRAME SHOWN IN HALF
RAISED POSITION

Gantry Transporting Waste Package



Waste Package On Support Pedestal

Waste Package On Support Pedestal

Emplacement Gantry With Waste Package

Current Assumptions

- The repository will be designed for a retrievability period up to 100 years after initiation of emplacement. (Note: This is twice as long as 10CFR60.111(b))
- Retrieval of emplaced waste may be performed for the following reasons
  - — Failure in site, waste package, or some other system causing an unreasonable risk to public health and safety

Current Assumptions (continued)

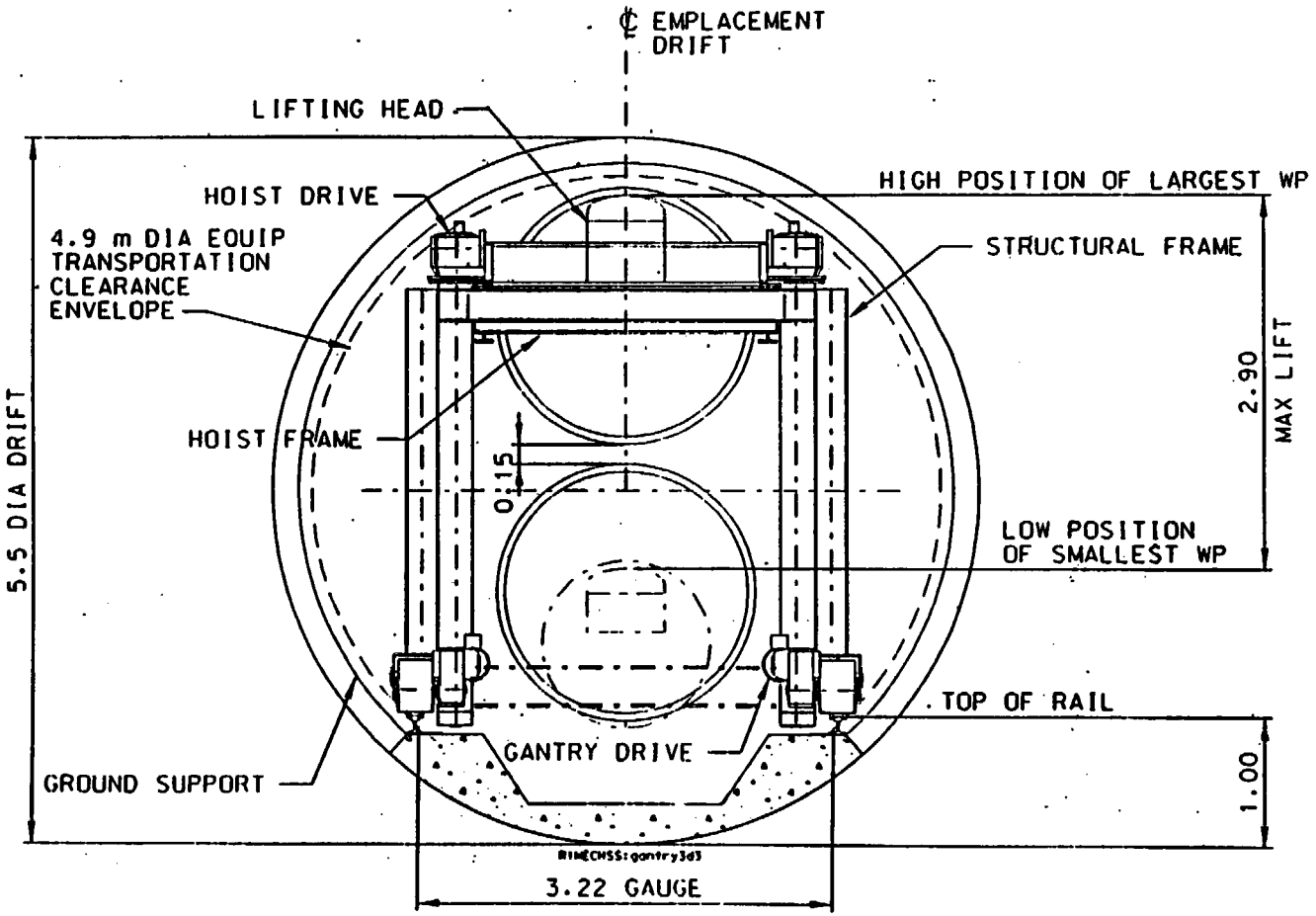
- — The determination that recovery of valuable resources from the spent nuclear fuel is necessary
- Proof of principle demonstration if necessary for waste package retrieval will be conducted following license application.
- Specific design and procedures for retrieval will be performed when, and if, retrieval of the waste package is directed.

Design Events To Be Evaluated

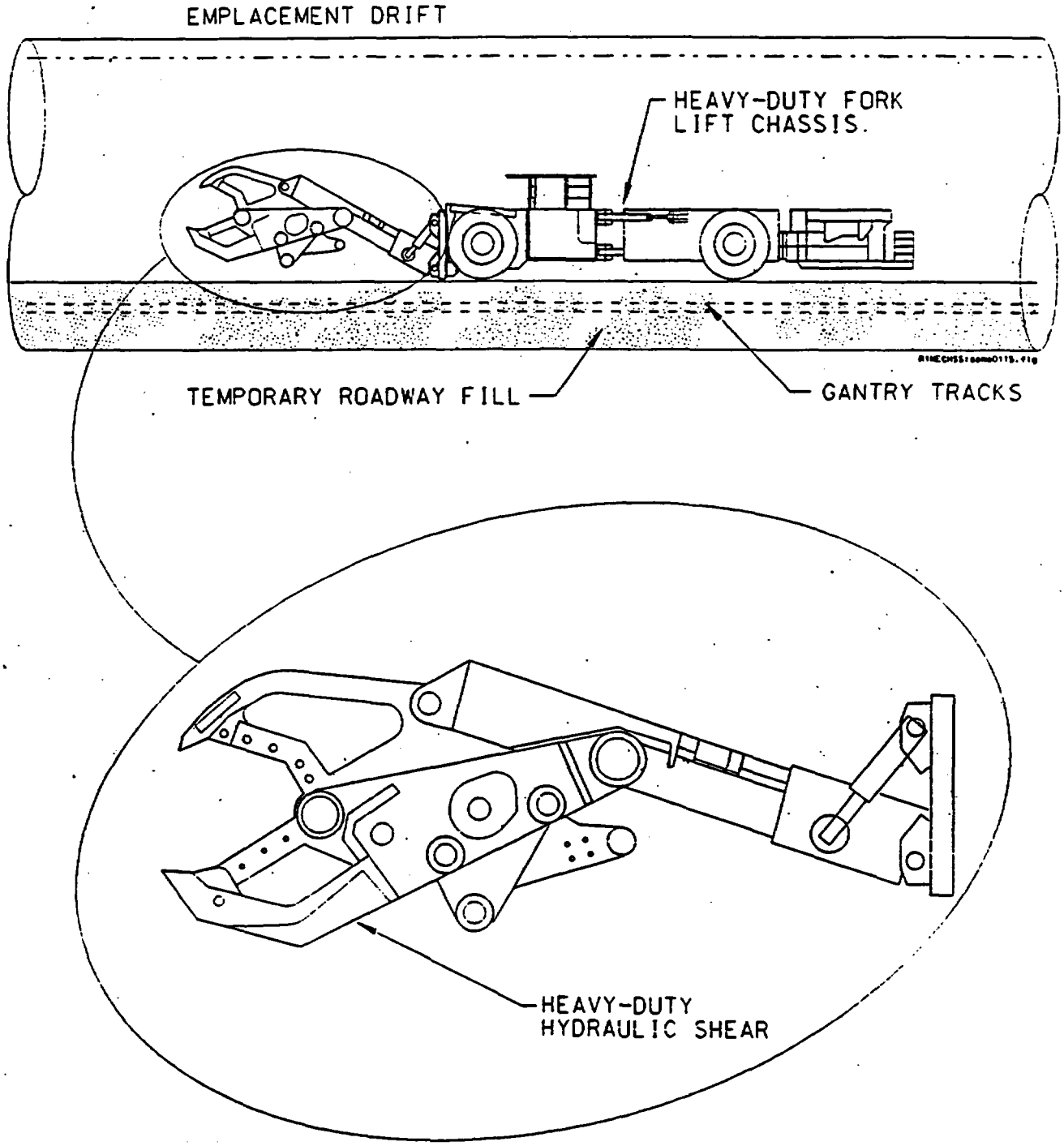
- Ground support failure resulting in damaged waste packages, and damage to the gantry rail, invert, and waste package support structure.
- Minor ground support failure resulting in debris on waste packages and gantry track and power supply system would impede retrieval.
- Failure of control systems would impede retrieval although backup systems and equipment will be available to handle such situations.
- Leaking waste packages contaminating the underground facilities would impede recovery.

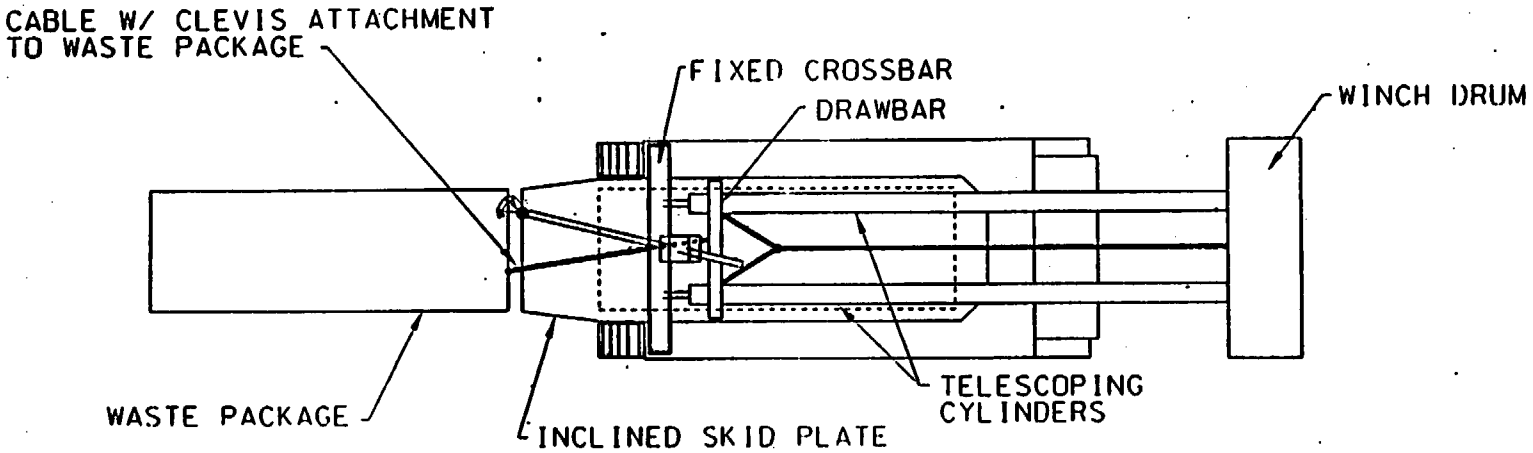
Off Normal Scenarios That May Necessitate Retrieval:

- WP Transporter Derailment
- Rock and Ground Support Collapse on WP
- Non Mechanistic Flooding
- Loaded Gantry Failure

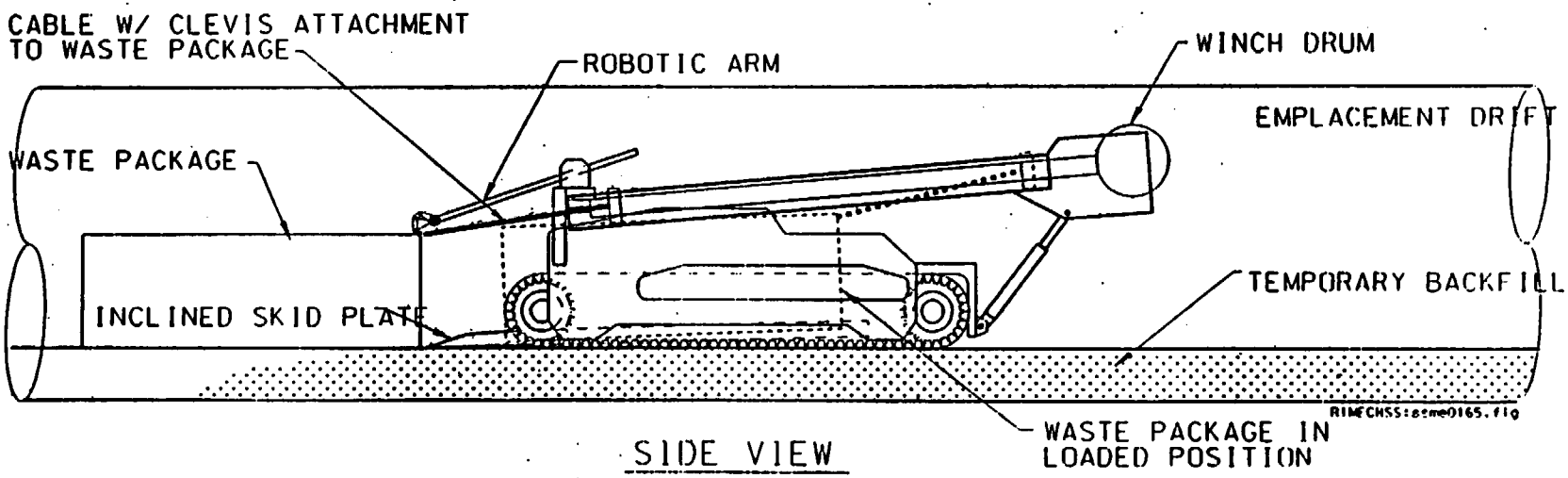


HOIST FRAME SHOWN IN RAISED POSITION

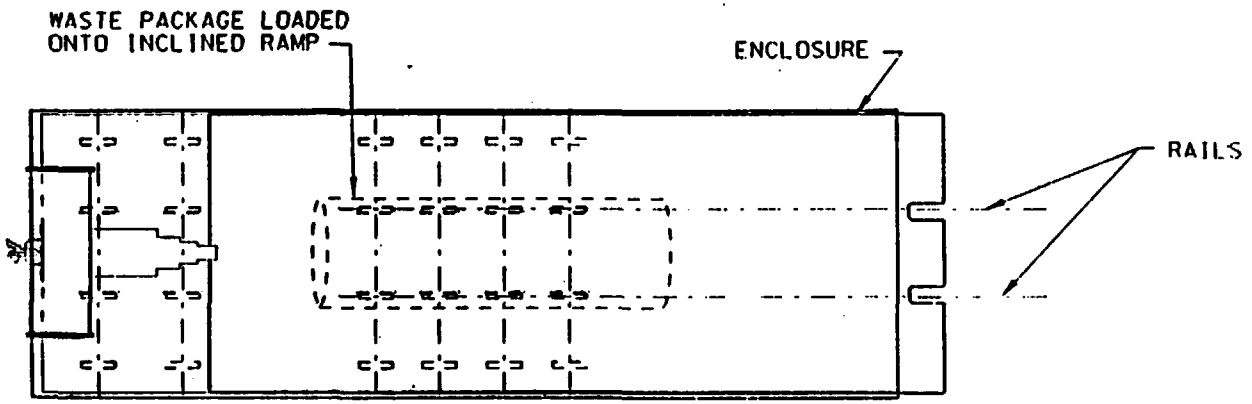

EMPLACEMENT DRIFT
HEAVY-DUTY FORK LIFT CHASSIS.
TEMPORARY ROADWAY FILL
GANTRY TRACKS
HEAVY-DUTY HYDRAULIC SHEAR



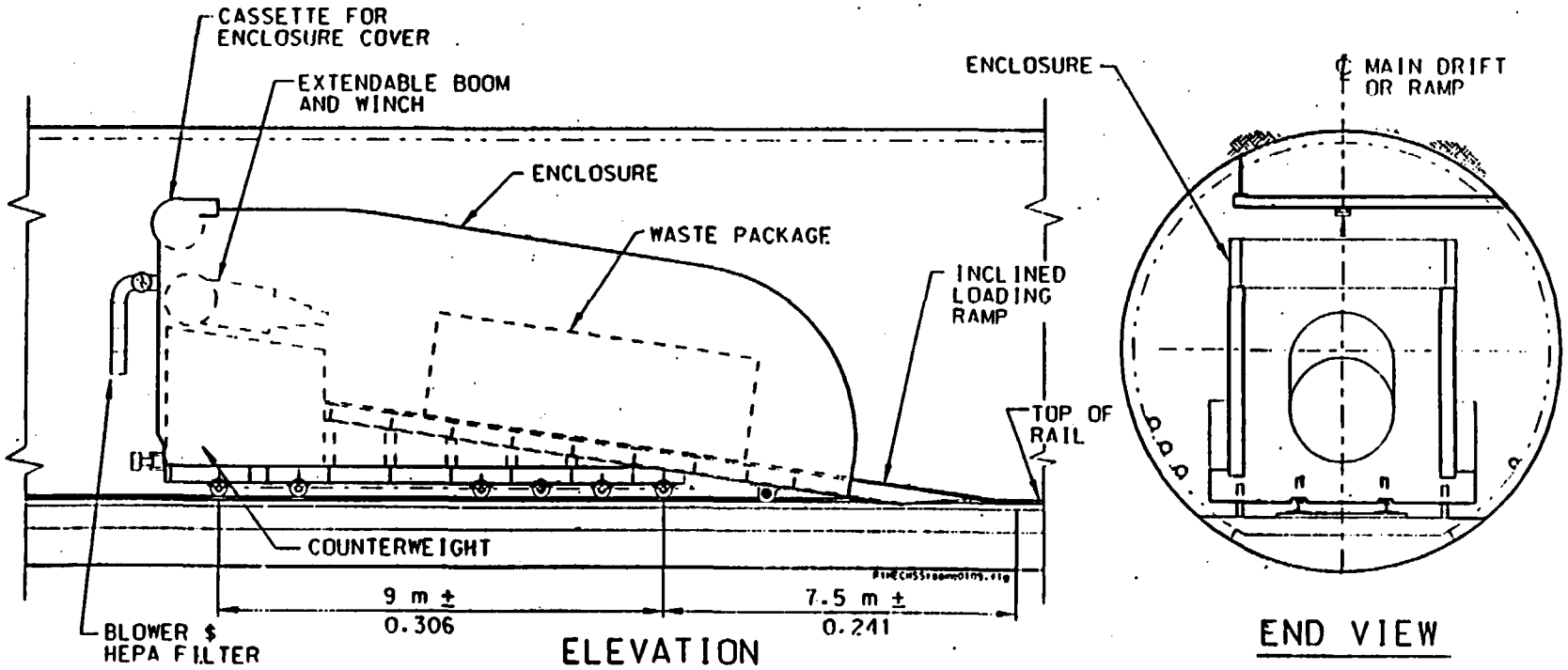
PLAN VIEW



SIDE VIEW



PLAN



ELEVATION

END VIEW

Remaining Resolution Items

- DBE Study to identify events with a potential to disrupt normal retrieval operations. FY97 & 98
- Design analyses to develop methodologies and equipment for handling off-normal situations. FY97 & 98

Plan To Close Issue

- The systems engineering study will describe the strategy for retrieval and analyses will provide a preliminary design of waste package transportation system, the mechanism for loading and unloading waste packages, the emplacement gantry - also used for retrieval, and the subsurface layout and facilities design. Other analyses will address ventilation and retrieval scenarios.

Plan To Close Issue (continued)

- VA design during FY97 and FY98, will develop the strategy for retrieval, and retrieval equipment and remote handling systems.
- VA design will also address retrieval under off-normal conditions, in such cases special recovery equipment may be required. The following table lists the tasks, including analyses and studies, that will be performed to develop a viable retrieval approach.

Title	Description	ECD
Retrievability Strategy Report	A Systems Engineering study to examine retrieval issues and develop a retrievability strategy with sufficient detail to support development of the License Application Plan. The study will provide input to the FY 97 repository retrieval design for Viability Assessment.	4/97
Waste Package Transport and Emplacement Equipment Analysis	Develops system for transporting waste packages from surface to the subsurface emplacement horizon and emplacing in the emplacement drifts. Normal retrieval is considered a reversal of the emplacement process.	8/97
Repository Subsurface Layout Configuration Analysis	Develops subsurface layout configuration for the emplacement drifts, access ramps and mains, and ventilation openings. Layout development addresses constructability, waste package transportation and emplacement, and retrieval.	3/97
Equipment for Waste Package Retrieval	Develops preliminary equipment description for recovery of waste package, waste package transporter, and retrieval gantry involved in off-normal situations.	7/97

Title	Description	ECD
Sub Surface HVAC Analysis	Perform analysis that establishes normal ventilation conditions and system capacities as they apply to normal operations and retrieval processes.	5/97
Airflow Control Analysis	Determine the quantity and type of airflow control devices to be used under normal and retrieval conditions to allow for altered airflow scenarios.	3/97
Near Field Design Analysis	Develop a description of the near field conditions that could be expected during the retrieval process. This provides input for equipment evaluation and performances.	8/97
DBE/Scenario Analysis	Develops the scenarios under which retrieval would be performed. This includes evaluation of package spacing, waste type, temporary redistribution of waste packages, and logistics for the retrieval process.	3/97

Title	Description	ECD
Retrieval Scenario Analysis	Develop the scenarios under which retrieval would be performed. This includes evaluation of package spacing, waste type, temporary redistribution of waste packages, and logistics of the retrieval process.	3/98
RH&C Description Document	Prepare a description of the Remote Handling and Controls equipment that is envisioned for the emplacement equipment. These same controls will be utilized in the retrieval equipment, and will serve as input to the retrieval equipment design.	10/97
Retrieval Drawings and Specifications	Develop drawings and outline specifications that depict and describe the equipment to be utilized under the expected retrieval conditions and scenarios. These products are preliminary in nature, not to be used for procurement of fabrication, and will serve as input to detailed design for the following design phase.	10/97
Refinement of Equipment Description	Enhance the design of the major retrieval equipment items to address remote handling and control, and special handling scenarios developed under RP47500.	6/98

ATTACHMENT 7

FUTURE FOCUS OF QUARTERLY TECHNICAL MEETING

OBJECTIVE: Timely, clear information exchange with NRC

CURRENT STATUS:

PURPOSE: Status construction and testing work in ESF and surface-based testing

SCHEDULE: Quarterly

FORMAT: Videoconference

TITLE: ESF Technical Meeting

PROPOSED ENHANCEMENTS:

PURPOSE:

Provide status and progress made since last update for construction, design, and testing (including surface, subsurface, and laboratory)

Include repository related activities and update of design status

Involve other technical disciplines as necessary (e.g. performance assessment)

SCHEDULE:

Remain quarterly

Flexible agenda to include other areas of design or related topics (e.g. waste package issues, links to and feeds from performance assessment)

Flexible meeting length to allow discussion

FORMAT:

Continue to use videoconferencing, but consider scheduling periodic face-to-face interactions

TITLE:

Change title of meeting to reflect broader technical agenda and change in focus of current work

Rename "Quarterly Technical Meeting"

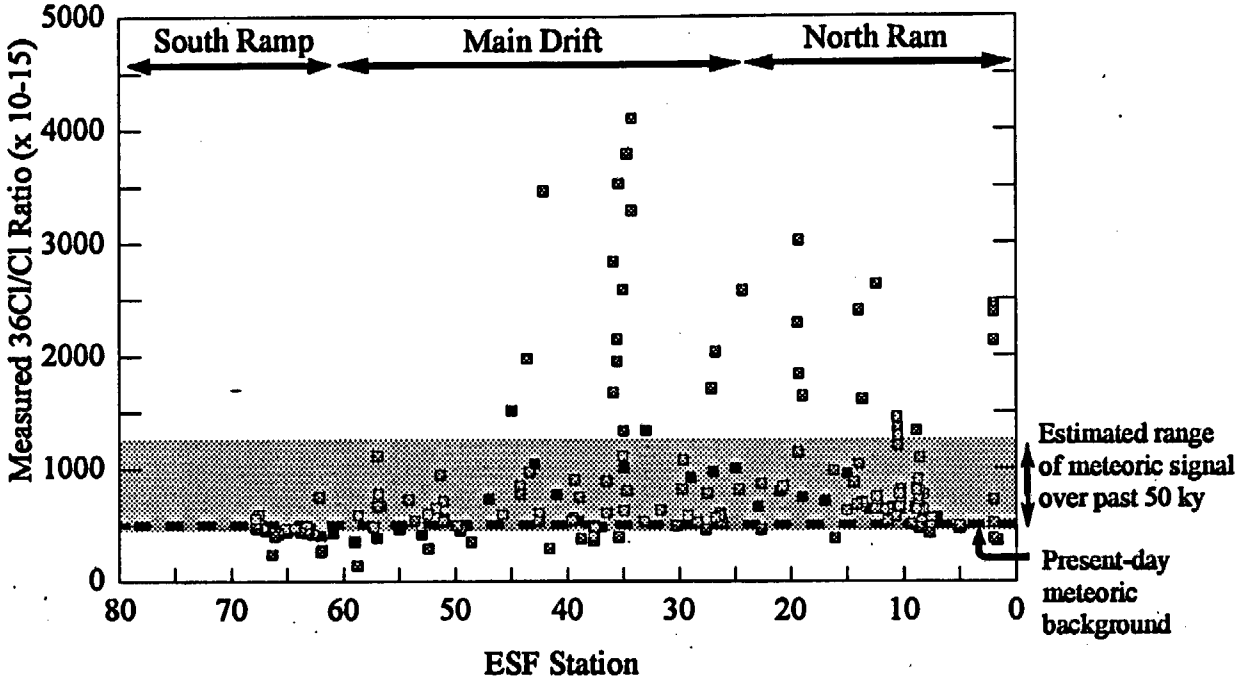


Figure 2. Distribution of 36Cl/Cl ratios measured for rock samples, as a function of distance along the ESF as measured from the North Ramp Portal. ESF stations are marked in 100-m increments. Samples with ratios exceeding 1250 x 10-15 are considered to contain a component of bomb-pulse 36Cl. Data from Appendix B.