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

Received w/Ltr Dated 5/10/89

Reply to:

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MEMORANDUM

DATE: May 10, 1989

FOR: John J. Linehan, Director, Repository Licensing and Quality Assurance Project Directorate (HLPD), Division of High-Level Waste Management

FROM: Paul T. Prestholt, Sr. OR - YMP PTP

SUBJECT: Yucca Mountain Project (YMP) Site Report for the months of March and April, 1989

I. GEOLOGY

A. Prototype Drilling

Because of the Project's difficulty in obtaining air quality permits for prototype drilling on the Nevada Test Site (NTS), it has been decided to test drilling techniques and procedures off site. The prototype drilling program, as presently planned, will be conducted in two phases. The phase 1 activity will be located on a private mining property about 70 miles southwest of Salt Lake City. The phase 2 program depends on the availability of permits. Option one: No permits, drilling program conducted in

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Southern Utah in similar volcanic rocks. Option two: drilling would be conducted on the NTS if permits have been issued.

The objective of the phase 1 drilling program is to develop sample recovery equipment for 8 inch and 12 inch boreholes. Drilling systems involved include:

- Down hole dry coring systems
- Cuttings recovery system
- Blown-to-surface core system

The following is the phase 1 test summary:

- HQ (2.4") and PQ (3.5) coring systems inside 7" and 9 5/8" dual-tube pipe, both normal and reverse circulation with vacuum assist for cuttings removal
- Core recovery by air lift through long radius arm and core catcher system
- Drill/ream with 8"/12" tricone bits in closed and open center configurations
- Testing cuttings sampling system while drilling with 8"/12" hammers

Phase 1 mobilization is scheduled for May 8 with drilling commencing mid-May. Phase 1 is scheduled to last approximately 40 days. The Lang LM 120 drill rig will be used.

The phase 2 location decision and/or the holding of the LM 120 drill rig on standby is required by the end of the contract period.

In the February report it states that the LM 120 draw works are capable of pulling 1,200 pounds. That figure should be 120,000 pounds.

Recommendation: It is recommended that the phase 1 drilling program be observed by NRC technical staff.

B. In March, the NRC technical staff questioned the origin of a resistivity anomaly in Coyote wash (exploratory shaft facility, ESF location). The staff's concern was transmitted to the DOE Yucca Mountain Project Office (YMPO) and I have been informed that a Technical Assessment Review (TAR) has been started to look into the problem. A report is expected in about two months.

C. In a May 20, 1985 letter, the staff indicated the amount and type of rock samples the NRC required from ESF construction. Since the Center will now have the lead in testing such samples, the DOE-YMPO have asked that the staff revisit the May 20 letter to be sure that the sample request is still valid.

II. HYDROLOGY

Due to the stop work order imposed on the USGS, only the maintenance of ongoing activities is being done at this time.

III. GEOCHEMISTRY

There are no new activities to report.

IV. REPOSITORY ENGINEERING - ESF

A. Nuclear Waste Technical Review Board (NWTRB)

On April 11 and 12 the DOE-YMP had a meeting with, and gave a presentation to, the NWTRB. A handout is enclosed.

The presentation to the NWTRB by the DOE-YMP was designed to show the NWTRB (from the handout):

a. 1) How regulatory requirements influence scope of site characterization program

2) How regulatory requirements constrain the site characterization activities

3) How the scientific needs are designed to get information to answer regulatory requirements

4) How engineering must accommodate scientific needs within constraints of regulatory requirements

b. Designed to help NWTRB understand that answers to straight forward engineering questions <u>must</u> (in High-level Waste Program) consider regulatory and scientific needs.

c. As NWTRB becomes more familiar with program, presentations can be more focused to direct questions and answers.

Prior to this meeting, the NWTRB had asked the Project to discuss two questions:

- Why not raise bore ES-2?

- Why not build the repository perimeter drift as part of the ES testing program?

To answer the first question, DOE-YMP discussed the following:

- The desirable features of the ESF construction method chosen, both scientific and regulatory

- Engineering considerations

- Comparison of construction methods
  - Raise boring
  - Raise boring - slashing
  - Raise boring - V mole
  - Blind drilling (wet)
  - Conventional shaft sinking

The conclusion reached by the DOE-YMP was that (from the handout):

- Conventional mining techniques best support the regulatory and scientific needs of site characterization:
  - Routine accessibility to the shaft during construction
  - Limited disturbance of in situ rock conditions with proper use of smooth wall blasting techniques
  - Timely
  - Demonstrated technology

To answer the NWTRB's second question, the Project presented the following (from the handout):

FEASIBILITY OF PERIMETER DRIFT DEVELOPMENT

- To understand feasibility of using current ESF configuration to support repository perimeter drift development, need to consider:
  - Worker safety considerations
  - Possible construction-to-test interference
  - Impact on flexibility for additional exploration

CONSIDERATIONS IN ASSESSING IMPACT OF REPOSITORY PERIMETER DRIFT DEVELOPMENT ON FLEXIBILITY FOR ADDITIONAL EXPLORATION FROM ESF

- Capability of current support systems (muck removal,

ventilation, etc.) to accommodate perimeter drift development without precluding other possible drifting

- Title I study design of possible drifting to south, indicated sufficient flexibility in Title I design to accommodate the 10,000 ft of additional drifting
- Perimeter drift configuration would require further evaluation including schedule requirements but could possibly exceed capacity of muck removal system.

SUMMARY OF PRINCIPAL ENGINEERING CONSIDERATIONS RELATED TO EARLY REPOSITORY PERIMETER DRIFT DEVELOPMENT

- Viability of establishing perimeter drift elevation and grade
  - Without more extensive stratigraphic control
  - Without constraining feasibility of expansion into candidate regions
  - Without refining repository design and related criteria
- Feasibility of using current ESF configuration to support development
  - Increased access/egress requirements (dual heading, or additional accessways) related to worker safety
  - Further consideration of possible construction-to-test interference would be required
  - Possible operation of muck removal system at or near capacity could preclude other exploratory drifting

SUMMARY

- Program for 3-dimensional characterization includes a systematic approach as well as investigation of anomolous features and drifting to investigate structures; the program is designed to be representative
- Expect program as developed to be sufficient and does retain flexibility to expand or refocus activities if warranted

- A perimeter drift early in the site characterization program could constrain repository layout
- Improved data base could indicate need for additional exploratory drifting (perhaps coincident with mains, drifts, perimeter drifts) or indicate viability of perimeter drift
- Repository design concepts should include development plans that could utilize early perimeter, mains, or access drifts

CONCLUSION

Considering:

1. The conceptual nature of the current layout
2. The need to limit the extent of excavations
3. The need to limit impacts to the site
4. The need to develop a representative three-dimensional description of the site

A perimeter drift does not appear to be warranted at this time.

Information from the Site Characterization Program will help define the repositiory boundaries and may warrant additional drifting, perhaps a perimeter drift, at a future date.

At the conclusion of the discussions concerning the feasibility of raise boring at least one shaft and of constructing the perimeter drift in conjunction with the ESF, it was decided that the DOE-YMP would conduct additional studies to determine the possible benefit to the program of raise boring and that the construction of the perimeter drift with the ESF is not feasible.

Five key questions were identified that should be addressed early in site characterization (from the handout):

1. How many times & where should Ghost Dance Fault be penetrated?
2. How do we gain confidence that we have not missed a major

structure, or site characteristic, if we only do limited excavations?

3. Where could surface based studies occur that would help determine where to drift next?
4. What are our contingency plans for dealing with unexpected conditions?
5. When is the best time to undertake major E-W or N-S drifting in repository block?

B. Exploratory Shaft Facility status

- The OK to start Title II design work was received from DOE-Hq on April 17.

- Project office letter to the Architect Engineers (AEs) was issued April 17.

- QA audits of the AEs (Holmes and Narver and Fenix and Scisson) have been successfully completed.

There are still a number of concerns expressed by the NRC staff concerning the Title II design process as proposed by the DOE-YMP. These concerns are detailed in the May 4 memo from J. Kennedy, Section Leader, HLPD to R. Browning, Director, DHLWM.

V. LICENSING AND DOE-NRC INTERACTIONS

A. DOE-YMPO has asked for guidance concerning validation and verification (V and V) of proprietary computer software used by contractors to the program. The specific case concerns data acquisition and processing software developed by geophysical contractors such as Schlumberger, Birdwell and Lane Wells who perform geophysical down hole logging services. Also concerned are any geophysical contractors who might perform seismic, gravity, magnetometer or resistivity surveys for the program.

The geophysical contracting business is highly competitive and the various firms have developed complex acquisition and data

reduction computer programs designed to maximize each firm's competitive edge. In most cases, these firms are unwilling to subject their software to a V and V process.

There are a number of ways this problem can be handled. It's been suggested to DOE-YMPO that the Project develop a procedure that best fits the specific problem at the Test Site and then discuss it with the appropriate NRC staff.

B. The question has been raised concerning the participation of MSHA in the ESF design process. DOE has an MOU with MSHA (HLPD has a copy) and Mr. Don Schlick, DOE-YMPO, is working with Mr. Rod Brieland of the local MSHA office.

MSHA rules will be followed in the design and construction process but, MSHA will have no enforcement authority. However, MSHA personnel have been working with the design team. At this time, everyone seems satisfied with the arrangement.

C. During this report period there have been four trips to the Test Site with staff from White Flint. Of particular interest was the tour for Chairman Zech and three of his staff, NMSS Office Director Robert Bernero and HLPD Director John Linehan.

The tour included a visit to "G" tunnel, the Carpet Bag Fault, Sedan Crater, the Sample Management Facility and Yucca Mountain. I personally enjoy conducting tours of the HLW Program activities at the Test Site for NRC Senior Management personnel and I hope we will have more such tours in the future.

D. Enclosed is a proposed outline for the SCP Semiannual Progress Report (SPR) and draft preparation schedule. The document is expected to have four chapters, each about 50 pages long. The document will summarize data obtained between April

15, 1988 and April 15, 1989. The draft schedule has camera ready copy to the printer on June 19, 1989.

E. Public hearings on the SCP were held in Amargosa Valley on March 20, Las Vegas on March 21, and in Reno on March 23. A memo concerning these meetings has been sent to the Director, HLPD.

F. Two new Technical Project Officers (TPO) have been appointed as of April 17. Dr. Les Jardine is now TPO for Lawrence Livermore National Laboratory (LLNL) and Mr. John Nelson is now TPO for SAIC.

VI. NRC - STATE OF NEVADA INTERACTIONS - None.

VII. GENERAL

Meetings attended:

March 14 Meeting with Ted Petrie et al on ESF construction start

March 15 Meeting with Jim Blaylock and Nancy Voltura concerning validation and verification of proprietory computer software programs

March 20 Public SCP hearing, Amargosa Valley

March 21 Public SCP hearing, Las Vegas

March 23 Test Site tour, Jim Conway, HLPD

March 29 Mr. Jay Smith and Mr. Tom Colandrea, EEI. Memo concerning this meeting to Director, HLPD

April 3 ASQC meeting, Las Vegas
to April 5

April 10 Meeting with Ed Wilmot, Deputy Manager, YMPO with John Linehan

April 11 Test Site tour with Commission Chairman Zech and staff

April 12 DOE - NWTRB meeting

April 17 Test Site, John Peshel, HLGP

April 18 Meeting with Ted Petrie et al

April 21 TPO-Project Manager meeting

April 24 Meeting with Ted Petrie et al

April 24 Meeting with Ed Wilmot

April 25 CNWRA introduction meeting

April 26 Test Site tour with CNWRA representatives

April 27 Mr. Dennis Serig, NMSS/IMOB with Mr. John Shaler, SAIC and Mr. Dick Bullock, Fenix and Scisson

cc: With enclosures: K. Stablein, R. E. Adler, J. E. Latz
Without enclosures: C. P. Gertz, R. R. Loux, M. Glora, D. M. Kunihiro, R. E. Browning, G. Cook, L. Kovach, S. Gagner, K. Turner, H. Thompson, H. Denton, R. Benero

Enclosures: 4/21/89 TPO Meeting (Jerry King)-Status Report on Plan for Implementing Recommendations from ESF Title I design Acceptability Analysis and Exploratory Shaft Current Status (John Robson); NWTRB Meeting 4/11-12/89, Agenda, Approach, and Results (M. B. Blanchard); Prototype Drilling, etc.; SPR Outline

TPO MEETING

STATUS REPORT ON PLAN FOR IMPLEMENTING RECOMMENDATIONS FROM ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS

PRESENTED BY

JERRY L. KING

APRIL 21, 1989

UNITED STATES DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE / YUCCA MOUNTAIN PROJECT OFFICE

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Attachment 3

PURPOSE / FEATURES OF DAA IMPLEMENTATION PLAN, CONT.

- IDENTIFY WHEN & HOW DAA REPRESENTATIVES WILL INTERFACE WITH COGNIZANT TPO AND A/E--EARLY COMMUNICATION ESSENTIAL
- PROVIDE SCHEDULE, TIES TO ESF NETWORK
- MAP DAA RECOMMENDATIONS TO APPROPRIATE ESF PHYSICAL SUBSYSTEM ELEMENTS AND SNL PERFORMANCE-ANALYSIS PACKAGES
- IMPLEMENTATION PLAN TO BE CIRCULATED FOR INFORMAL REVIEW & COMMENT, SUBMITTED FOR 06-03 REVIEW, AND PUBLISHED AS APPENDIX TO ORIGINAL TECHNICAL ASSESSMENT REVIEW PLAN (CONTROLLED DOCUMENT)

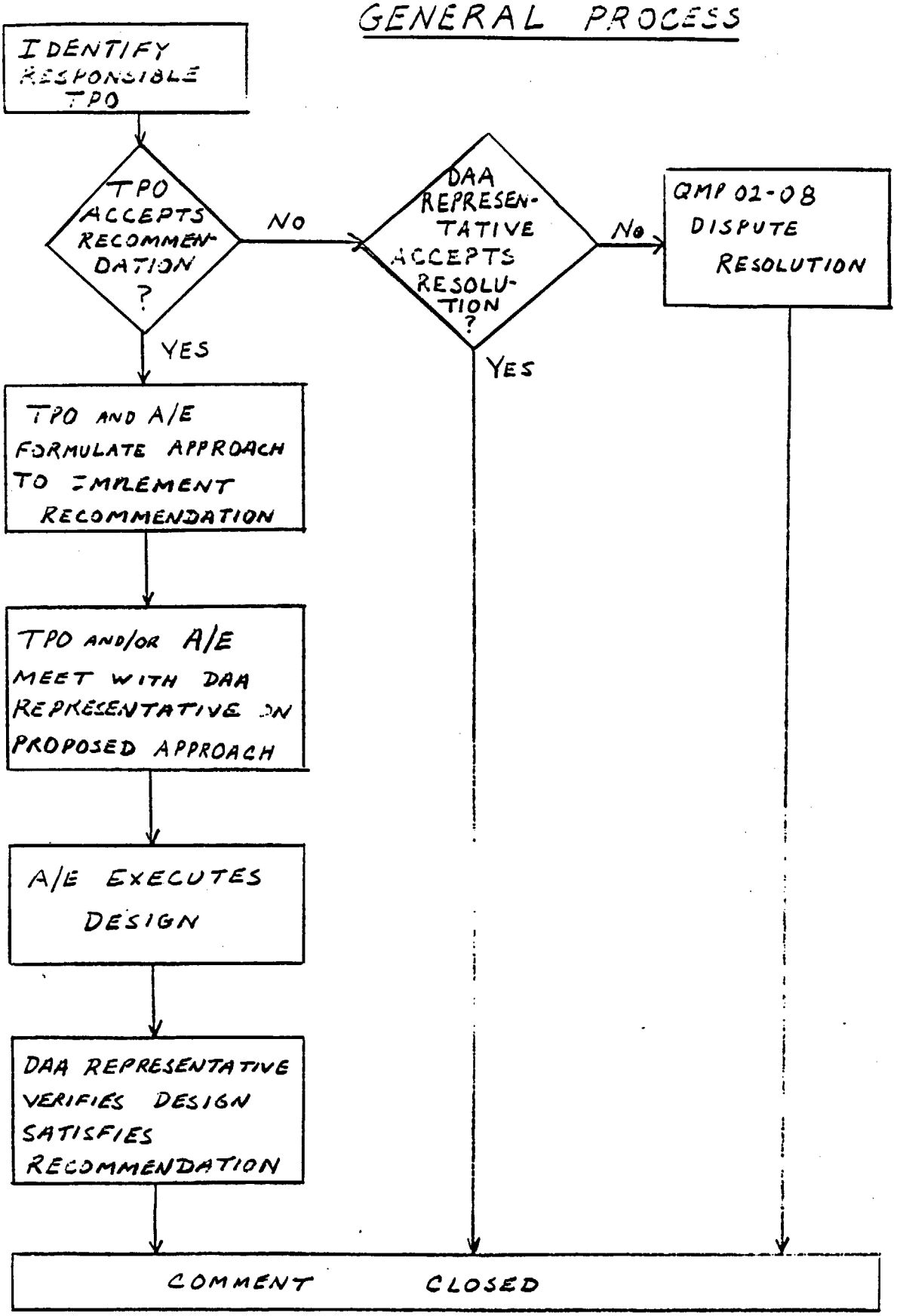
PURPOSE / FEATURES OF DESIGN ACCEPTABILITY ANALYSIS (DAA) IMPLEMENTATION PLAN

- PROVIDE MEANS OF CLOSING OUT 54 DAA COMMENTS / RECOMMENDATIONS
- IN ACCORDANCE WITH QMP-02-08
- IDENTIFY RESPONSIBLE TPO'S
- PROVIDE SYSTEM TO TRACK PROGRESS IN RESOLVING DAA COMMENTS
- PROVIDE FOR VERIFICATION OF ACTIONS TAKEN IN RESPONSE TO DAA RECOMMENDATIONS
- DESCRIBE QA RECORDS TO BE PRODUCED & RETAINED

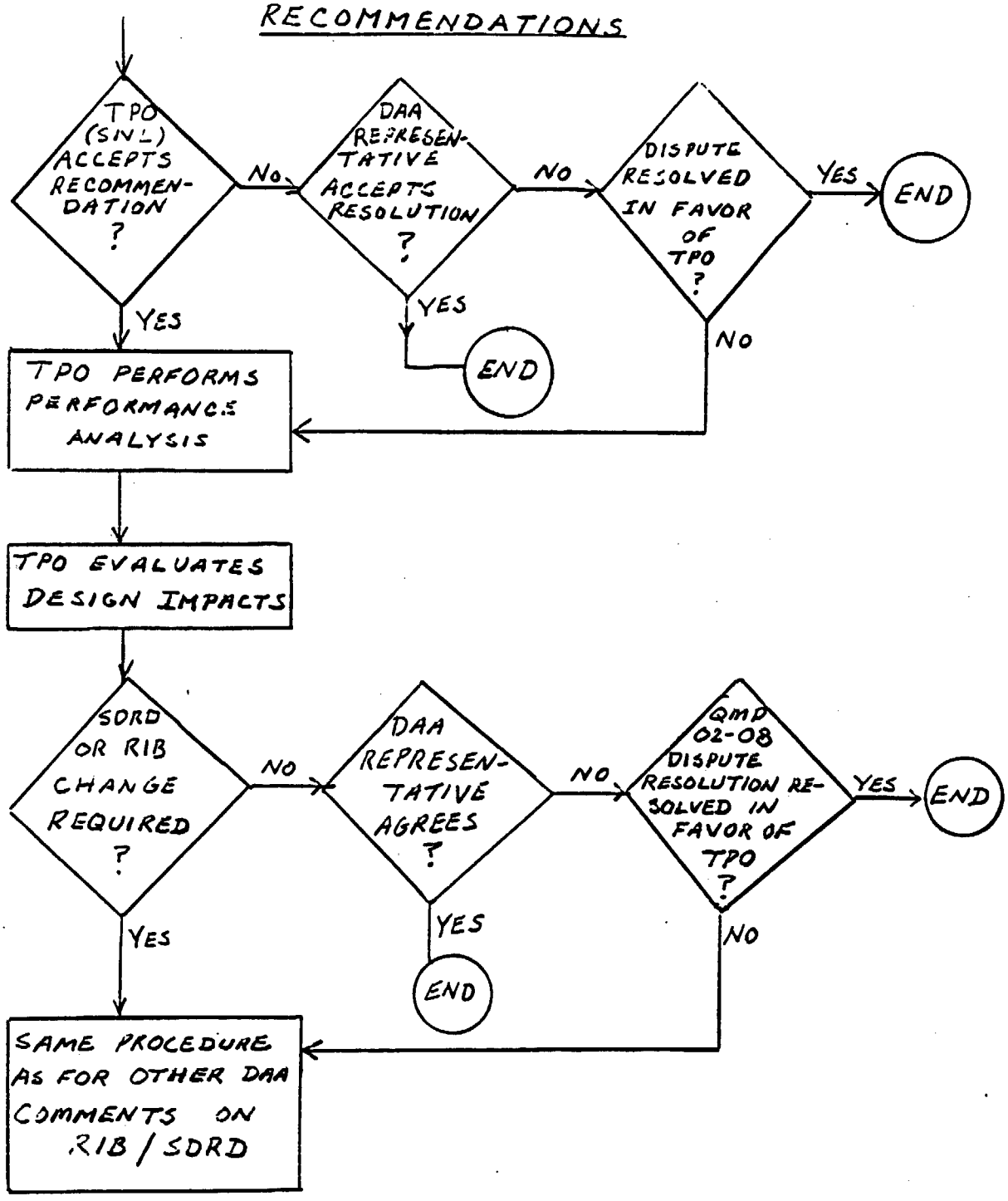
BREAKDOWN OF RECOMMENDED ACTIONS

RECOMMENDED ACTION	QUANTITY
PERFORM PERFORMANCE-RELATED ANALYSIS	27
PUT DATA IN RIB	2
PUT REQUIREMENTS IN SDRD	≈13
MODIFY PROCEDURES, SPECIFICATIONS, DRAWINGS, ACCEPTANCE CRITERIA	≈8
REVIEW ALL TESTING PROCEDURES	2
MINOR CORRECTIONS TO SCP, CDR	2

GENERAL PROCESS



DETAILED EXAMPLE: PERFORMANCE ANALYSIS RECOMMENDATIONS



EXPLORATORY SHAFT

CURRENT STATUS

JOHN ROBSON

Attachment 6

ESF STATUS

- BUDGET VALIDATION
  - DRY RUN AT HQ ON APRIL 25, 1989
  - FORMAL PRESENTATION TO MA ON MAY 2-3, 1989 IN LAS VEGAS
- WAS
  - PRESENTED AT HQ ON APRIL 28, 1989

ESF STATUS

- TITLE II
  - RECEIVED OK FROM HQ ON APRIL 17, 1989 IN THE A.M.
  - PROJECT OFFICE LETTER TO AEs April 17, 1989 IN THE P.M.
- QA AUDITS
  - F&S AUDIT LAST WEEK WENT WELL
  - H&N AUDIT NEXT WEEK

ESF STATUS

- SAFETY ANALYSIS
  - SAFETY ANALYSIS WILL BE PREPARED FOR ESF
  - CURRENTLY WORKING WITH NVO AND HQ STAFF TO REFINE THE SCOPE
  - PROJECT OFFICE LEVEL SAFETY AND HEALTH PROGRAM IS BEING FORMULATED
- HOIST CONSULTANT REPORT
  - SECOND CONSULTANTS REPORT DUE TODAY
- ES BRANCH IS SUPPORTING NTS POWER SUPPLY SYSTEM STUDY

ESF STATUS

- PRESENTATION MADE TO THE INSTITUTE OF SHAFT DRILLING TECHNOLOGY APRIL 20, 1989
- READINESS REVIEW TEAM WORK IS UNDER WAY FOR START OF ESF CONSTRUCTION
- ADDITIONAL SITE ROCK AND SOILS PROPERTIES NEEDED FOR EARLY ES DESIGN IS BEING ADDRESSED BY THE AEs, PROJECT OFFICE, AND USGS/BR

MEETING WITH THE NWTRB ON APRIL 11 &12, 1989

AGENDA, APPROACH, AND RESULTS

by

M. B. BLANCHARD

o PRESENTATION FORMAT

A) DESIGNED TO SHOW NWTRB:

1) HOW REGULATORY REQUIREMENTS INFLUENCE SCOPE OF CHARACTERIZATION PROGRAM
2) HOW REGULATORY REQUIREMENTS CONSTRAIN THE CHARACTERIZATION ACTIVITIES
3) HOW THE SCIENTIFIC NEEDS ARE DESIGNED TO GET INFORMATION TO ANSWER REGULATORY REQUIREMENTS
4) HOW ENGINEERING MUST ACCOMMODATE SCIENCTIFIC NEEDS WITHIN CONSTRAINTS OF REGULATORY REQUIREMENTS

B) DESIGNED TO HELP NWTRB UNDERSTAND THAT ANSWERS TO STRAIGHT FORWARD ENGINEERING QUESTIONS MUST (IN HIGH LEVEL WASTE PROGRAM) CONSIDER REGULATORY AND SCIENTIFIC NEEDS

C) AS NWTRB BECOMES MORE FAMILIAR WITH PROGRAM, PRESENTATIONS CAN BE MORE FOCUSED TO DIRECT QUESTIONS AND ANSWERS

AGENDA
FOR THE
NUCLEAR WASTE TECHNICAL REVIEW BOARD
BRIEFING ON APRIL 11-12, 1989

by

MAX BLANCHARD
DIRECTOR, REGULATORY AND SITE EVALUATION DIVISION
YUCCA MOUNTAIN PROJECT OFFICE

AGENDA

TUESDAY, APRIL 11, 1989

9:00	WELCOME	C. GERTZ
9:10	INTRODUCTORY REMARKS	T. ISAACS & D. DEERE
9:30	REVIEW AGENDA	M.BLANCHARD
10:00	KEY REGULATORY CONCERNS - HIGHLIGHTED FOUR KEY REGULATORY ASPECTS: 60.2, 60.15, 60.140, AND 60.151	R. STEIN
11:15	LUNCH	

APPROACH TO EXPLORATORY SHAFT CONSTRUCTION AND ALTERNATIVES CONSIDERED

12:30 REGULATORY CONSIDERATIONS — M. BLANCHARD

- REGULATORY ASPECTS CONSIDERED BY PROJECT RELATED TO CONSTRUCTION METHOD SELECTION. ADDRESS REG. GUIDES AND STAFF POSITIONS

1:00 SCIENTIFIC CONSIDERATIONS — W. WILSON

- UZ MODELS, AND NEEDS FROM ESF THAT INFLUENCE ESF. CONSTRUCTION
- IMPACTS OF WATER AND BLAST DAMAGE ON TESTING.

2:30 BREAK

2:45	ENGINEERING CONSIDERATIONS - SCIENCE NEEDS THAT ARE DISCRIMINATORS IN CONSTRUCTION METHOD SELECTION - ATTRIBUTES OF FIVE ALTERNATIVE METHODS	K. BEALL
3:45	CONCLUSIONS	M. BLANCHARD
4:00	FURTHER DISCUSSION	ALL
4:30	ADJOURN	

WEDNESDAY, APRIL 12, 1989

8:00	REGULATORY CONSIDERATIONS - REGULATORY ASPECTS CONSIDERED BY PROJECT RELATED TO INCORPORATING A PERIMETER DRIFT AS PART OF SITE CHARACTERIZATION	M. BLANCHARD
8:30	SCIENTIFIC AND TESTING CONSIDERATIONS - BACKGROUND INFORMATION: PRIMARY EXPLORATION AREA, ES LOCATION, EXISTING BOREHOLES - 3-D ASPECTS OF SURFACE AND ES TEST PROGRAMS AND INTEGRATION/REPRESENTATIVENESS	M. VOEGELE
10:00	BREAK	

10:15	ENGINEERING CONSIDERATIONS - VIABILITY OF INTEGRATION OF EARLY PERIMETER DRIFT INTO REPOSITORY: STRUCTURE, STRATIGRAPHY, PRIMARY AREA, GRADES, DRIFT LENGTH, SAFETY	J. TILLERSON
11:30	CONCLUSIONS	M. BLANCHARD
11:45	FURTHER DISCUSSION	ALL
12:30	ADJOURN	

DECISION TO CONSTRUCT THE ESF BY CONVENTIONAL METHODS; BENEFITS OF RAISE BORING

INTRODUCTION

THE METHOD USED FOR CONSTRUCTION OF THE ESF MUST:

- o LIMIT SITE IMPACTS
- o SUPPORT SITE CHARACTERIZATION INFORMATION NEEDS

CONSIDERATIONS INCLUDE:

- o REGULATORY CONSTRAINTS AND GUIDANCE
- o SCIENTIFIC NEEDS FOR CHARACTERIZATION
- o ENGINEERING/DESIGN

SUMMARY

IN SELECTION OF THE SHAFT CONSTRUCTION METHOD, DOE CONSIDERED REGULATORY CONSTRAINTS IN THE CONTEXT OF:

(1) THE NEED TO PROTECT THE SITE

(2) THE NEED TO OBTAIN SITE CHARACTERIZATION AND LICENSE APPLICATION INFORMATION

(3) THE NEED TO USE REASONABLY AVAILABLE TECHNOLOGY

CONSTRUCTING REPOSITORY PERIMETER DRIFT AS PART OF SITE CHARACTERIZATION

INTRODUCTION

- o ESF CONSTRUCTION AND TESTING BEGINS BEFORE SUBMITTAL OF A LICENSE APPLICATION
  - CHARACTERIZE SITE
  - PROVIDE DATA FOR LICENSE APPLICATION
- o OBJECTIVES AND SCOPE OF SITE CHARACTERIZATION IDENTIFIED IN: NWPA, 10 CFR 60, AND 10 CFR 960
- o SITE CHARACTERIZATION, INCLUDING SURFACE AND SUBSURFACE ACTIVITIES, IS FIRST PHASE IN LICENSE PROCESS

THE EXTENT OF ESF EXCAVATION CONSIDERS

(1) THE NEED TO OBTAIN REPRESENTATIVE DATA

(2) THE NEED TO ACCOMMODATE GROA DESIGN AND CONSTRUCTION, INCLUDING SPECIFIC DESIGN REQUIREMENTS IN 10 CFR 60

(3) PHASING OF MAJOR CONSTRUCTION IN TERMS OF THE LICENSING PROCESS

SUMMARY

THE SITE CHARACTERIZATION PROGRAM IS COMPOSED OF A COMPREHENSIVE SURFACE AND SUBSURFACE EXPLORATION PROGRAM DESIGNED TO GATHER REPRESENTATIVE (BOUNDING) INFORMATION WHILE

(1) MAINTAINING FLEXIBILITY

(2) ADDRESSING CONCERNS ON FEATURES OF INTEREST

(3) LIMITING POTENTIAL SITE AND GROA DESIGN IMPACTS

(4) RECOGNIZING LICENSING PROCESS LIMITATIONS AND,

(5) PROVIDING NECESSARY INFORMATION FOR LICENSING

ACTION ITEMS FROM APRIL 11 & 12 MEETING:

1. DAA
2. ANNOTATED SCP 8.4
3. SCOTT & BONK MAP
4. SPA
5. NRC COMMENTS ON SCP/CD & DOE RESPONSES
6. SBIP & SITE ATLAS
7. SCP TO DR. CORDING
8. ADDITIONAL STUDIES ABOUT ESF CONSTRUCTION METHOD: CAN RAISE BORING BE A BENEFIT TO PROGRAM?

OTHERS: COMPATIBILITY OF SURFACE BASED & UNDERGROUND INVESTIGATIONS & STRATEGY FOR EXPANDING DRIFTING

KEY QUESTIONS THAT WILL NEED TO BE ADDRESSED EARLY IN SITE CHARACTERIZATION

1. HOW MANY TIMES & WHERE SHOULD GHOST DANCE FAULT BE PENETRATED?
2. HOW DO WE GAIN CONFIDENCE THAT WE HAVE NOT MISSED A MAJOR STRUCTURE, OR SITE CHARACTERISTIC, IF WE ONLY DO LIMITED EXCAVATIONS?
3. WHERE COULD SURFACE BASED STUDIES OCCUR THAT WOULD HELP DETERMINE WHERE TO DRIFT NEXT?
4. WHAT ARE OUR CONTINGENCY PLANS FOR DEALING WITH UNEXPECTED CONDITIONS?
5. WHEN IS THE BEST TIME TO UNDERTAKE MAJOR E-W OR N-S DRIFTING IN REPOSITORY BLOCK?

APRIL 19 HQ/PO MEETING ABOUT FUTURE INTERACTIONS BETWEEN DOE & NWTRB

- LESSONS LEARNED

  - MEETING WENT WELL: EFFECTIVE, RESPONSIVE, PROFESSIONAL
  - COULD IMPROVE ON:
    - ESTABLISH OVERALL THEME & STAY WITH IT
    - KEEP BRIEFINGS CONCISE
    - AVOID HASTILY DEVELOPED POSITIONS
    - LAYOUT OPTIONS CLEARLY
    - INSURE PROS & CONS ARE BALANCED
    - TAKE BRIEF MINUTES FOR INTERIM USE
    - ESTABLISH A MORE FORMAL PROTOCOL FOR PLANNING, PREPARATION, REHEARSALS, BRIEFINGS & FOLLOWUP

APRIL 19 HQ/PO MEETING ABOUT FUTURE INTERACTIONS BETWEEN DOE & NWTRB

- o DEVELOP FORMAL TRACKING SYSTEM
  - ESTABLISH EARLY ACTION ITEM LIST & MONITOR PROGRESS (INCLUDE: WHAT, WHO WHEN)
  - REVIEW TRANSCRIPTS FOR IMPLICIT & EXPLICIT ACTIONS
  - RESPOND TO BOARD REQUESTS FOR INFORMATION
  - ADDRESS BOARD'S RECOMMENDATIONS

- o FUTURE INTERACTIONS WITH NWTRB
  - MAY 15-17 PERFORMANCE ASSESSMENT BRIEFING
  - JUNE 26-28 BRIEFINGS BY STATE, YMP, 1 DAY TOUR OF SITE

DECISION TO CONSTRUCT THE ESF BY CONVENTIONAL METHODS; BENEFITS OF RAISE BORING

INTRODUCTION

THE METHOD USED FOR CONSTRUCTION OF THE ESF MUST:

- o LIMIT SITE IMPACTS
- o SUPPORT SITE CHARACTERIZATION INFORMATION NEEDS

CONSIDERATIONS INCLUDE:

- o REGULATORY CONSTRAINTS AND GUIDANCE
- o SCIENTIFIC NEEDS FOR CHARACTERIZATION
- o ENGINEERING/DESIGN

GENERAL SCIENTIFIC CONSIDERATIONS RELATED TO ESF CONSTRUCTION METHOD

- PRINCIPAL REASON FOR CONSTRUCTING ESF IS TO OBTAIN SITE CHARACTERIZATION DATA

- THEREFORE, THE CONSTRUCTION METHOD SHOULD OPTIMIZE THE ABILITY TO:
  - MAKE OBSERVATIONS OF AMBIENT IN SITU CONDITIONS, PROCESSES, AND RELATIONSHIPS
  - OBTAIN RELIABLE SAMPLES FOR ANALYSIS

- TO HELP MEET SCIENTIFIC OBJECTIVES, CERTAIN FEATURES OF AN ESF CONSTRUCTION METHOD ARE DESIRABLE:
  1. DIRECT ACCESS TO SHAFT DURING CONSTRUCTION
  2. MINIMAL DISTURBANCE OF AMBIENT SITE CONDITIONS
  3. ABILITY TO MONITOR MAGNITUDE AND EXTENT OF DISTURBANCE

NWTWILS5P.AII/4-11,12-89

Attachment 5

DESIRABLE FEATURES OF ESF CONSTRUCTION METHOD

1. ACCESS TO SHAFT DURING CONSTRUCTION

- DIRECT, FREQUENT, PROMPT
- EVALUATE PERCHED WATER
- OBTAIN ROCK SAMPLES
- CONDUCT SHAFT-WALL MAPPING
- MONITOR DISTURBANCE
  - POTENTIAL ADVERSE EFFECTS ON SITE CONDITIONS
  - MECHANICAL RESPONSE OF ROCK MASS

DESIRABLE FEATURES

(CONTINUED)

2. MINIMIZE CONSTRUCTION-RELATED DISTURBANCE OF SITE CONDITIONS

- DISTURBANCE OF <u>HYDROGEOLOGIC</u> CONDITIONS
  - POTENTIAL EFFECTS; ROCK-MASS RESPONSE
  - ANALYSES
  - CONCLUSIONS
- DISTURBANCE OF <u>GEOCHEMICAL</u> CONDITIONS
  - POTENTIAL EFFECTS
  - ANALYSES AND CONCLUSIONS

DESIRABLE FEATURES OF ESF CONSTRUCTION METHOD

3. ABILITY TO MONITOR DISTURBANCES

- NEED TO VERIFY MODELS AND CHECK PREDICTIONS
- IN ES HYDROLOGIC TESTS, NEED TO ACCOUNT FOR DISTURBANCES
- REQUIRES PRE- AND POST-CONSTRUCTION DATA
- CONDUCT CONSTRUCTION-PHASE MONITORING TESTS

SUMMARY

- SCIENTIFIC CONSIDERATIONS EXERT A MAJOR INFLUENCE ON SELECTION OF SHAFT-CONSTRUCTION METHOD AT YUCCA MOUNTAIN

- UZ SETTING AT YUCCA MOUNTAIN INFLUENCES SPECIFIC INFORMATION NEEDS

- GENERAL SCIENTIFIC REQUIREMENTS:

  - MAKE HYDROGEOLOGIC AND GEOCHEMICAL OBSERVATIONS
  - OBTAIN RELIABLE ROCK AND WATER SAMPLES
  - HAVE DIRECT ACCESS DURING CONSTRUCTION
  - MINIMIZE CONSTRUCTION-RELATED DISTURBANCES
    * FLUID LOSSES AND ROCK DAMAGE
  - MONITOR DISTURBANCES
    * CHARACTERIZATION, PERFORMANCE
    * MECHANICAL RESPONSE

ENGINEERING CONSIDERATIONS

II. CONSTRUCTION METHOD SELECTION CRITERIA

1. SITE CHARACTERIZATION
2. CONSTRUCTIBILITY
3. HEALTH AND SAFETY
4. ENVIRONMENT
5. SCHEDULE

ENGINEERING CONSIDERATIONS

II. CONSTRUCTION METHOD SELECTION CRITERIA (CONTINUED)

A. DISCRIMINATING CRITERIA

1. SITE CHARACTERIZATION
   - ROCK OBSERVATION
   - HYDROLOGIC OBSERVATION
   - ACCESS TO MULTIPLE HORIZONS
   - SAMPLE COLLECTION
   - ROCK DAMAGE
   - FLUID LOSSES
2. CONSTRUCTIBILITY
   - WATER AND GROUND CONTROL
   - UNEXPECTED CONDITIONS
   - OVERBREAK
5. SCHEDULE
   - CONSTRUCTION TIME

II. CONSTRUCTION METHOD

B. OTHER IMPORTANT CRITERIA

2. CONSTRUCTIBILITY

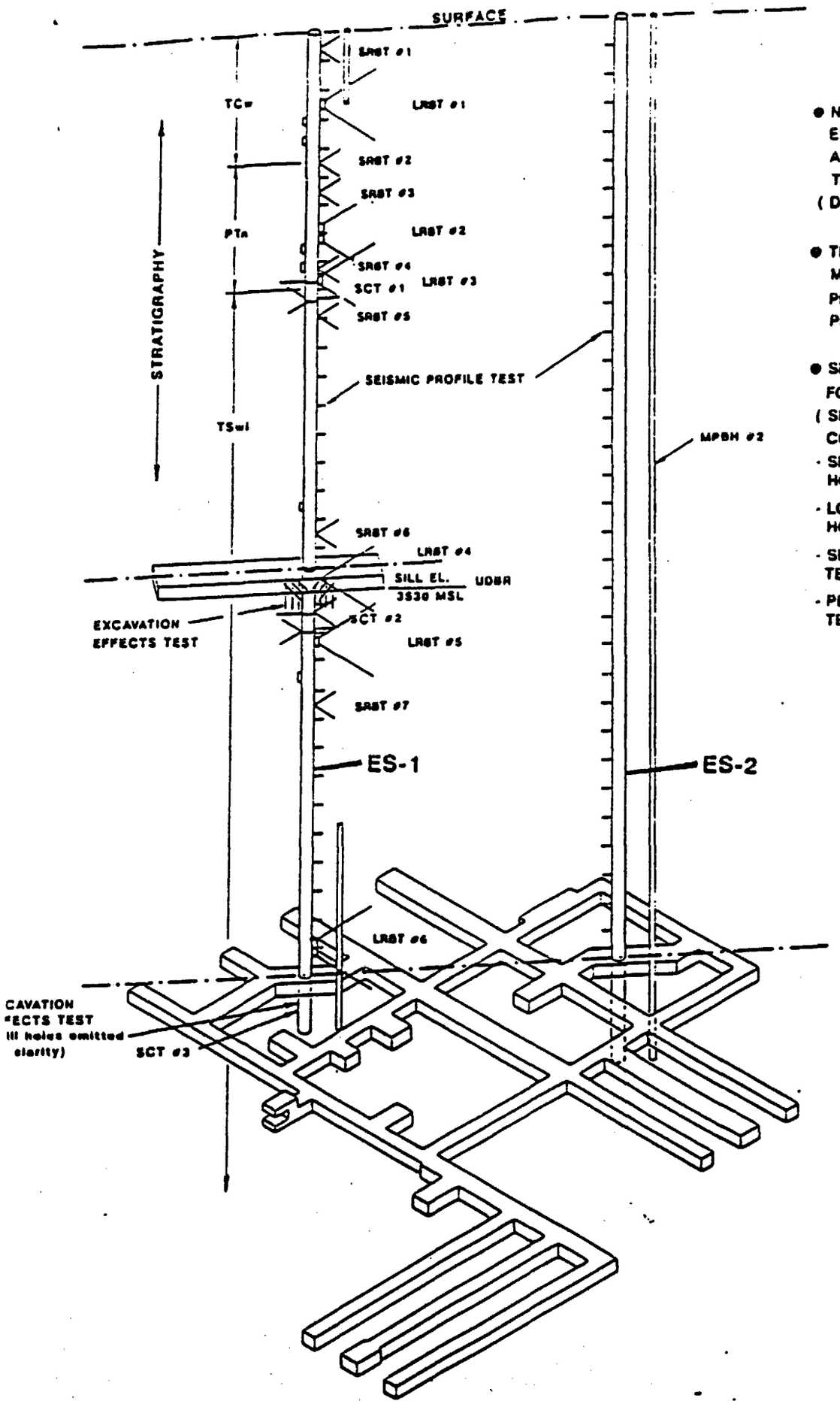
- SHAFT
- EXPERIENCE

3. HEALTH AND SAFETY

- INDUSTRIAL HAZARDS
- WORKING CONDITIONS

4. ENVIRONMENTAL

- RECLAMATION
- SURFACE DISTURBANCE
- EFFLUENT CONTROL
- AIR QUALITY



- NO. OF LANDINGS IN ES-1 REQ'D. TO ACCESS & SUPPORT TESTS----20 (DOES NOT INCLUDE UDBR & MTL)
- TIME REQUIRED FOR MAPPING INCLUDING PREPARATION - 3 HOURS PER 2 METER INTERVAL
- SHAFT TIME REQUIRED FOR TEST CONSTRUCTION (SINKING STOPS DURING CONSTRUCTION)
  - SHORT RADIAL BORE HOLES TEST - 2 WEEKS
  - LONG RADIAL BORE HOLES TEST - 2 WEEKS
  - SHAFT CONVERGENCE TEST - 2 WEEKS
  - PERCHED WATER TEST - INDEFINITE

SHAFT CONSTRUCTION PHASE TEST LOCATIONS

COMPARISON OF CONSTRUCTION METHODS

RAISE BORING

- MINIMAL ROCK DAMAGE
- MINIMAL OVERBREAK IN GOOD GROUND CONDITIONS
- DOESN'T PROVIDE EARLY OR CONTINUED ACCESS FOR SITE CHARACTERIZATION ACTIVITIES DURING SHAFT CONSTRUCTION
- DOESN'T ALLOW COLLECTION OF BULK SAMPLES
- OFFERS NO CONTROL FOR INFLOWING WATER AND SLOUGHING GROUND
- MAY NOT DETECT UNEXPECTED CONDITIONS QUICKLY
- CANNOT START ES-2 UNTIL ES-1 IS COMPLETED - RESULTS IN A LONGER SHAFT CONSTRUCTION SCHEDULE

COMPARISON OF CONSTRUCTION METHODS

RAISE BORING/SLASHING

- PROVIDES EARLY AND CONTINUED ACCESS FOR SITE CHARACTERIZATION DURING SLASHING
- ALLOWS COLLECTION OF BULK SAMPLES
- SHAFT WILL BE PLUMB AND STRAIGHT
- RAISE BORED HOLE OFFERS NO CONTROL FOR INFLOWING WATER
- AMBIENT HYDROLOGIC CONDITIONS MAY BE COMPROMISED BY INITIAL RAISE BORED HOLE
- MAY NOT DETECT UNEXPECTED CONDITIONS IN THE RAISE BORED HOLE
- OVERBREAK CAN BE LIMITED WITH CONTROLLED BLASTING TECHNIQUES AND TIMELY INSTALLATION OF GROUND SUPPORT
- CANNOT START ES-2 UNTIL ES-1 IS COMPLETED - RESULTS IN A LONGER SHAFT CONSTRUCTION SCHEDULE

COMPARISON OF CONSTRUCTION METHODS

RAISE BORING/V MOLE

- MINIMAL ROCK DAMAGE
- PROVIDES EARLY AND CONTINUED ACCESS FOR SITE CHARACTERIZATION DURING SHAFT CONSTRUCTION
- CAN DETECT, EVALUATE AND RESPOND TO UNEXPECTED CONDITIONS IN THE LARGER BORED HOLE
- MINIMAL OVERBREAK AND TIMELY INSTALLATION OF GROUND SUPPORT
- SHAFT WILL BE PLUMB AND STRAIGHT
- ALLOWS SOME COLLECTION OF BULK SAMPLES
- AMBIENT HYDROLOGIC CONDITIONS MAY BE COMPROMISED BY INITIAL RAISE BORED HOLE
- RAISE BORED HOLE OFFERS NO CONTROL FOR INFLOWING WATER
- MAY NOT DETECT UNEXPECTED CONDITIONS IN THE RAISE BORED HOLE
- CANNOT START ES-2 UNTIL ES-1 IS COMPLETED - RESULTS IN A LONGER SHAFT CONSTRUCTION SCHEDULE

COMPARISON OF CONSTRUCTION METHODS

BLIND DRILLING (WET)

- MINIMAL OVERBREAK IN GOOD GROUND CONDITIONS
- DOESN'T PROVIDE EARLY OR CONTINUED ACCESS FOR SITE CHARACTERIZATION
- DOESN'T ALLOW COLLECTION OF BULK SAMPLES
- HYDROFRACTURING FROM THE DRILLING MUD COULD DAMAGE THE ROCK
- DRILLING FLUID LOSSES COULD ADVERSLY IMPACT SITE CHARACTERIZATION AND REPOSITORY PERFORMANCE
- OFFERS LIMITED CONTROL FOR WATER INFLOW AND SLOUGHING GROUND
- MAY NOT DETECT UNEXPECTED CONDITIONS
- SHAFT MAY NOT BE PLUMB OR STRAIGHT

COMPARISON OF CONSTRUCTION METHODS

CONVENTIONAL SINKING

- PROVIDES EARLY AND CONTINUED ACCESS FOR SITE CHARACTERIZATION
- ALLOWS COLLECTION OF BULK SAMPLES
- WATER AND GROUND CONTROL PROCEDURES CAN BE INITIATED IMMEDIATELY
- CAN READILY DETECT, EVALUATE AND RESPOND TO UNEXPECTED CONDITIONS
- OVERBREAK CAN BE LIMITED WITH CONTROLLED BLASTING TECHNIQUES AND TIMELY INSTALLATION OF GROUND SUPPORT
- SHAFT WILL BE PLUMB AND STRAIGHT
- RESULTS IN MINIMUM SHAFT CONSTRUCTION SCHEDULE

CONCLUSIONS

- CONVENTIONAL MINING TECHNIQUES BEST SUPPORT REGULATORY AND SCIENTIFIC NEEDS OF SITE CHARACTERIZATION:

  - ROUTINE ACCESSIBILITY
  - LIMITED DISTURBANCE OF IN SITU ROCK CONDITIONS
  - TIMELY
  - DEMONSTRATED TECHNOLOGY

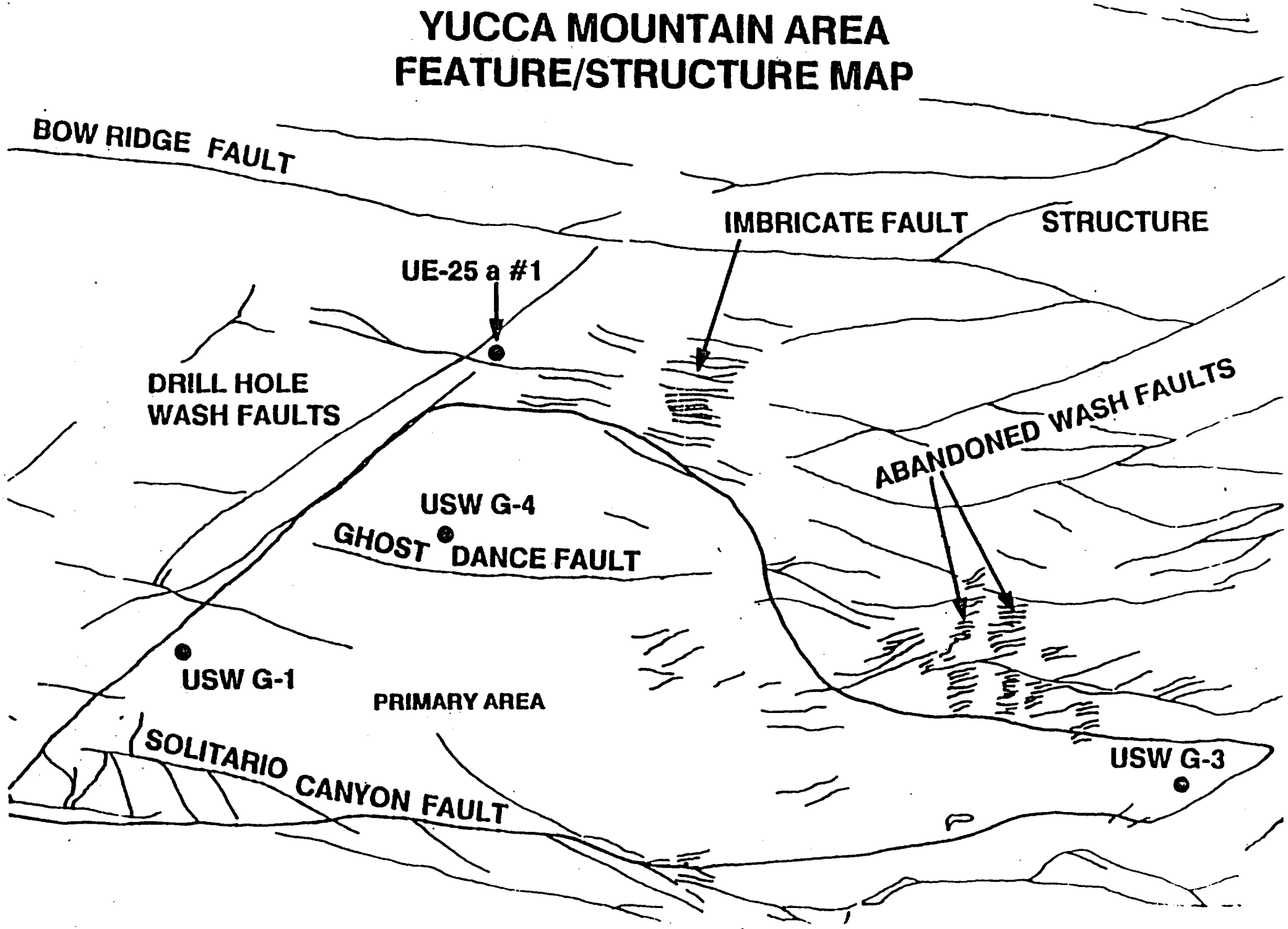
SCIENTIFIC AND TESTING CONSIDERATIONS

OUTLINE OF PRESENTATION

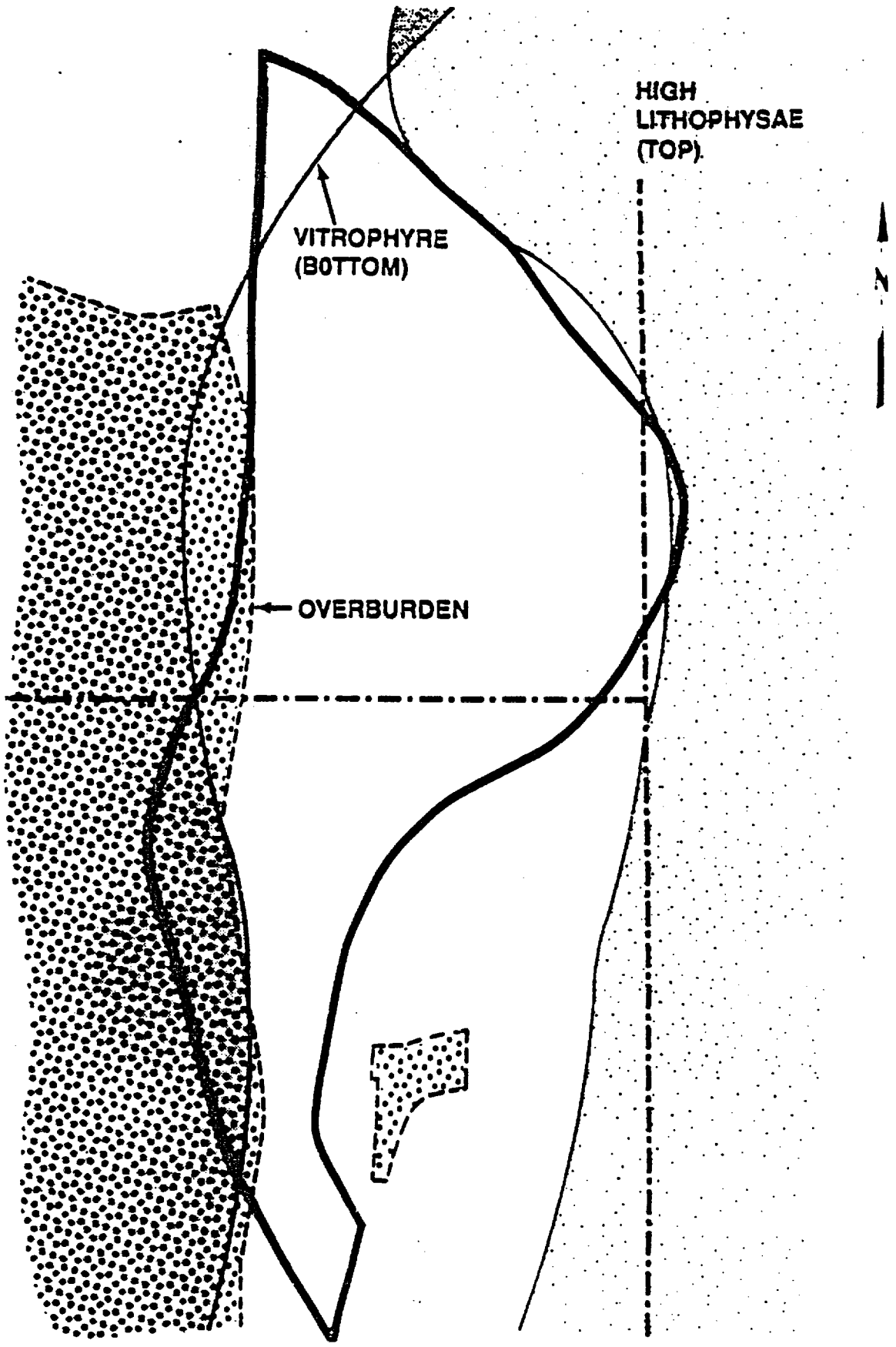
- DESCRIBE SURFACE BASED PROGRAM TO ACQUIRE INFORMATION NEEDED FROM SITE CHARACTERIZATION
- DESCRIBE ESF BASED PROGRAM TO ACQUIRE INFORMATION NEEDED FROM SITE CHARACTERIZATION

  - INDICATE ROLES OF SURFACE AND SUBSURFACE PROGRAMS IN A REPRESENTATIVE CHARACTERIZATION PROGRAM

YUCCA MOUNTAIN AREA FEATURE/STRUCTURE MAP



STRATIGRAPHIC FEATURES



SCIENTIFIC AND TESTING CONSIDERATIONS

MAJOR ELEMENTS OF THE PROGRAM

- SURFACE BASED
  - BOREHOLE COVERAGE:
    - * SYSTEMATIC DRILLING PROGRAM - SITE AND SURROUNDING AREA (PHENOMENA CHARACTERISTICS, TRENDS AND VARIABILITY)
    - * FEATURE SAMPLING PROGRAM - INVESTIGATE SPECIAL FEATURES
  - OTHER ACTIVITIES:
    - * MAPPING, GEOPHYSICAL SURVEYS, TRENCHING, METEOROLOGY, ET CETERA
- UNDERGROUND
  - SYSTEMATIC MAPPING AND SAMPLING
  - ESF TESTS TO CHARACTERIZE PROCESSES AND CONDITIONS
  - EXPLORATORY DRIFTING

SCIENTIFIC AND TESTING CONSIDERATIONS

- SURFACE-BASED DRILLING PROGRAM
  - INVOLVES BOREHOLES TO THE WATER TABLE, IN OR ADJACENT TO THE REPOSITORY BLOCK
  - GEOLOGIC INVESTIGATION HOLES, INCLUDING SLANTED AND FEATURE
  - BOREHOLE AND CORE TEST DATA TO CHARACTERIZE STRATIGRAPHY, MATRIX POTENTIAL DISTRIBUTION, MOISTURE MOVEMENT ALONG CONTACTS AND FAULTS, GASEOUS PHASE PROCESSES
  - SAMPLING TO SUPPORT GEOCHEMICAL, HYDROCHEMICAL, NATURAL TRACERS INVESTIGATIONS

SCIENTIFIC AND TESTING CONSIDERATIONS

- ESF CHARACTERIZATION PROGRAM
  - EVALUATE CONSTRUCTION EFFECTS ON ROCK MASS PERFORMANCE CHARACTERISTICS NEAR THE SHAFTS AND OTHER OPENINGS
  - INVESTIGATE DIFFUSION PROCESSES, FRACTURE/MATRIX HYDROLOGIC EQUILIBRIUM, INCLUDING SCALE DEPENDENCE, WATER MOBILITY IN FRACTURES, NATURAL TRACERS
  - OBSERVE AND EVALUATE GEOMECHANICAL RESPONSES, INCLUDING SCALE DEPENDENCE, AND TO DRIFTING THROUGH MAJOR STRUCTURES
  - INVESTIGATE NEAR-FIELD (WASTE CANISTER ENVIRONMENT) AND DRIFT SCALE HEATING EFFECTS IN THE HOST ROCK

SCIENTIFIC AND TESTING CONSIDERATIONS

- EXPLORATORY DRIFTING
- PROGRAM TO INVESTIGATE POTENTIALLY ADVERSE GEOLOGIC STRUCTURES COMPLEMENTS SURFACE BASED INVESTIGATIONS (EG. MAPPING, SLANTED HOLES)
- FEATURES TO BE INVESTIGATED ENCOMPASS A RANGE OF CONDITIONS

FLUX	LATERAL DIVERSION
HYDROLOGIC CHARACTER	AGE
TYPE OF FAULTING	NATURE OF FAULTS AT DEPTH
OFFSET	

REPOSITORY CONSTRUCTION FEASIBILITY

SCIENTIFIC AND TESTING CONSIDERATIONS

- EXPLORATORY DRIFTING

  - 3 LONG DRIFTS TO INVESTIGATE SEVERAL STRUCTURES WITH A RANGE OF FEATURES

    IMBRICATE NORMAL FAULTING
    - HIGH STRUCTURAL DIP?
    - HIGH FLUX?
    - COMPETENT ROCK?

    DRILL HOLE WASH FEATURE
    - PRE-QUATERNARY AGE FAULT?
    - HIGH FLUX?
    - COMPETENT ROCK?
    - REPOSITORY EXPANSION BEYOND?

    GHOST DANCE FAULT
    - HYDROLOGIC SIGNIFICANCE?
    - GROUND SUPPORT IMPLICATIONS FOR REPOSITORY?

  - PROVISION TO INVESTIGATE OTHER FAULTS OR STRUCTURE

SCIENTIFIC AND TESTING CONSIDERATIONS SUMMARY

SITE CHARACTERIZATION IS AN INTEGRATED, BALANCED SET OF INVESTIGATIONS DERIVED FROM STRATEGIES TO EXAMINE SITE ATTRIBUTES FROM SURFACE AND SUBSURFACE BASED INVESTIGATIONS

SITE PERFORMANCE DEPENDS ON THE FULL UNSATURATED ZONE SECTION AND CONDITIONS INFLUENCED BY THE SATURATED ZONE

STRATEGY FOR DEMONSTRATING LONG TERM PERFORMANCE EMPHASIZES THE STRATA OVERLYING AND UNDERLYING THE HOST ROCK

EFFECTS OF FAULTING ON PERFORMANCE DEPEND ON THE FULL UZ AND ARE CHARACTERIZED BY A VARIETY OF APPROACHES

PRINCIPAL ENGINEERING FUNCTIONS RELATED TO ESF DESIGN, CONSTRUCTION, AND OPERATION

- PROVIDE TESTING FACILITY THAT WILL ALLOW GATHERING DATA OF ACCEPTABLE QUALITY
- LIMIT IMPACTS OF ESF CONSTRUCTION, OPERATIONS, AND TESTING ON PERFORMANCE
- ALLOW EFFECTIVE INTEGRATION WITH REPOSITORY DESIGN
- PROVIDE SAFE ENVIRONMENT
- PROVIDE FLEXIBILITY FOR EXPANDED EXPLORATION AND TESTING

ENGINEERING CONSIDERATIONS RELATED TO REPOSITORY PERIMETER DRIFT DEVELOPMENT

- VIABILITY OF INTEGRATION WITH REPOSITORY
- FEASIBILITY OF USING CURRENT ESF CONFIGURATION TO SUPPORT DEVELOPMENT CONSIDERING

  DATA QUALITY
  SAFE WORKING ENVIRONMENT
  FLEXIBILITY FOR EXPANSION

WHY IS THE PERIMETER OF THE PROPOSED REPOSITORY SHAPED AS IT IS?

PERIMETER SHAPE IN CONCEPTUAL DESIGN INFLUENCED BY:

- CONSTRAINTS ON USABLE AREA

  - STRUCTURAL FEATURES
  - OVERBURDEN REQUIREMENTS
  - MAINTAINING REPOSITORY WITHIN DESIRED SECTION OF TOPOPAH SPRING UNIT

- CONSTRAINTS ON REPOSITORY DEVELOPMENT

  - DESIRABLE EQUIPMENT OPERATING CONSTRAINTS ($\leq$10% GRADE)
  - DESIRABLE EXTENT OF ACCESS DRIFTS ($\leq$3000' FOR BETTER VENTILATION)

WHAT ARE THE PRINCIPAL UNCERTAINTIES IN THE DESIGN RELATED TO EARLY DEVELOPMENT OF THE REPOSITORY PERIMETER DRIFT?

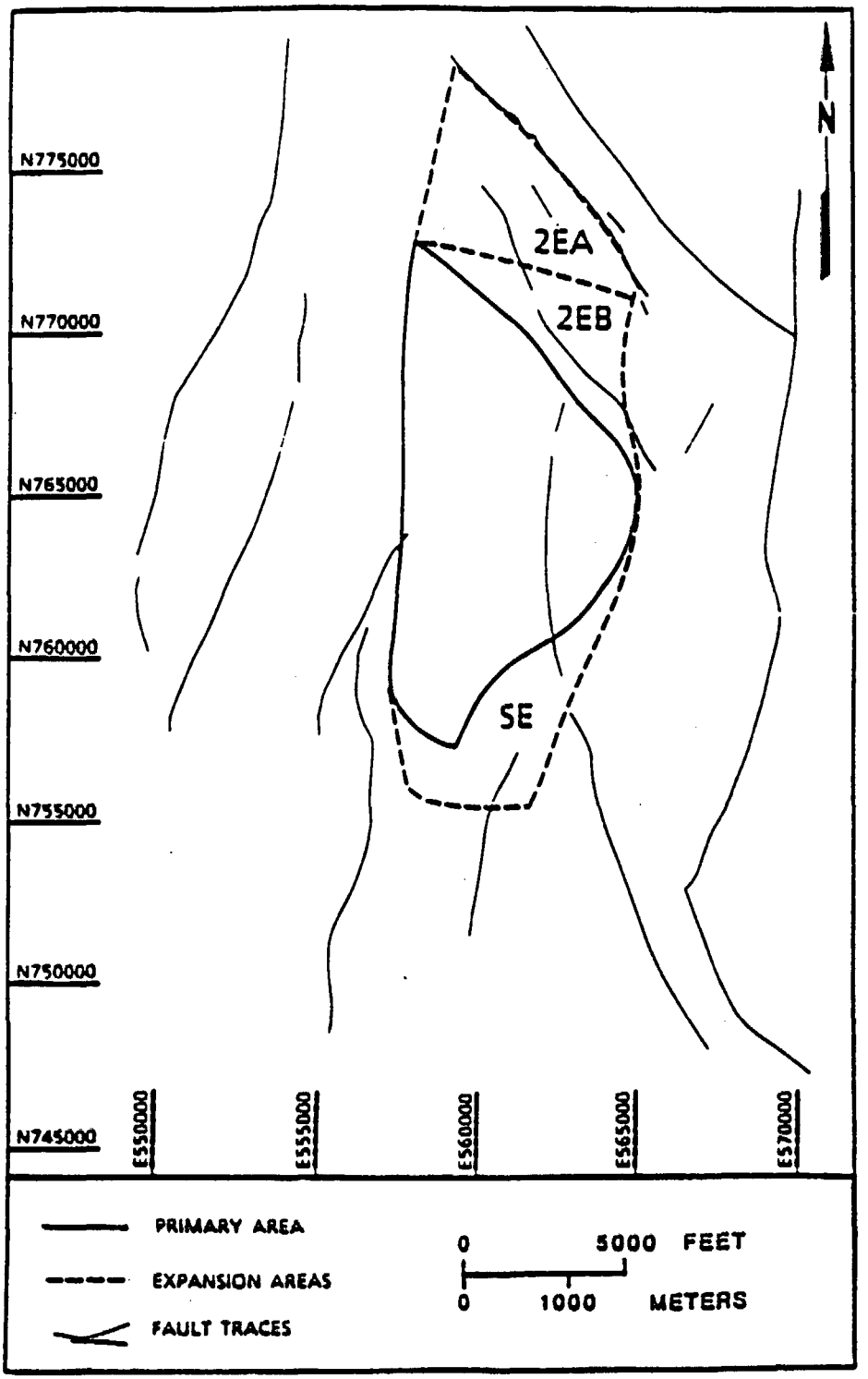
- LOCATION OF TsW1/TsW2 BOUNDARY
  - LIMITED STRATIGRAPHIC CONTROL AVAILABLE FROM CURRENT SURFACE-BASED EXPLORATORY BOREHOLES
  - SITE CHARACTERIZATION RESULTS COULD POTENTIALLY ALLOW LOWER GRADES IN REPOSITORY DRIFTS
- UNDERGROUND LOCATION AND EFFECT OF STRUCTURAL FEATURES
  - CURRENT CONCEPTUAL DESIGN RECOGNIZES POTENTIAL UNCERTAINTIES IN FAULT PROJECTION TO DEPTH

WHAT ARE THE PRINCIPAL UNCERTAINTIES IN THE DESIGN RELATED TO EARLY DEVELOPMENT OF THE REPOSITORY PERIMETER DRIFT?

(CONTINUED)

- FEASIBILITY/NECESSITY OF REPOSITORY EXPANSION INTO CANDIDATE AREAS (SE AND 2E)
  - EARLY DEVELOPMENT OF PERIMETER DRIFT WOULD COMPLICATE REPOSITORY DEVELOPMENT IN EXPANSION REGIONS
- MATURITY OF DESIGN AND RELATED CRITERIA
  - DEVELOPMENT OF ADVANCED CONCEPTUAL DESIGN AND LICENSE APPLICATION DESIGN COULD RESULT IN CHANGES IN ELEVATION, GRADE, OR LATERAL EXTENT

PREFERRED EXPANSION AREAS



FEASIBILITY OF PERIMETER DRIFT DEVELOPMENT

- TO UNDERSTAND FEASIBILITY OF USING CURRENT ESF CONFIGURATION TO SUPPORT REPOSITORY PERIMETER DRIFT DEVELOPMENT, NEED TO CONSIDER:
  - WORKER SAFETY CONSIDERATIONS
  - POSSIBLE CONSTRUCTION-TO-TEST INTERFERENCE
  - IMPACT ON FLEXIBILITY FOR ADDITIONAL EXPLORATION

CONSIDERATIONS IN ASSESSING IMPACT OF REPOSITORY PERIMETER DRIFT DEVELOPMENT ON FLEXIBILITY FOR ADDITIONAL EXPLORATION FROM ESF

- CAPABILITY OF CURRENT SUPPORT SYSTEMS (MUCK REMOVAL, VENTILATION, ETC.) TO ACCOMMODATE PERIMETER DRIFT DEVELOPMENT WITHOUT PRECLUDING OTHER POSSIBLE DRIFTING

  - TITLE I STUDY DESIGN OF POSSIBLE DRIFTING TO SOUTH, INDICATED SUFFICIENT FLEXIBILITY IN TITLE I DESIGN TO ACCOMMODATE THE 10,000 FT OF ADDITIONAL DRIFTING

  - PERIMETER DRIFT CONFIGURATION WOULD REQUIRE FURTHER EVALUATION INCLUDING SCHEDULE REQUIREMENTS BUT COULD POSSIBLY EXCEED CAPACITY OF MUCK REMOVAL SYSTEM

SUMMARY OF PRINCIPAL ENGINEERING CONSIDERATIONS RELATED TO EARLY REPOSITORY PERIMETER DRIFT DEVELOPMENT

- VIABILITY OF ESTABLISHING PERIMETER DRIFT ELEVATION AND GRADE
  - WITHOUT MORE EXTENSIVE STRATIGRAPHIC CONTROL
  - WITHOUT CONSTRAINING FEASIBILITY OF EXPANSION INTO CANDIDATE REGIONS
  - WITHOUT REFINING REPOSITORY DESIGN AND RELATED CRITERIA
- FEASIBILITY OF USING CURRENT ESF CONFIGURATION TO SUPPORT DEVELOPMENT
  - INCREASED ACCESS/EGRESS REQUIREMENTS (DUAL HEADING, OR ADDITIONAL ACCESSWAYS) RELATED TO WORKER SAFETY
  - FURTHER CONSIDERATION OF POSSIBLE CONSTRUCTION-TO-TEST INTERFERENCE WOULD BE REQUIRED
  - POSSIBLE OPERATION OF MUCK REMOVAL SYSTEM AT OR NEAR CAPACITY COULD PRECLUDE OTHER EXPLORATORY DRIFTING

SUMMARY

- PROGRAM FOR 3-DIMENSIONAL CHARACTERIZATION INCLUDES A SYSTEMATIC APPROACH AS WELL AS INVESTIGATION OF ANOMOLOUS FEATURES AND DRIFTING TO INVESTIGATE STRUCTURES; THE PROGRAM IS DESIGNED TO BE REPRESENTATIVE

- EXPECT PROGRAM AS DEVELOPED TO BE SUFFICIENT AND DOES RETAIN FLEXIBILITY TO EXPAND OR REFOCUS ACTIVITIES IF WARRANTED

- A PERIMETER DRIFT EARLY IN THE SITE CHARACTERIZATION PROGRAM COULD CONSTRAIN REPOSITORY LAYOUT

- IMPROVED DATA BASE COULD INDICATE NEED FOR ADDITIONAL EXPLORATORY DRIFTING (PERHAPS COINCIDENT WITH MAINS, DRIFTS, PERIMETER DRIFTS) OR INDICATE VIABILITY OF PERIMETER DRIFT

- REPOSITORY DESIGN CONCEPTS SHOULD INCLUDE DEVELOPMENT PLANS THAT COULD UTILIZE EARLY PERIMETER, MAINS, OR ACCESS DRIFTS

CONCLUSION

CONSIDERING:

1. THE CONCEPTUAL NATURE OF THE CURRENT LAYOUT
2. THE NEED TO LIMIT THE EXTENT OF EXCAVATIONS
3. THE NEED TO LIMIT IMPACTS TO THE SITE
4. THE NEED TO DEVELOP A REPRESENTATIVE THREE - DIMENSIONAL DESCRIPTION OF THE SITE

A PERIMETER DRIFT DOES NOT APPEAR TO BE WARRANTED AT THIS TIME

INFORMATION FROM THE SITE CHARACTERIZATION PROGRAM WILL HELP DEFINE THE REPOSITORY BOUNDARIES AND MAY WARRANT ADDITIONAL DRIFTING, PERHAPS A PERIMETER DRIFT, AT A FUTURE DATE

PROTOTYPE DRILLING

- PHASE 1: Near Salt Lake City, Utah (approx. 70 miles SW)
- PHASE 2:

  OPTION 1 - NTS

  a) Test equipment at depth in volcanics

  b) Conduct training

  OPTION 2 - (a) Southern Utah (b) NTS

  a) Test sample recovery equipment at depth in similar volcanics

  b) Test equipment on-site for verification and conduct training

Attachment 7

PHASE I
OBJECTIVE SUMMARY

- **OBJECTIVE:**

  Develop Sample Recovery Equipment for 8" and 12" boreholes. (Depth as req'd to test equipment)

- **SYSTEMS INVOLVED:**

  1) Downhole dry coring systems
  2) Cuttings recovery system
  3) Blown-to-Surface core system

PHASE 1
TEST SUMMARY

- HQ & PQ coring systems inside 7" & 9 5/8" dual-tube pipe, both normal and reverse circulation with vacuum assist for cuttings removal.
- Core recovery by air lift through long radius arm and core catcher system.
- Drill/Ream with 8"/12" tricone bits in closed and open center configurations.
- Testing cuttings sampling system while drilling with 8"/12" hammers.

PHASE I COST & SCHEDULING

- TOTAL PLANNED COST:

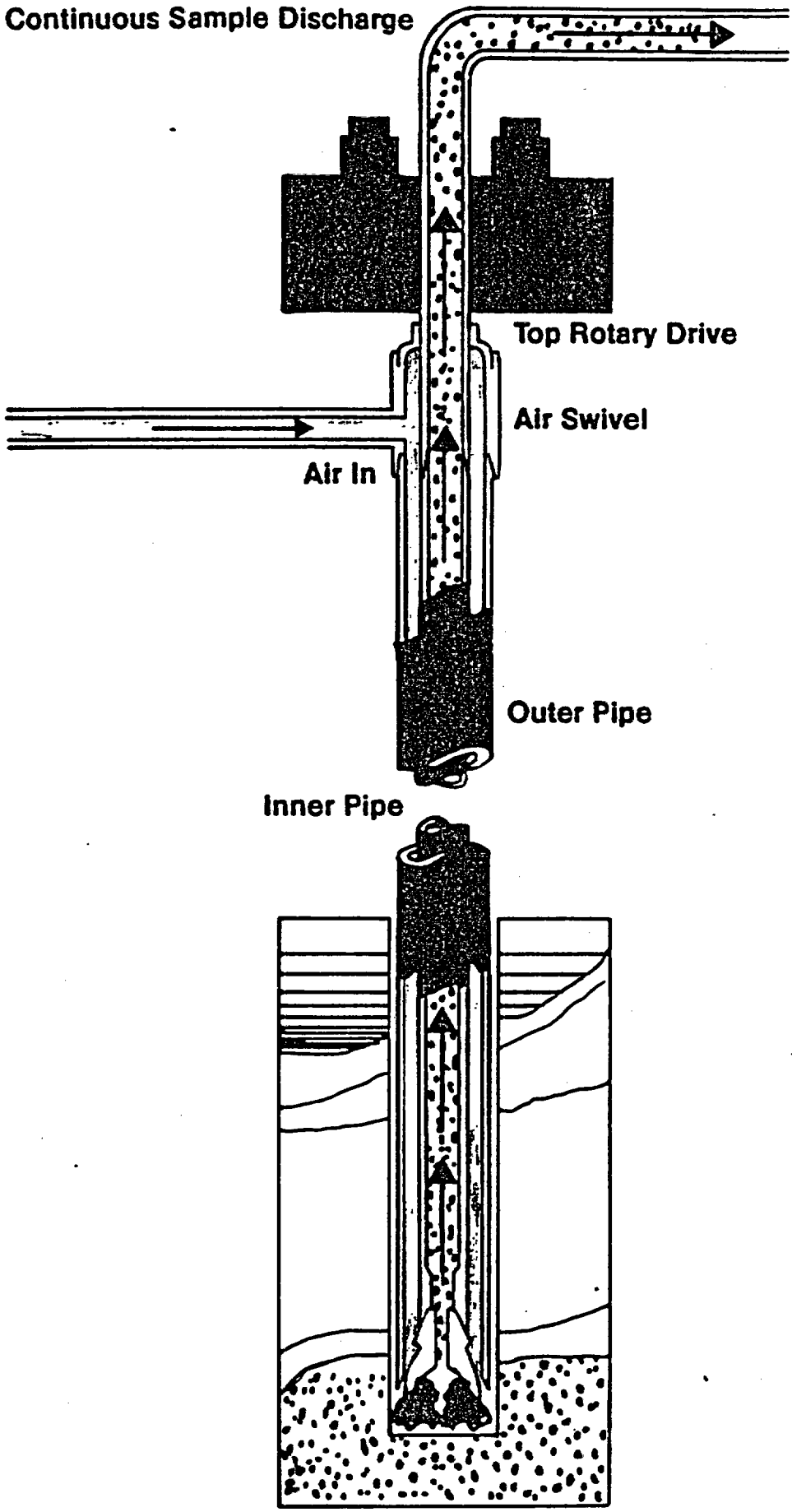
  $189K

- CONTRACTED DURATION:

  1) 20 Days standby @ $2.6K/day
  2) 20 Days drilling @ $6.01K/day (incl. all support equipment)
  3) Tentative mobilization May 8th

- DECISION POINT:

  Phase II location decision and/or holding LM120 drill rig on standby required by end of contract period.


Continuous Sample Discharge
Top Rotary Drive
Air Swivel
Air In
Outer Pipe
Inner Pipe

SPR OUTLINE

1.0 EXECUTIVE SUMMARY

2.0 STATUS OF ACTIVITIES RELATED TO SITE CHARACTERIZATION

2.1 PREPARATORY ACTIVITIES

- QUALITY ASSURANCE PROGRAM
- ESF DESIGN AND CONSTRUCTION
- SURFACE-BASED TESTING PREPARATION
- PERMITTING
- PUBLIC MEETINGS AND PUBLIC HEARINGS

2.2 STATUS OF SITE PROGRAMS

2.3 STATUS OF REPOSITORY DESIGN

2.4 STATUS OF WASTE PACKAGE DESIGN

2.5 STATUS OF SEAL SYSTEM DESIGN

2.6 STATUS OF PERFORMANCE ASSESSMENT

3.0 SCHEDULES

4.0 REFERENCES

(2) 1st SPR Prep. Schedule (as of Tuesday March 21)

DRAFT

	S	M	T	W	T	F	S
APRIL		10	11	12	13	14 INPUT DUE TO HQ	15
6	17	18	19	20	21	22	
	← PREPARE DRAFT SPR →						
13	24	25	26	27	28 DISTRIBUTE DRAFT SPR TO REVIEWERS	29	
	← PREPARE DRAFT SPR →						
20	1	2	3	4	5 REVIEWERS' COMMENTS DUE TO HQ	6	
	← DRAFT SPR OUT FOR REVIEW →						
MAY 7	8	9	10	11	12	13	
	← REVIEW AND RESPOND TO COMMENTS →						
14	15	16	17	18	19	20	
	← COMMENT RESOLUTION WORKSHOP (IF NECESSARY) →						
21	22	23	24	25	26	27	
	← CONSOLIDATED MARKUP →			← PRG BRIEFING AND SIGN-OFF →			
28	29	30	31	1	2	3	
	← PRODUCTION OF CONCURRENCE DRAFT →						
JUNE 4	5	6	7	8	9	10	
	← CONCURRENCE REVIEW AND SPR MODIFICATIONS (SIMULTANEOUSLY) →						
11	12	13	14	15	16	17	
	← CONCURRENCE REVIEW AND SPR MODIFICATIONS (SIMULTANEOUSLY) →						
18	19 CAMERA-READY TO PRINTER	20	21	22	23	24	
25	26	27	28	29	30	1	
JULY 2	3	4	5	6	7	8	
9	10	11	12	13	[redacted]	15	

DRAFT