Rec'd Letter dtd. 3/11/94
F

# SUMMARY OF U.S. NUCLEAR REGULATORY COMMISSION AND U.S. DEPARTMENT OF ENERGY MEETING ON THE EXPLORATORY STUDIES FACILITY

On February 3, 1994, representatives of the Nuclear Regulatory Commission, U.S. Department of Energy (DOE), State of Nevada Nuclear Waste Project Office, and Nye and Clark Counties, Nevada, participated in a meeting on the exploratory studies facility. The purpose of the meeting was to continue discussions on items relevant to the ESF design and design control process. The meeting agenda is included as Attachment 1 and the list of attendees is Attachment 2 to this summary. Copies of presenters' handouts are included in Attachment 3.

The meeting featured discussions of actions being taken to improve the ESF design control process and an update on progress made on the ESF design and construction. There were also discussions of the rationale for the enhanced ESF design layout and the surface drilling program being conducted in support of ESF design and design decisions. The planned presentation on the DOE procedure for reportable geologic conditions (See Attachment 3) was deferred to the next meeting. Ample time for questions was allotted during all presentations.

During the meeting NRC staff provided comments on the results of its observation of the review of design package 2B. Those comments were:

1. There appeared to be no substantial DOE presence during the design review.

2. Observers of the design review found interfaces between task groups lacking (i.e., lack of integration between the technical and construction task groups).

3. There needs to be a clear statement of where DOE is in the design process at the beginning of each design review.

4. Reviewers did not believe that the responses received from the design group during the review were adequate.

5. The process DOE is now employing prior to design reviews (i.e., availability of pertinent documents two weeks prior to the design review) is very helpful to the NRC staff.

6. More time is needed during the review for questions and answers.

DOE stated that its representatives would be more visible during future reviews and also agreed that the integration between technical and construction task groups needs improvement. DOE is also willing to allow more time for reviewer/observer comments and questions during design reviews.

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PDR WASTE
WM-11 PDR

Participants agreed that all agenda items, other than the deferred item, were covered at the meeting, but representatives of NRC, State of Nevada, and Clark and Nye Counties agreed that additional discussion of DOE's document hierarchy for the ESF was needed and should be included on the next meeting's agenda. The State of Nevada representative requested that explanations of the Determination of Importance Evaluation (DIE) and how DIEs are integrated with the design are needed. The State also requested that at the next bimonthly meeting, DOE explain how decisions related to test alcove locations and excavation and integrated with technical test requirements.

The Clark and Nye County representatives agreed that the meeting had been useful. The Clark County representative requested that DOE provide some examples of trade-off studies conducted at the next bimonthly ESF meeting. The Nye County representative stated that there appeared to be no formal mechanism for inputs of technical data into the design. This concern was addressed at the meeting, but participants agreed that further discussion of this concern is needed at future meetings.

The NRC staff requested that the document hierarchy discussion at the next meeting include a discussion of the DIE reports and provide insite into how the different documents in the hierarchy are used and are related to each other. It was also suggested that DOE provide examples by following requirements through the entire design control process to illustrate how a requirement is incorporated into the design and provide an example of a design change and how that change would be dealt with in the design process. The staff agreed with the Nye County representative's comment that there appears to be no formal mechanism for integrating technical data into the design and requested additional discussion on this topic at future meetings. The staff also stated that it does not understand the rationale for the seismic design values presented for underground permanent items. DOE agreed to provide a statement of the rationale. The NRC staff also requested a copy of DOE STD 1021-92 and a copy of the description and rationale for the enhanced ESF design, when available.

The NRC staff requested that the next ESF bimonthly meeting be held in Washington, DC, in April. This request was agreed upon by the DOE, State of Nevada, and Affected Counties present. In addition to the items above, meeting participants requested a status report on ESF design and construction and the availability and use of technical data to support ESF decisions.

Charlotte Abrams 3/8/94

Charlotte Abrams, Sr. Proj. Mgr.
Repository Licensing and Quality
Division of High-Level Waste
Management
Office of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission

Christian E. Einberg 3/9/94

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

Attachment 1

# DOE-NRC TECHNICAL MEETING DRAFT AGENDA
# EXPLORATORY STUDIES FACILITY DESIGN AND CONSTRUCTION UPDATE

February 3, 1993

| | | |
|---|---|---|
| 8:00 | Opening Remarks | DOE, NRC, State, Counties, Affected Parties |
| 8:10 | Overview of Meeting<br>- Conduct of ESF Package 2B Design Review | DOE (Petrie-YMP) |
| 8:30 | Question and Answer Session on DOE Document Hierarchy | DOE/NRC |
| 9:00 | Update on M&O Improvement Plan | DOE (Sandifer-M&O) |
| 9:30 | Discussion of ESF Enhancement Decision and Rationale for Replacement of East-West Drift through Center of Repository Block | DOE (McKenzie - M&O) |
| 10:15 | Update on ESF Design and Construction Progress | DOE (Replogle-YMP) |
| 10:45 | BREAK | |
| 11:00 | ESF Seismic Design Basis for Surface and Sub-surface Items | DOE (Quittmeyer-M&O) |
| 11:30 | Use of NRC's Draft STP: Consideration of Fault Displacement Hazards in Geologic Repository Design | DOE (Stanley-M&O) |
| 11:50 | LUNCH | |
| 1:00 | Discussion of DOE Procedure for Notification of Unusual Geologic Conditions | DOE (Jones, YMP) |
| 1:20 | Drilling Program<br>- Support of ESF Design<br>- Changes to SBT Program Relative to ESF Design Schedule<br>- Integration of NRG Drillholes<br>- Drilling Results Indicating Higher North End Block | DOE (Williams-YMP) |
| 2:50 | BREAK | All |
| 3:00 | Open Discussion | All |
| 3:30 | Closing Comments | State/Counties/Affected Parties |

DOE-NRC TECHNICAL MEETING AGENDA
EXPLORATORY STUDIES FACILITY DESIGN AND CONSTRUCTION UPDATE

February 3, 1993 (continued)

| | | |
|---|---|---|
| 4:00 | NRC Comments | NRC |
| 4:30 | Closing Remarks | DOE, NRC, State, Counties/Affected Parties |
| 5:00 | ADJOURN | |

NOTES:

1) Each topic on the agenda includes time allotted for discussion.
2) Location is Room 450, Bank of America Building Tower, 101 Convention Center Drive, Las Vegas, NV

Attachment 2

# DOE/NRC TECHNICAL EXCHANGE
## EXPLORATORY STUDIES FACILITY DESIGN AND CONSTRUCTION UPDATE
## FEBRUARY 3, 1994

| | PRINT NAME | COMPANY | TITLE |
|---|---|---|---|
| 1 | Chris Einberg | DOE/HQ | Engineer |
| 2 | ALI HAGHI | M&O | Engineer |
| 3 | Bakr Ibrahim | NRC | Geophysicist |
| 4 | JOHN D JENKINS | ILF/WESTON | ENGINEER |
| 5 | Jim York | WESTON | SR SCIENTIST |
| 6 | MYSORE NATARAJA | NRC | CHIEF, GEOTECH Eng. Section |
| 7 | Kenneth R Hooks | NRC | QA |
| 8 | Charlotte Abrams | NRC | Sr Proj Mgr |
| 9 | NICK STELLAVAR | Nye Co | ON Site Dep |
| 10 | NORMAN T. SIMMS | M&O | REG. ENGINEER |
| 11 | Robert M. Sandifer | M&O | Deputy, M&O Operations |
| 12 | Steve Frishman | State of NV | |
| 13 | A. KUBO | M&O | AGM Systems |
| 14 | NANCY CHAPPELL | M&O/R&L | REG & LICENSING |
| 15 | JIM KEPLEEN | DOE | ESF |
| 16 | Steve LeRoy | M&O/Duke | Consulting Scientist |
| 17 | KEITH LORD | SAIC/DOE | Sr Proj ENGR |
| 18 | Bob Price | NEVADA LEGISLATURE | ASSEMBLYMAN |
| 19 | DENNIS ROYER | DOE/YMPO | Chief Systems |
| 20 | Stu Nisbit | M&O/Duke | Reg. Lic. |
| 21 | BILL HINZE | ACNW | — |
| 22 | Judy Treichel | NVNWTF | Ex. DIR. |
| 23 | | | |
| 24 | | | |

**DOE/NRC TECHNICAL EXCHANGE**
**EXPLORATORY STUDIES FACILITY DESIGN AND CONSTRUCTION UPDATE**
**FEBRUARY 3, 1994**

| | PRINT NAME | COMPANY | TITLE |
|---|---|---|---|
| 1 | RICHARD POWE | SAIC | QA SPECIAL ASST |
| 2 | WILLIAM BOYLE | DOE | STAFF SCIENTIST |
| 3 | BRUCE MABRITO | NRC | CNWRA QA |
| 4 | Asad Chowdhury | CNWRA | Manager - RDCO |
| 5 | DAN McKENZIE | M&O MK | ESF PROJECT ENGINEER |
| 6 | Bradley M. Bush | SAIC/T&ASS | Intergovernmental Advisor |
| 7 | E. J. TIESENHAUSEN | CLARK COUNTY | ENG. SPEC. |
| 8 | RICK WEEKS | YMRAD/QATSS | QA. SPECIALIST |
| 9 | DANA ROGERS | M&O MK | REPOS DESIGN |
| 10 | John Pilvar | NRC | On-Site Rep |
| 11 | [illegible] | DOE | Field Fire Panel Chief |
| 12 | Chris Henkel | EEI/UWASTE | Program Manager |
| 13 | RUSS McFARLAND | NWTRB | SENIOR STAFF |
| 14 | [illegible] | ACNW | Staff Scientist |
| 15 | mary manning | L.V. SUN. | Reporter |
| 16 | Bruce T. Stanley | M&O/MK | Repos. Design |
| 17 | SUSAN JONES | DOE/RSED | ACTING Director RSED |
| 18 | RICHARD QUITTMEYER | M&O/WCFS | Manager, Tech. Site Integration |
| 19 | Rick Nolting | M&O/MK | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
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U.S. DEPARTMENT OF ENERGY

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SITE CHARACTERIZATION
PROJECT

# DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

# INTRODUCTORY REMARKS


PRESENTED BY

**EDGAR H. PETRIE**
DEPUTY DIRECTOR


FEBRUARY 3, 1994
LAS VEGAS, NEVADA

Attachment 3

# EXPECTED MEETING RESULTS

## DOE will communicate

- ESF Package 2B Design Review
- Update on M&O Improvement Plan and ESF enhancement
- ESF Enhancement Decision Process
- ESF Seismic Design Basis
- Use of NRC STP on Fault Displacement Hazards
- DOE Procedure for Unusual Geologic Conditions
- Drilling Program

# ESF DESIGN REVIEWS

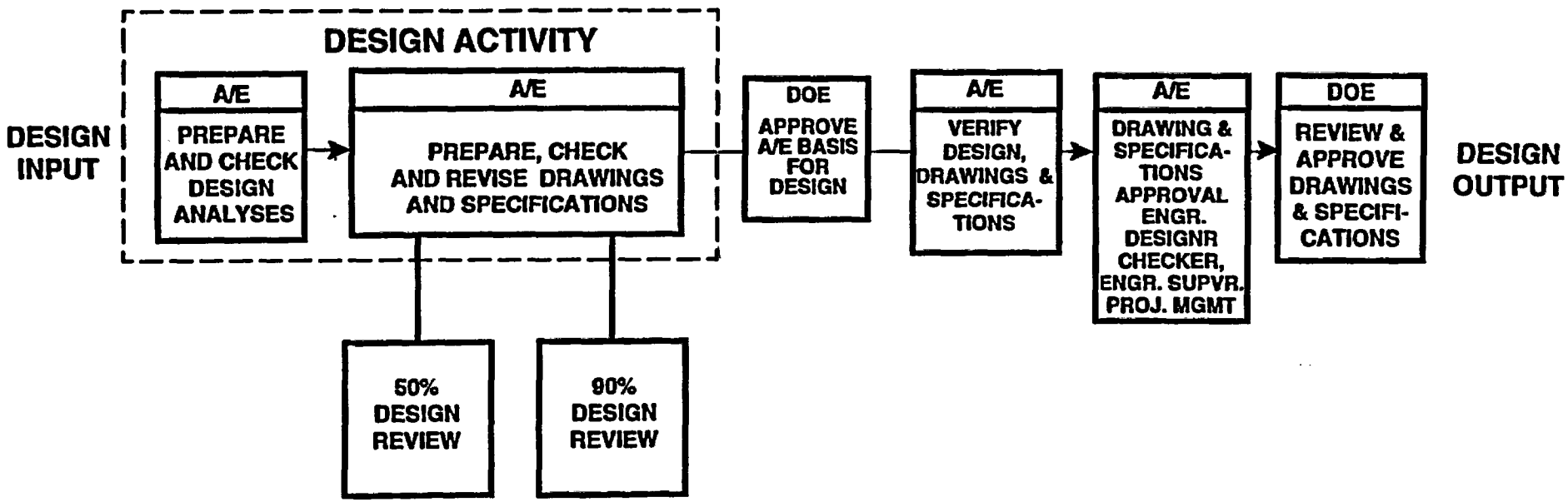
# DOE ESF DESIGN REVIEW

The M&O has been given responsibility for reviewing design in accordance with DOE plans and orders. The M&O holds major design reviews at the 50% and 90% points of the design. Packages will be mailed approximately two weeks prior tothe design review meeting

| | |
|---|---|
| Day 1 | Mail design package to reviewers containing overview and instructions for reviewing the package |
| Day 2-14 | Reviewers familiarize themselves with package |
| Day 15-17 | Design review meeting<br>- Complete review of package and process (1 day)<br>- Formal presentation of package (2 days) |
| Day 17-20 | Reviewers submit comments |
| Day 17-31 | Responses to comments prepared<br>- Prepare redlines to documents as needed |
| Day 31 | Responses transmitted to reviewers |
| Day 31-38 | Reviewers review modified documents and responses |
| Day 38-39 | Comment resolution meeting, if needed |

This process implements QAP 3-14, Technical and Management Reviews. The comment resolution process is conducted per QAP 3-1, Technical Document Reviews.
Note: The times above are typical

# ESF DESIGN PROCESS




DSGNPRC.129/1-31-94

# PACKAGE 2 CONTENTS

**2A:** Conveyor system (procurement only)

**2B:** Ventilation System (procurement only)
Fire Protection (procurement only)
Rail System (procurement only)
Subsurface Electrical System (procurement only)
Design Analyses

**2C:** North Ramp Excavation from starter tunnel to end of curve (2740 meters), ground support systems, subsurface (SS) electrical systems, SS mechanical systems, SS fire protection, SS monitoring and warning systems, SS conveyor systems

# OBSERVER PARTICIPATION IN ESF DESIGN REVIEWS

- Day 1 — Design packages to observers (NRC, State, NWTRB, Counties)
- Day 2-14 — Observers review package
- Day 15-17 — Design review meeting
- Day 17 — Observations due (Observers provide to M&O observer liaison)
- Day 17-31 — Prepare responses to observations
- Day 31 — Discuss responses with observers
- Day 38-39 — Observers attend comment resolution meeting at their discretion

Note: Observations may relate to the process or the technical content

# LIST OF DESIGN REVIEWS

| Date | Subject |
|---|---|
| 6/9/88 | Title I 50% Technical Assessment Review |
| 8/8/88 | Title I 90% Technical Assessment Review |
| 6/17/91 | North Access Independent Technical Review of Design Study to Revise Title I DSR |
| 8/12/91 | South Access Independent Technical Review of Design Study to Revise Title I DSR |
| 3/30/92 | Package 1A Title II Design 50% Independent Technical Review |
| 7/27/92 | Package 1A Title II Design 90% Independent Technical Review |
| 8/17/92 | Design Verification for Design Package 1A Highwall and Starter Tunnel with Classification Analyses |
| 4/12/93 | Package 1B Title II Design 50% Independent Technical Review |
| 4/19/93 | Package 2A Title II Design 50% Independent Technical Review |
| 7/19/93 | Package 2A Title II Design 90% Independent Technical Review |
| 8/2/93 | Package 1B Title II Design 90% Independent Technical Review |
| 1/5-7/94 | Package 2B Title II Design 90% Independent Technical Review |

# ESF EVENTS

## Completed Events

- Design Package 1B released for construction
- Alcove #1, Starter Tunnel (Anisotropy/Hydrochemistry)

## Upcoming Events

- Package 2C 90% Design Review - 4/94
- Package 1D 90% Design Review - 6/94
- Package 8A 50% Design Review - 9/94
- TBM receipt - 4/94

# DOE-NRC TECHNICAL MEETING

ON

# EXPLORATORY STUDIES FACILITY

## UPDATE ON M&O DESIGN CONTROL IMPROVEMENT PLAN

R.M. SANDIFER
FEBRUARY 3, 1994

# M&O MGDS DESIGN CONTROL IMPROVEMENT PLAN

- M&O developed this action plan in response to CARs and self-examination
- M&O made a commitment to develop a series of improvements to the design control process
- The plan was put in place to increase confidence of external agencies and DOE in M&O's ability to properly control our design procedures and processes

# M&O MGDS DESIGN CONTROL IMPROVEMENT PLAN

- Provides a review of design-control-related issues to coordinate resolution within framework of integrated effort to arrest long-term problems
- The Plan allows a thorough review of our design control process in general, to identify weaknesses or shortcomings

# ACTION ITEM TOTALS

- Open Action Items (FY/94 - 4; FY/95 - 2) 6
- Closed Action Items 48
- Total Action Items 54

# OPEN CORRECTIVE ACTIONS

- Ensure QAP-2-3 (Classification of Items) completed and approved for use at MGDS (OQA acceptance required per contract. Completed QAP 6.2 review of QAP-2-3. M&O approved version has been implemented.) (02/18/94)
- Procedure review team to trial run the existing procedures and revisions to ensure procedures are adequate (subcommittee to the QA Working Committee). (2/18/94) (9 Procedures have been through the PRT process. 4 remain to be reviewed by the PRT.)

# OPEN CORRECTIVE ACTIONS

- Develop MGDS Design Process Guidelines Manual (3/25/94)
- DOE EDD & M&O A-E Management evaluation of implementation of Design Control Improvement Plan (4/1/94) The M&O will close out the DCIP after completion of the management evaluation. The two Action Items to be completed in FY95 will be tracked separately.
- Incorporate relevant RSN BFD sections for Package 1A into M&O BFD; prepare base line change for combined BFD. (FY95)
- Revise RSN drawings, specifications, calculations for new traceability; adopt fully as M&O products. (FY95)

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# DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

# THE ENHANCED ESF LAYOUT - RATIONALE AND PROCESS


*PRESENTED BY*

**DAN McKENZIE**

ESF PROJECT ENGINEER


FEBRUARY 3, 1994
LAS VEGAS, NEVADA

# FACTORS CONTRIBUTING TO THE CHANGE IN THE ESF LAYOUT

- Flattening the grades will result in a significant enhancement to both the safety and overall operability of the ESF

# FACTORS CONTRIBUTING TO THE CHANGE IN THE ESF LAYOUT

(CONTINUED)

- The availability of updated geologic information
  - Drilling of NRG-6 confirmed that the TSw1-TSw2 contact was higher in the north end of the block
  - Recent work on the Ghost Dance Fault mapping indicates that it is a significant feature

# FACTORS CONTRIBUTING TO THE CHANGE IN THE ESF LAYOUT

(CONTINUED)

- The desire, expressed in the ESF Alternatives Study to allow for potential repository configurations which:
  - Maximize the distance from emplacement drifts to the water table
  - Avoid having emplacement drifts cross the Ghost Dance Fault

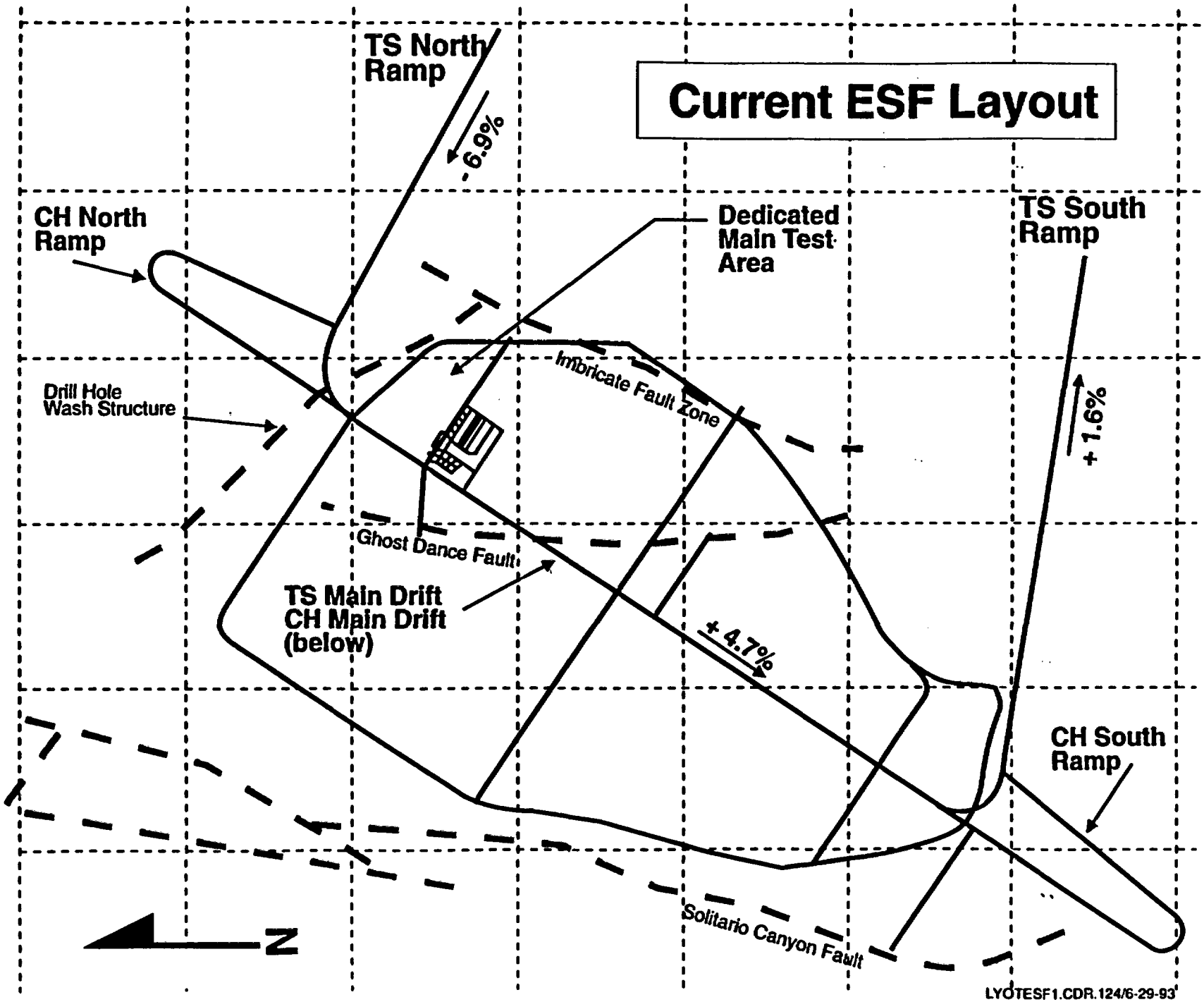
## IDENTIFICATION OF FAVORABLE FEATURES IN HIGHLY RATED OPTIONS

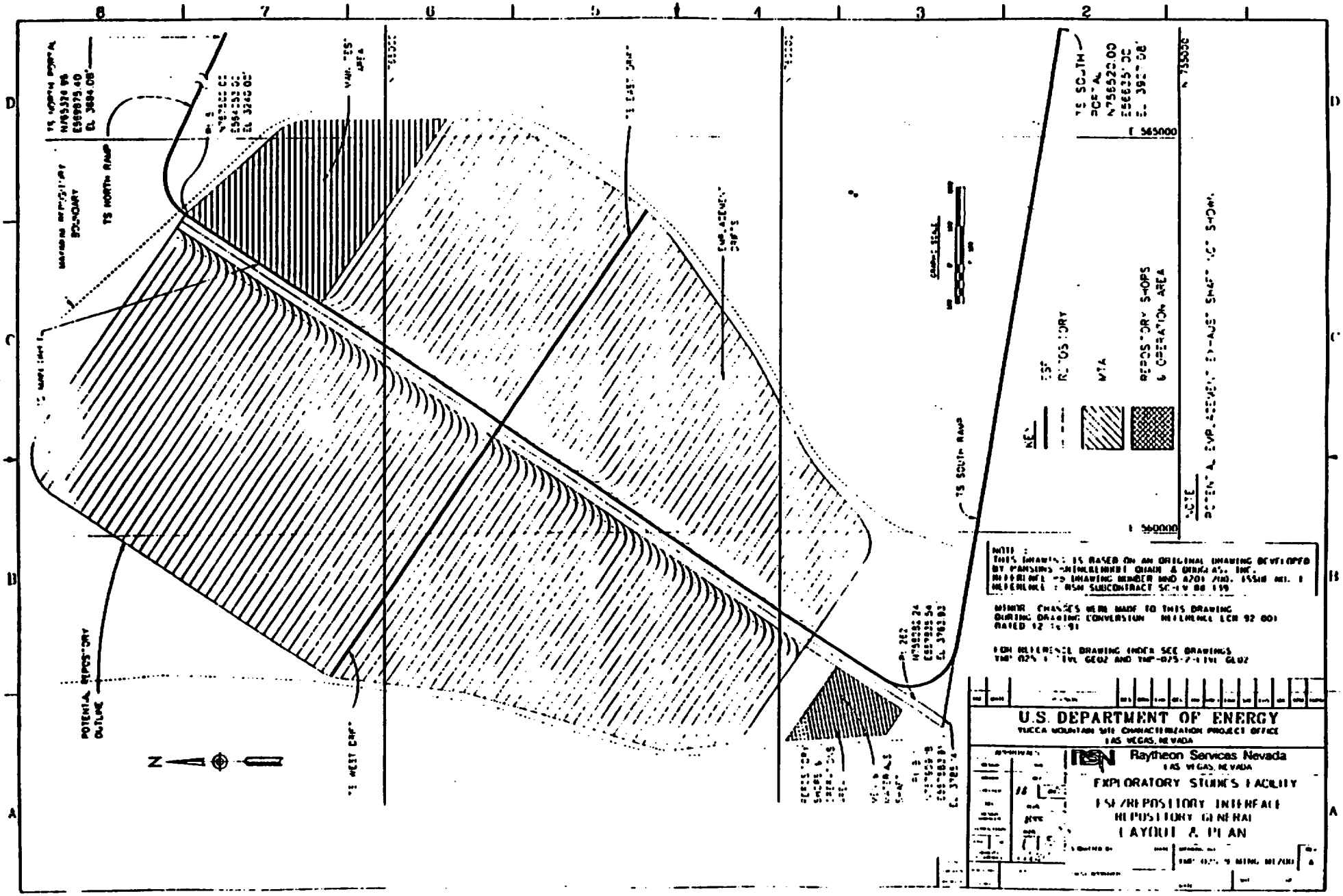
| TOP-RANKED OPTIONS: RANK | OPTION | 1 NUMBER OF RAMP(S) | 2 NUMBER OF SHAFT(S) | 3 NUMBER OF ACCESSES | 4 MTL LOCATION FLEXIBILITY | 5 MECHANICAL MINED ACCESSES | 6 NO GRAVITY FLOW PATHWAY FROM TS UNIT TO CHn | 7 MAXIMIZE DISTANCE FROM EMPLACEMENT LEVEL TO WATER TABLE | 8 AVOID EMPLACEMENT DRIFTS CROSSING GHOST DANCE FAULT | 9 MAXIMIZE EXPOSED ROCK – ON AND OFF BLOCK | 10 FLEXIBILITY FOR EARLY DRIFTING IN TS OR CH OR BOTH | 11 2 INTERCEPTS OF GHOST DANCE FAULT IN TS | 12 E-W DRIFT IN TS | 13 (LARGER MTL AREA TO AVOID INTERFERENCES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30 | 2 | 0 | 4 | ✔ | ✔ | ✔ | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| 2 | 23 | 2 | 0 | 4 | | ✔ | | | | | | ✔ | ✔ | ✔ |
| 3 | 24 | 1 | 1 | 5 | | ✔ | | | | | ✔ | ✔ | ✔ | ✔ |
| 4 | 13 | 2 | 0 | 4 | ✔ | ✔ | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| 5 | 6 | 2 | 0 | 4 | | ✔ | | | | | | ✔ | ✔ | ✔ |
| 6 | 7 | 1 | 1 | 5 | | ✔ | | | | | | ✔ | ✔ | ✔ |
| 7 | 2 | 1 | 1 | 5 | | | | | | | | ✔ | ✔ | ✔ |
| 8 | 19 | 1 | 1 | 5 | | | | | | | | ✔ | ✔ | ✔ |
| 9 | 25 | 1 | 1 | 5 | | ✔ | | | | | ✔ | ✔ | ✔ | ✔ |
| 10 | 4 | 1 | 2 | 5 | | | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| . | . | | | | | | | | | | | | | |
| . | . | | | | | | | | | | | | | |
| . | . | | | | | | | | | | | | | |
| 20 | 15 | 1 | 1 | 4 | | | | ✔ | ✔ | | | ✔ | ✔ | ✔ |

# FACTORS CONTRIBUTING TO THE CHANGE IN THE ESF LAYOUT

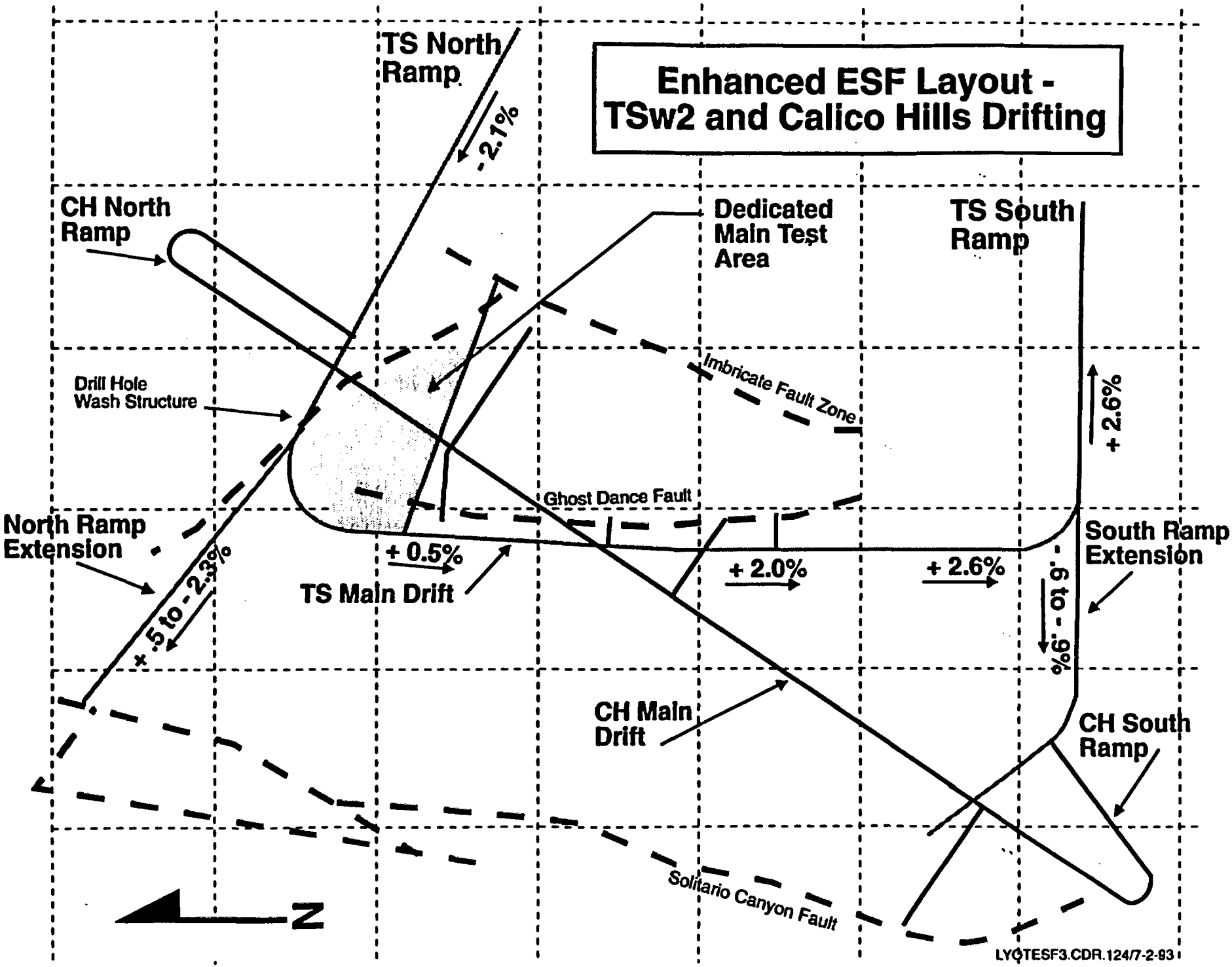
(CONTINUED)

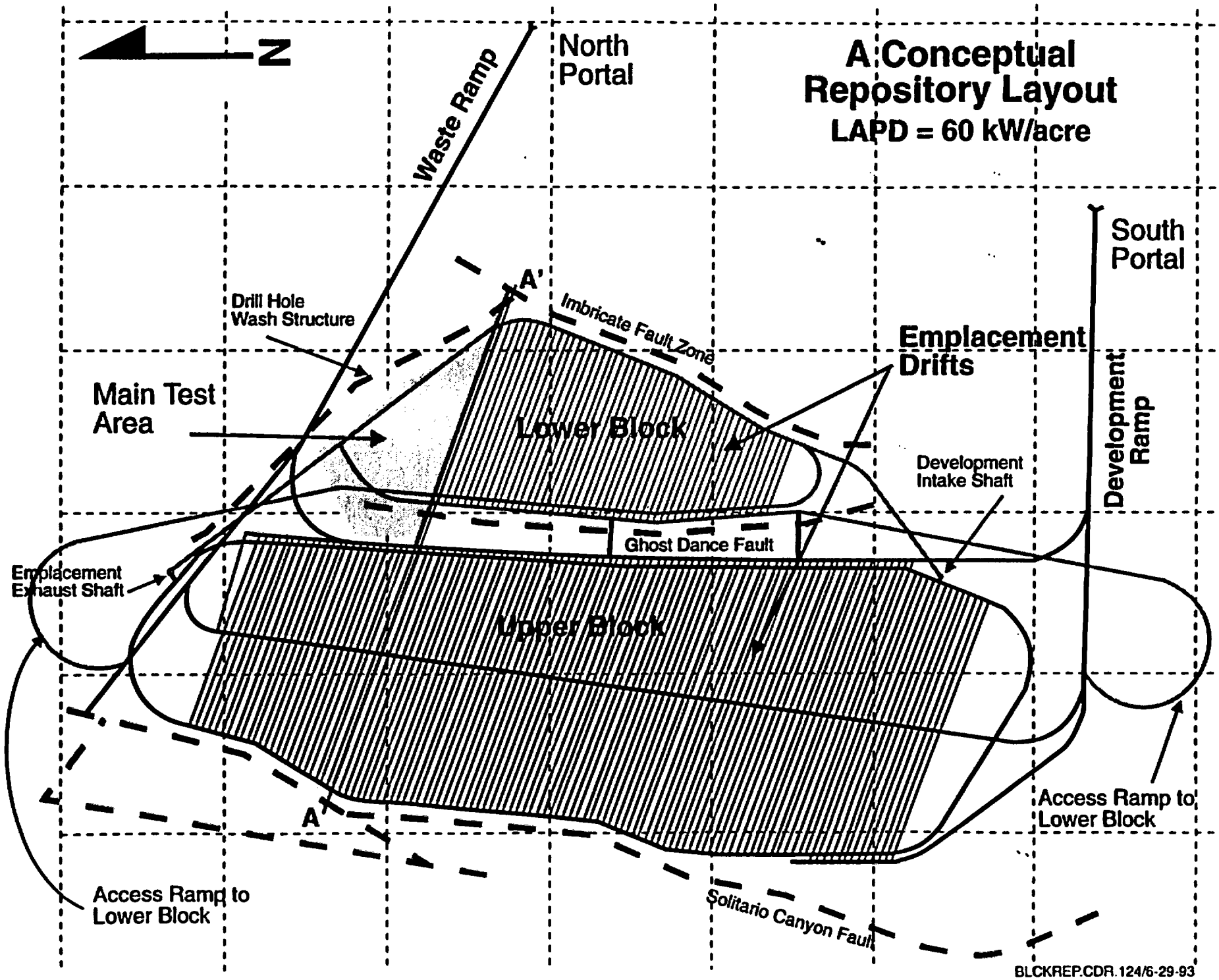
- The potential for larger, heavier waste package concepts:
  - Heavier loads (in the range of 100 to 150 tons) would strongly suggest rail haulage
  - If a heavy waste package concept is adopted, and the enhancement was not made, the transport concepts would be limited
  - The enhancement will allow development of potential repository concepts compatible with a wide range of waste package sizes


Current ESF Layout
TS North Ramp
-6.9%
CH North Ramp
Dedicated Main Test Area
TS South Ramp
Drill Hole Wash Structure
Imbricate Fault Zone
+ 1.6%
Ghost Dance Fault
TS Main Drift
CH Main Drift (below)
+ 4.7%
CH South Ramp
Solitario Canyon Fault
N
LYOTESF1.CDR.124/6-29-93

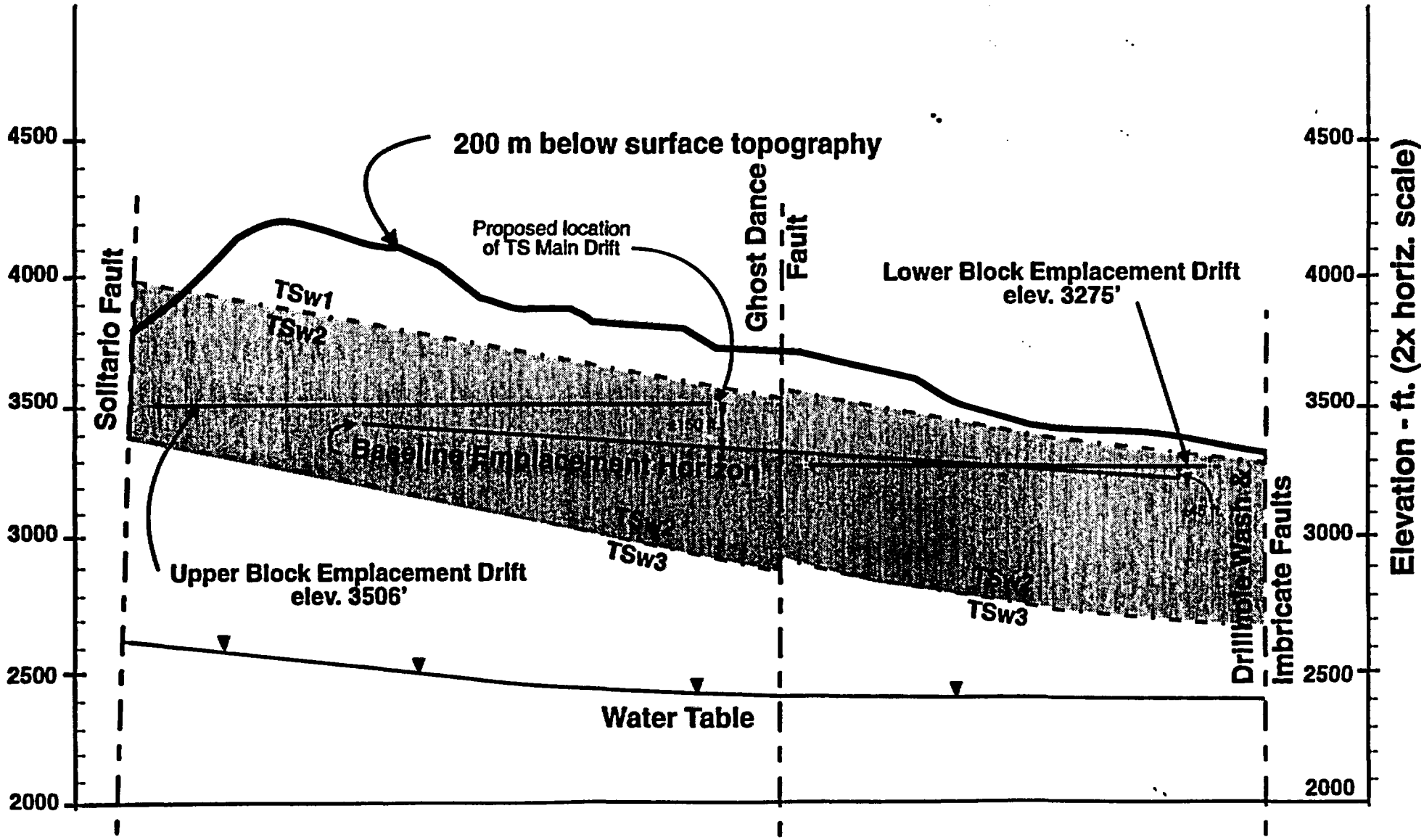


TS NORTH RAMP
TS SOUTH RAMP
TS SOUTH PORTAL
POTENTIAL REPOSITORY OUTLINE
MAXIMUM REPOSITORY BOUNDARY
E 565000
E 560000
KEY
ESF
REPOSITORY
MTA
REPOSITORY SHOPS & OPERATION AREA
NOTE :
THIS DRAWING IS BASED ON AN ORIGINAL DRAWING DEVELOPED BY PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
MINOR CHANGES WERE MADE TO THIS DRAWING DURING DRAWING CONVERSION
U.S. DEPARTMENT OF ENERGY
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT OFFICE
LAS VEGAS, NEVADA
RSN Raytheon Services Nevada
LAS VEGAS, NEVADA
EXPLORATORY STUDIES FACILITY
ESF/REPOSITORY INTERFACE
REPOSITORY GENERAL
LAYOUT & PLAN


Enhanced ESF Layout -
TSw2 and Calico Hills Drifting
TS North Ramp
-2.1%
CH North Ramp
Dedicated Main Test Area
TS South Ramp
Drill Hole Wash Structure
Imbricate Fault Zone
+ 2.6%
Ghost Dance Fault
North Ramp Extension
+ .5 to - 2.3%
+ 0.5%
TS Main Drift
+ 2.0%
+ 2.6%
South Ramp Extension
- .6 to - .9%
CH Main Drift
CH South Ramp
Solitario Canyon Fault
N
LYOTESF3.CDR.124/7-2-93


N
A Conceptual Repository Layout
LAPD = 60 kW/acre
North Portal
Waste Ramp
South Portal
Development Ramp
Drill Hole Wash Structure
Main Test Area
A'
Imbricate Fault Zone
Emplacement Drifts
Lower Block
Development Intake Shaft
Ghost Dance Fault
Emplacement Exhaust Shaft
Upper Block
A
Access Ramp to Lower Block
Access Ramp to Lower Block
Solitario Canyon Fault
BLCKREP.CDR.124/6-29-93

# Section A - A'




Note: Plane of section cuts through lowest emplacement drift in step-block layout.

SECTA-AR.CDR.124/6-29-93

# PROCESS FOLLOWED TO DEVELOP AND IMPLEMENT THE CHANGE

- The change was proposed in a comment made during the 50% Design Review of Title II Package 2
  - The comment centered on the use of rail haulage, and recommended making a change in the layout to flatten the grades
- As a result of the comment, a team was formed to evaluate the possibility of adjusting the layout
- The team produced the "Enhanced ESF" configuration with input from SNL (the IGIS geologic model) and the ESF Test Coordinator, LANL

# PROCESS FOLLOWED TO DEVELOP AND IMPLEMENT THE CHANGE

(CONTINUED)

- A briefing describing the plan was developed, and presented to YMP Management in June, 1993. The Project Manager made the decision at that time to proceed with Title II design under the assumption that the enhanced ESF would be baselined
- The description and rationale of the change was formalized in an M&O Design Analysis developed IAW M&O QAP 3-9. The Analysis is entitled "Description and Rationale for Enhancement to the Baseline ESF Configuration" #B00000000-01717-0200-00089

# PROCESS FOLLOWED TO DEVELOP AND IMPLEMENT THE CHANGE

(CONTINUED)

- The Analysis was technically reviewed IAW M&O QAP 3-1

Reviewers who had not been involved with the development of the concept were selected from the major program areas:

| | | |
|---|---|---|
| Mike Voegele | SAIC | Programmatic Issues |
| Dennis Williams | DOE | Geology/SBT Interface |
| Jaime Gonzalez | DOE | Mining |
| Hemi Kalia | LANL | ESF Testing |
| Jim Houseworth | M&O | Performance Assessment |
| Jim Blink | LLNL | Waste Package, Repository Performance |
| Robert Justice | M&O | Quality Assurance |

95 comments were received. All were resolved and the document updated. A complete review records package was submitted to Records IAW QAP 3-1

# PROCESS FOLLOWED TO DEVELOP AND IMPLEMENT THE CHANGE

(CONTINUED)

- The analysis was submitted to the Level 3 (M&O) Change Control Board IAW M&O QAP 3-4.

  The analysis was subsequently baselined and distributed as a controlled document

# PROCESS FOLLOWED TO DEVELOP AND IMPLEMENT THE CHANGE

(CONTINUED)

- A Change Request was prepared IAW YMP AP 3.3Q and submitted to the Level 2 (Project Level) CCB to change the project baseline to reflect the new configuration. The Analysis described above was included as an attachment to the CR for information. The following other project documents were included in the CR as "Affected Documents":
  - Reference Information Base (RIB)
  - Site Atlas
  - Preliminary Safety Analysis Report (PSAR)
  - Exploratory Studies Facility Design Requirement (ESFDR) document
  - ESF Technical Baseline
  - ESF Plan

# PROCESS FOLLOWED TO DEVELOP AND IMPLEMENT THE CHANGE

(CONTINUED)

## The Level 2 CCB is currently considering the change

# REPLACEMENT OF EAST-WEST CROSS DRIFTS WITH RAMP EXTENSIONS

# THE REPLACEMENT OF THE EAST-WEST CROSS DRIFTS WITH RAMP EXTENSIONS IS DISCUSSED IN THE DESIGN ANALYSIS PREVIOUSLY MENTIONED

# EAST-WEST CROSS DRIFTS

- Total length of excavation = 2,063 meters
- Allow examination of approximately 2/3 of the vertical extent of the TSw2
- Are located in the center of the potential repository block

# NORTH AND SOUTH RAMP EXTENSIONS

- Total length of excavation = 3,620 meters
- Allow examination of over 90% of the entire vertical extent of the TSw2
- Are located at the ends of the potential repository block

# ADVANTAGES OF THE EXTENSIONS

- Provides exposure of all strata to be utilized for emplacement
- Exposure of two distinct and separate areas
- Allows more flexibility with respect to potential repository area

# DISADVANTAGES OF THE EXTENSIONS

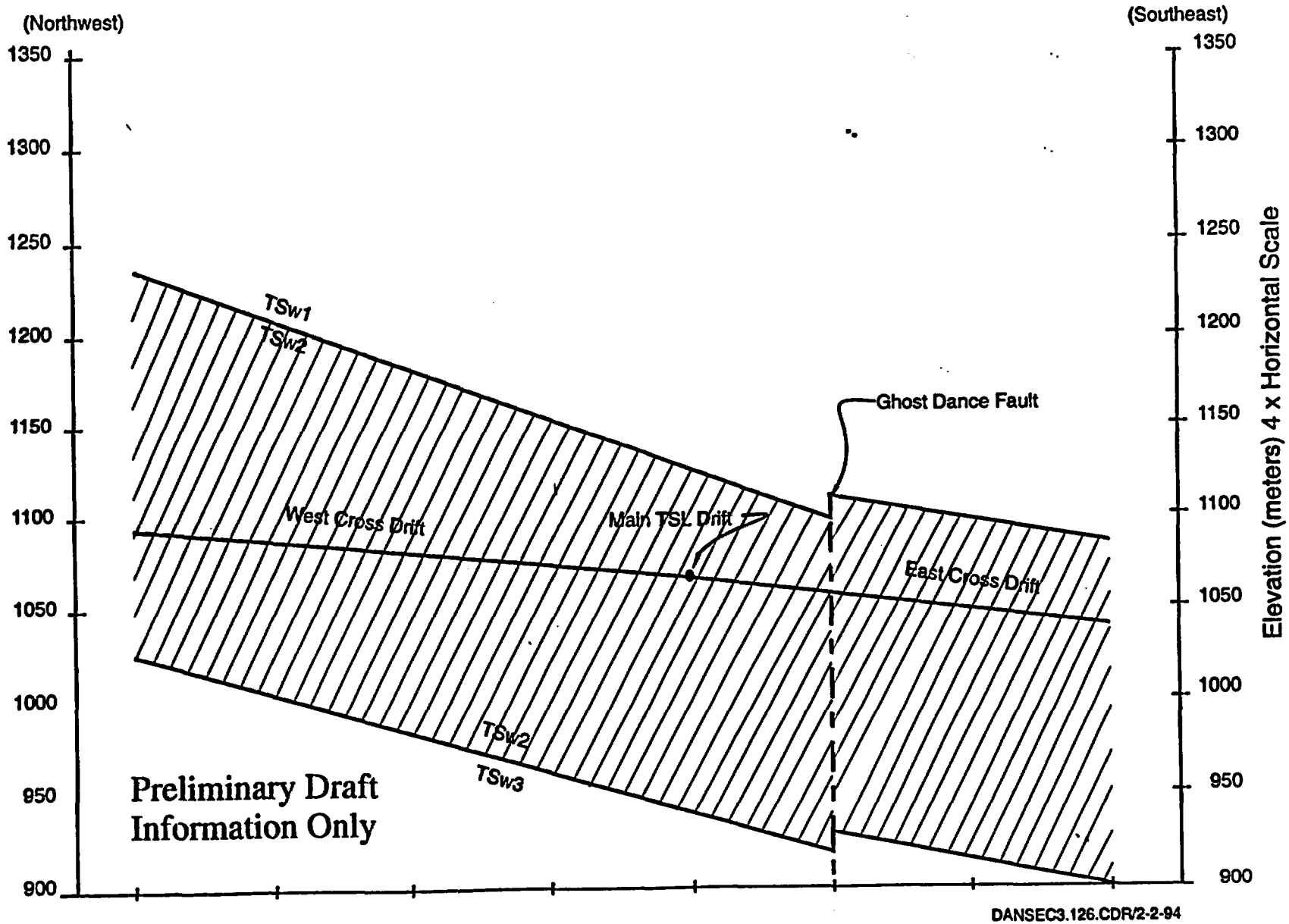
- Cost increase due to more excavation

# GUIDANCE FROM NRC:

"Various techniques are available to help gain an understanding of the geologic setting. However, drifting remains one of the most promising methods to resolve uncertainties. It also represents one of the more difficult challenges for coordinating the ESF design with the GROA design. Optimum ESF drift orientation and length may not necessarily coincide with the preferred GROA layout. A careful balancing of site characterization needs with geologic repository performance objectives will be essential."

...NUREG 1439 (July, 1991)

# SECTION THROUGH EAST-WEST CROSS DRIFT



Preliminary Draft
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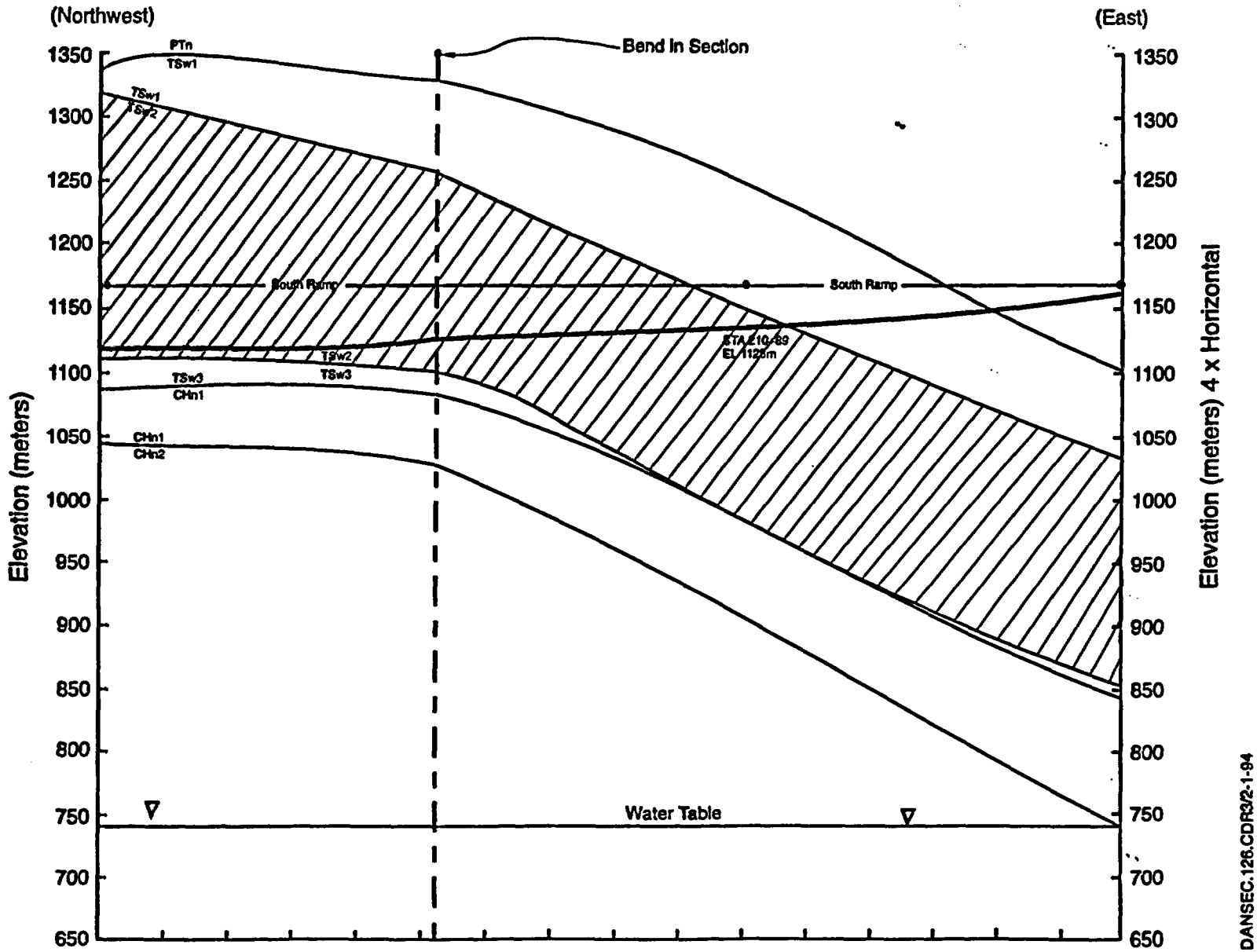
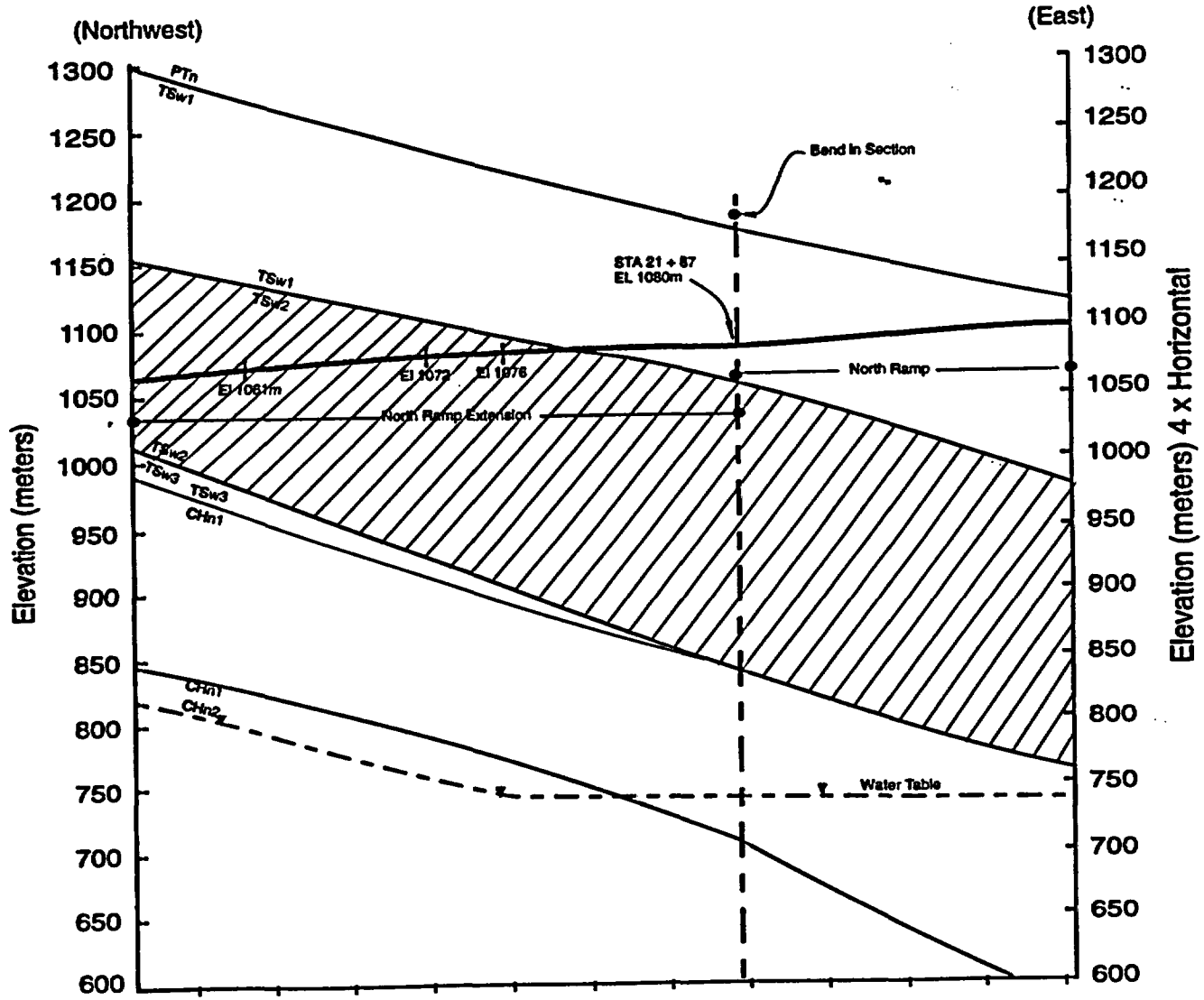
# SECTION THROUGH SOUTH RAMP EXTENSION




DANSEC.126.CDR3/2-1-94

# SECTION THROUGH NORTH RAMP EXTENSION

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DANSEC2.126.CDR/2-2-94

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

# DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

# ESF DESIGN AND CONSTRUCTION PROGRESS


PRESENTED BY

JAMES M. REPLOGLE

CHIEF, EXPLORATORY STUDIES FACILITY BRANCH


FEBRUARY 3, 1994

LAS VEGAS, NEVADA

# PRESENTATION PARAMETERS

- ESF design and construction progress information is based on projected budgets of:
  - FY94 = $55M
  - FY95 = $101M
  - FY96 = $114M
  - FY97 = $119M
- ESF packages are described either by configuration items (where defined) or projected scope

# PACKAGE 1A:
# NORTH PORTAL SITE PREPARATION

## Configuration items:

- Tunnel Boring Machine (TBM), TBM starter tunnel, pad and access road, pad water system; switchgear building, rock and topsoil storage area, Test Alcove 1

## Design Status

- All items complete and accepted for construction

# PACKAGE 1A:
# NORTH PORTAL SITE PREPARATION

(CONTINUED)

## Construction status:

- Complete
  - TBM starter tunnel
  - Pad and access road
  - Rock and topsoil storage area
  - Test Alcove #1

- In process
  - TBM
  - Switchgear building
  - Pad water system

## Acceptance status: Pending

# PACKAGE 1B:
# NORTH PORTAL SURFACE FACILITIES AND UTILITIES

## Configuration items:

- Change House building, shop building, pad sewer system, pad electrical system, pad waste water system, pad drainage, explosive storage area, pad and access road, water system, surface rail

## Design Status

- All items complete and accepted for construction

# PACKAGE 1B: NORTH PORTAL SURFACE FACILITIES AND UTILITIES

(CONTINUED)

## Construction status:

- In process
  - Pad sewer system
  - Pad electrical system
  - Pad waste water system
  - Pad drainage
  - Pad water system
- Scheduled for FY95
  - Change House building
  - Shop building
  - Pad and access road
  - Explosive storage area

## Acceptance status: Pending

Preliminary Draft Information Only

ESFD&CJR5.PM4.126/2-3-94

# PACKAGE 1C:
# NORTH PORTAL SURFACE FACILITIES AND UTILITIES

## Configuration items:

- Compressed air systems, standby power

## Design Status

- In process, complete mid-FY94

## Construction Status: Complete FY95

- Compressed air systems
- Standby power

## Acceptance Status: Pending

# PACKAGE 1D:
# NORTH PORTAL SURFACE FACILITIES AND UTILITIES

## Design Scope:

- Operations building, warehouse building, steam cleaning system, pad and access roads, covered storage, fuel storage system, pad electrical system, Integrated Data System (IDS) subsurface safety and alarm system

## Design Status

- In process, complete FY95

## Construction Status: Start FY95 - Complete FY96

## Acceptance Status: Pending

# PACKAGE 2A:

Configuration Items: None. Components only

Design Status: Complete

Construction Status: Procurement only, complete FY95

Acceptance Status: Pending

# PACKAGE 2B:

## Configuration items:

- None. Components, trade studies and analysis

## Design Status

- 90% Design Review in process

## Construction Status: Procurement only FY94

## Acceptance Status: Pending

# PACKAGE 2C: NORTH RAMP TO TOPOPAH SPRING LEVEL (TSL)

## Configuration items:

- North Ramp Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor systems

## Design Status

- In process - Complete late FY94

## Construction Status: Start FY94 - Complete FY95

## Acceptance Status: Pending

Preliminary Draft Information Only

ESFD&CJR10.PM4.126/2-3-94

# PACKAGE 3A: SOUTH PORTAL SITE PREPARATION

## Design Scope:

- Pad and access roads, pad water and sewer systems, pad drainage

## Design Status

- Start FY95 - Complete FY96

## Construction Status: Start FY95 - Complete FY96

## Acceptance Status: Pending

# PACKAGE 3B: SOUTH PORTAL FACILITIES AND UTILITIES

## Design Scope:

- Fan/Airlock structure, portal control building, shop building, warehouse building, pad utilities

## Design Status

- Start FY95 - Complete FY96

## Construction Status: Start FY95 - Complete FY96

## Acceptance Status: Pending

# PACKAGE 4: SOUTH RAMP TO TOPOPAH SPRING LEVEL (TSL)

## Design Scope:

- South Ramp Excavation/breakthrough, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

## Design Status

- Start FY95 - Complete FY95

## Construction Status: Start FY96 - Complete FY96

## Acceptance Status: Pending

# PACKAGE 5: NORTH RAMP TO CALICO HILLS LEVEL (CH)

## Design Scope:

- North Ramp To Calico Hills Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

## Design Status

- Start FY96 - Complete FY97

## Construction Status: Start FY98 - Complete FY00

## Acceptance Status: Pending

# PACKAGE 6: SOUTH RAMP TO CALICO HILL LEVEL (CH)

## Design Scope:

- South Ramp To Calico Hills Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

## Design Status

- Start FY96 - Complete FY97

## Construction Status: Start FY97 - Complete FY99

## Acceptance Status: Pending

# PACKAGE 7: CALICO HILL (CH) DRIFTING

## Design Scope:

- Calico Hills Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

## Design Status

- Start FY96 - Complete FY97

## Construction Status: Start FY99 - Complete FY01

## Acceptance Status: Pending

# PACKAGE 8A: TOPOPAH SPRING LEVEL (TSL) MAIN DRIFT

## Design Scope:

- TSL main drift excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

## Design Status

- Start FY94 - Complete FY95

## Construction Status: Start FY95 - Complete FY96

## Acceptance Status: Pending

# PACKAGE 8B: TOPOPAH SPRING LEVEL (TSL) NORTH RAMP EXTENSION

## Design Scope:

- North Ramp Extension Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

## Design Status

- Start FY95 - Complete FY96

## Construction Status: Start FY97 - Complete FY98

## Acceptance Status: Pending

# PACKAGE 8C: TOPOPAH SPRING LEVEL (TSL) SOUTH RAMP EXTENSION

## Design Scope:

- South Ramp Extension Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

## Design Status

- Start FY95 - Complete FY96

## Construction Status: Start FY97 - Complete FY98

## Acceptance Status: Pending

Preliminary Draft Information Only

ESFD&CJR19.PM4.126/2-3-94

# PACKAGE 9: TOPOPAH SPRING LEVEL (TSL) MAIN TEST AREA

## Design Scope:

- TSL Main Test Area Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

## Design Status

- Start FY95 - Complete FY96

## Construction Status: Start FY96 - Complete FY98

## Acceptance Status: Pending

# PACKAGE 10: OPTIONAL SHAFT

## Design Scope:

- Optional shaft excavation, linings and ground support, support utilities, site and pad preparation

## Design Status

- Start FY97 - Complete FY98

## Construction Status: Start FY98 - Complete FY00

## Acceptance Status: Pending

# ESF Seismic Design Basis

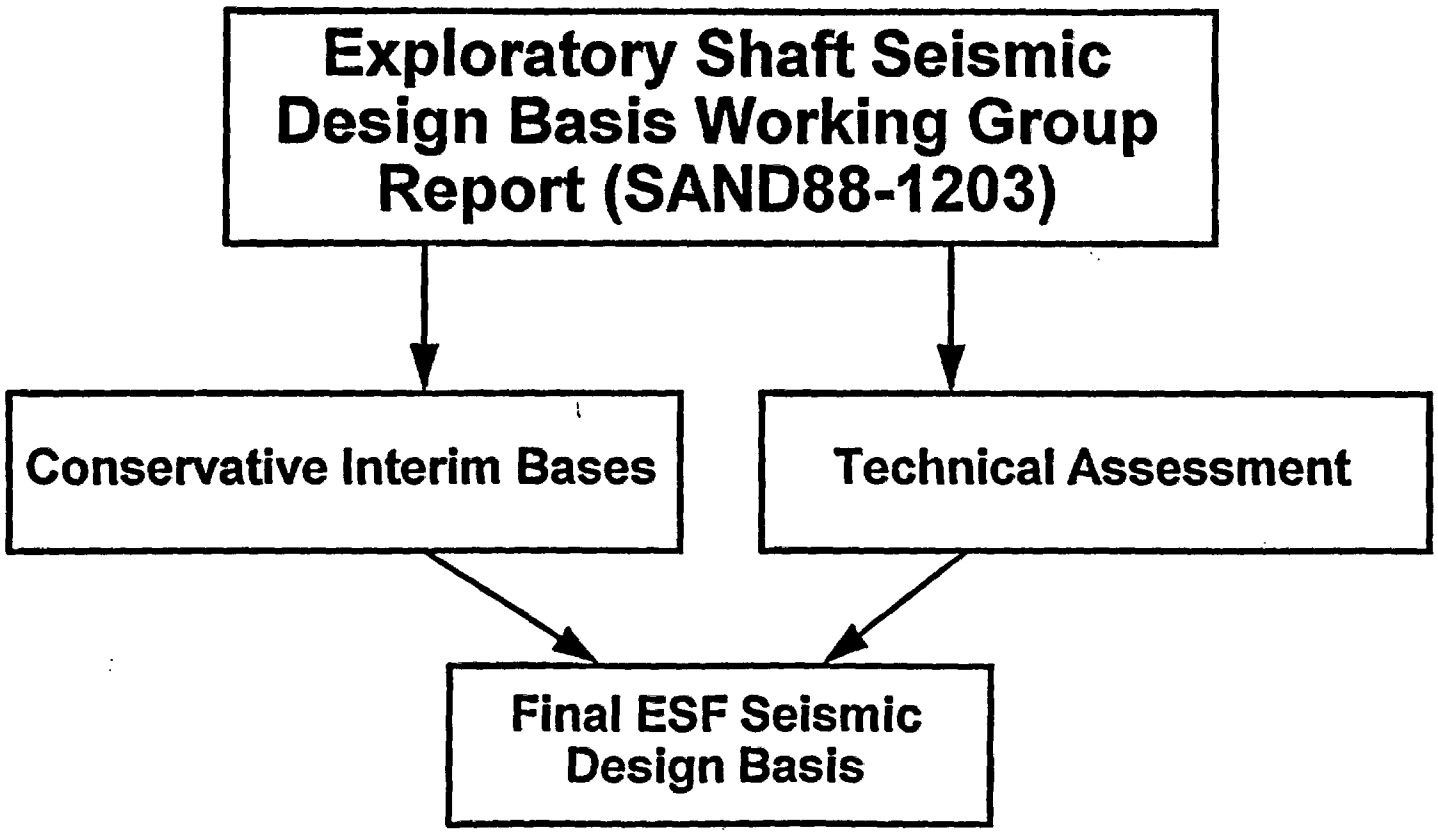
## DOE-NRC TECHNICAL EXCHANGE ON THE EXPLORATORY STUDIES FACILITY TITLE II DESIGN

Richard C. Quittmeyer
February 3,1994

# SCOPE OF PRESENTATION

- Evolution of Seismic Design Basis for ESF
  - Exploratory Shaft Seismic Design Basis Working Group Report (SAND88-1203)
  - Interim Bases
  - Technical Assessment of SAND88-1203
- Preview of Technical Assessment Results

# EVOLUTION OF ESF SEISMIC DESIGN




Preliminary Predecisional Draft Material

# WORKING GROUP REPORT (SAND88-1203)

- **Status**
  - Issued in 1990
  - Referenced in DOE response to SCA Comment 121
- **Content**
  - Considered configuration consisting of two shafts and an underground test area.
  - Conservatively recommended that design basis be consistent with that for a "low-hazard" or "essential" facility according to DOE Order 6430.1 "U.S. DOE General Criteria Manual"
  - Provided vibratory ground motions for design consistent with those having a 10 percent chance of being exceeded in 100 years (assumed lifetime of the ESF)

# WORKING GROUP REPORT (SAND88-1203)

- Content (continued)
  - For conservativeness, included an additional factor of 10 in assessing the possibility of fault displacement ($10^{-4}$)
  - Based on available probabilistic seismic hazard analyses, selected a magnitude 6.5 earthquake on the Bare Mountain fault as the design basis earthquake
  - Selected a 700 KT underground nuclear explosion in Buckboard Mesa as the design basis UNE

# WORKING GROUP REPORT (SAND88-1203)

- Control Ground Motions

| FROM DESIGN BASIS EARTHQUAKE | | | FROM DESIGN BASIS UNE | | |
|---|---|---|---|---|---|
| | ACCEL. (G) | VELOCITY (CM/SEC) | | ACCEL. (G) | VELOCITY (CM/SEC) |
| VERTICAL | 0.3 | 20 | VERTICAL | 0.2 | 9 |
| HORIZONTAL | 0.3 | 30 | RADIAL | 0.1 | 12 |
| | | | TRANSVERSE | 0.1 | 12 |

- Control Fault Displacement
  - Recommended that fault displacement not be considered in design

Preliminary Predecisional Draft Material

# WORKING GROUP REPORT (SAND88-1203)

- Other Recommendations
  - For added conservatism
    - > Take no credit of attenuation of ground motion with depth
    - > Check designs for satisfactory performance when subjected to ground motion 1.67 times the design basis motions

# ESF RE-CONFIGURATION

- Implications for Seismic Design Basis
  - Given re-configuration of ESF including ramps and drifts instead of shafts, DOE initiated a Technical Assessment (QMP-02-08 / YAP-2.1Q) of the Working Group Report (SAND88-1203)
  - Pending completion of the Technical Assessment, a conservative interim basis was put in place

# INTERIM BASIS

- Control Ground Motions

| | SURFACE | SUB-SURFACE |
|---|---|---|
| ESF (TEMPORARY) | UBC (ZONE 4) | 0.3 g |
| ESF (PERMANENT) | 0.75 g [TBV] * | 0.4 g [TBV] * |
| REPOSITORY | 0.75 g [TBV] | 0.4 g [TBV] |

* In some cases, ESF permanent items will be designed to the criteria for temporary items, if the item can be upgraded or replaced to meet repository criteria at a later date

- Control Fault Displacements
  - ESF design should allow items to be upgraded or replaced to meet repository criteria at a later date

# INTERIM BASIS

- **Basis is Conservative**
  - With respect to temporary structures, Yucca Mountain is near the boundary between UBC zones 2B and 3; thus design in accordance with zone 4 is conservative
  - According to past seismic hazard analysis (SAND86-7013), peak ground acceleration of 0.75 g has an annual probability of between $10^{-4}$ and $10^{-5}$ of being exceeded
  - Represents median ground acceleration from a magnitude 7.7 earthquake at a distance of about 2 km. Current indications are that such an event is larger than those expected in the immediate vicinity of Yucca Mountain

# TECHNICAL ASSESSMENT

- Scope
- Review of Working Group Report (SAND88-1203)
- Preliminary Results for New Recommendation

# TECHNICAL ASSESSMENT

- Scope
  - Evaluate recommendations of the Working Group Report in light of the current ESF configuration, and increased knowledge on the tectonic framework in the vicinity of Yucca Mountain
  - If the guidance of the Working Group is no longer appropriate, recommend a new seismic design basis for the ESF

# TECHNICAL ASSESSMENT

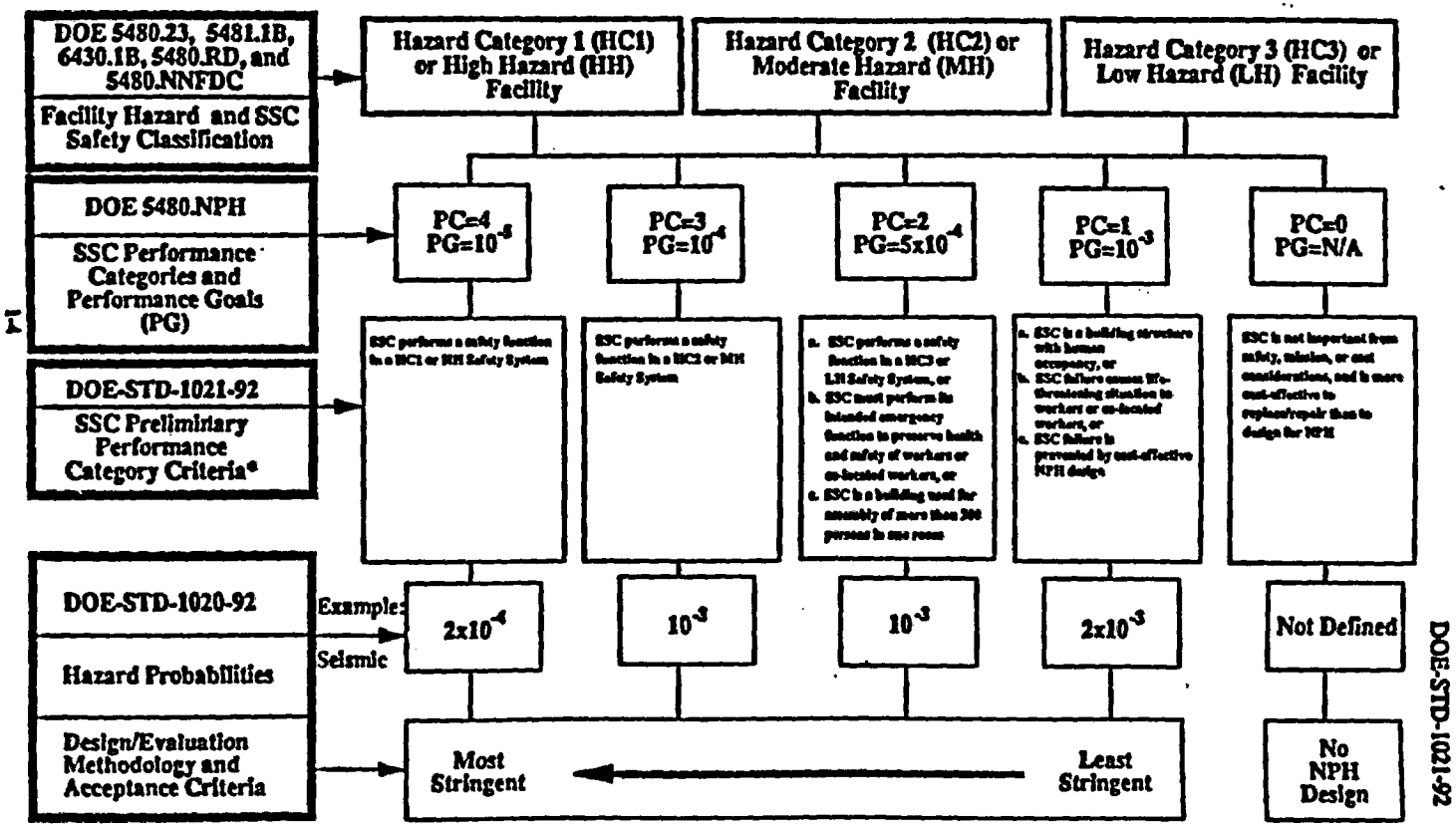
- Review of the Working Group Report
  - Assumptions related to the configuration of the Exploratory Shaft Facility are inappropriate given the current configuration of the ESF involving ramps and drifts
  - Data acquired through site characterization activities suggest that the design basis seismic event at the site may differ from that used by the Working Group
  - Multiple levels of conservatism may result in an overly conservative result
  - Summary: The Working Group Report is outdated and thus the recommended seismic design basis is no longer appropriate

# TECHNICAL ASSESSMENT

- Approach for New Recommendation
  - Provide seismic design basis consistent with "performance-goal based design" process
    - > Risk-based design
    - > Uses performance categories with associated performance goals and seismic design criteria
    - > Items are categorized according to the adverse consequences of their failure
  - Update probabilistic seismic hazard assessment to support determination of a seismic design basis

# TECHNICAL ASSESSMENT

**Figure 1-1: Relationship among Facility Hazard Class/Category, SSC Performance Category and Pertinent DOE Orders and Standards.**




Preliminary Predecisional Draft Material

# TECHNICAL ASSESSMENT

- Preliminary Results - Seismic Hazard Analysis
  - Sources identified and evaluated on the basis of preliminary results from site characterization activities
    - > 24 fault sources
    - > 1 background zone
  - Evaluation of uncertainties in recurrence and maximum magnitude
  - Ground motion / attenuation based on available relations for the western U.S.

# TECHNICAL ASSESSMENT

- **Preliminary Results - Seismic Hazard Analysis (continued)**

| Ground Motion Parameter | Annual Exceedance Probability | | |
|---|---|---|---|
| | Category 1 | Category 2 & 3 | Category 4 |
| | $2 \times 10^{-3}$ | $1 \times 10^{-3}$ | $2 \times 10^{-4}$ |
| Peak Acceleration (g) | 0.19 | 0.27 | 0.53 |
| Peak Velocity (cm/sec) | 11 | 16 | 34 |

Preliminary Predecisional Draft Material

# TECHNICAL ASSESSMENT

- **Preliminary Results - Attenuation with Depth**
  - Examined limited site specific data from explosions and earthquakes
  - Evaluated attenuation of ground motion with depth from other studies in southern California and Japan
  - Recommendations:

| Depth (m) | Reduction in PGV | | Reduction in PGA | |
|---|---|---|---|---|
| | Horizontal | Vertical | Horizontal | Vertical |
| 100 | 0.70 | 0.80 | 0.60 | 0.70 |
| 200 | 0.55 | 0.65 | 0.50 | 0.60 |
| 300 | 0.40 | 0.50 | 0.40 | 0.50 |

Preliminary Predecisional Draft Material

# SUMMARY

- The Working Group Report (SAND88-1203) is outdated with respect to the current ESF configuration
- A conservative interim basis is being used for ESF design
- Results of a preliminary probabilistic seismic hazard assessment confirm that the interim basis is adequately conservative

# DOE-NRC Technical Meeting on Exploratory Studies Facility

## CONSIDERATION OF FAULT DISPLACEMENT HAZARDS IN GEOLOGIC REPOSITORY DESIGN

Bruce T. Stanley
February 3, 1994

NUREG-1ZZZ

# STAFF TECHNICAL POSITION ON CONSIDERATION OF FAULT DISPLACEMENT HAZARDS IN GEOLOGIC REPOSITORY DESIGN

Public Comment Draft - March 1993

Keith I. McConnell, Michael P. Lee

Division of High-Level Waste Management
Office of Nuclear Material Safety and Safeguards

U.S. Nuclear Regulatory Commission

Washington, D. C. 20555

DRAFT

# Type I Faults

"Type I faults refer to those faults or fault zones that are subject to displacement, are of sufficient length, and are located in such a manner that they may affect repository design and/or performance. As such, they should be investigated in detail (McConnel et al., 1992, pg. 5).

# Issues Presented in the STP Addressing Fault Displacement Hazards in Repository Design

- Type I faults inside the controlled area present a potentially adverse condition which may be mitigated by design, limited engineering, or other favorable conditions.
- Repository design of structures and systems in Type I fault areas may be acceptable if displacement is adequately addressed.
- Complex engineering is difficult to assess in providing "reasonable assurance" that solutions are adequate. Avoidance is preferable.

# Issues Presented in the STP Addressing Fault Displacement Hazards in Repository Design (cont'd)

- Descriptions of solutions and assessments must be in sufficient detail to provide "reasonable assurance" of engineered and natural barrier effectiveness.

- Avoidance of Type I fault areas is clearly preferred over engineering solutions.

- DOE should seek early resolution of fault-related design and performance issues.

# Staff Position Synopsis

- Type I faults inside the controlled area, do not, by themselves, disqualify a candidate site.
- There are basically two ways to handle design of structures and systems in Type I fault areas;
  - avoidance of the area
  - if unavoidable, then demonstrate with "reasonable assurance" that 10 CFR 60 performance objectives are met.

<u>Note</u>: Reliance on engineering may be of limited value.

# DOE Current Approach for Assessment of Displacement Hazard

- Evaluate seismic sources, recurrence, and upper bound magnitude.
- Evaluate actual displacement conditions within GROA.
- Characterize the type of displacement and probable magnitude/rate.
- Evaluate uncertainty.
- Hazard assessment will be covered in Study Plan 8.3.1.17.3.6 "Probabalistic Seismic Hazard Analysis".

# Character of Fault Displacement

- Sudden potentially large displacement resulting from tectonic events.
- Long term slow continuous movement and/or small displacement events.

# Potentially Affected Subsurface Areas

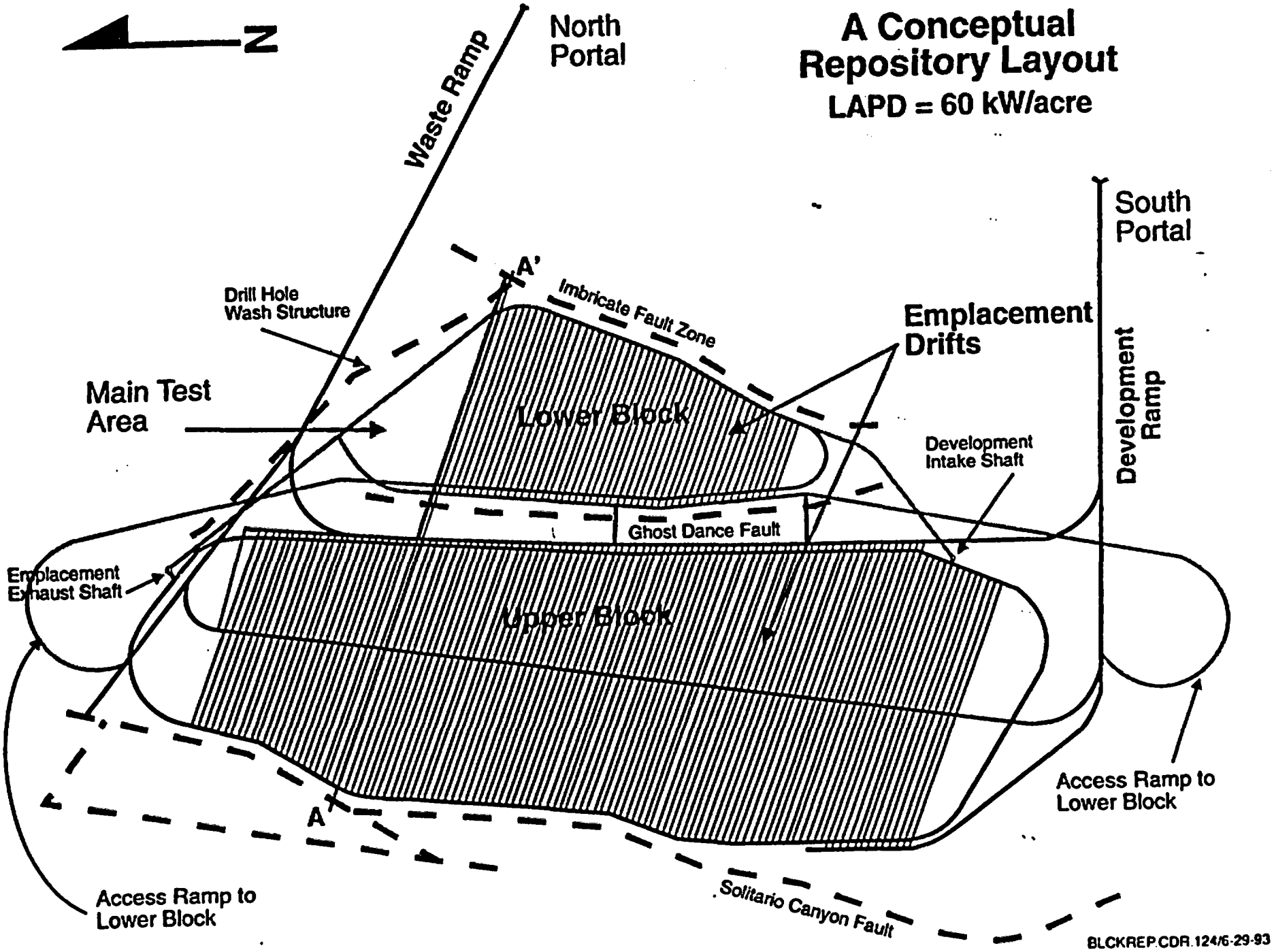
- Waste Emplacement Locations
- Accesses

# Potentially Affected Items or Systems

- Waste Packages
- Waste Package Near Field Environment
- Critical Accesses
- Critical Support Systems (Utilities, structures, etc.)

# General Design Features

- Enhanced ESF/Repository reference Configuration embodies the primary "avoidance" philosophy expressed in the STP.
- All subsurface openings will be mapped to identify geologic structures.
- Design has inherent flexibility to allow strategic waste package emplacement, retrieval, and movement.
- The engineered waste package is, in itself, structurally sound.


N
North Portal
Waste Ramp
A Conceptual Repository Layout
LAPD = 60 kW/acre
South Portal
Development Ramp
A'
Imbricate Fault Zone
Drill Hole Wash Structure
Emplacement Drifts
Main Test Area
Lower Block
Development Intake Shaft
Ghost Dance Fault
Emplacement Exhaust Shaft
Upper Block
Access Ramp to Lower Block
A
Access Ramp to Lower Block
Solitario Canyon Fault
BLCKREP.CDR.124/6-29-93

# Methods to Mitigate Slow Continuous Movement and Small Displacement Events

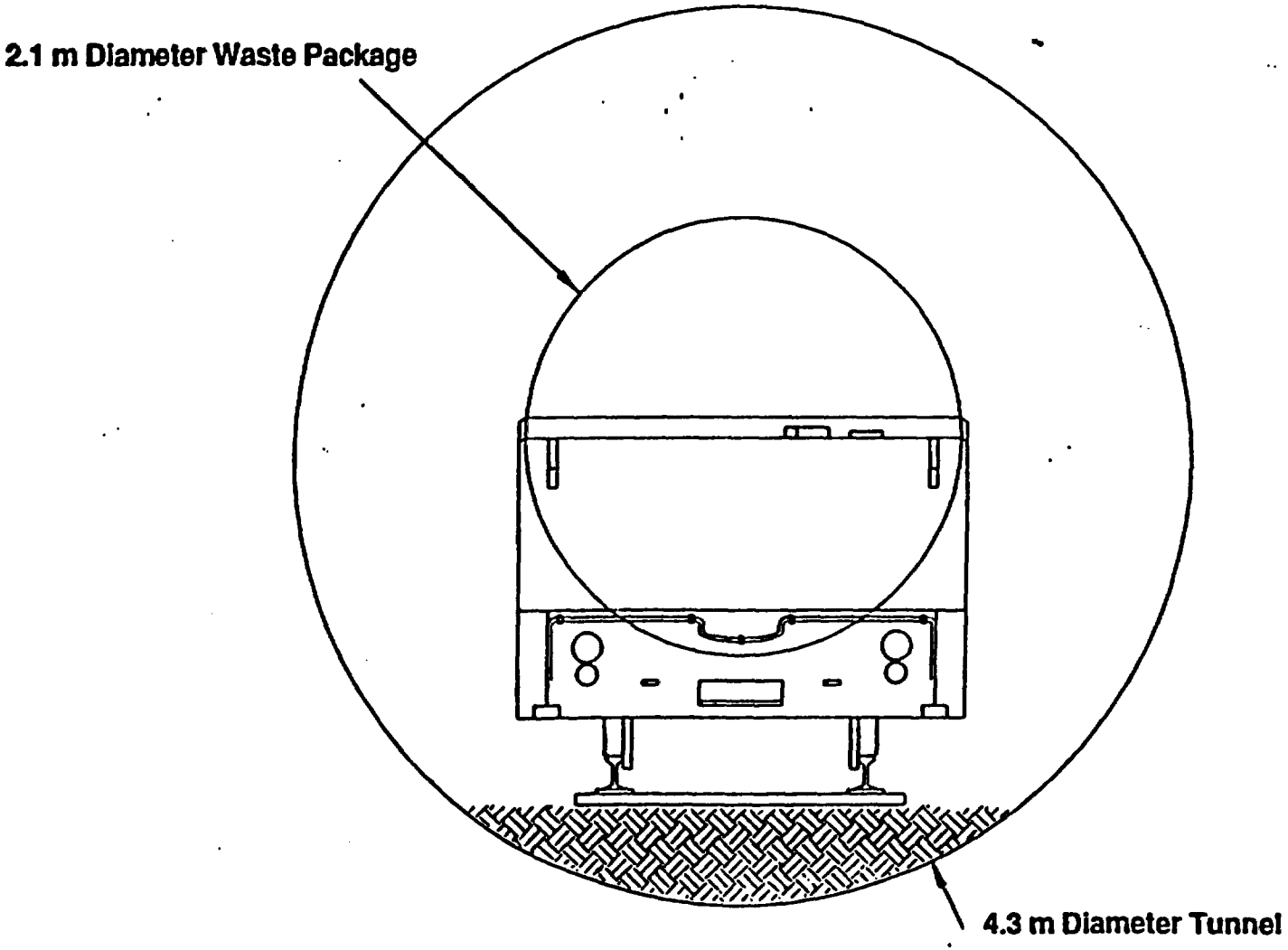
- Avoidance
- Maintenance
- Realignment of utilities, systems, etc.
- Periodic re-construction of structures

<u>Note:</u> These methods primarily apply to non-emplacement areas.

# Methods to Mitigate Large Displacement Events

- Emplacement areas avoid Type I fault proximity.
- In-drift emplacement inherently avoids unforseen displacement and subsequent "shearing" danger.
- Different methods of access (i.e. shafts) are located to avoid Type I faults.
- Redundant systems ensure against complete disruption due to fault displacement, e.g. utilities, multiple door airlocks, etc.

# Rail Waste Transporter




**Preliminary Drawing**
(BEST AVAILABLE COPY)

DCACDSKB12.125.NWTRB/7-13/14 93

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

# ADMINISTRATIVE PROCEDURE (AP-6.14): REPORTABLE GEOLOGIC CONDITIONS REVISION 0, 2/1/91

*PRESENTED BY*

SUSAN JONES

FEBRUARY 3, 1994

# PURPOSE:

Documentation and reporting of significant unexpected geologic conditions (analogous to reactor industry reports of significant events)

# SCOPE:

Provides guidelines for:

- Identifying whether an unexpected geologic condition is reportable to the US Nuclear Regulatory Commission (NRC)
- Documenting subsequent actions
- Notifying the NRC

# APPLICABILITY:

Applies during the pre-license application phase to all Project Office staff and Project Participants engaged in Site Characterization Activities in which unexpected geologic conditions of interest may be encountered

## Activities include:

- Construction of the Exploratory Shaft Facility (ESF), ESF shafts, ramp, and drifts
- Surface-based drilling and testing
- Other test and evaluation activities related to site characterization on the surface or underground

# APPLICABILITY:

(cont.)

- Procedure does NOT apply to reporting of Unusual Occurrences which is dealt with in Yucca Mountain Administrative Procedure YAP-30.1, Occurrence Reporting and Processing of Operations Information

- "Unusual Occurrence" would relate to a non-emergency condition that has significant impact or potential for impact on safety, environment, health, security, or operations (i.e., environmental spill, degradation of personnel safety, etc), as defined in DOE Order 5000.3B

# CRITERIA:

## REPORTABLE GEOLOGIC CONDITION

### Geologic Condition:

Refers to geologic-related fields such as hydrology, geochemistry, tectonics, and rock mechanics

### Reportable Geologic Condition:

A. One determined to be significant and to require notification of the NRC and other agencies

B. One that if not investigated in a timely manner could result in the loss of data relevant to characterization

# CRITERIA:

(cont.)

## SIGNIFICANT (or SIGNIFICANCE)

A specific condition so different from predicted or expected range of values or events that it may:

- Impact the design and construction of the ESF, waste package, or geologic repository
- Have a potentially adverse impact on the ability to characterize the site or on the isolation capability of the site
- Be a potential deficiency in the site's characteristics that could, if not further examined and evaluated or corrected, be a potential safety hazard or an important deviation from established design criteria and basis
- Be sufficiently relevant such that acquisition of additional data would be required to document the condition

# CRITERIA:

(cont.)

## DELAY OF WORK

Temporary work stoppage during which a potentially reportable geologic condition may be investigated and evaluated for significance. Length of the work stoppage is dependent on the time required to determine the significance of the geologic condition and, if determined significant, the time to decide on an appropriate course of action.

# RECORDS OF REPORTABLE GEOLOGIC CONDITIONS

All such reports shall be documented and included in the permanent Project records in accordance with Records Management Plan (YMP/93-08)

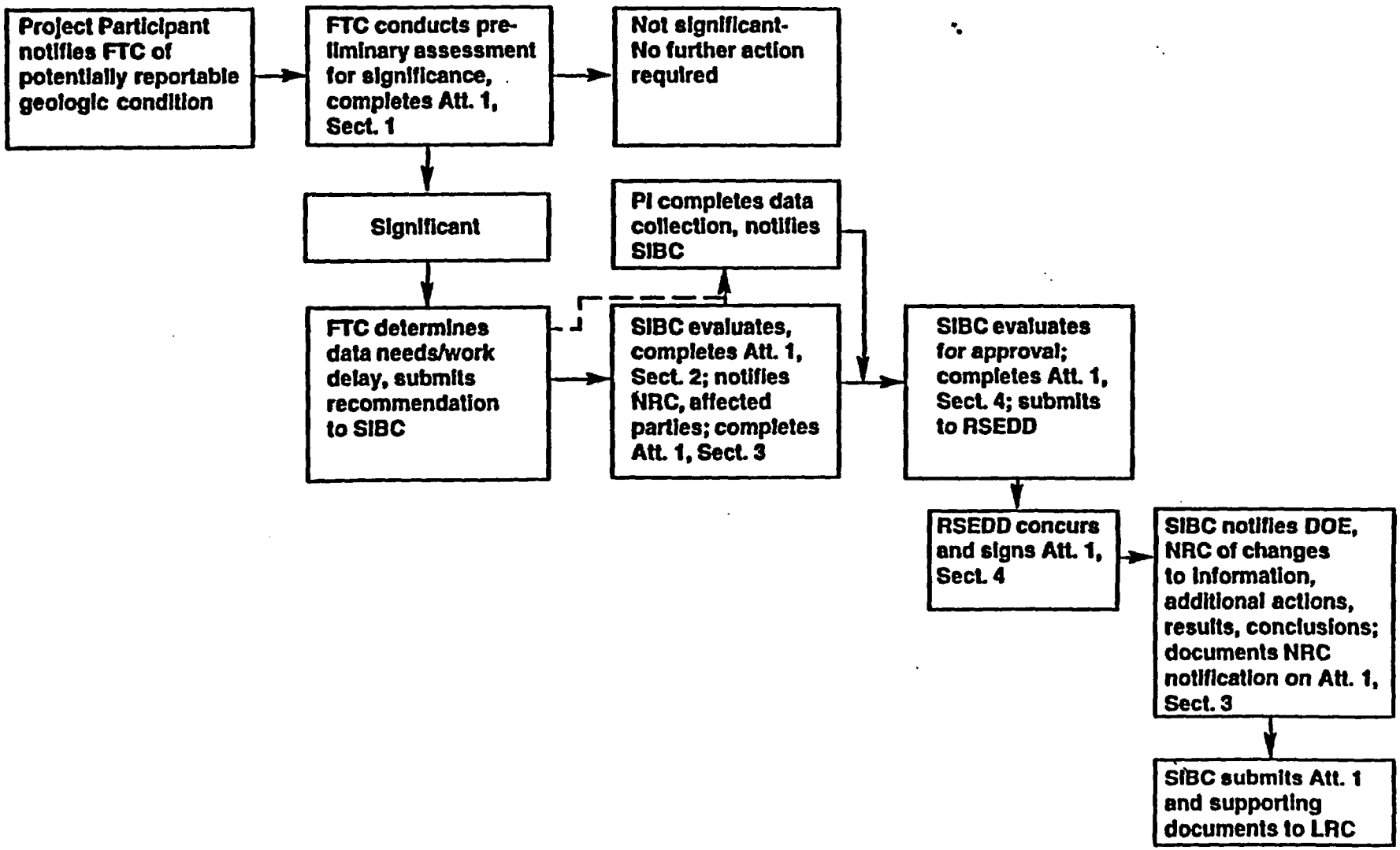
Items to be submitted as part of a records package:

- Report forms and copies
- All records produced from additional data collection activities
- Copies of notifications to the NRC/OR and State of Nevada officials
- Completed record package must be submitted to the Local Records Center

# FUNCTIONAL RESPONSIBILITIES UPON INITIATION OF AP-6.14 PROCESS

| | |
|---|---|
| Field Personnel | Identify condition |
| | Determine significance |
| | Recommend data needs/work delay |
| SIB Branch Chief | Agrees/disagrees with initial response |
| | Notifies NRC/OR and any other affected parties |
| | Communicates with DOE management and NRC all changes to earlier information, additional actions, and results |
| | Documents actions and notifications |
| RSED Director | Concurs with proposed actions |
| Principal Investigator (PI) | Completes data collection |

# AP-6.14 PROCESS AND FUNCTIONAL RESPONSIBILITIES




APRCGSJ10.PM4.DOE/1-28-94

# LITTLE SKULL MOUNTAIN CASE STUDY

- Little Skull Mountain Earthquake occurred June 29, 1992 at 0314 PDT
- AP-6.14 process was begun to determine whether the earthquake should be categorized as a "Reportable Geologic Condition"
- Investigation under Study Plan 8.3.1.17.4.1 was recommended and initiated to study the aftershocks, to characterize seismic source parameters and attenuation in the Yucca Mountain vicinity, and to search for surface faults
- The AP-6.14 criteria to declare the event a "Reportable Geologic Condition" were not met

# LITTLE SKULL MOUNTAIN CASE STUDY
(cont.)

## Criterion 1:

Impact to the design and construction of the ESF, waste package, or geologic repository

- An earthquake of M=5.6 was not unexpected for the region
- Study Plan 8.3.1.17.4.1 was in place to study such an event
- Peak horizontal accelerations of 0.10 to 0.16 g were well below the conceptual design of 0.4 g

## Criterion 2:

Potentially adverse impact on the ability to characterize the site or on the isolation capability of the site

- No evidence was found to indicate adverse impact on site characterization activities or site isolation capability.

# LITTLE SKULL MOUNTAIN CASE STUDY
## (cont.)

### Criterion 3:

**Potential deficiency of the site's characteristics that could, if not further examined and evaluated or corrected, be a potential safety hazard or an important deviation from established design criteria and basis**

- On-site recordings indicated groundwater level changes of ±0.8 foot, returning to normal within 30 minutes of the earthquake event
- Damage to the Field Operations Center was noted as a result of this earth quake, but delays to site characterization activities were minimally delayed
- Site drilling was not impacted
- No surface faulting was observed

### Criterion 4:

**Sufficient relevancy to site characterization such that acquisition of additional data would be required to document the condition**

- Study Plan 8.3.1.17.4.1, in place prior to the earthquake, was implemented as planned to investigate the event

# LESSONS LEARNED FROM LITTLE SKULL MOUNTAIN EARTHQUAKE

Revision of AP-6.14 "Reportable Geologic Conditions" necessary:

- DOE Field Test Coordinator to focus on performance of technical analysis
- M&O support staff to document events in "real time"

Revision to AP-6.14 should be completed prior to Tunnel Boring Machine start of operations

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

# DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

## BOREHOLE SAMPLING, TESTING AND MONITORING PROGRAM


*PRESENTED BY*

**DENNIS R. WILLIAMS**

CHIEF, SITE INVESTIGATIONS BRANCH


DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

**FEBRUARY 3, 1994**

LAS VEGAS, NV

# TOPICS OF DISCUSSION

- Support of ESF Design
- Changes to the Surface-Based Testing Program Relative to the ESF Design Schedule
- Integration of NRG Drillholes
- Drilling Results Indicating a Higher North-End Block

PRELIMINARY DRAFT
INFORMATION ONLY

# MYTH

- This is a drilling program

# FACT

- This is a testing and sampling program
- We are not just drilling Yucca Mountain, but are testing and sampling Yucca Mountain

PRELIMINARY DRAFT
INFORMATION ONLY

# TOPICS OF DISCUSSION

- Support of ESF Design
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PRELIMINARY DRAFT
INFORMATION ONLY

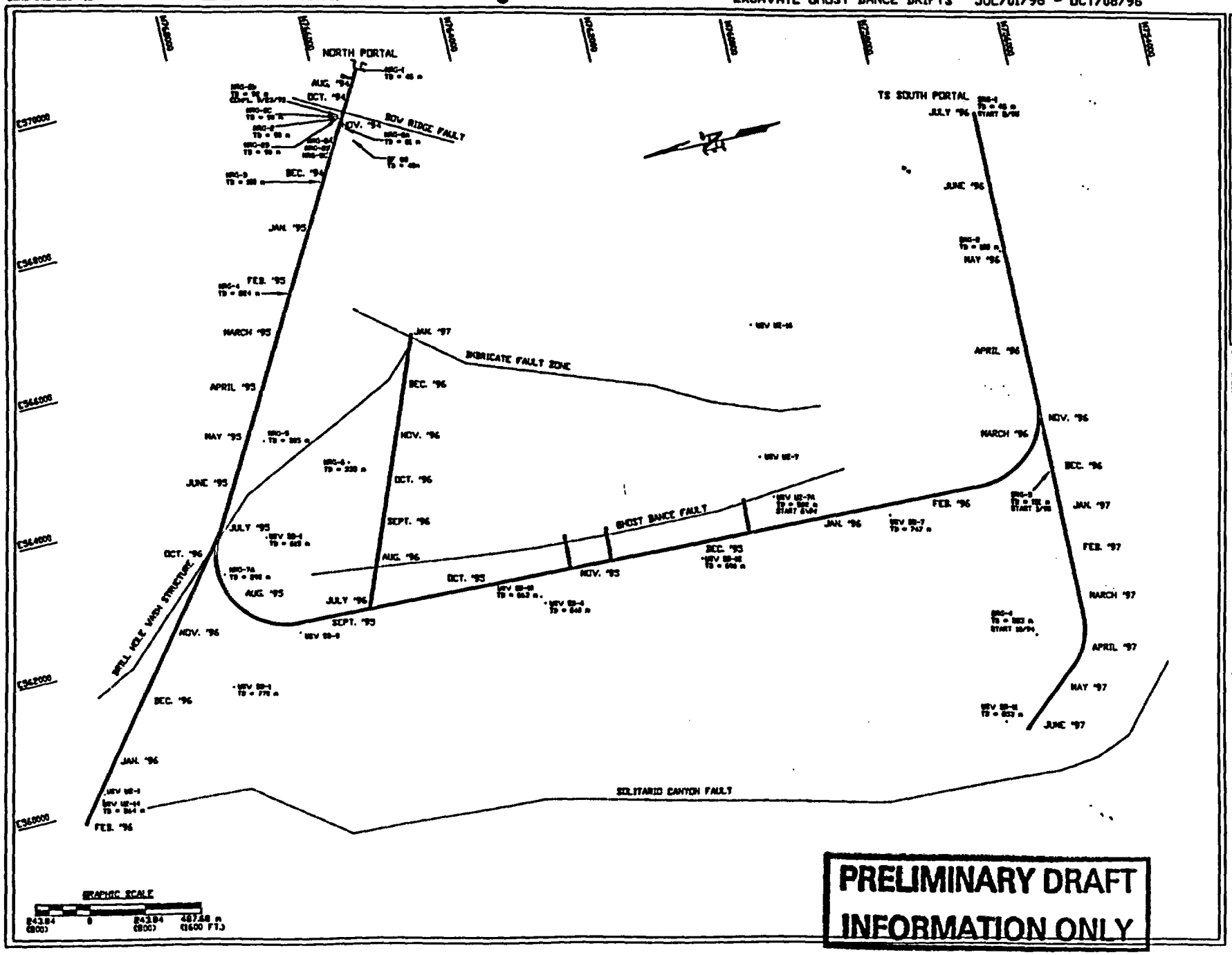
LEGEND:

FAULT ZONE
RAMP CONFIGURATION
REFERENCE GRID
BOREHOLE LOCATION

COMPLETE
IN PROGRESS
PLANNED

FOR SIMPLICITY, THE CORE TEST AREA HAS NOT BEEN ILLUSTRATED

| | |
|---|---|
| EXCAVATE MTA - THERMAL TEST | MAY/01/96 - DEC/09/96 |
| EXCAVATE REMAINING MTA | DEC/09/96 - FEB/10/98 |
| EXCAVATE GHOST DANCE DRIFTS | JUL/01/96 - OCT/08/96 |




LOS ALAMOS NATIONAL LABORATORY
TEST COORDINATION OFFICE - YUCCA MOUNTAIN PROJECT
PROJECT: NRG, SRG, SD AND UZ BOREHOLE/ESF LOCATIONS AND SHEDULE

CAD FILE DESIGNER: AUTOCAD R12 | REVISION: A | REVISED: NOTED | REVISION: 04
DRN. BY: L. WEAVER | APPROVED BY: ON FILE | N.L. CLONCKE/D.L. DAVIS | DATE DRN: 1/24/94
NOTES: ADMINISTRATIVE/ILLUSTRATIVE USE ONLY | PLOT DATE: 1/31/94

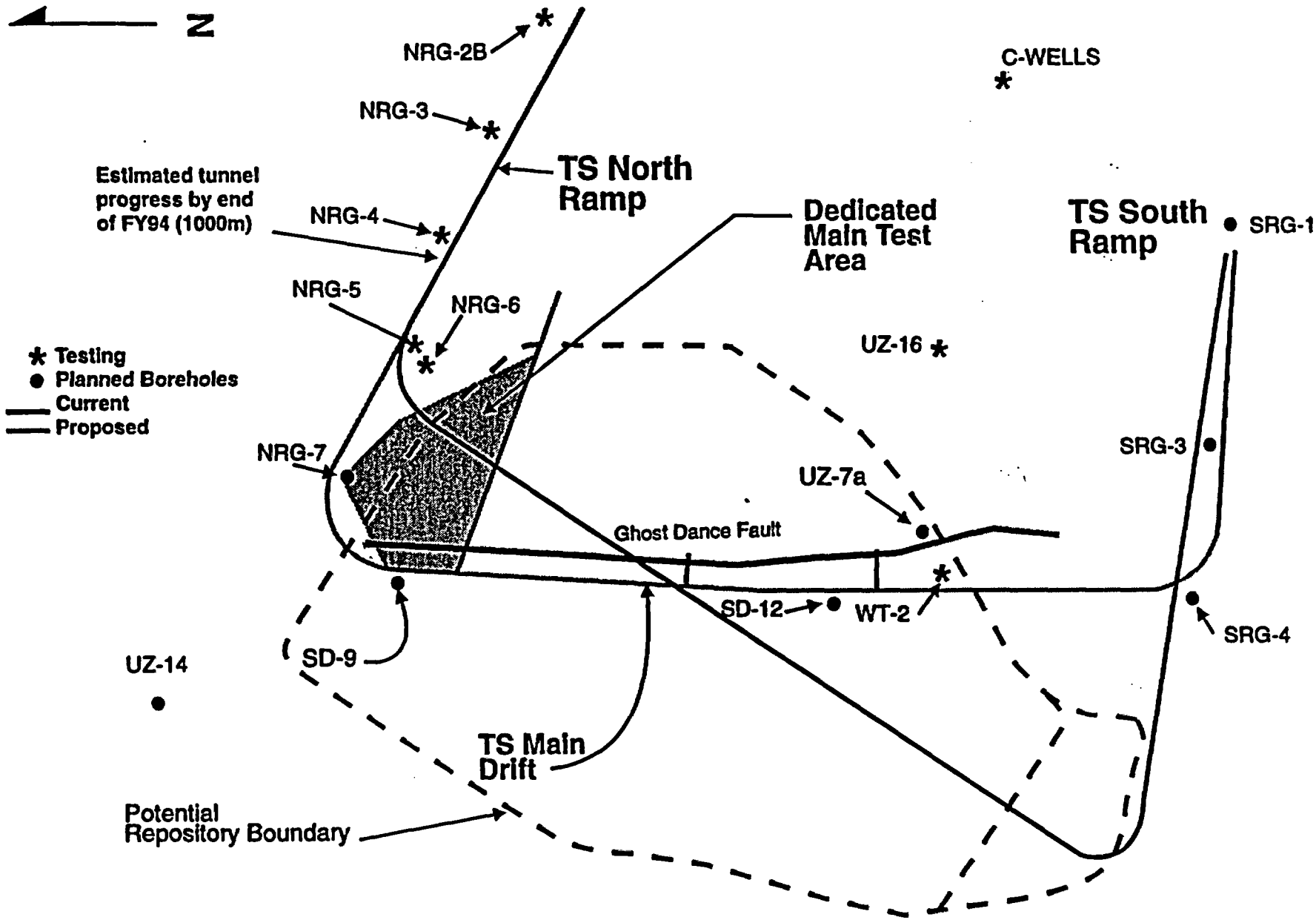
COORDINATES:
NORTH PORTAL BOX CUT FACE AT CS 0+00 ALIGNED AS APPROXIMATELY LOCATED AT CS 1+40 TWO THOUSAND FEET GRID. ENGLISH COORDINATES ARE BASED ON THE NEVADA STATE COORDINATE SYSTEM CENTRAL ZONE. DIMENSIONS AND ELEVATIONS ARE SHOWN IN METERS. METERS ARE ROUNDED TO TWO DECIMAL PLACES. WHERE DISCREPANCIES BETWEEN ELEVATIONS AND GRADIENTS OCCUR DUE TO ROUNDING ELEVATIONS WILL GOVERN. STARTER TUNNEL CONFIGURATION AND AZIMUTH FOR THE FIRST 4,940 m (800 FT) IS BASED ON TITLE II PACKAGE IN DESIGN DRAWINGS.

EXISTING DRILLHOLE LOCATIONS ARE BASED ON FIELD SURVEYS. PROPOSED DRILLHOLE LOCATIONS ARE BASED ON INFORMATION CONTAINED IN THE YUCCA MOUNTAIN PROJECT, "SCHEDULE LOCATIONS FOR YUCCA MOUNTAIN PROJECT", NEVADA.

FAULT TRACE LOCATIONS EXCEPT FOR THE BOV RIDGE FAULT, ARE PLOTTED FROM DATA PROVIDED BY RICK DAVIS, LANL. THE BOV RIDGE FAULT TRACE FROM UNDERGROUND FIELD REPORT 94-4, PRELIMINARY GEOLOGIC MAP AND SECTIONS, BY SCOTT AND BONK. THE BOV RIDGE FAULT TRACE IS AN AT-DEPTH PROJECTION BASED ON PRELIMINARY FIELD WORK FROM OH-CORE WORK AND SOIL INVESTIGATIONS.

ILLUSTRATION BASED ON START, FINISH AND OTHER EXCAVATION MILESTONES. DATES DO NOT CORRESPOND TO A LINEAR EXCAVATION RATE.

DATES OBTAINED FROM MAO SCHEDULE "ESTIMATED PRELIMINARY DRAFT", OBTAINED 04/29/93.




# Current and Proposed ESF Alignment and FY94 Proposed Drilling and Testing Programs

PRELIMINARY DRAFT
INFORMATION ONLY

# FY92-93-94 PROGRAM

## (1/31/94 Updated Estimate)

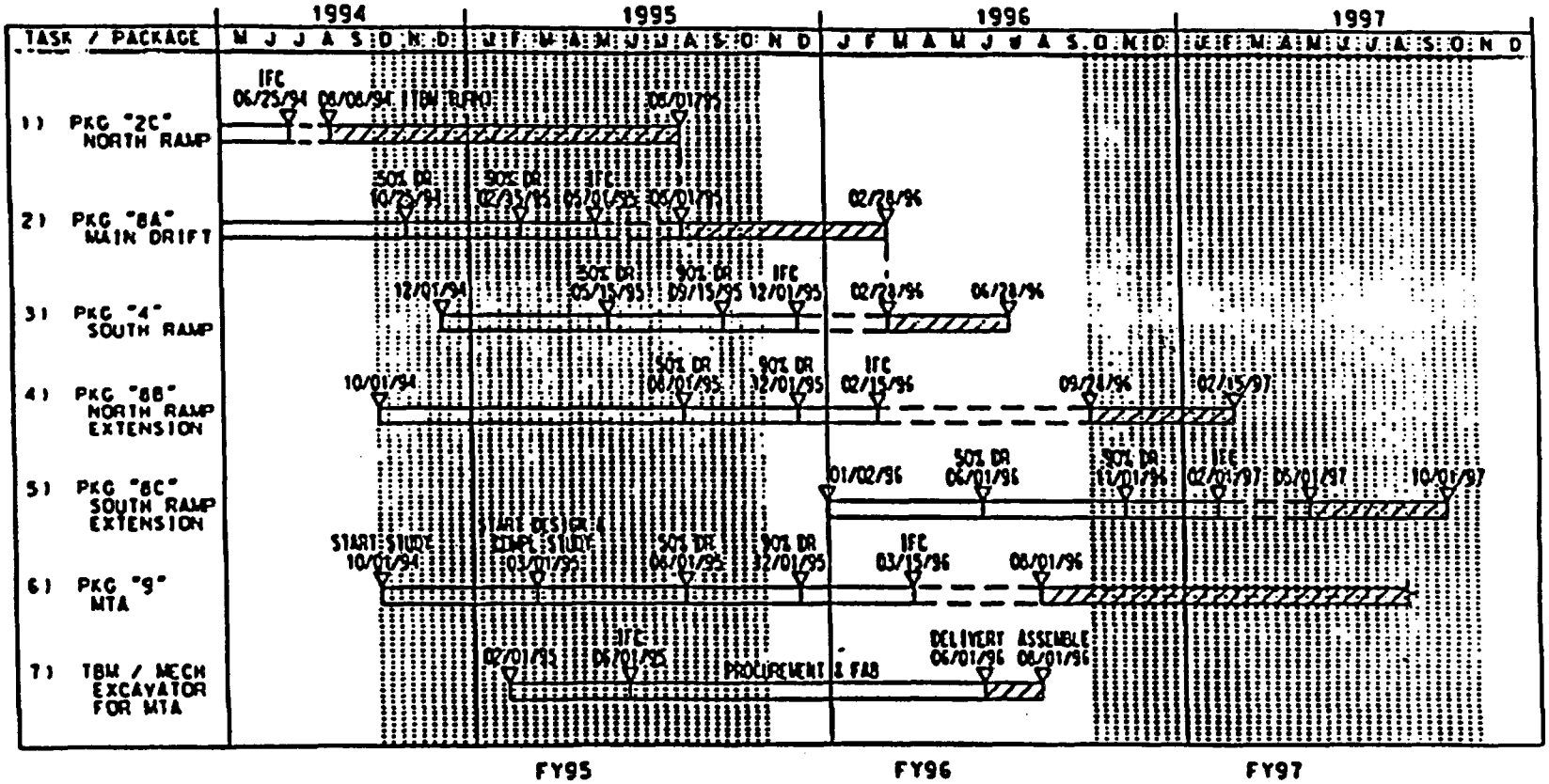
| | FY-92 | | FY-93 | | FY-94 | |
|---|---|---|---|---|---|---|
| Program | Ft.(Holes) | Direct $ | Ft.(Holes) | Direct $ | Ft.(Holes) | Direct $ |
| UZ | 800 (1) | $635K | 2600 (2) | $1591K | 2200 (1) | $1150K |
| SD | | | | | 4475 (2) | $1710K |
| UZN | 2242 (16) | $621K | 1000 (7) | $ 247K | | |
| RAMP | 150 (1) | $ 36K | 4400 (7) | $1060K | 1445 (1) | $ 459K |
| Total = | 3192 FT & | $1292K | 8000 FT & | $2898K | 8120 FT & | $3319K |

Testing, Completion, and
Monitoring in FY94:
6-9 Rig Months, Direct $ 750-800K

Note: Numbers account for add'l hydrologic testing for ramp baseline analysis.

PRELIMINARY DRAFT
INFORMATION ONLY

# ESF DESIGN CONSTRUCTION PLAN - 12/17/93




**LEGEND:**

IFC = ISSUE FOR CONSTRUCTION / PROCUREMENT

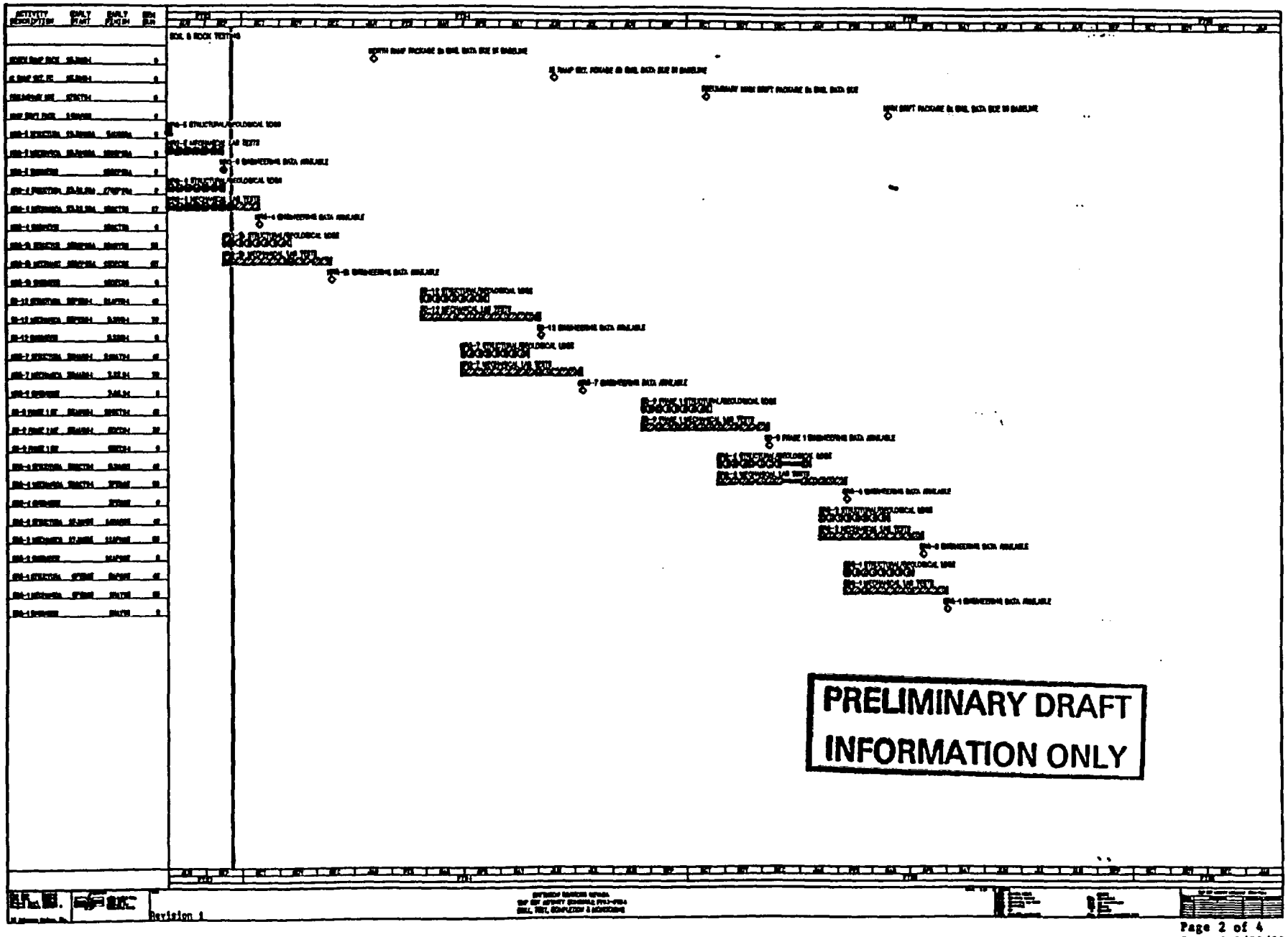
DR = DESIGN REVIEW

= DESIGN ACTIVITY

= MOBILIZATION / PROCUREMENT ACTIVITY

= CONSTRUCTION ACTIVITY

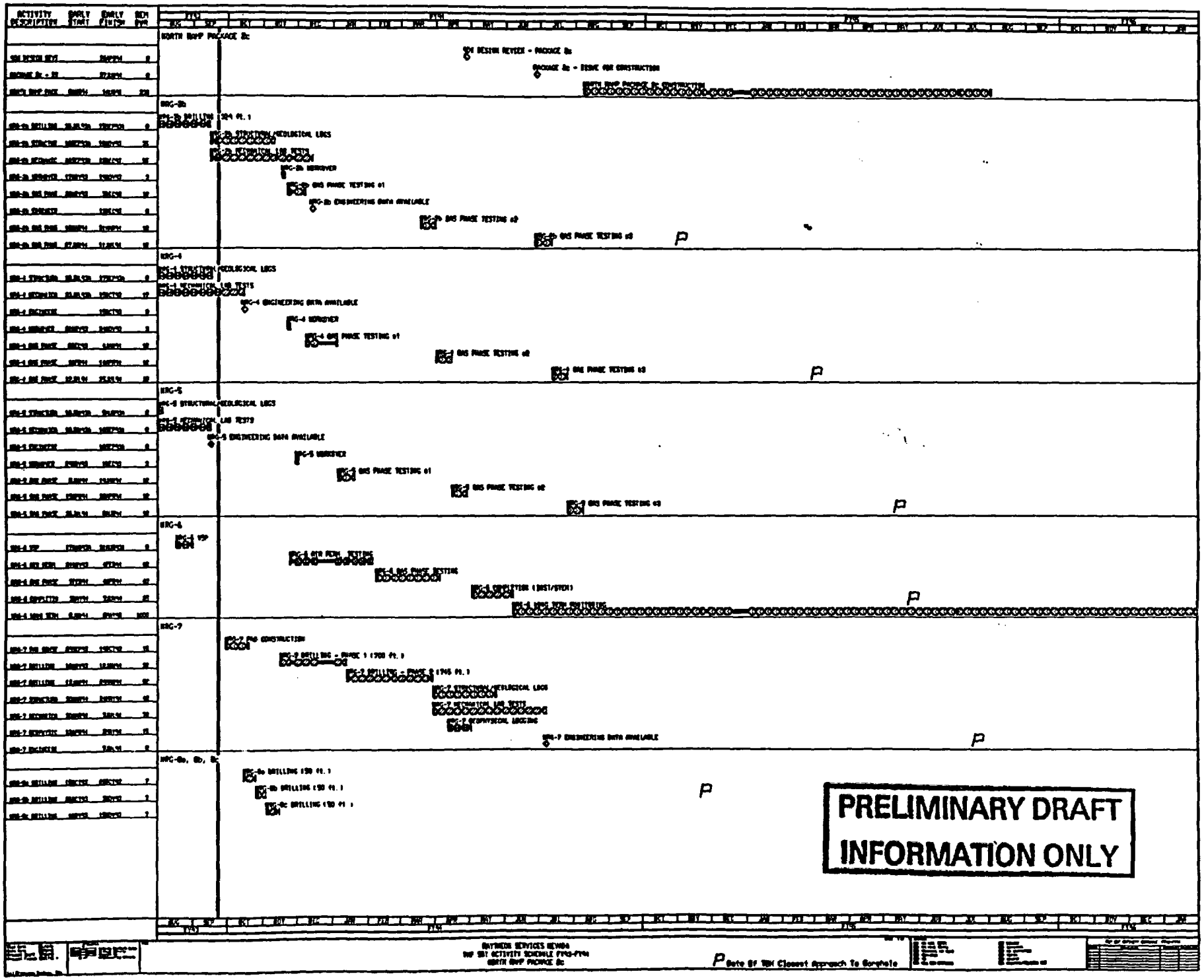
**PRELIMINARY DRAFT**
**INFORMATION ONLY**




Revision 1

# ESF DESIGN PACKAGE 2C
# NORTH RAMP

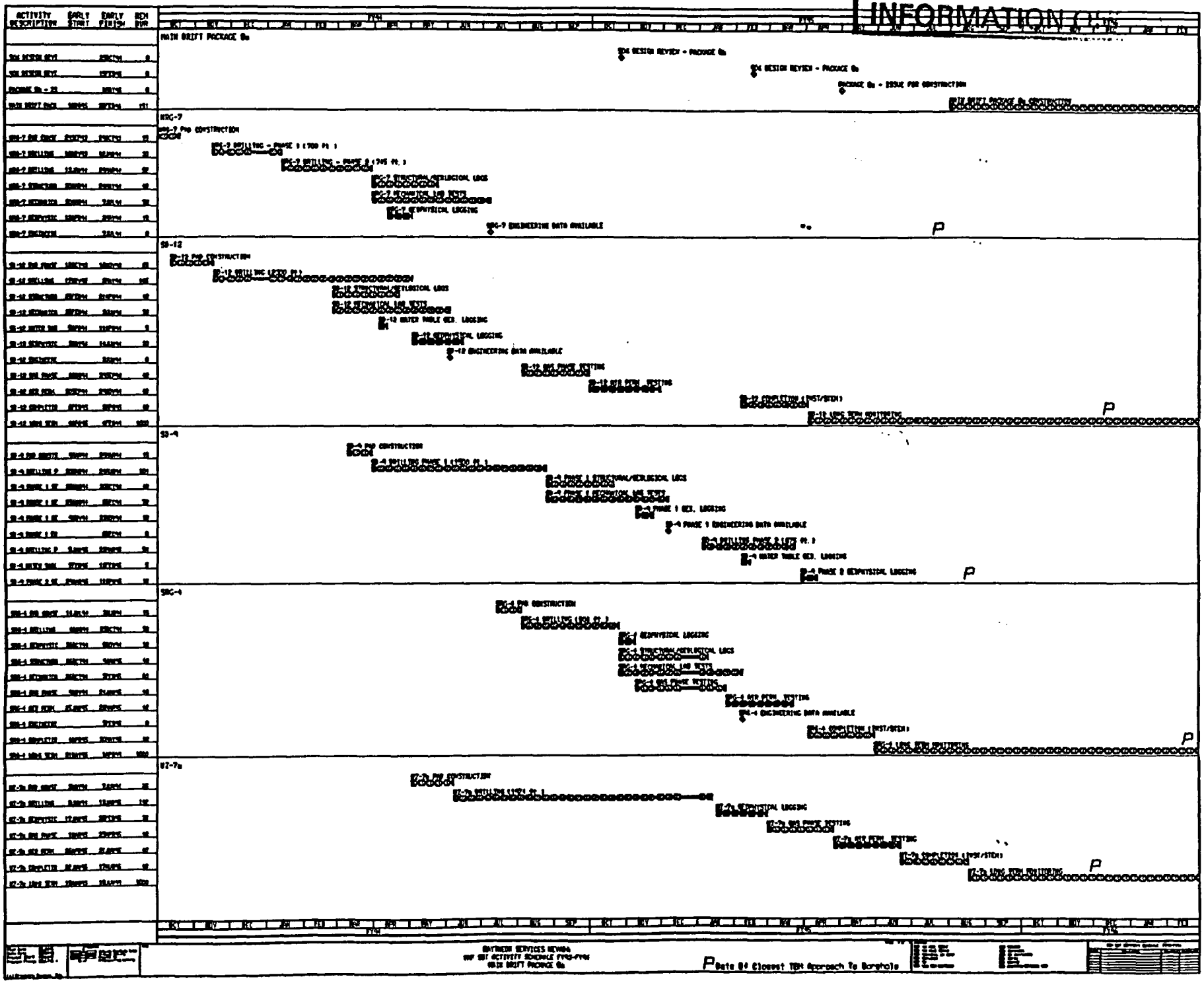
PRELIMINARY DRAFT
INFORMATION ONLY


ACTIVITY DESCRIPTION
EARLY START
EARLY FINISH
DUR DAYS
FY93
FY94
FY95
FY96
NORTH BWIP PACKAGE 8c
DESIGN REVIEW - PACKAGE 8c
PACKAGE 8c - ISSUE FOR CONSTRUCTION
NORTH BWIP PACKAGE 8c CONSTRUCTION
WRG-8b
WRG-4
WRG-5
WRG-6
WRG-7
WRG-8a, 8b, 8c
P
PRELIMINARY DRAFT
INFORMATION ONLY
OVERHEAD SERVICES NEWMA
BWIP SRI ACTIVITY SCHEDULE FY93-FY96
NORTH BWIP PACKAGE 8c
P Date Of TBM Closest Approach To Borehole

# ESF DESIGN PACKAGE 8A
# MAIN DRIFT

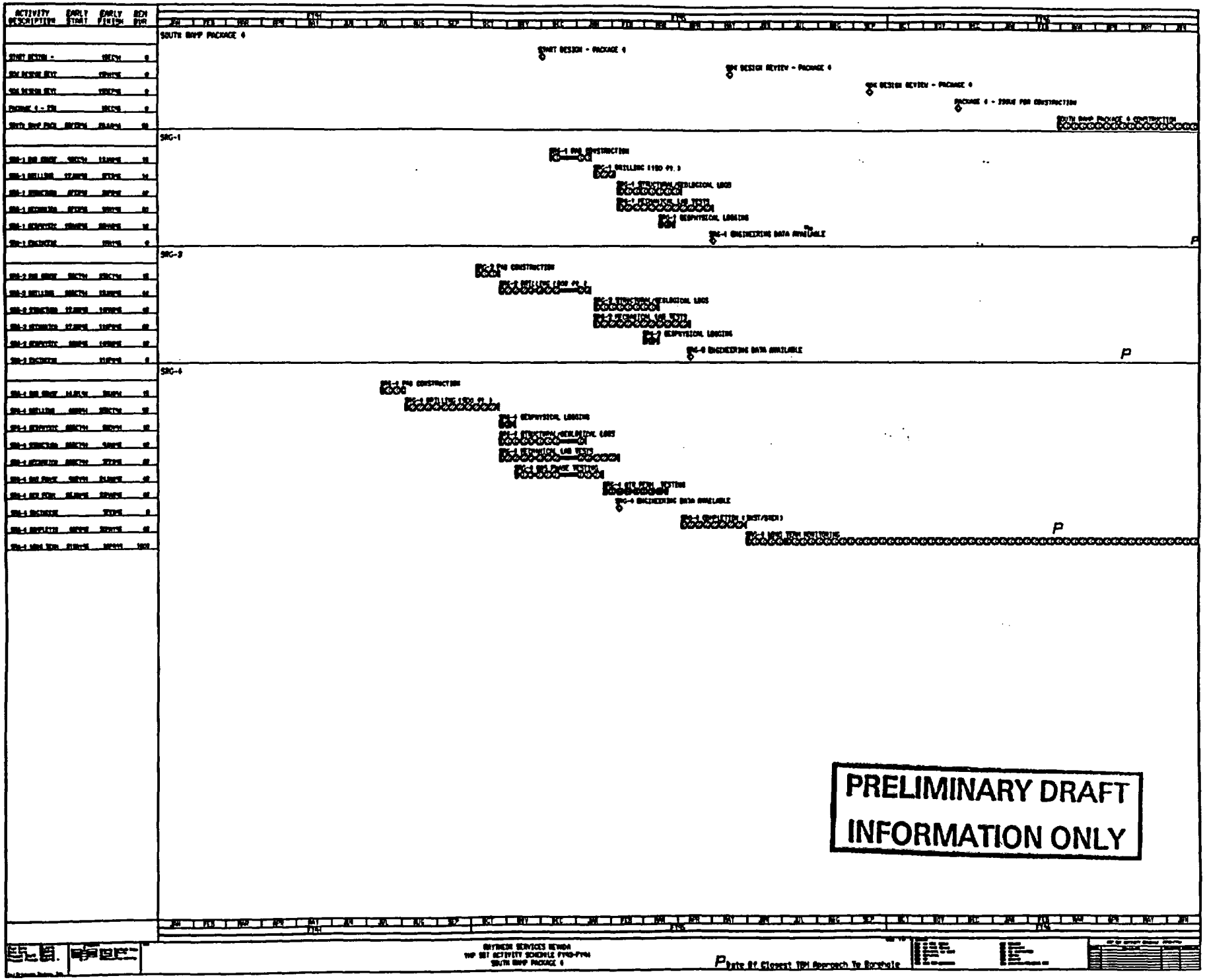
PRELIMINARY DRAFT
INFORMATION ONLY

PRELIMINARY
INFORMATION



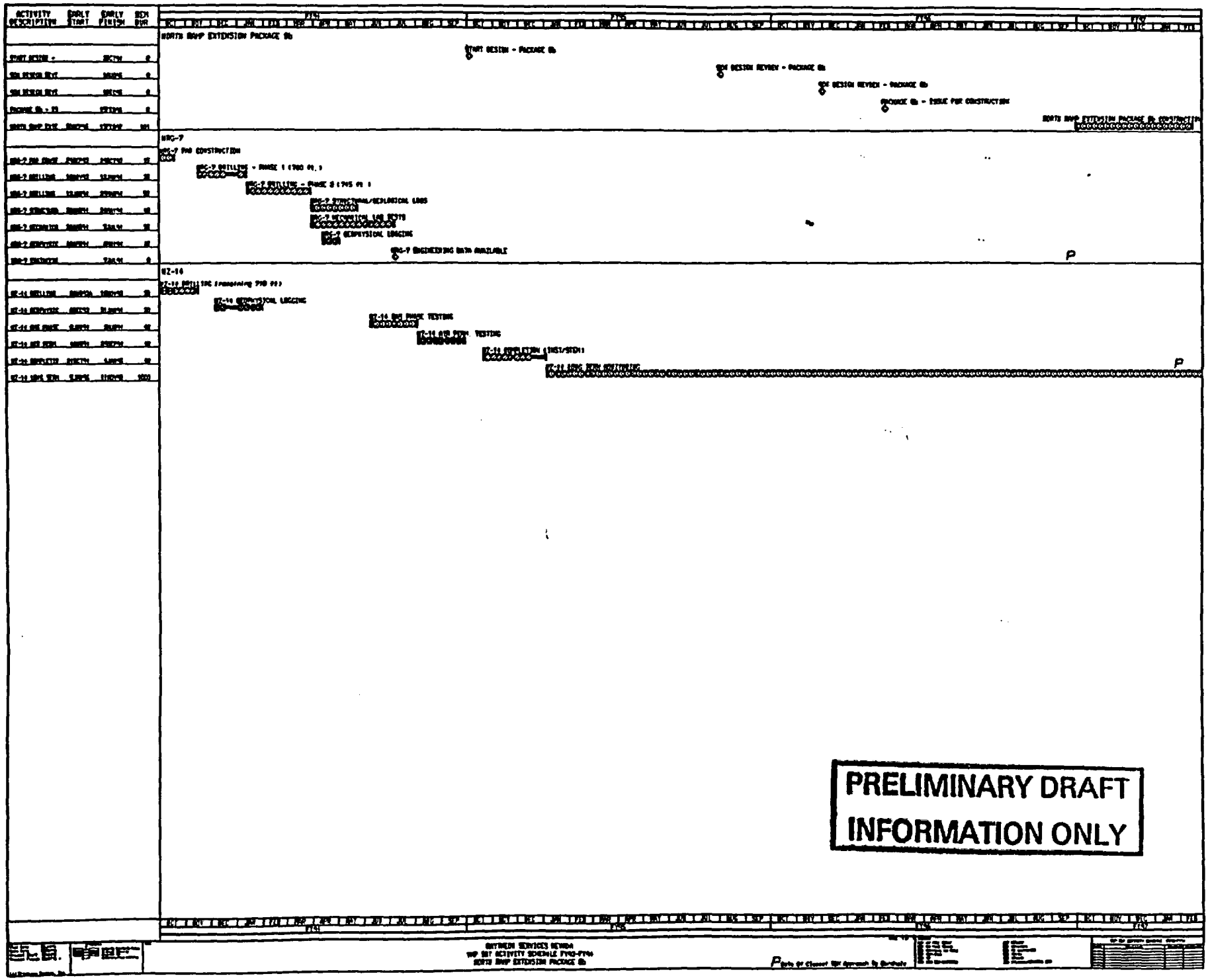
# ESF DESIGN PACKAGE 4
# SOUTH RAMP

PRELIMINARY DRAFT
INFORMATION ONLY


ACTIVITY DESCRIPTION
EARLY START
EARLY FINISH
REM DUR
SOUTH RAMP PACKAGE 4
START DESIGN - PACKAGE 4
SRG-1
SRG-2
SRG-4
P
PRELIMINARY DRAFT
INFORMATION ONLY
P Date Of Closest TBM Approach To Borehole

# ESF DESIGN PACKAGE 8B
# NORTH RAMP EXTENSION

PRELIMINARY DRAFT
INFORMATION ONLY


ACTIVITY DESCRIPTION
EARLY START
EARLY FINISH
REM DUR
NORTH RAMP EXTENSION PACKAGE 0b
START DESIGN - PACKAGE 0b
NRG-7
NZ-14
P
PRELIMINARY DRAFT
INFORMATION ONLY

# ESF DESIGN PACKAGE 8C
# SOUTH RAMP EXTENSION

- **DESIGN & CONSTRUCT**

| | |
|---|---|
| Start Design - | 1/96 |
| 50%DR - | 6/96 |
| 90%DR - | 11/96 |
| IFC - | 2/97 |
| Construct - | 5/97 - 10/97 |

- **BOREHOLES**

| | |
|---|---|
| Start SRG-4 - | 10/94 |
| Start SRG-5/SD-11 - | TBD |

PRELIMINARY DRAFT
INFORMATION ONLY

# TOPICS OF DISCUSSION

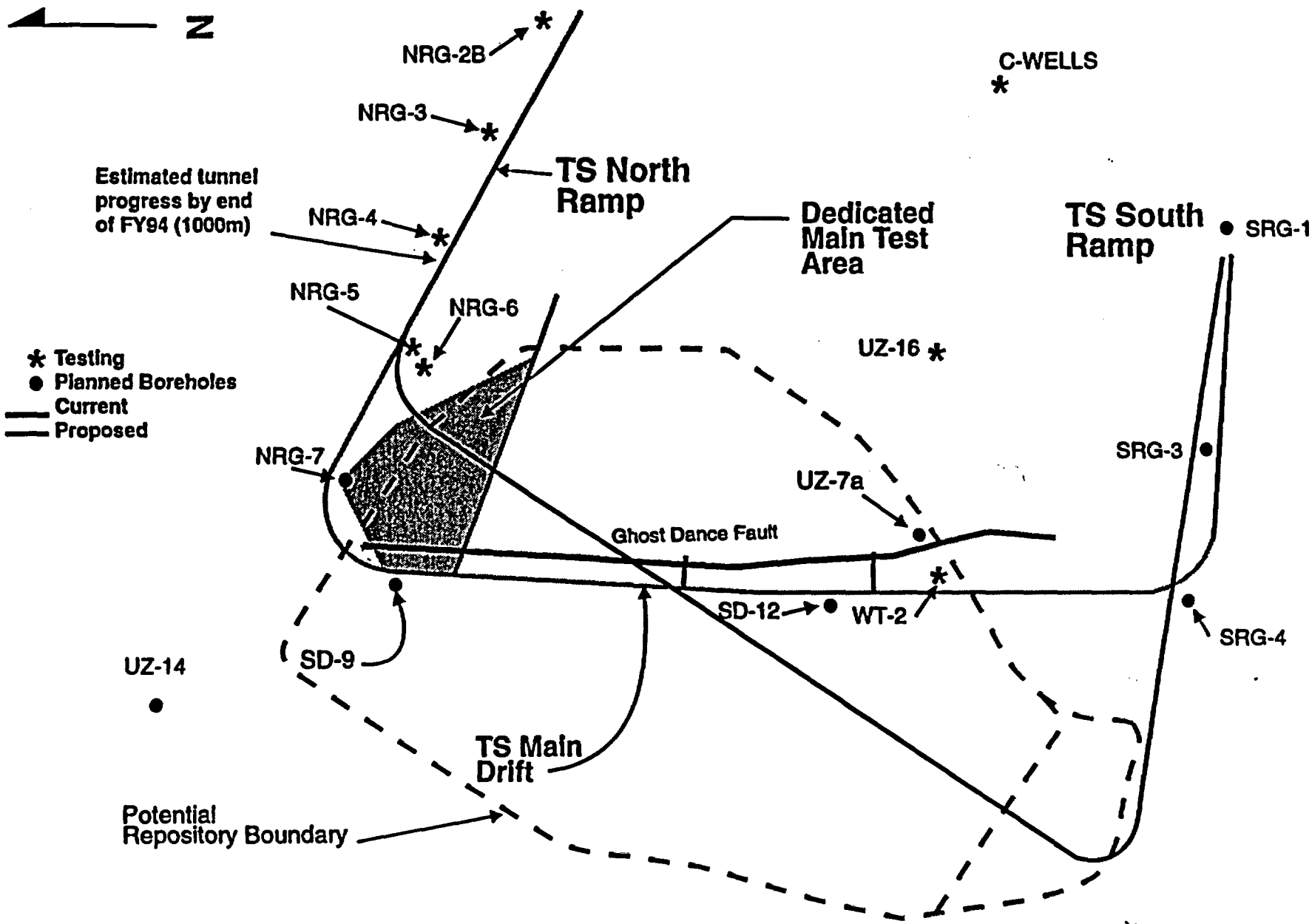
- Support of ESF Design
- Changes to the Surface-Based Testing Program Relative to the ESF Design Schedule
- Integration of NRG Drillholes
- Drilling Results Indicating a Higher North-End Block

PRELIMINARY DRAFT
INFORMATION ONLY

# WORK SCOPE CONSOLIDATION

- Fewer holes, but holes are multipurpose
- More information per hole
- Information is used for characterization and design

PRELIMINARY DRAFT
INFORMATION ONLY




# Current and Proposed ESF Alignment and FY94 Proposed Drilling and Testing Programs

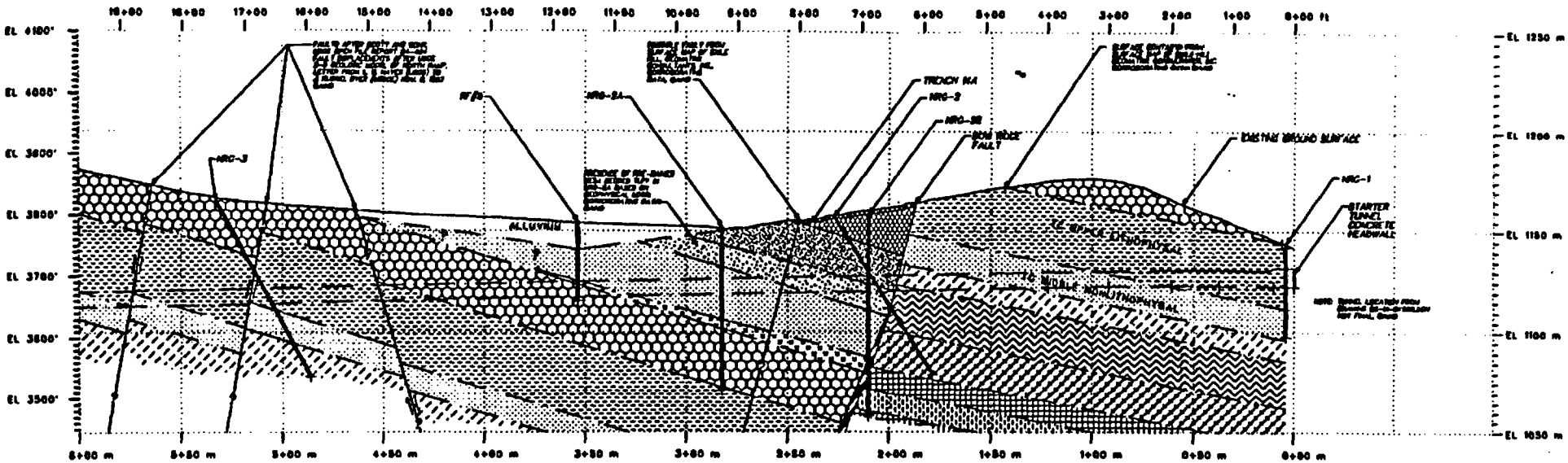
**PRELIMINARY DRAFT**
**INFORMATION ONLY**

LYOTRD.CDR.124/12-10-93

CROSS SECTION CONSTRUCTED ALONG RAMP ALIGNMENT – AZIMUTH 299°

0 20 40 60 80 100m

1 : 2000




| FORMATION | MEMBER | MAJOR ZONES | CORRELATIVE SUBZONES | FURTHER DESCRIPTION |
|---|---|---|---|---|
| TIMBER MOUNTAIN TUFF | RAINIER MESA | | | LITHIFIED, NONWELDED |
| | | | | NONLITHIFIED, TUFF AND FALLOUT |
| | ? | | | |
| | | PRE-RAINIER MESA TUFF | | NONLITHIFIED, TUFF AND FALLOUT |
| | | TUFF UNIT "2" | | PYROCLASTIC FLOW AND FALLOUT |
| | | PRE-TUFF UNIT "2" | | REWORKED PYROCLASTIC FLOW AND FALLOUT |
| PAINTBRUSH TUFF | TIVA CANYON | UPPER NONLITHOPHYSAL | CAPROCK UPPER CLIFF | NONWELDED TO DENSELY WELDED |
| | | UPPER LITHOPHYSAL | | DENSELY WELDED |
| | | MIDDLE NONLITHOPHYSAL | | DENSELY WELDED |
| | | LOWER LITHOPHYSAL | | DENSELY WELDED |
| | | PALISADE | | DENSELY WELDED |
| | | COLUMNAR | | DENSELY WELDED |
| | PAH CANYON | REWORKED TUFF | | NONWELDED |
| | | | | NONWELDED |
| | | REWORKED TUFF | | NONWELDED |

STRATIGRAPHIC NOMENCLATURE IN DEVELOPMENT BY USGS

LEGEND

- LITHOLOGIC CONTACT, SOLID LINE WHERE APPROXIMATE, DASHED LINE WHERE INFERRED
- FAULT ZONE
- FAULT, ?–ATTITUDE UNCERTAIN
- PROPOSED TUNNEL OUTLINE

ESF NORTH RAMP
YUCCA MOUNTAIN PROJECT
SITE CHARACTERIZATION
CROSS SECTION THROUGH EXILE HILL
NORTH RAMP 0+00 to 6+00m

Sandia National Laboratories

DRAWN: RJL/12-10-93 HOR. SCALE: AS SHOWN
CHECKED: GDB VERT. SCALE: AS SHOWN

REVISIONS

QA:QA

PRELIMINARY DRAFT
INFORMATION ONLY

# PNEUMATIC TESTING PROGRAM

- Modified to obtain data before excavation of the ESF

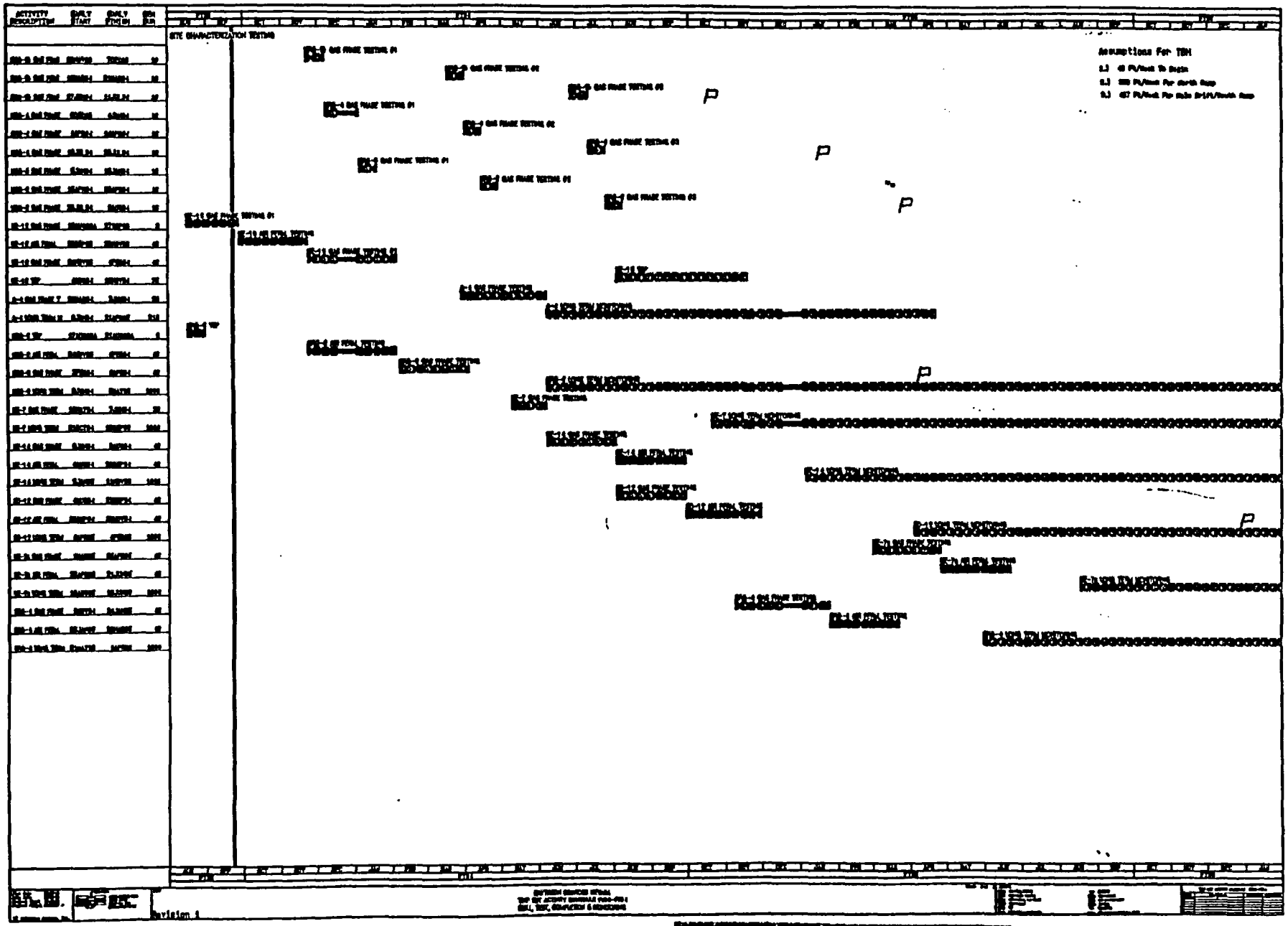
  - NRC SCA Comment 123

  - SCP Progress Report Question

  - State of Nevada letter

  - USGS letter

PRELIMINARY DRAFT
INFORMATION ONLY




PRELIMINARY DRAFT
INFORMATION ONLY

# FUTURE DEVELOPMENTS FOR THE SBT PROGRAM

- Flexible schedule - dependent on future funding and events

- Will continue to be multipurpose

  UZ-14 for North Ramp extension
  SD11/SRG5 for South Ramp extension

- Up-to-date notification of changes

PRELIMINARY DRAFT
INFORMATION ONLY

# TOPICS OF DISCUSSION

- Support of ESF Design
- Changes to the Surface-Based Testing Program Relative to the ESF Design Schedule
- Integration of NRG Drillholes
- Drilling Results Indicating a Higher North-End Block

PRELIMINARY DRAFT
INFORMATION ONLY

# EXAMPLES OF INTEGRATION

- Design - Rock properties samples used for thermal-mechanical tests
- Geophysics program - Surface with borehole
- Stratigraphy & structure - Tectonics
- UZ program - moisture content
- Pneumatic testing in existing holes
- Updated maps

PRELIMINARY DRAFT
INFORMATION ONLY

# TOPICS OF DISCUSSION

- Support of ESF Design
- Changes to the Surface-Based Testing Program Relative to the ESF Design Schedule
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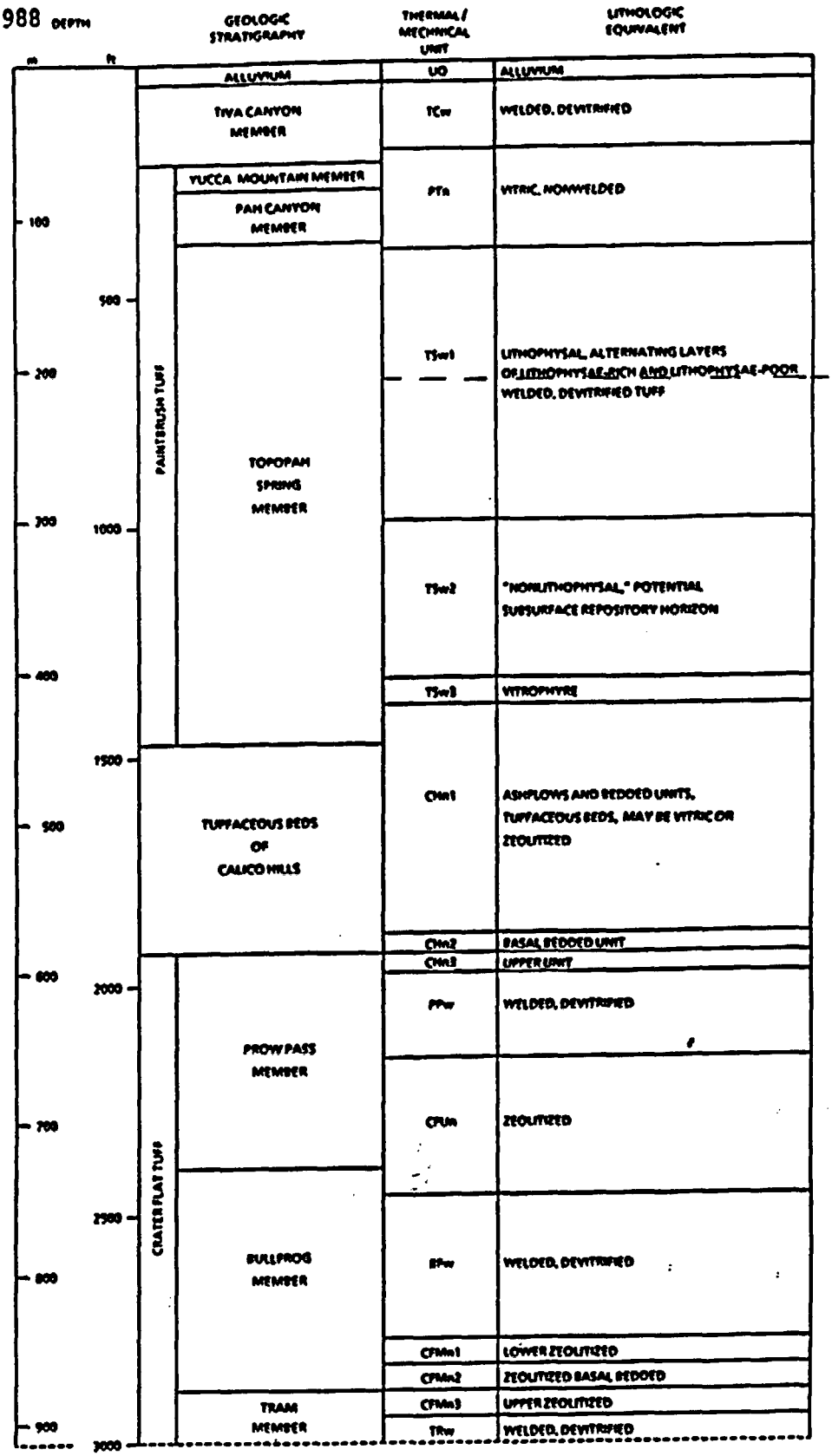
PRELIMINARY DRAFT
INFORMATION ONLY




PRELIMINARY DRAFT
INFORMATION ONLY

Figure 6-6. Correlation between the thermal/mechanical stratigraphy and the geologic stratigraphy. Modified from SNL (1987)

# HISTORY OF TSw1/TSw2 CONTACT

- 1985 Ortiz et al
- 1991 Sample Overview Committee
- 1993/94 NRG and SD holes
- 1994 Re-examination of the TM stratigraphy

PRELIMINARY DRAFT
INFORMATION ONLY

# TSw1/TSw2 ELEVATIONS (ft)

| • Hole | Ortiz et al | SOC |
|---|---|---|
| UE-25a#1 | 2713 | 3314 |
| USW G-1 | 3352 | 3634 |
| USW GU-3 | 4167 | 4137-4167 |
| USW G-4 | 3430 | 3487 |
| USW G-2 | 3605 | |
| UE-25a#7 | | 3308 |

PRELIMINARY DRAFT
INFORMATION ONLY

# TSw1/TSw2 - NRG & SD Holes

- Elevation at North Ramp/TS Main Intersection

| | |
|---|---|
| Three-point solution - | 3368 feet |
| LYNX 3-D - | 3404 feet |

- NRG-6

| | |
|---|---|
| Predicted - | 3427 feet |
| Observed - | 3379 feet |
| Geophysics - | 3379 - 3389 feet |

- NRG-7

| | |
|---|---|
| Observed - | 3444 feet |

PRELIMINARY DRAFT
INFORMATION ONLY

## STRATIGRAPHIC PICKS - CORES (USGS) AND GEOPHYSICAL LOGS
(PRELIMINARY DATA - SUBJECT TO CHANGE)

| | | | BOREHOLES → | NRG4 | | NRG5 | | NRG6 | | UZ-16 | | WT2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STRATIGRAPHY ↓ (PROPOSED-USGS) | | | PICKS → | USGS | LOGS | USGS | LOGS | USGS | LOGS | USGS | LOGS | USGS | LOGS |
| GROUP | Tiva Canyon Tuff | | | | | | | | | | | | |
| | Crystal-Rich Unit | Vitric zone | | | | | | | | | | | |
| | | Nonlithophysal zone | | | | | | | | | | | |
| | Crystal-Poor Unit | U. lithophysal zone | | | | | | | | | | | |
| | | M. nonlithophysal zone | | | | | | | | | | | |
| | | L. lithophysal zone | | | | | | -0- | | | | | |
| | | L. nonlithophysal zone | | 271 | | | 55 | | | 40?? | | 91 | |
| | | Vitric zone | | [306 | | . | 136.3 | [133 | | [136 | | [190 | |
| | bedded tuff | | | . | | 209? | | . | | . | | . | |
| | Yucca Mtn Tuff | | | . | | . | | . | | . | | . | |
| | bedded tuff | | 375 | 332] | | . | 158.6 | 168] (P) | | 164] | | 220] | |
| | Pah Canyon Tuff | | 381 | | | | 174.9 | | | | | | |
| | bedded tuff | | 458 | 464 | | 282 | 220.6 | 220 (P) | | 191 | | 282 | |
| PAINTBRUSH | Topopah Spring Tuff | | | | | | | | | | | | |
| | Crystal-rich Unit | Vitric zone | 468.1 | | | | 246.7 | | 188.8 | | 270 | | |
| | | Nonlithophysal zone | 488.9 | 488 | | 329 (P) | 263.2 | 269 (P) | 238.9 | 228 | | 281 | |
| | | Lithophysal zone | 660.5 | 661 | | 499(P) | 429 | 428 | 357.8 | 340? | | 386 | |
| | Crystal-poor Unit | Lithic-rich zone | | | | | | | | | | | |
| | | U. nonlithophysal zone | | | | | | | | | | | |
| | | U. lithophysal zone | 710 | NR | 689.7 | (P) | 465.5 | | 371 | WO | | | |
| | | M. nonlithohphysal zone | | | 796 | [768-789] | 713 | [703-713] | 549 | 543 | | 590 | |
| | | L. lithophysal zone | | | 901 | 900 | 810 | 810 | 690 | 667 | | 727 | |
| | | L nonlithophysal zone | | | | 1227? | | | 916 ? | 925 | | 1003 | |
| | | Vitrophyric zone | | | | | | | 1111 | 1106 | | 1165 | |
| | Calico Hills Formation | | | | | | | | 1201.3 | 1198 | 1303 | 1302 | |
| Crater Flat Group | Prow Pass | | | | | | | | 1465 | 1497 | | 1696 | |
| | Bull Frog | | | | | | | | | | | | |
| | LOG TOTAL DEPTH | | | 724 | | 1349 | | 1092 | | 1653 | | 2042 | |
| | TOTAL DEPTH | | | 726.0 | | 1350.0 | | 1100 | | 1658.2 | | 2060 | |

NNN? Pick questionable (P) Pipe signal may interfer [NNN-. . . . NNN] Log response transitional over the interval noted

NR Not recorded on log WO Washed-out hole

1/31/94 - For information only - PRELIMINARY DATA - SUBJECT TO CHANGE

PRELIMINARY DRAFT
INFORMATION ONLY

# Re-examination of the Thermal-Mechanical Stratigraphy

- TSw1/TSw2 standoff - what is the contact?
- Stratigraphic compendium
- Peer Review of RIB data

PRELIMINARY DRAFT
INFORMATION ONLY

# MOVEMENT OF THE CONTACT

- Gradational changes in units
- Structure
- Interpretation by individuals & task groups

<u>THE ROCKS HAVE NOT CHANGED</u>

PRELIMINARY DRAFT
INFORMATION ONLY

P. Justus, NRC, Las Vegas, NV

Los Alamos
NATIONAL LABORATORY
Los Alamos, New Mexico 87545