DOE-NRC TECHNICAL EXCHANGE ON THE ESF TITLE II DESIGN

Determination of Importance Evaluations (DIEs)

For ESF Title II Design

9311100206 - Part 2

P. S. Hastings
October 4, 1993

B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services

ATTACHMENT (12)

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

DETERMINATION OF IMPORTANCE EVALUATIONS

(DIEs)

FOR ESF TITLE II DESIGN

Peter S. Hastings
CRWMS M&O
July 27, 1993

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

DOE Implementation of NUREG-1318

- AP-6.17Q: Q-List, Quality Activities List (QAL), and Program Requirements List (PRL)
- Direct Inclusion - need for waste isolation evaluation methodology
- AP-5.28Q: DOE/AT review of QA Grading Reports
- DIGE Management Plan
- AP-6.17Q evolution to Q-List and MC-List - deletion of QAL - activities assume importance of affected items
- Participants responsible for grading their own Q items, evaluating activities, and applying controls under their own QA program
- DOE (through AT) maintains control Q-List - participants recommend changes
- For ESF - M&O Plan for Evaluating Items and Activities in the MGDS Program for Importance to Safety and Waste Isolation

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

Q-List Updates

- Revisions to SCP Q-List inadvertantly omitted from previous updates - discussion of changes included in PR-8
  - Q-List changes as a result of transition to new QARD
  - Deletion of QAL - activities controlled based on importance of affected item(s)
- PR-9 will more fully describe new process and implementation of new QARD

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

DIE Purpose

- Provide indication of a specific item's potential impact on safety or waste isolation

- Provide for the application of QA controls on the item or associated activities appropriate to the results of that determination

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

DIEs

- Concept derived from lessons learned from experience with 10CFR50.59 evaluations at commercial nuclear facilities - evaluation of changes, tests, experiments, etc. - determine impact an item or associated activity might have on safety or licensing basis

- Virtually every modification or procedure undergoes a screening or full evaluation prior to approval; no changes to the licensing basis or margin of safety are approved without evaluation and application of appropriate controls.

- Potential repository (once licensed) would ultimately be subject to same regulation per 10CFR60.44

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

Important to Safety (ITS)

To prevent ESF construction from precluding the site as potential repository, we control ESF design in accordance with 10CFR60.

- ITS defined explicitly in 10CFR60: a signficant contributor to (or relied on to mitigate) a postulated event that results in 0.5 REM or higher exposure at the nearest boundary of the restricted area of the potential repository.

- DIE Evaluation questions to evaluate ITS impact:

    - Would failure of the item directly cause release of radioactive materials that exceeds the 0.5 rem criterion in 10CFR60?

    - Is the item required to mitigate an accident that could exceed the 0.5 rem criterion in 10CFR60?

    - Could failure of the item initiate an accident resulting in an off-site does of 0.5 rem if mitigation features are not considered?

    - Are there other factors, such as previous analyses, a body of consensus, or direct inclusion, that leads to the conclusion that the item is ITS?

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

Important to Waste Isolation (ITWI)

- ITWI is defined in terms of site's ability to isolate waste or prevent water or radionuclide movement as part of a potential repository.

- DIEs consider:
  - Potential waste isolation function of the item
  - Potential changes to the site's hydrological, geochemical, or geomechanical characteristics as a result of implementation or use of the item
  - Site characterization activities

Important to Waste Isolation (ITWI)

- ITWI is defined in terms of site's ability to isolate waste or prevent water or radionuclide movement as part of a potential repository.
  - Will the item perform a waste isolation function (part of the natural or engineered barrier, acts to inhibit radionuclide transport, prevents or discourages human instrusion into the engineered barrier, or otherwise substantially contributes to waste isolation)?
  - Could the item or associated activities result in changes to the hydrological characteristics of the site by creating significant ponding or the possibility for drainage into the underground facility?
  - Could associated activities, or use or failure of temporary items associated with the activities, result in the introduction of fluids or other materials that might affect the geochemical characteristics of the site?
  - Could the item or associated activities affect the geomechanical characteristics of the site?
  - Will the results of the activity be used to characterize the site?
  - Could construction or operation of the item result in alteration of the results of any current or planned site characterization tests?

Site Characterization

- 10CFR60.15 requires conduct of site characterization activities in such a way as to limit adverse affects on the long-term performance of the potential repository to the extent practical.

- In addition, in accordance with NUREG-1318, our definition of ITWI includes "important to site characterization" since site characterization provides basis for understanding performance of natural barriers:

  - Does an item or its use have significant potential to bias or disrupt site characterization testing in an unpredictable way?

  - Does an item or its use have significant potential to bias or disrupt a critical site characterization test, or one that cannot be repeated?

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

Q-List

- Q-List - YMPO-maintained document that tracks permanent ITS and ITWI items
- MC-List (Management Control list) - tracks permanent non-ITS and -ITWI items
- M&O recommends changes to the Q- and MC-Lists based on results of DIEs

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

Permanence

- ITS - part of the potential pre-closure repository - radiological accidents are only possible during repository operations

- ITWI - part of the potential post-closure repository and relied on as part of the engineered or natural barrier

- Q-list only includes permanent items

A temporary item that is determined to be ITS or ITWI is not included on the Q-list, but is still subject to all appropriate QA controls!!

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

Controls

- DIE conclusion - item is or is not ITS/ITWI
- Selection of controls (including controls on associated activities) is part of the evaluation process
- Ensuring quality may include controls during design, procurement, construction, operation, maintenance, decommissioning

Controls (continued)

- *Q procedure* for construction, operation, maintenance, or surveillance and testing
- *Engineering instructions* to transmit information about proper control of an activity to the field via specifications and drawings
- *Removal requirements* to proscribe removal of a temporary item prior to operation of repository (item may be re-evaluated as part of a permanent SSC)
- Change to the *Q-list*

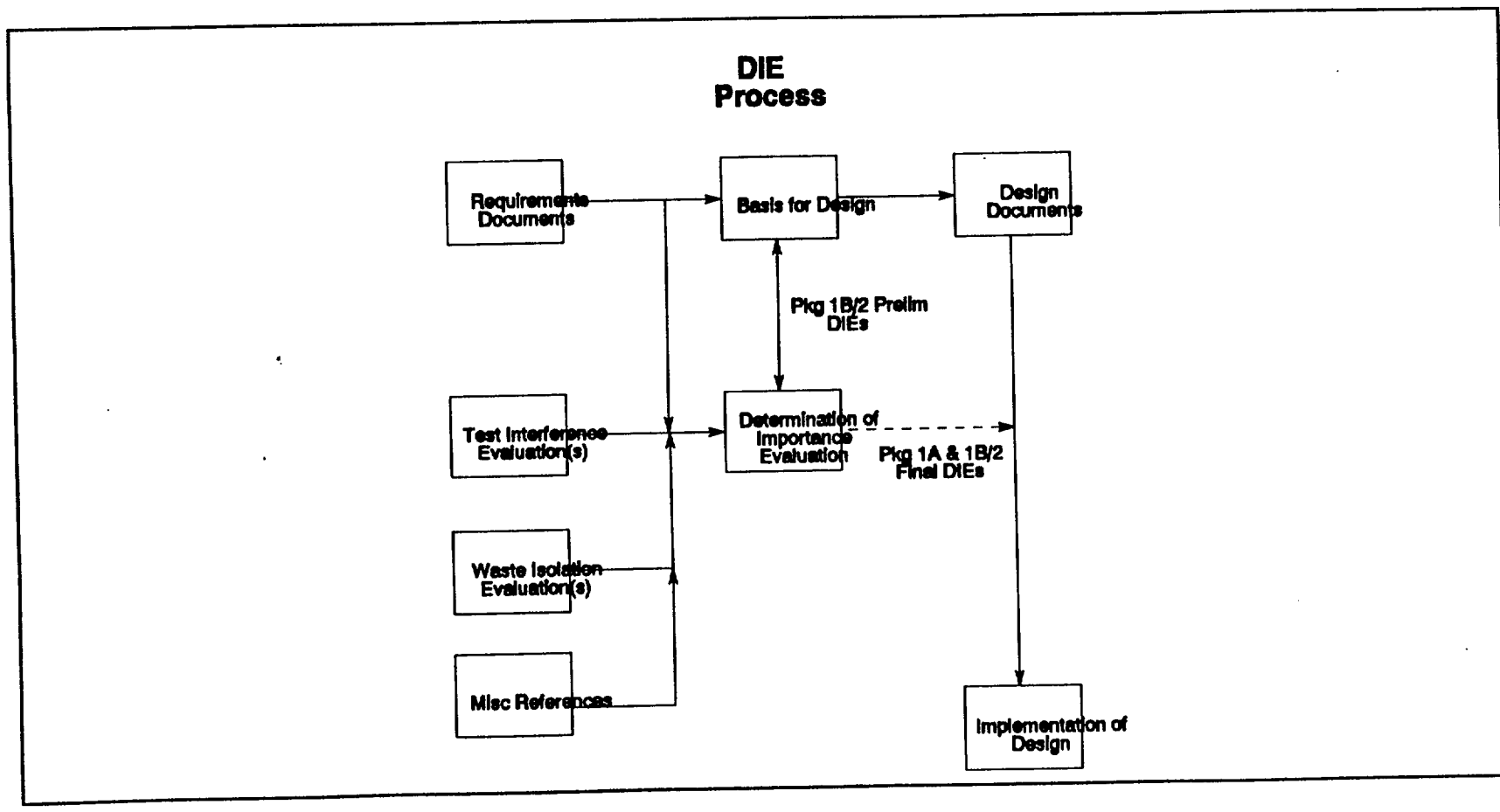
DOE-NRC TECHNICAL EXCHANGE ON THE EXPLORATORY STUDIES FACILITY TITLE II DESIGN

Existing Evaluations

- Surface
  - N. Portal Pad (1A)
  - Stormwater System (1A)
  - Rock Storage Area (1A)
  - Starter Tunnel Steel Arch (i.e., "ARMCO") Section (1A)
  - Switchgear Building/Tenant Improvements (1A)
  - Water Supply System (1A)
  - Water Distribution System (1B)
  - 69 kV Power & Feeder (1B)
  - Change House & Shop Buildings (1B)
  - Explosives Storage Area (1B)
  - Site Grading, Paving, H-Road Widening (1B)
  - Sanitary Sewer System (1B)
  - Subsurfae (i.e., Excavation) Wastewater Pond (1B)
- Subsurface
  - Starter Tunnel Drill-and-Blast Section (1A)
  - North Ramp & Utilities (2A)
  - Review of Transportation Study
- Review of Procurement Specifications for:
  - Tunnel Boring Machine (TBM)
  - Conveyor System
  - Electrical Switchgear & Transformer for TBM

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

- Package 1A designs:
  - designs complete
  - evaluations not likely to play a major role in development of the design
  - assurance of an adequate design prior to beginning construction (especially through waste isolation and test interference evaluations)
- Package 1B and Package 2: DIE process to be incorporated into the design prior to 90% Design Review


DIE
Process
Requirements Documents
Basis for Design
Design Documents
Pkg 1B/2 Prelim DIEs
Test Interference Evaluation(s)
Determination of Importance Evaluation
Pkg 1A & 1B/2 Final DIEs
Waste Isolation Evaluation(s)
Misc References
Implementation of Design

Evaluation Process

- Inputs to evaluation process:
  - Requirements documents;
  - Waste Isolation evaluations;
  - TFM (Tracers, Fluids, and Materials) evaluations;
  - Test-to-test and test-to-construction interference evaluations;
  - Accident assessments (later);
  - Other appropriate references.
- All DIEs are documented as QA engineering analyses in accordance with QAP-3-9 regardless of conclusion

QARD Implementation (In Progress)

- QAP-2-3
  - o includes checklists for consistency of evaluation
  - o requires evaluation to document basis for classification (similar to current AP-6.17Q)
- QACMD (QA Classification Methodology Document)/revisions to DIE Plan
  - o methodology document for specific evaluations (e.g., PRA methodology, etc.)
  - o continues guidance for application of controls to items/activities

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

QAP-2-3 Classifications

QA-1	ITS
QA-2	ITWI
QA-3	important to radwaste
QA-4	important to potential interaction (seismic category II, etc.)
QA-5	imporant to fire protection
QA-6	important to physical protection (SNM, S&S, etc.)
QA-7	important to occupational personnel exposure

- Latest revision of QARD adopts these classifications

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

Example - Starter Tunnel Drill-and-Blast Section

Conclusion	Control Requirement
ITS - assumed to house potential safety systems as part of the permanent repository - transport path for waste emplacement and a path for ventilation equipment with potential ITS significance.	Include on Q-List
ITS - likely to take credit for the ground support system in minimizing likelihood of rockfall, and rockfall is conservatively assumed to be an initiating event in an accident scenario	Control application of commercial-grade materials and require inspection/maintenance of ground support system - *prepare backup slide w/more detail*
ITWI - slope of the first 33 feet of Starter Tunnel - limit the potential for hydrological changes by preventing water runoff from entering the tunnel	Verify as-built slope of tunnel floor upon completion and after significant reconstruction or maintenance
ITWI - provide method for preventing water intrusion into the ventilation system evase	Modify design
ITWI (SC) - trace all water used underground - provides reasonable assurance that normal use of construction water will not interfere with site characterization results	Control use of water underground; require procedures on operation and maintenance of tracer injection system

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

Example - Surface Water Supply System

Conclusion	Control Requirement
ITS - none	None
ITWI - limit on use of construction water of 2 gal/yd^2/day, averaged over a six- month period	Provide QA limit in "water use" specification
ITWI - location of the water tanks because of role of proper placement in preventing water from draining toward North Ramp/Starter Tunnel	Provide information in design basis to prevent unreviewed changes
ITWI - provide indication of system leakage to allow detection of 350 gal/day averaged over a six-month period	Modify design
ITWI (SC) - mitigate potential test interference on C^{14} testing by preventing spread to surrounding environment of oil from oil-soaked sand beneath water storage tanks	Modify design

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

ESF CONSTRUCTION AND VENTILATION IMPACT ON BASELINE CONDITIONS

(SITE CHARACTERIZATION ANALYSIS COMMENT 123 AND STATE OF NEVADA LETTER OF FEB. 4, 1993 TO THE NRC)

PRESENTED BY

DENNIS WILLIAMS

CHIEF, SITE INVESTIGATIONS BRANCH

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

ATTACHMENT (13) OCTOBER 4-5, 1993

Item T #12

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

SCA COMMENT 123
JULY 31, 1989

- **Comment paraphrased: Effects of ventilation on exploratory shafts and underground testing rooms may have been underestimated in evaluation of:**
  - **Potential interference with acquiring licensing data**
  - **Potential irreversible changes to baseline site condition**
  - **Ability of the site to isolate waste**

- **Recommendation: "At an early date, but before construction of the ESF is begun, DOE should provide an analysis of effects of ESF ventilation on adjacent rock, including both liquid and gas flows"**

PRELIMINARY DRAFT
DNTET2DE1.126/10-4-93

SCA COMMENT 123 INITIAL RESPONSE, CURRENT EVALUATION, AND STATUS

- **Initial response**
  - "Effects of ventilation of drying front is likely underestimated" is incorrect, because shaft will be lined with concrete (December 14, 1990)
- **Current evaluation**
  - Initial response not applicable under current design of using ramps and limited shotcrete linings
  - Secondary effects on baseline conditions (e.g., geochemistry) and effect on waste isolation under consideration
- **Status**
  - Comment remains open
  - Technical input and requirements to close comment in process by DOE

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

QUESTION 1, NRC REVIEW OF PROGRESS REPORTS 6 AND 7 MAY 5, 1993

- **NRC comment**
  - "What evaluation has DOE made of the potential for air movement from the ESF to adversely impact the collection of geochemical data necessary for site characterization?"
- **NRC recommendation**
  - In a timely manner, consider effect of air movement from ESF on surface-based geochemical tests
  - If anticipated to be significant, collect data before it can be compromised
- **Status**
  - Under evaluation by DOE
  - USGS reviewing testing program based on proposed revision to ESF

PRELIMINARY DRAFT
DNTET2DE3.126/10-4-93

STATE OF NEVADA (JOHNSON) LETTER TO NRC (YOUNGBLOOD) FEBRUARY 4, 1993

Concern

- Continued priority assigned to early excavation of ESF
- Lack of predisturbance pneumatic database
- Suggests current schedule may prevent adequate characterization to support performance assessments and regulatory determinations
- Recommends tunneling delay to allow carefully designed surface-based testing program, with specific mention of pneumatic conductivity of bedded zone

STATE OF NEVADA (JOHNSON) LETTER TO NRC (YOUNGBLOOD) FEBRUARY 4, 1993

(CONTINUED)

Response

- Schedules for surface-based testing and ESF construction are under review to ensure pre-disturbance pneumatic data is obtained
- Enhanced surface-based data acquisition underway
- Study plans are being modified to respond to NRC and State of Nevada concerns

TECHNICAL RECOMMENDATIONS FROM USGS

- **Establish baseline conditions in unsaturated zone:**
  - Implement before disturbance by ESF construction (complete testing; monitor several months)
  - Monitor during construction and operation

- **Implement additional testing program before disturbance**

PRELIMINARY DRAFT

TECHNICAL RECOMMENDATIONS FROM USGS

(CONTINUED)

- **Accelerate test program**
  - To baseline conditions within or close to repository but away from construction

- **Develop and implement similar test program along alignment of proposed ESF excavation**

TECHNICAL RECOMMENDATIONS FROM USGS

(CONTINUED)

- Improve analytical models to simulate multi-phase flow under realistic stratigraphic, structural, and boundary conditions

- To predict effects of ESF construction on flow in the unsaturated zone

DOE POSITION

- DOE agrees that NRC, State of Nevada and U.S. Geological Survey concerns are valid

TEST PROGRAM

Based on study plans

- 8.3.1.2.2.3 Characterization of the Percolation in the Unsaturated Zone - Surface Based Studies
- 8.3.1.2.2.4 Characterization of the Yucca Mountain Unsaturated Zone in the ESF
- 8.3.1.2.2.5 Diffusion Tests in the ESF
- 8.3.1.2.2.6 Characterization of the Yucca Mountain Unsaturated Zone Gaseous - Phase Movement
- 83.1.2.2.7 Hydrochemical Characterization of the Unsaturated Zone
- 8.3.1.2.2.8 Fluid Flow in Unsaturated, Fractured Rock

STUDY PLAN STATUS

8.3.1.2.2.3 Characterization of the Percolation in the Unsaturated Zone - Surface Based Studies

- Completed NRC Phase I Review March 1992
- Relevance - includes tests to determine in-situ hydrologic properties that control liquid and gas flow

STUDY PLAN STATUS

(CONTINUED)

8.3.1.2.2.4 Characterization of the Yucca Mountain Unsaturated Zone in the ESF

- Revision 1 completed NRC Phase I Review March 1993
  - Note: revision 1 contains only 4 activities: radial borehole tests, perched water tests, hydrochemistry tests, and excavation effects tests
- Revision 2, which is currently in YMPO review, will add the activity for the hydrologic properties of major faults
- Relevance - includes tests to determine in-situ hydrologic properties that control liquid and gas flow and to evaluate the impact of ramp and drift construction on these properties

TESTING PROGRAM IN COORDINATION WITH TBM EXCAVATION

- **Location of existing and planned boreholes targeted for sampling and monitoring**
  - At distance from proposed excavations
  - In close proximity to proposed excavations

- **Additionally, the ESF (underground) component of sampling and monitoring**

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

USGS TECHNICAL DETAILS OF TESTING PROGRAM

PRELIMINARY DRAFT

DNTET2DE10.126/10-4-93

CONCLUSIONS

- **In coordination with USGS, DOE will:**
  - Accelerate surface-based testing program
- **Revise sequence of site-characterization testing to reflect original testing logic**
- **DOE is committed to collection of baseline information prior to ESF construction**

PRELIMINARY DRAFT

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

ESF CONSTRUCTION AND VENTILATION IMPACT ON BASELINE CONDITIONS

(SITE CHARACTERIZATION ANALYSIS COMMENT 123 AND STATE OF NEVADA LETTER OF FEB. 4, 1993 TO THE NRC)

PRESENTED TO

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

OCTOBER 4-5, 1993

PART. II #13

STUDY PLAN STATUS

(CONTINUED)

8.3.1.2.2.5 Diffusion Tests in the ESF

- Completed NRC Phase I Review January 1993
- Relevance - includes tests to determine "in-situ" the extent to which nonsorbing tracers diffuse into the water-filled pores of the Yucca Mountain tuffs

STUDY PLAN STATUS

(CONTINUED)

8.3.1.2.2.6 Characterization of the Yucca Mountain Unsaturated Zone Gaseous - Phase Movement

- Completed NRC Phase I Review October 1991
  - Note: Revision 1, which incorporates the new ESF configuration, is currently in review by YMPO
- Relevance - includes tests to determine transmission and storative properties for gas flow and to describe the pre-waste emplacement gas flow field

STUDY PLAN STATUS

(CONTINUED)

83.1.2.2.7 Hydrochemical Characterization of the Unsaturated Zone

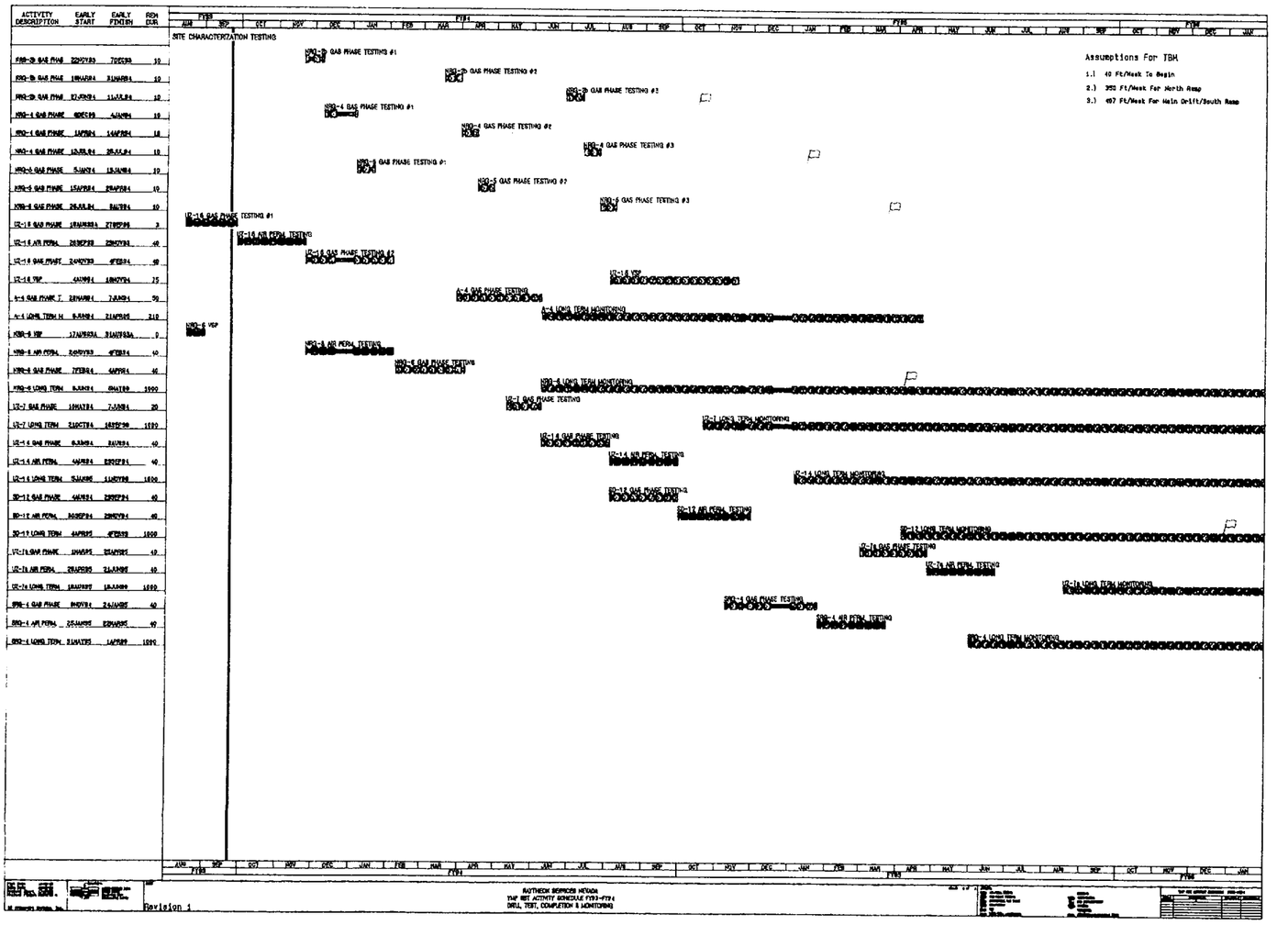
- **Completed NRC Phase I Review May 1992**
  - **Note: Revision 1, which incorporates the new ESF configuration, is currently in review by YMPO**
- **Relevance - includes tests to determine transport mechanisms, flow directions, fluxes and travel times of gas within the unsaturated zone**

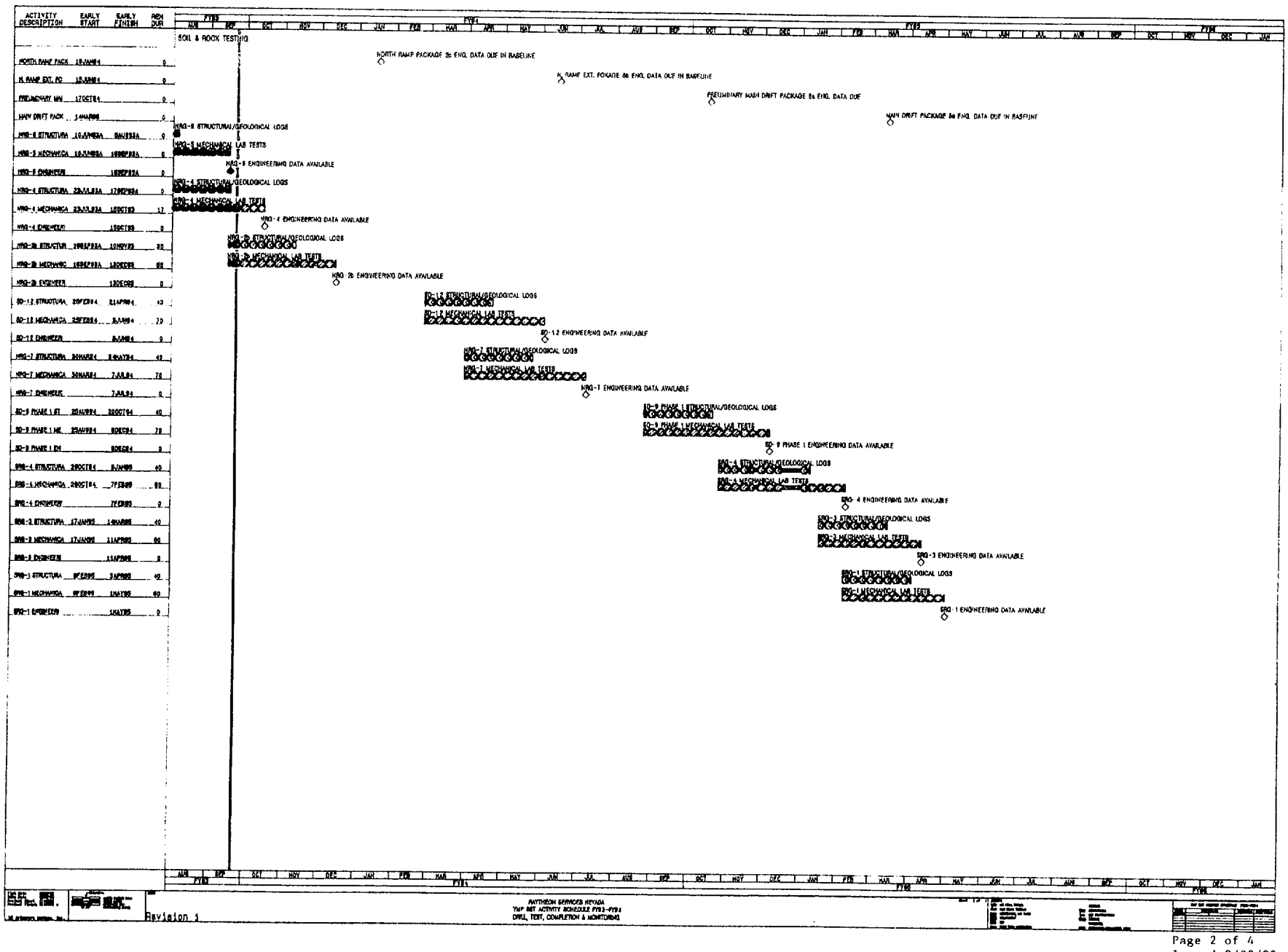
STUDY PLAN STATUS

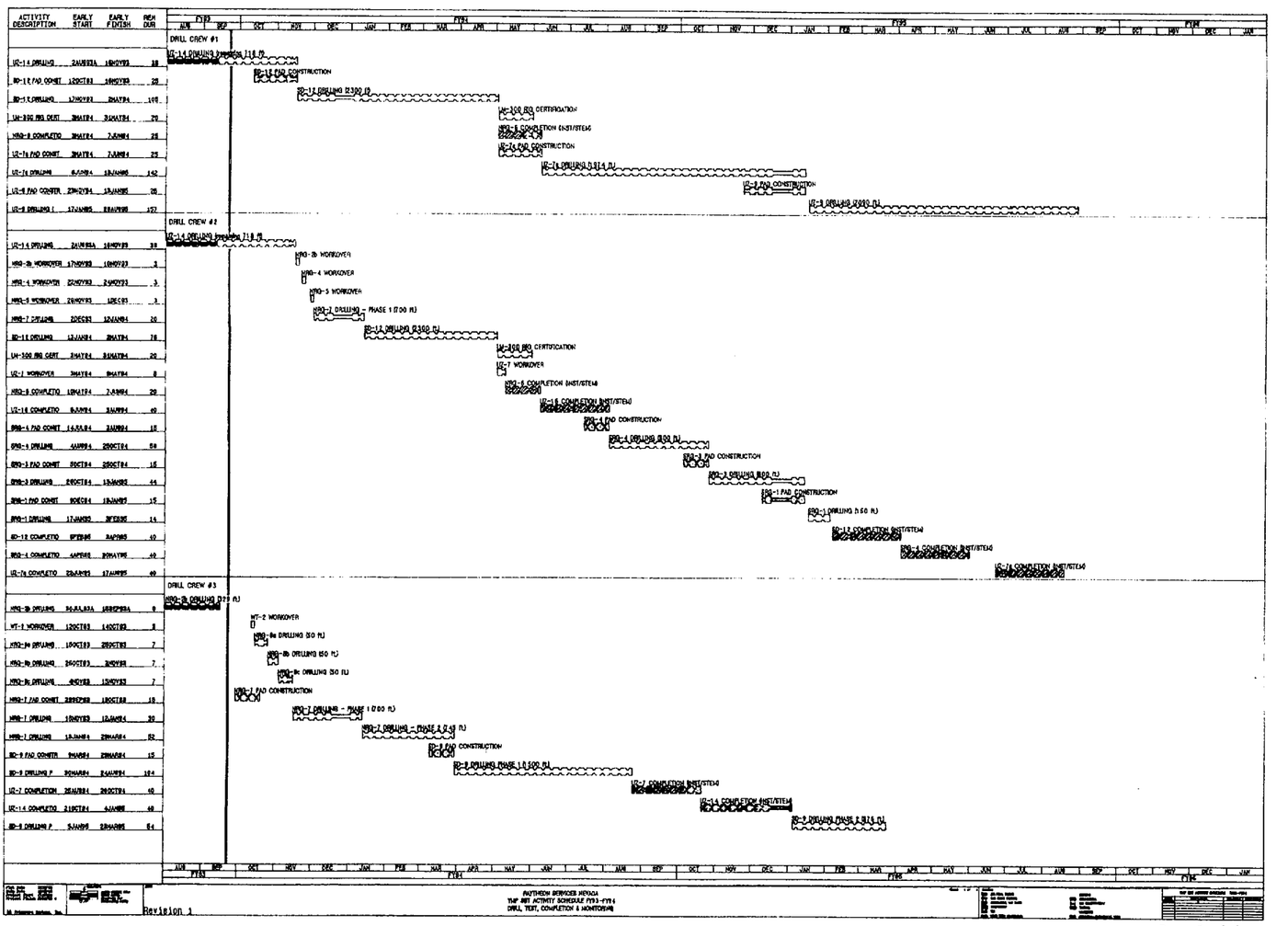
(CONTINUED)

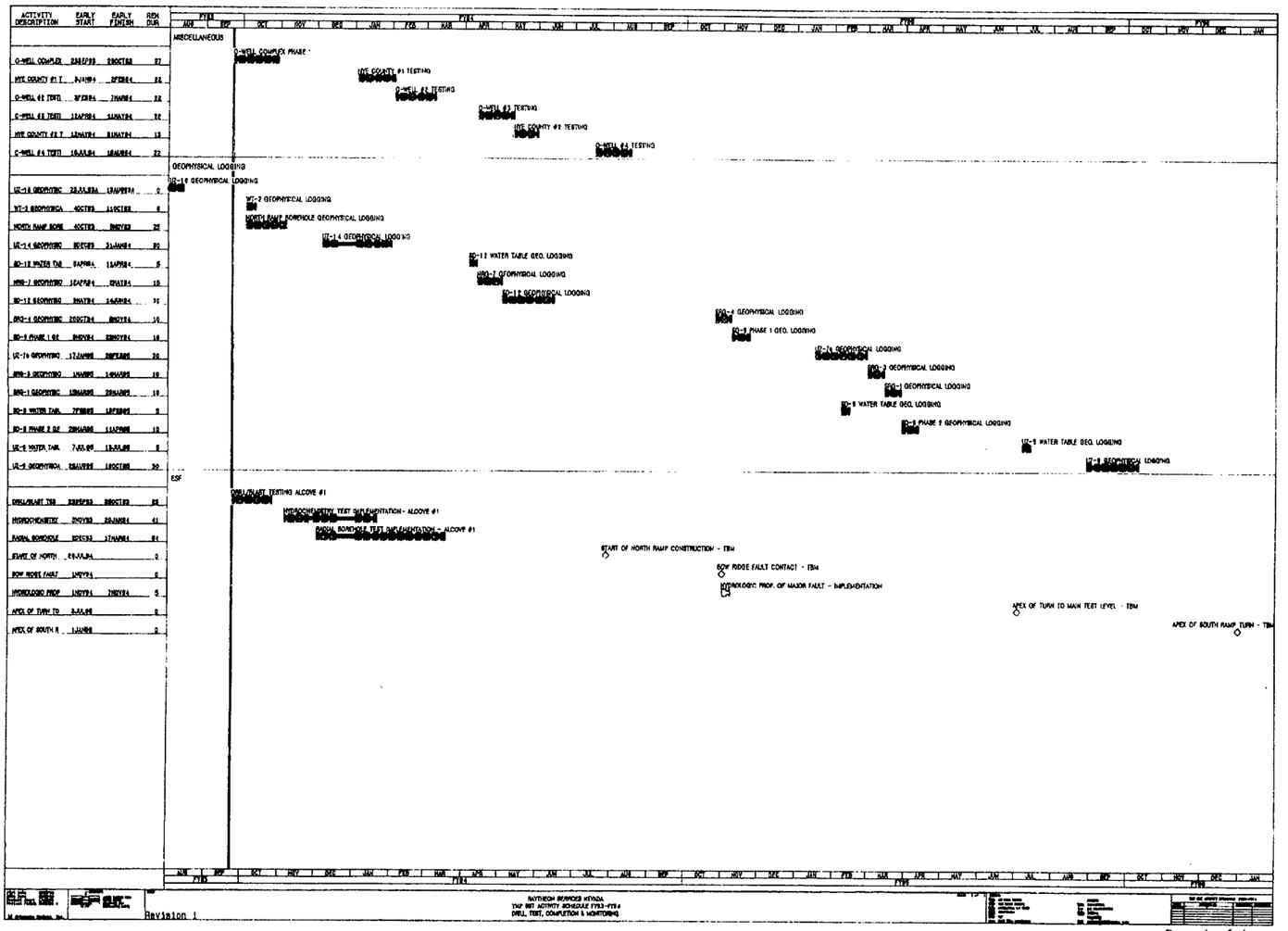
8.3.1.2.2.8 Fluid Flow in Unsaturated, Fractured Rock

- **Completed NRC Phase I Review January 1993**
  - **Note: Revision 1, which incorporates the new ESF configuration, is currently in review by YMPO**
- **Relevance - Develop detailed conceptual and numerical models of fluid flow and transport within unsaturated, fractured rock**

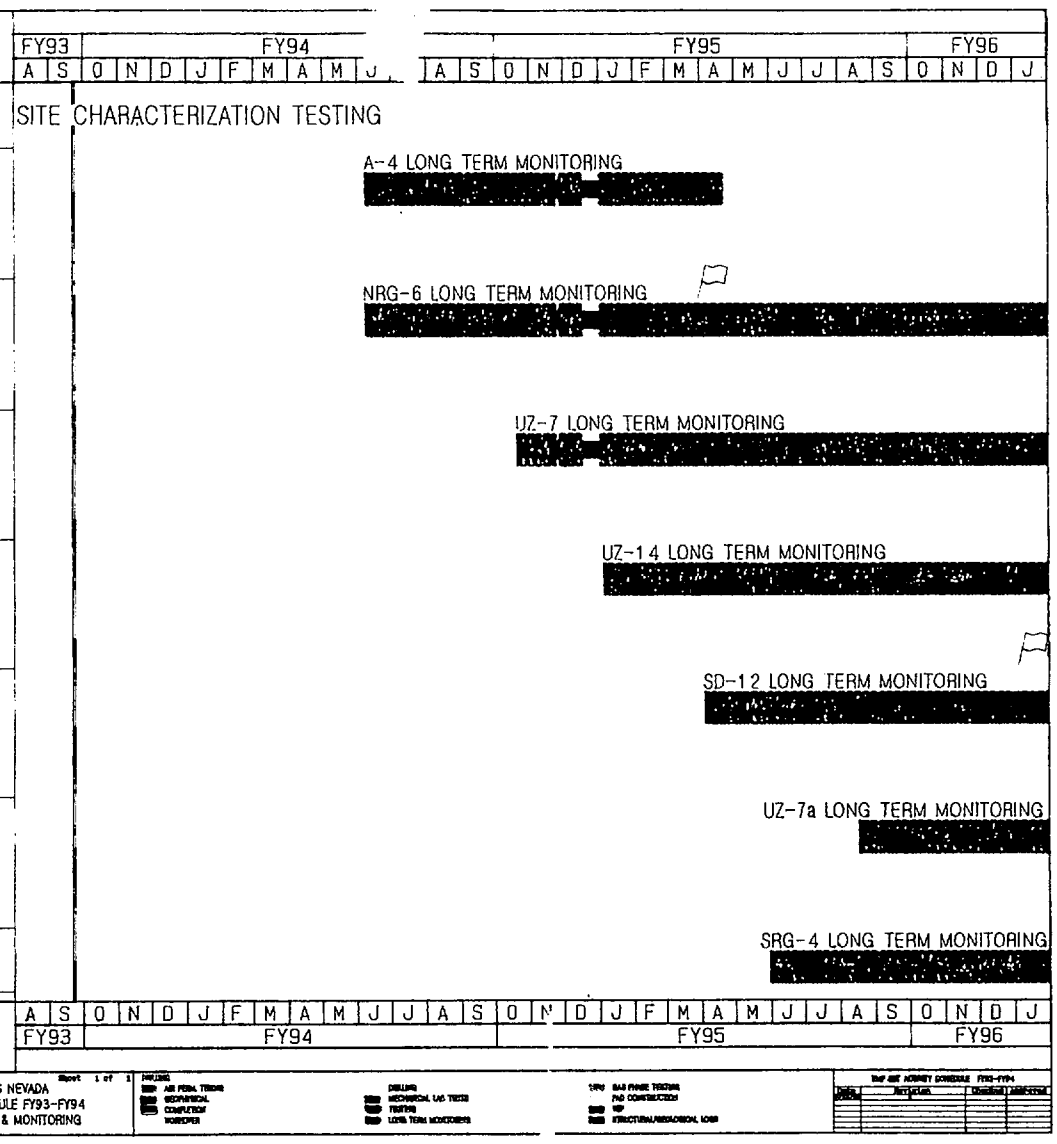

ACTIVITY DESCRIPTION
EARLY START
EARLY FINISH
RDM DUR
FY93
FY94
FY95
SITE CHARACTERIZATION TESTING
Assumptions For TBM
1.) 40 Ft/Week To Begin
2.) 350 Ft/Week For North Ramp
3.) 407 Ft/Week For Main Drift/South Ramp
Revision 1
RAYTHEON SERVICES NEVADA
THE RST ACTIVITY SCHEDULE FY93-FY94
DRILL TEST, COMPLETION & MONITORING


ACTIVITY DESCRIPTION
EARLY START
EARLY FINISH
REM DUR
FY93
FY94
FY95
FY96
SOIL & ROCK TESTING
NORTH RAMP PACKAGE 3c ENGL DATA DUE IN BASELINE
N. RAMP EXT. PACKAGE 4b ENGL DATA DUE IN BASELINE
PRELIMINARY MAIN DRIFT PACKAGE 5a ENGL DATA DUE
MAIN DRIFT PACKAGE 6a ENGL DATA DUE IN BASELINE
NRG-8 STRUCTURAL/GEOLOGICAL LOGS
NRG-8 MECHANICAL LAB TESTS
NRG-8 ENGINEERING DATA AVAILABLE
NRG-4 STRUCTURAL/GEOLOGICAL LOGS
NRG-4 MECHANICAL LAB TESTS
NRG-4 ENGINEERING DATA AVAILABLE
NRG-2b STRUCTURAL/GEOLOGICAL LOGS
NRG-2b MECHANICAL LAB TESTS
NRG-2b ENGINEERING DATA AVAILABLE
SD-12 STRUCTURAL/GEOLOGICAL LOGS
SD-12 MECHANICAL LAB TESTS
SD-12 ENGINEERING DATA AVAILABLE
NRG-7 STRUCTURAL/GEOLOGICAL LOGS
NRG-7 MECHANICAL LAB TESTS
NRG-7 ENGINEERING DATA AVAILABLE
SD-9 PHASE 1 STRUCTURAL/GEOLOGICAL LOGS
SD-9 PHASE 1 MECHANICAL LAB TESTS
SD-9 PHASE 1 ENGINEERING DATA AVAILABLE
SRG-4 STRUCTURAL/GEOLOGICAL LOGS
SRG-4 MECHANICAL LAB TESTS
SRG-4 ENGINEERING DATA AVAILABLE
SRG-3 STRUCTURAL/GEOLOGICAL LOGS
SRG-3 MECHANICAL LAB TESTS
SRG-3 ENGINEERING DATA AVAILABLE
SRG-1 STRUCTURAL/GEOLOGICAL LOGS
SRG-1 MECHANICAL LAB TESTS
SRG-1 ENGINEERING DATA AVAILABLE
Revision 1
RAYTHEON SERVICES NEVADA
YMP RBT ACTIVITY SCHEDULE FY93-FY96
DRILL, TEST, COMPLETION & MONITORING


ACTIVITY DESCRIPTION
EARLY START
EARLY FINISH
REM DUR
FY93
FY94
FY95
FY96
DRILL CREW #1
DRILL CREW #2
DRILL CREW #3
RAYTHEON SERVICES NEVADA
TMF RBT ACTIVITY SCHEDULE FY93-FY96
DRILL, TEST, COMPLETION & MONITORING
Revision 1


ACTIVITY DESCRIPTION
EARLY START
EARLY FINISH
REM DUR
MISCELLANEOUS
GEOPHYSICAL LOGGING
ESF
START OF NORTH RAMP CONSTRUCTION - TBM
BOW RIDGE FAULT CONTACT - TBM
APEX OF TURN TO MAIN TEST LEVEL - TBM
APEX OF SOUTH RAMP TURN - TBM
RAYTHEON SERVICES NEVADA
TMP WBS ACTIVITY SCHEDULE FY93-FY94
DRILL, TEST, COMPLETION & MONITORING
Revision 1

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	REM DUR
A-4 LONG TERM M	8JUN94	21APR95	210
NRG-6 LONG TERM	8JUN94	6MAY98	1000
UZ-7 LONG TERM	21OCT94	16SEP98	1000
UZ-14 LONG TERM	5JAN95	11NOV98	1000
SD-12 LONG TERM	4APR95	4FEB99	1000
UZ-7a LONG TERM	18AUG95	18JUN99	1000
SRG-4 LONG TERM	31MAY95	1APR99	1000



Revision 1 Issued 9/23/93

RAYTHEON SERVICES NEVADA
YMP SBT ACTIVITY SCHEDULE FY93-FY94
DRILL, TEST, COMPLETION & MONITORING

U.S. DEPARTMENT OF ENERGY/
U.S. NUCLEAR REGULATORY COMMISSION
TECHNICAL EXCHANGE
LAS VEGAS, NEVADA, OCTOBER 4-5, 1993

SUBJECT: SURFACE-BASED TESTING TO PROVIDE INFORMATION ON THE UNDISTURBED SITE AHEAD OF ESF CONSTRUCTION

PRESENTER: ROBERT W. CRAIG

PRESENTER'S TITLE AND ORGANIZATION: DEPUTY TECHNICAL PROJECT OFFICER
U.S. GEOLOGICAL SURVEY
LAS VEGAS, NEVADA

PRESENTER'S TELEPHONE NUMBER: (702) 794-7142

ATTACHMENT (14)

Objectives

- Obtain data prior to ESF construction
- Monitor effects of ESF construction on baseline conditions
- Assess impacts of ESF construction on site conditions

Data Collection Covered Primarily by Three Study Plans

Study 8.3.1.2.2.3

- Characterization of the percolation in the Unsaturated Zone - Surface-Based Study

- Determine the *in situ* bulk-permeability and bulk hydraulic properties of the unsaturated media

- Evaluate *in situ* distribution of potential energy and the pneumatic and hydraulic properties of the conducting rock

Data Collection Covered Primarily by Three Study Plans

(Continued)

Study 8.3.1.2.2.6

- Characterization of the Yucca Mountain Unsaturated-Zone Gaseous-Phase Movement

- Determine, by flow, pressure, and gas-composition measurements the near field air conductivities, storativity, and anisotrophy of units

- Monitoring of gaseous circulation with time, and flow profiles with depth, should provide data that can be used to determine bulk pneumatic conductivity by model calibration

Data Collection Covered Primarily by Three Study Plans

(Continued)

Study 8.3.1.2.2.7

- Hydrochemical Characterization of the Unsaturated Zone

- Understand the gas-transport mechanism, and provide evidence of gas-flow direction, flux, and travel time within the unsaturated zone

- Evaluate the effects of air introduced to the system (natural or man-made) in order that the study provide valid results

Data

- Pneumatic permeability
- Gas chemistry
- *In situ* distribution of moisture, pressure, and temperature

Data Use to Assess Impacts Covered Primarily by One Study Plan

Study 8.3.1.2.2.8

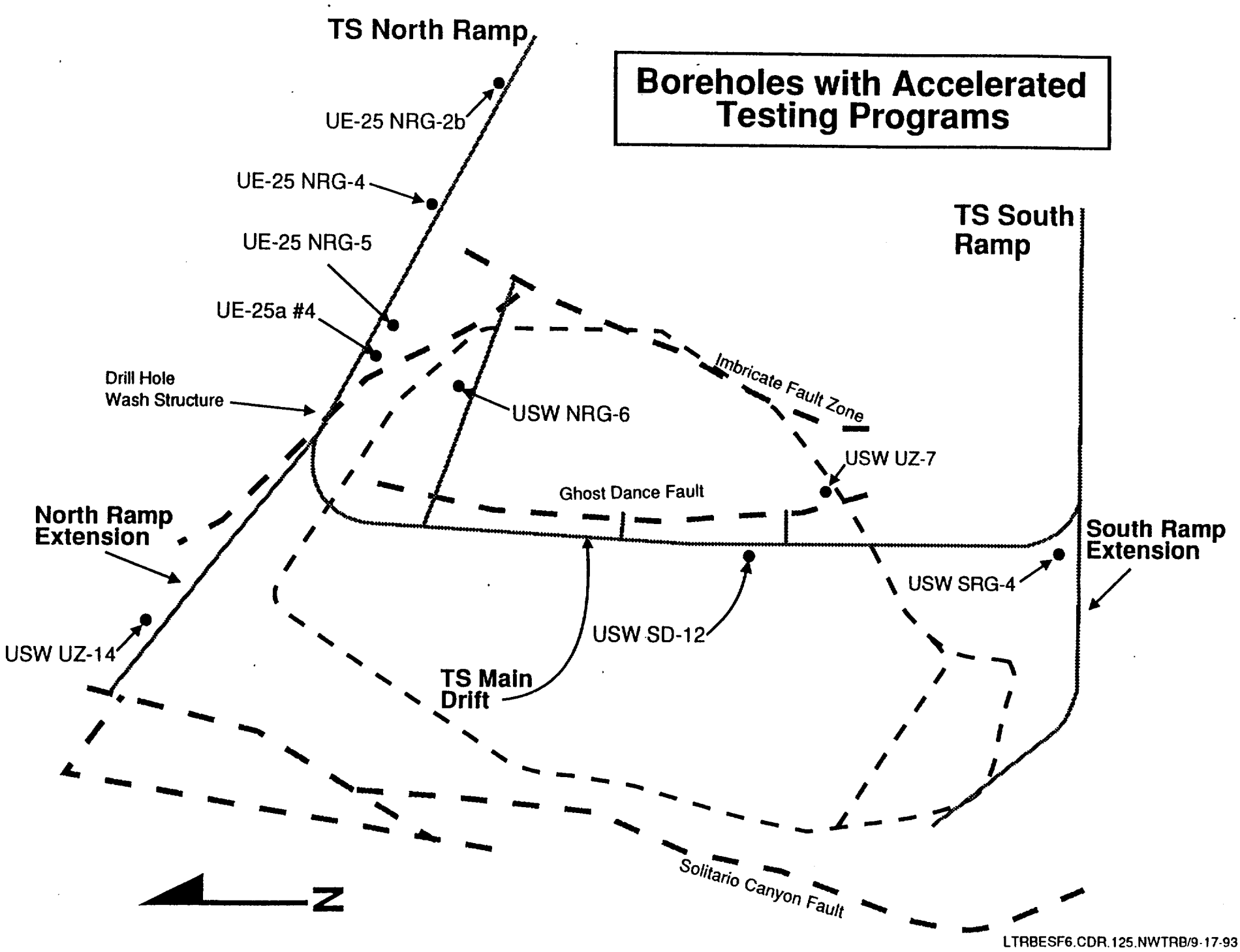
- **Fluid Flow in Unsaturated, Fractured Rock**
  - Models to help design and interpret hydrologic and pneumatic tests
  - Provide information about model parameters that can be incorporated into site-scale models

Applicable Methods/Tests

- **Gas-phase circulation**
  - Flow surveys
  - Selected gas-chemistry (CH_4, $C0_2$)
  - Shut-in pressures
- **UZ Hydrochemistry**
  - Large-scale borehole gas sampling
  - Long-term periodic gas sampling
- **UZ Percolation, Surface-based study**
  - Air-permeability testing
  - *In situ* long term monitoring of moisture, pressure, and temperature

Experience to Date in Obtaining Similar Data

- **USW UZ-1**
  - Instrumentation
  - Gas sampling
- **G-Tunnel**
  - Development of instrumentation methods
- **Hydrologic Research Facility auger holes**
  - Demonstration of instrumentations methods
- **USW UZ-6/6s**
  - On-going study; topographic effects, barometric effects
- **Apache Leap**
  - Air-permeability prototype testing with packer systems


Boreholes with Accelerated Testing Programs
TS North Ramp
UE-25 NRG-2b
UE-25 NRG-4
UE-25 NRG-5
UE-25a #4
Drill Hole Wash Structure
USW NRG-6
TS South Ramp
Imbricate Fault Zone
USW UZ-7
Ghost Dance Fault
North Ramp Extension
South Ramp Extension
USW SRG-4
USW SD-12
USW UZ-14
TS Main Drift
Solitario Canyon Fault
N
LTRBESF6.CDR.125.NWTRB/9-17-93

Pre-ESF Construction Data Collection

UE-25a#4	• Monitor gas pressures; shut-in pressures to overlap with USW NRG-6
UE-25 NRG-2b	• Flow surveys • Selected gas chemistry collected from tubing in open-hole • Isolated gas chemistry and shut-in pressures; round-robin with seasons, continuous as TBM approaches
UE-25 NRG-4	• Flow surveys • Selected gas chemistry collected from tubing in open-hole • Isolated gas chemistry and shut-in pressures; round-robin with seasons, continuous as TBM approaches
UE-25 NRG-5	• Flow surveys • Selected gas chemistry collected from tubing in open-hole • Isolated gas chemistry and shut-in pressures; round-robin with seasons, continuous as TBM approaches
USW NRG-6	• Flow surveys • Selected gas chemistry collected from tubing in open-hole • Isolated gas chemistry and shut-in pressures • Air permeability testing • Instrument; long term monitoring for pressure, water potential, and temperature; periodic gas sampling

SBTBCRG8.125.NWTRB/10-19/20-93

Pre-ESF Construction Data Collection

(Continued)

USW UZ-14	• Geophysical logging • Gas-phase testing • Gas-chemistry sampling • Air permeability testing • Instrument for long-term monitoring; periodic gas-sampling
USW UZ-7	• Geophysical logging • Gas-phase testing • Gas-chemistry sampling • Air permeability testing • Instrument for long-term monitoring; periodic gas-sampling
USW SD-12	• Geophysical logging • Gas-phase testing • Gas-chemistry sampling • Air permeability testing • Iinstrument for long-term monitoring; periodic gas-sampling
USW SRG-4	• Geophysical logging • Gas-phase testing • Gas-chemistry sampling • Air permeability testing • Instrument for long-term monitoring; periodic gas-sampling

SBTBCRG9.125.NWTRB/10-19/20-93

Pre-ESF Construction Data Collection

(Continued)

		STUDY			
		Gas Phase	UZ Hydro-chemistry	UZ Percolation	
Well	Status			Air-K	Instrument
USW NRG-6	Existing	X	X	X	X
UE-25a#4	Existing	X			
UE-25 NRG-2b	Existing*	X			
UE-25 NRG-4	Existing*	X			
UE-25 NRG-5	Existing*	X			
USW UZ-7	Existing*	X	X	X	X
USW UZ-14	In progress	X	X	X	X
USW SD-12	Planned	X	X	X	X
USW SRG-4	Planned	X	X	X	X

* Requires 6 inch diameter borehole and/or casing pulled.

SBTBCRG10.125.NWTRB/10-19/20-93

Summary

Collection of pre- and concurrent-ESF construction pneumatic, gas chemistry, and in situ moisture, pressure and temperature data will be accomplished in order to account for ESF impacts on site characterization efforts

DOE-NRC TECHNICAL EXCHANGE ON THE ESF TITLE II DESIGN

FIRE SUPPRESSION

STEVEN R. SOBOLIK, SNL
OCTOBER 5, 1993

ATTACHMENT #15

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

FIRE SUPPRESSION

SNL performed analyses to estimate the potential impact on waste isolation of water used underground for ESF construction and testing operations. Among the aspects of water use considered were:

1. Routine water use during the ramp and drift excavation by tunnel boring machines (TBMs), principally for dust control.
2. Water used for drilling purposes
3. Water used for washing walls
4. **Water used for fire fighting.**
5. Failure of sump pumps to remove waste and mine drainage water.
6. Accidental breakage of water pipes
7. Water use for testing purposes
8. Accidental water spills by the TBMs and other equipment.
9. Leakage of water pipes, including for water supply and for waste water and mine drainage water removal.

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

FIRE SUPPRESSION

CRITERIA FOR IMPACT TO WASTE ISOLATION

1. Infiltrated water shall not cause a change in saturation at the potential repository horizon in 10,000 years. (SAND91-0792; SAND92-2248, in review); **OR**

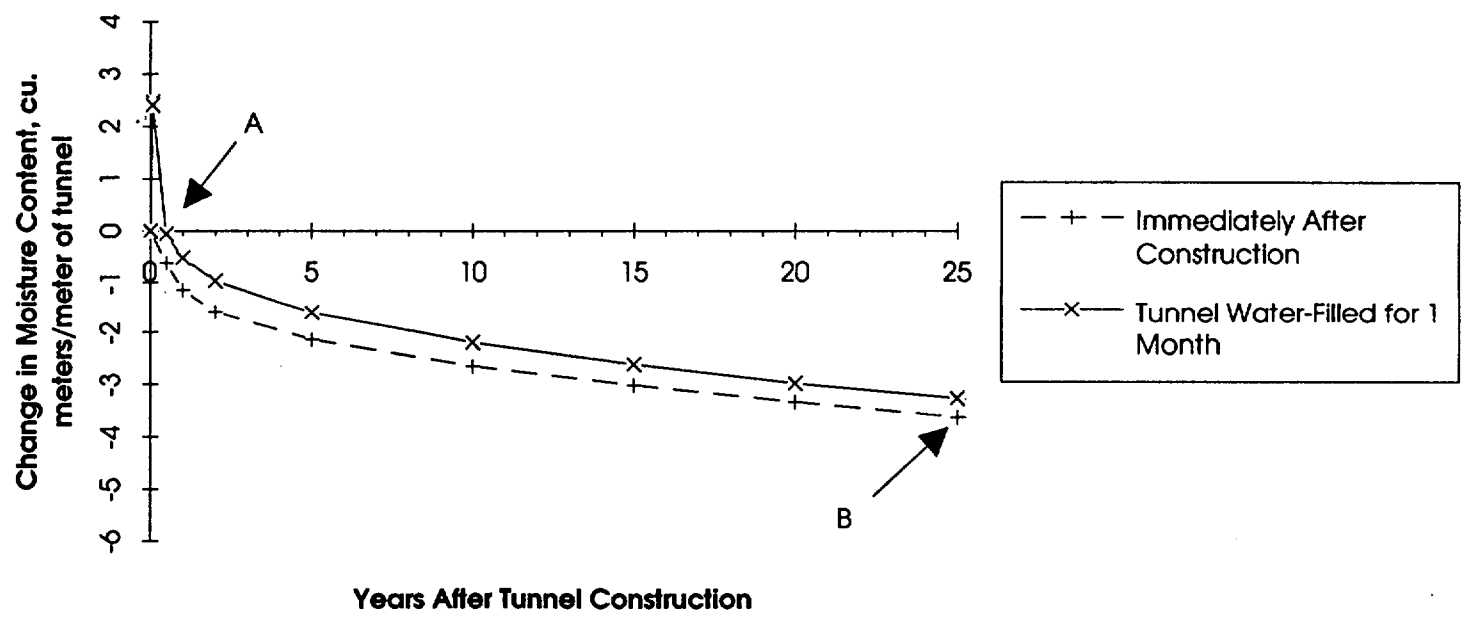
2. Water used in underground construction and operation of the ESF facility and in the planned testing activities will not interfere with the repository's ability to contain waste if that water or an equal volume of water from the same region is removed during construction and by required or prescribed ventilation during the preclosure phase of the ESF and repository operation.

DESCRIPTION OF CALCULATIONS

- Used computer program NORIA-SP
  - In SNL's Software QA System
  - Code verified with comparison to analytical solution (SAND90-2542)
  - No validation work completed; validation experiments in progress at SNL
- 10 m tunnel simulated in both the Topopah Spring welded unit (TSw2) at the repository horizon and in the Paintbrush Tuff nonwelded unit (PTn)
- Tunnel is totally filled with water for one month, to simulate fighting fire or line rupture
- Comparison between effects of no evaporation and ventilation with 90% R.H. air
- Water movement followed through 100 years

TOPOPAH SPRING FIRE SUPPRESSION

Change in Steady-State Moisture Content in TSw2 Due to Ventilating with Air at 90% Relative Humidity



A. Ventilation removes all infiltrated water from TSw2 in approximately 6 months

B. Negligible long-term effect of infiltrated water on in situ saturation

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

TOPOPAH SPRING FIRE SUPPRESSION

RESULTS FROM TSW2 CALCULATIONS

- Ventilation removes all additional water within six months -- water has insignificant long-term impact on drying conditions in tunnel walls
- If none of the water is removed, minimal long-term effect on surrounding matrix

VENTILATION

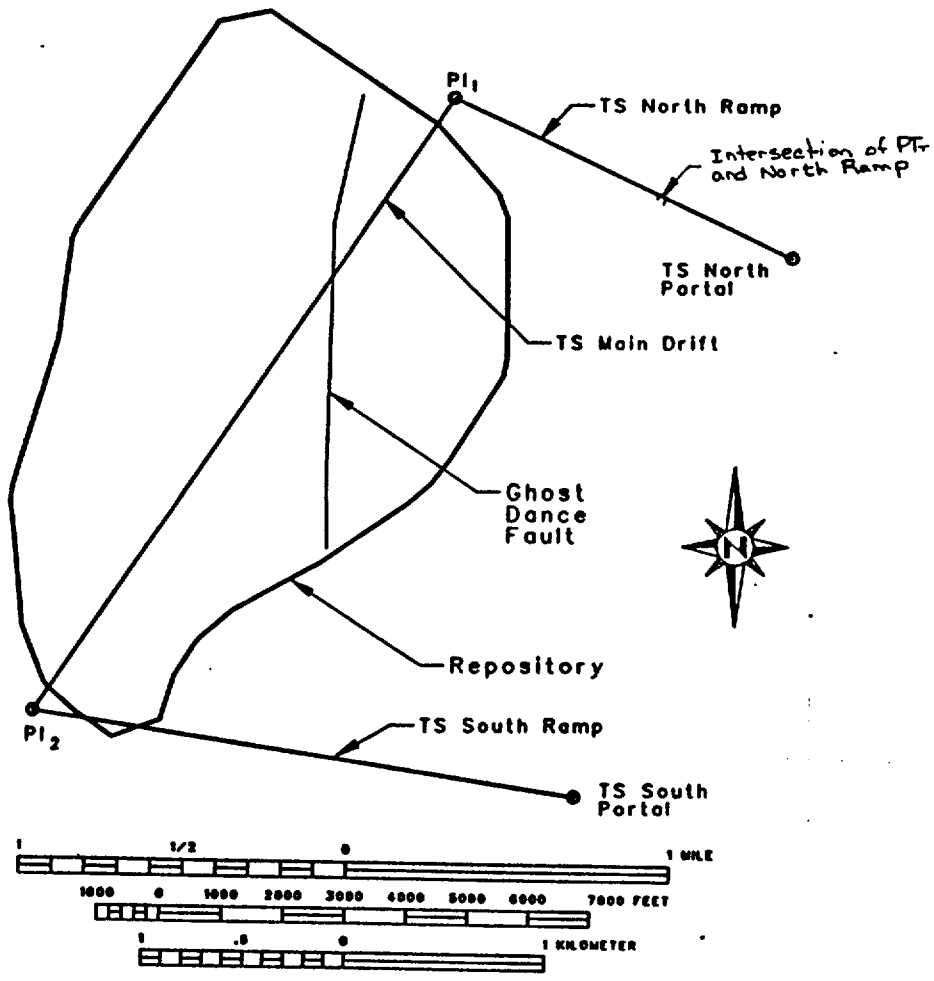
Ventilation model assumes suction pressure at wall surface as a function of relative humidity and temperature of ventilating air. Assumptions include 90% relative humidity, boundary condition at the surface achieved in 24 hr, constant temperature of 300K, no thermal/hydrologic effects due to waste emplacement.

PERMEABILITY DUE TO FRACTURES

TSw2 bulk permeability used here was 3×10^{-16} m^2 (Peters et al., 1984), corresponding to fracture apertures of 4-6 μm. Other experiments suggest permeability in TSw2 of 10^{-13} to 10^{-11} m^2 (apertures of 100 μm to 1 mm).

- Larger fractures will drain faster ==> less water in matrix near tunnel
- Undetermined potential impact on nearly-saturated Calico Hills.

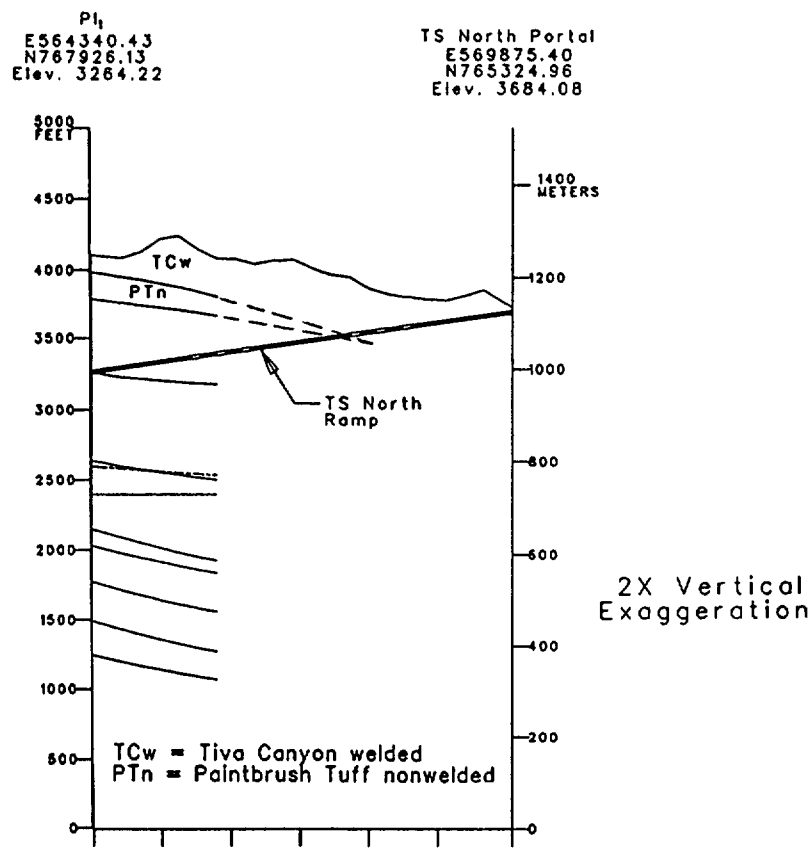
PAINTBRUSH TUFF FIRE SUPPRESSION



- PTn Section of the North Ramp is approximately 800 m from the Conceptual Drift Perimeter Boundary (CDPB)

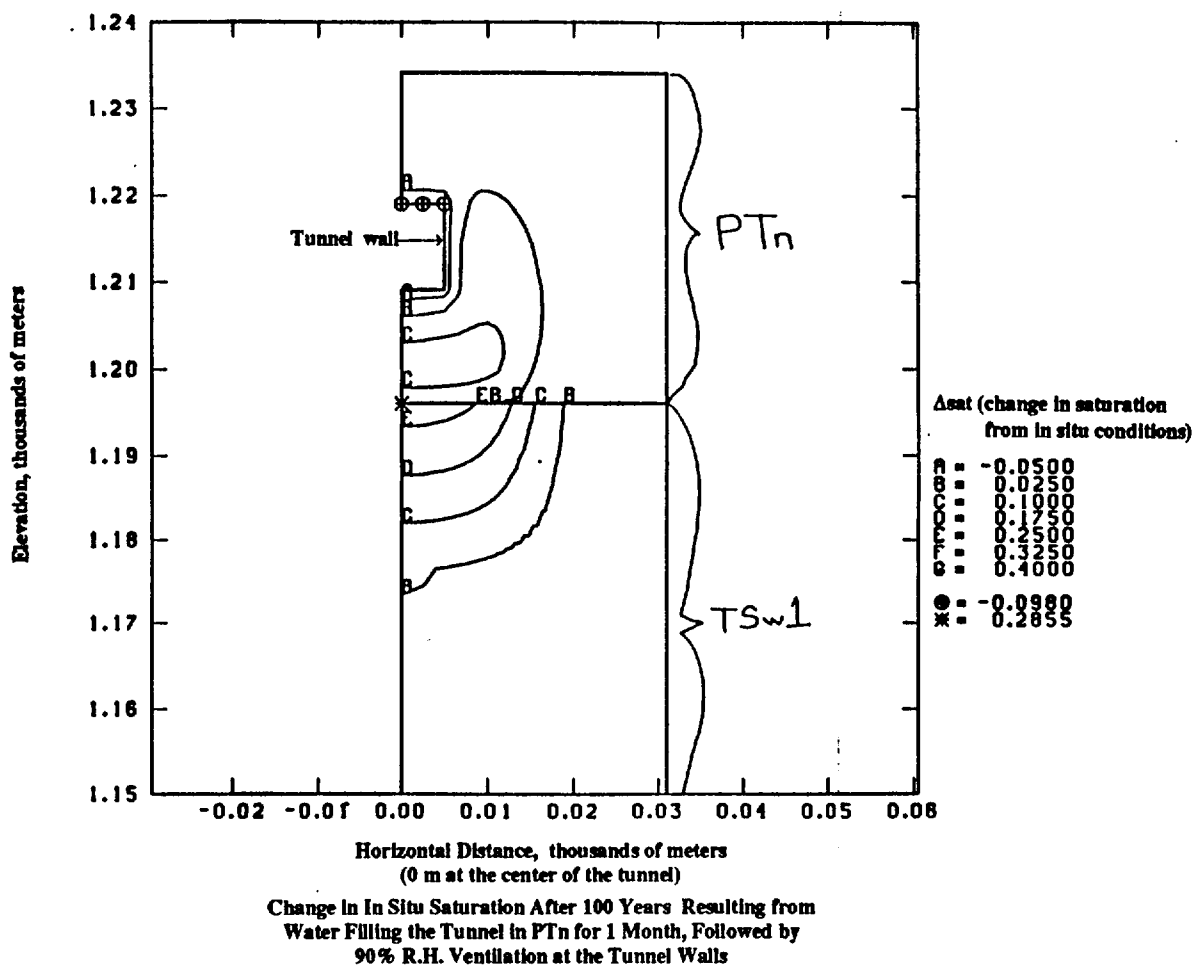
DOE-NRC TECHNICAL EXCHANGE ON THE EXPLORATORY STUDIES FACILITY TITLE II DESIGN

PAINTBRUSH TUFF FIRE SUPPRESSION



- PTn Section of the North Ramp is short.

PAINTBRUSH TUFF FIRE SUPPRESSION



Change in In Situ Saturation After 100 Years Resulting from Water Filling the Tunnel in PTn for 1 Month, Followed by 90% R.H. Ventilation at the Tunnel Walls

- Mostly downward flow - lateral flow only 10 m from the tunnel wall

PAINTBRUSH TUFF FIRE SUPPRESSION

RESULTS FROM PTn CALCULATIONS

- PTn is highly porous, can absorb much more water than Topopah Spring welded tuffs
- Flow is gravity-dominated
- Ventilation has minor effect on moisture retention
- PTn section of tunnel is short and 800 m from CDPB ==> no expected impact on waste isolation

FRACTURES AND FAULTS

The downdip location of the PTn section of the North Ramp from the CDPB, and the existence of vertical faults between the two locations, make minimal the likelihood of a connected fracture network which might transport water to the repository horizon. Site characterization activities including borehole core examinations and fracture mapping, and laboratory experiments on fracture/matrix interaction, are required to understand the specific characteristics of fracture flow at Yucca Mountain as they pertain to waste isolation.

FIRE SUPPRESSION

RESULTS OF THE ANALYSIS PERTAINING TO FIRE SUPPRESSION

- Pumping and ventilation may be used to mitigate most potential effects resulting from using large quantities of water for a major fire fighting operation in the ESF.
- If large quantities of water are used for fire fighting, there is a potential for water to move through fractures from Topopah Spring to Calico Hills which could result in a local change to the saturation level. Neither the change in in situ conditions in the Calico Hills nor its potential impact on system performance (if any) has been quantified.

FIRE SUPPRESSION

RECOMMENDATIONS

- Pending the above quantification, introduction of flammable materials which require large quantities of water as a fire suppressant should be controlled. Utilization of large amounts of water would be used only in emergency situations.
- Water from a fire-fighting operation should be removed as soon as possible. Water should not be allowed to stand on the floors of the tunnels (due to uncertainties in hydrologic and ventilation models, in situ conditions).
- In the event of prolonged contact between water and rock, the imbibition rate of water into the wall rock, fractures and faults should be monitored.
- The quantity of water added to or drawn out of the wall rock should be estimated during the construction of the tunnel to determine the effectiveness of ventilation to remove fire fighting water. This is needed so that proper determination can be made for the need to prescribe remedial ventilation.
- Extra precautions to prevent standing water should be taken near fracture or fault zones and in the Paintbrush Tuff nonwelded units.

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

FIRE SUPPRESSION

STATUS OF REPORT

- Results, recommendations transmitted in letter, L. E. Shephard (SNL) to E. H. Petrie (DOE), 5/28/93
- SAND93-1182 was submitted to YMPO for programmatic review on 9/30/93
- Results will be included in the Semi-annual Site Characterization Progress Report

DOE-NRC TECHNICAL EXCHANGE ON THE EXPLORATORY STUDIES FACILITY

TITLE II DESIGN

IMPACT OF UNDERGROUND DIESEL EMMISSIONS IN ESF

James E. Houseworth

M&O Performance Assessment

October 5, 1993

PRELIMINARY DRAFT

B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.

INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.

Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services

ATTACHMENT (16)

Background: Alternative For Equipment

- Primary alternatives are diesel or electric powered equipment

- Advantage of electric powered equipment
  - Avoids diesel exhaust
  - Avoids diesel fuel

- Advantages of Diesel Powered Equipment
  - Simplifies design and construction
  - Provides greater flexibility

Background: Potential Diesel Use in the ESF

- Personnel and materials transportation
- Earth-moving equipment
- Other construction equipment

Background: Waste Isolation Concerns

- Enhance waste package corrosion
- Facilitate radionuclide migration

Strategy to Evaluate Potential Impact of Diesel Emmissions

- Determine quantity retained
- Evaluate potential concentration of retained materials and compare with natural concentrations

Transport Modeling in Ventilated Tunnel

- Turbulent transport of diesel emissions
- Assume source of diesel emissions in center of tunnel
- Assume contaminant deposited upon contact with wall
- After 300 m, about 75% of emission have contacted wall
- Diesel operations will occur over entire tunnel, requiring transport of emissions over as much as 4000 m between source and ventilation intake

Assumptions for Diesel Exhaust Analyses

- 2000 bhp diesel utilization; one drill and blast and two TBM operations
- Lowest reported diesel exhaust concentration for each constituent without emission control technology
- Exhaust stream is diluted by ventilation flow of 6000 (ft^3/hr) / bhp
- ESF rock surfaces are moist due to natural water content of rock
- If repository is built, waste packages will be emplaced at leat 30 m from any ESF openings

Primary Constituents of Diesel Exhaust and Anticipated Quantities

• Inorganic Constituents	kg/yr
- Carbon Monoxide	5700.
- Carbon Dioxide	24,000.
- Nitric Oxide	12,000.
- Nitrogen Dioxide	600.
- Sulfur Dioxide	9200.
• Organic Constituents	kg/yr
- Hydrocarbon	11,000.
- Diesel Particulates	1800.

Carbon Dixoide

- Carbon Dioxide Emissions 1.8 ppm
- Natural Gas-Phase Carbon Dioxide Concentration 1000. ppm

Nitrogen Oxides

- Most Nitrogen Oxides Emitted as NO
- NO Emissions 120,000. kg in 10 years
- Partitioning of NO and NO_2 into Aqueous Phase to be Quantified
- If Retained as NO_3^- 250,000. kg in 10 years
- Maximum Aqueous Concentration Near Waste Packages 1300. ppm
- Natural Nitrate Levels 10. ppm

Sulfur Oxides

- Most Sulfur Oxides Emitted as SO_2
- SO_2 Emissions 93,000. kg in 10 years
- SO_2 Emissions are Highly Partitioned into Aqueous Phase
- If Retained as $SO_4^=$ 140,000. kg in 10 years
- Maximum Aqueous Concentration
  Near Waste Packages 730. ppm
- Natural Sulfate Levels 20. to 170. ppm

Hydrocarbon Vapor (HVC)

Hydrocarbon Emissions	0.18	ppm

- No Bulk Phase Condensation of Hydrocarbon due to Low Partial Pressure
- Diffusion into Rock Matrix in Gas Phase 0.6 kg in 10 Years
- Partition into Aqueous Phase 23. kg in 10 Years
- Adsorption on Rock Surfaces 230. kg in 10 Years

Hydrocarbon Vapor (HVC) (Continued)

- Maximum Aqueous Concentration Near Waste Packages 1. ppm
- Natural Sulfate Levels of Ground Water 1. ppm

Diesel Particulate Matter (DPM)

- Composed of Carbonaceous Material, Nongaseous Oxides, and Other Organics
- Total Emissions: 18,000. kg in 10 Years
- Maximum Aqueous Concentration
  Near Waste Packages 90. ppm
- Emission Control Technology May Be Able to Remove 98% of DPM from Exhaust Stream

Summary of Findings

Constituent	Natural Concentration (ppm)	Maximum Incremental Concentration At Waste Packages Due To Diesel Exhaust (ppm)
CO_2 (Gas Phase)	1000.	1.8
NO_3^- (Aqueous)	10.	1300.
$SO_4^=$ (Aqueous)	20. To 170.	1.
HCV (Aqueous)	1.	1.
DPM (Aqueous)	1.	90.

Conclusions

- Some components of diesel exhaust may be permanently retained and significantly alter the natural water composition.

- These retained components may influence waste package corrosion or radionuclide transport, with potential adverse impacts to the waste isolation.

Conclusions (Continued)

- Therefore we recommend electric powered transport to support the TBM.

- Improved scientific and engineering information will be used to make more realistic calculations of the potential impact of diesel on waste isolation to determine if diesel equipment may be used.

ESF Seismic Design Basis

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

Richard C. Quittmeyer
October 4-5, 1993

B&W Fuel Company
Duke Engineering & Services, Inc.
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INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services

ATTACHMENT (17)

Scope of Presentation

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

Exploratory Shaft Seismic Design Basis Working Group Report (SAND88-1203)

- Issued 1990, referenced in DOE response to SCA Comment 121
- Considered configuration consisting of two shafts and an underground test area
- Evaluated in terms of DOE Order 6430.1 - "United States Department of Energy General Criteria Manual"
- Determined that permanent items needed to be designed for worker safety and reasonably uninterrupted operation
- Recommended design basis, however, consistent with facility being "essential" or "low-hazard"

Exploratory Shaft Seismic Design Basis Working Group Report (SAND88-1203) continued

- 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)
- Included and additional factor of 10 in assessing the possibility of fault displacement (10-4)
- 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

Exploratory Shaft Seismic Design Basis Working Group Report (SAND88-1203) continued

- **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

- **Recommended that fault displacement not be considered in design**

Exploratory Shaft Seismic Design Basis Working Group Report (SAND88-1203) continued

- For conservatism, it was also recommended that:
  - No credit be taken for attenuation of ground motion with depth
  - Designs be checked for satisfactory performance when subjected to ground motion 1.67 times the design basis motions

Evolution of Seismic Design Basis for ESF

- Re-configuration of the ESF to include ramps and drifts motivated DOE to initiate a technical assessment (QMP-02-08) of the Working Group Report
- Until the technical assessment is complete, a conservative interim design basis was put in place

Interim Bases

- For permanent components, systems, and structures of Package 1A (the North Portal) (August, 1992)
  - 0.75 G horizontal and vertical ground motion at the surface
  - Conservative with respect to the Working Group Report (0.3 G) and the basis used for conceptual design of a potential repository in the site characterization plan (0.4 G)
    - -- 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 vicinity of Yucca Mountain
    - -- Represents ground acceleration with an annual rate of being exceeded of between 10-4 and 10-5 according to SAND86-7013

Interim Bases continued

- For temporary structures, use Uniform Building Code (UBC)
- For the package 1B (Starter Tunnel) and subsequent packages until the technical assessment is complete (April, 1993)

	SURFACE	SUBSURFACE
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

- With respect to surface temporary structure, Yucca Mountain is near the boundary between UBC zones 2B and 3; thus design in accordance with zone 4 is conservative

Status of 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

Status of Technical Assessment
continued

- **Review of 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 controlling 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
  - The Working Group Report is outdated, and the recommended seismic design basis is, therefore, no longer appropriate

Status of Technical Assessment
continued

- **Approach for new recommendation**
  - Provide seismic design basis consistent with DOE-STD-1020-92 (formerly UCRL 15910)
  - Update probabilistic seismic hazard assessment to support selection of a seismic design basis
  - Design ESF permanent items to maintain ability for upgrade to repository seismic design basis, if required
  - Design ESF using methodology described in "Drift Design Methodology and Preliminary Application for the Yucca Mountain Site Characterization Project" (SAND 89-0837)

Status of Technical Assessment
continued

- Schedule
  - Completion anticipated in October 1993. Delivery of recommendations to DOE
  - DOE approves report after review; the report will provide the basis for a revised response to SCA Comment 121 - 12/93

DOE-NRC Technical Exchange Exploratory Studies Facility Title II Design

Roofbolt and Ground Control Options

Robert S. Saunders

October 4 & 5, 1993

ATTACHMENT (18) #18

Roofbolt and Ground Control Options

Baselined Information Already Transmitted to NRC

- Site Characterization Program Baseline (SCPB)
- Exploratory Studies Facility Design Requirements (ESFDR)
- ESF Title II Design, Package 1A

Preliminary Draft

B & W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services

ESF Title II Design, Package 1A (1)

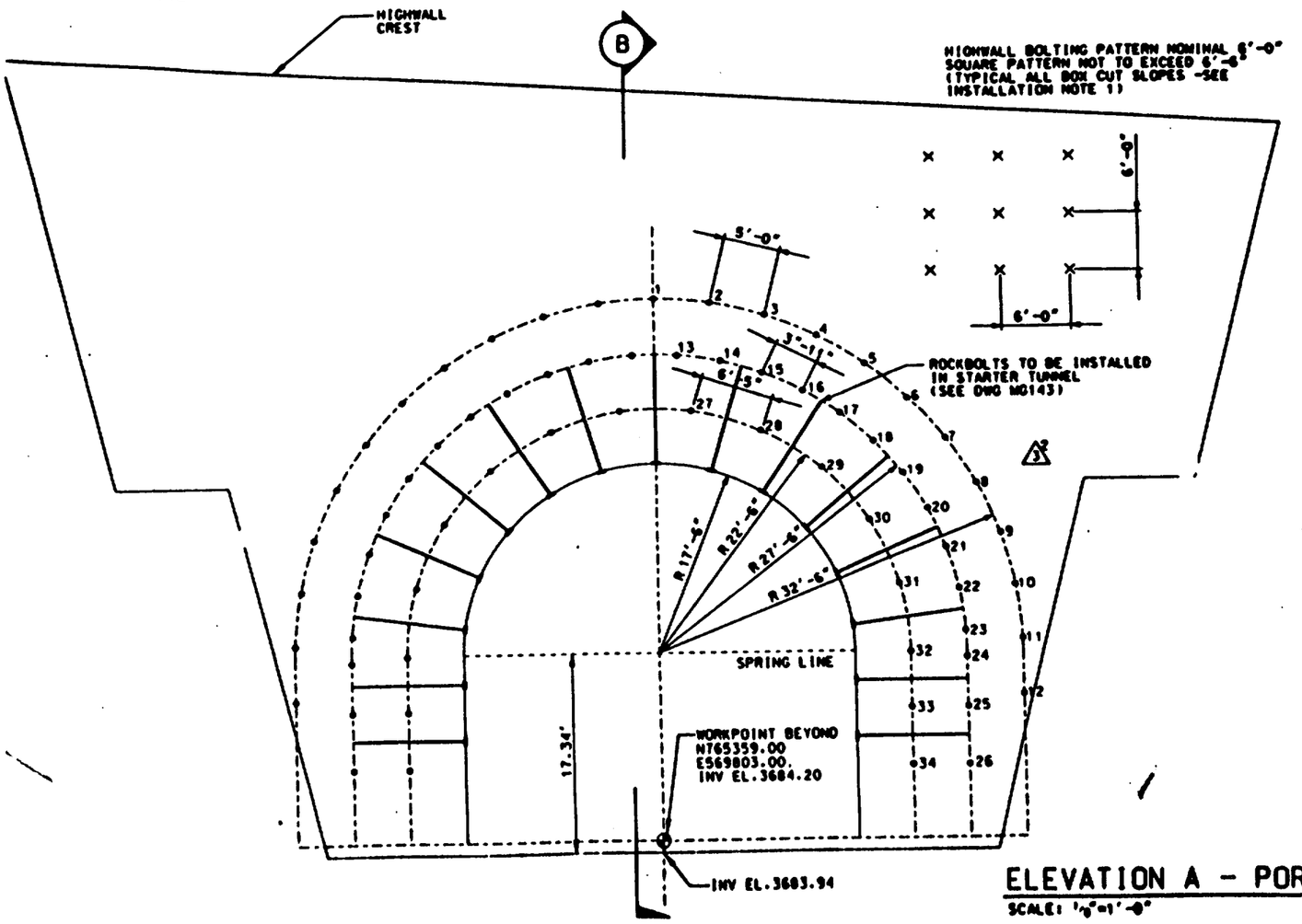
- Highwall Ground Control

  - 10 ft Split Set Rockbolts
  - 20 ft Resin Grouted (Cartridges) Rockbolts - Wire Mesh

- Starter Tunnel Ground Control

  - 10 ft Resin Grouted (Cartridges) Rockbolts On 5 ft by 5 ft Pattern
  - Welded Wire Fabric
  - Shotcrete

Preliminary Draft



ELEVATION A - PORTAL FAC

SCALE: 1/8"=1'-0"

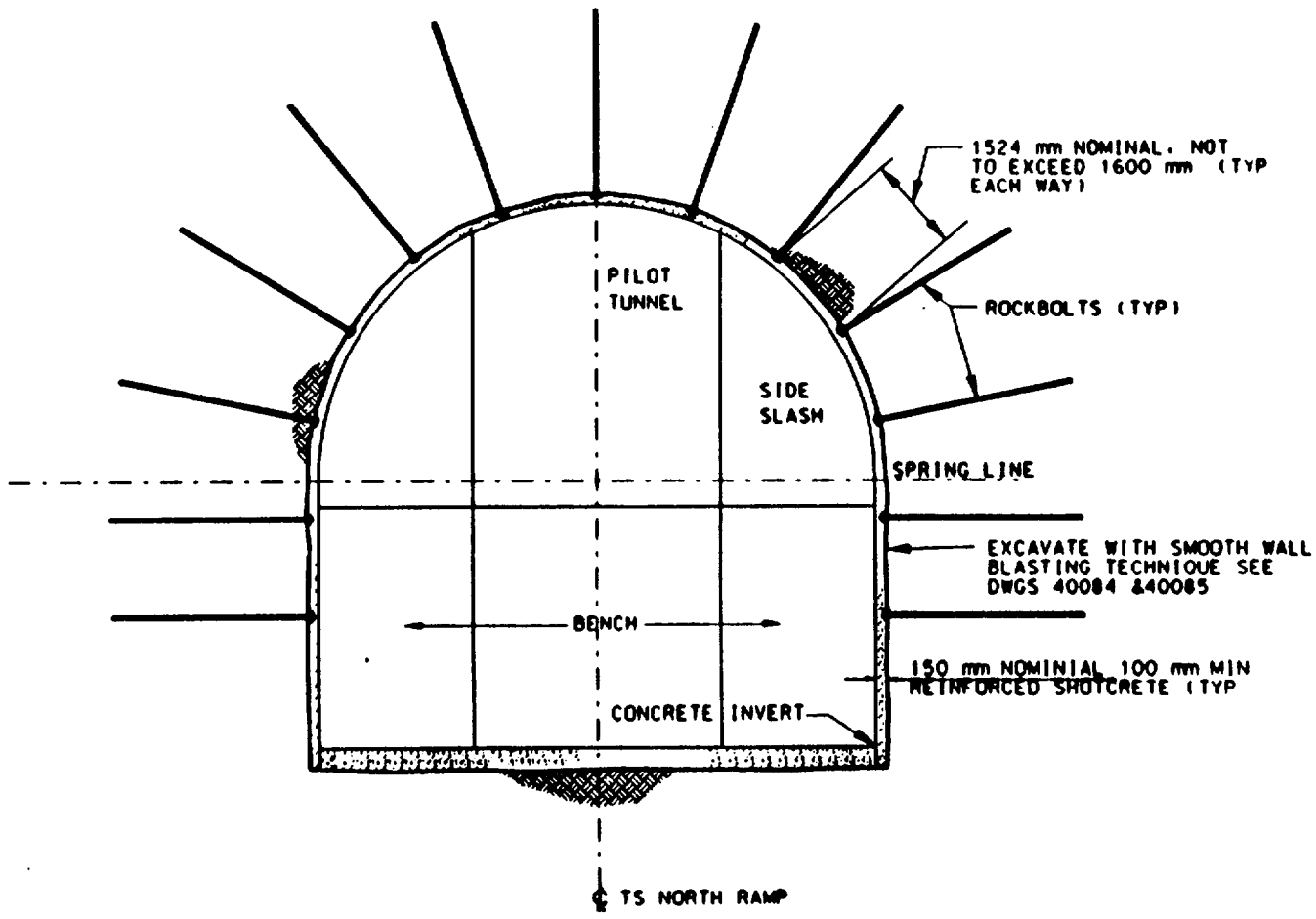
Roofbolt and Ground Control Options

ESF Title II Design, Package 1A (2)

- Integrated Excavation and Ground Support Approach - Based on New Austrian Tunnelling Method (NATM)

Preliminary Draft

B & W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services



TYPICAL STARTER TUNNEL SECTION

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Construction Experience (1)

- Learning Curve for Effective Blasting and Ground Support Designs
- Difficult* Ground Conditions Encountered At Starter Tunnel Entrance
- More Conservative Construction Approach Taken Than Originally Planned - Smaller Pilot Drift & Additional Bolts

* Rock Mass Quality (NGI & RMR) Estimated As "Poor" Category.

Preliminary Draft

Construction Experience (2)

- Ground Improved Inside Tunnel - Discontinuous Joints Interlocked Blocky Ground
- Resin Grouted Rockbolts Unsuitable For Vuggy ** and Fractured Ground
- Monitoring Indicates Stable Highwall

** Vuggy -- Lithophysal

Preliminary Draft

Testing and Acceptance (1)

- Determination of Importance Evaluations (DIEs) For QA Classification
- Test Interference Evaluations For Construction Materials
- Commercial Grade Materials Used In Quality Application
- Acceptance Testing For Ground Support Components Performed By Constructor

Preliminary Draft

Testing and Acceptance (2)

- Material Safety Data Sheets - Safety and Input For DIEs and Test Interference Evaluations
- In Situ Testing of Installed Ground Support Materials
- Operator Qualifications For Installing Ground Support (eg Qualification of Nozzlemen for Shotcreting)

Preliminary Draft

Testing and Acceptance (3)

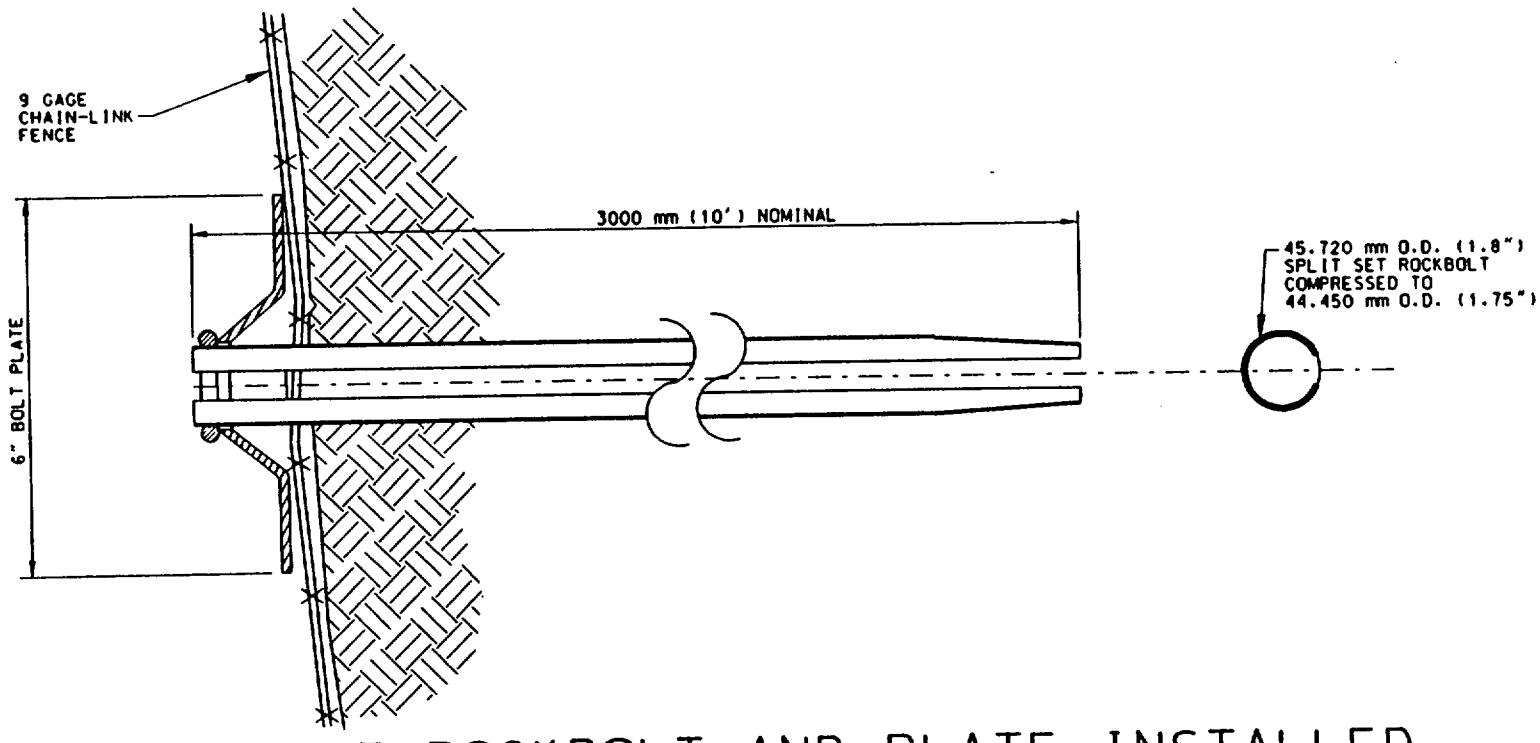
- Remedial Actions Include:
  - Monitoring (Deformation Points, Blast Vibration & Load Cells)
  - Install Additional Ground Support
  - Perform Additional Materials & In Situ Testing

Preliminary Draft

Ground Support Changes Resulting From Starter Tunnel Construction Experience (1)

- Design Changes Subject To Field Change Control Process
- Ground Support Changes Include:
  1. Substitution of Fibercrete For Shotcrete
  2. Introduction of Cement Grout For Anchoring Rock Bolts

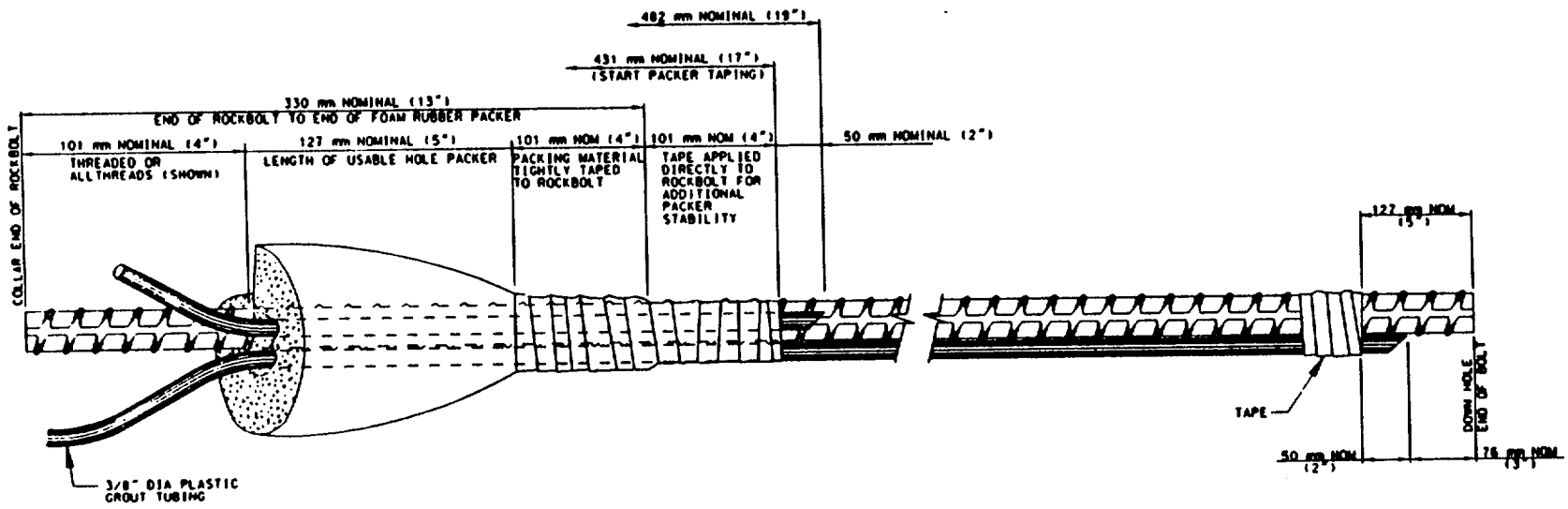
Preliminary Draft



SPLIT SET ROCKBOLT AND PLATE INSTALLED

NOT TO SCALE

/proj/esf_ss/stru/sketch/sk005.dgn



RESIN/CEMENT GROUTED ROCK BOLT

/proj/esf_ss/strw/sketch/sk005.dgn

Ground Support Changes Resulting From Starter Tunnel Construction Experience (2)

3. Introduction of Rockbolts With Sacrificial Drill Bit

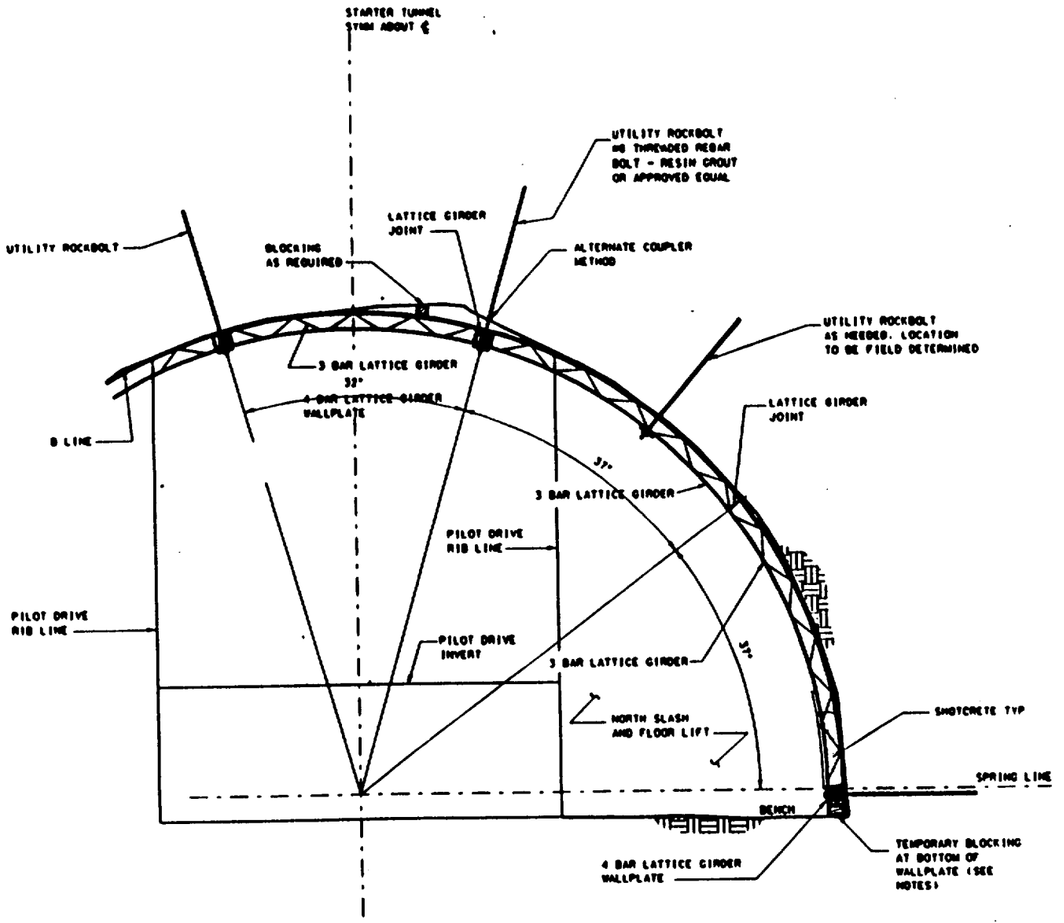
4. Installation of Lattice Girder and Fibercrete In Starter Tunnel For First 10 Meters

5. Use of Split Set Rockbolts & Lighter Weight Welded Wire Fabric For Personnel Protection

6. Introduction of Highwall Monitoring Program

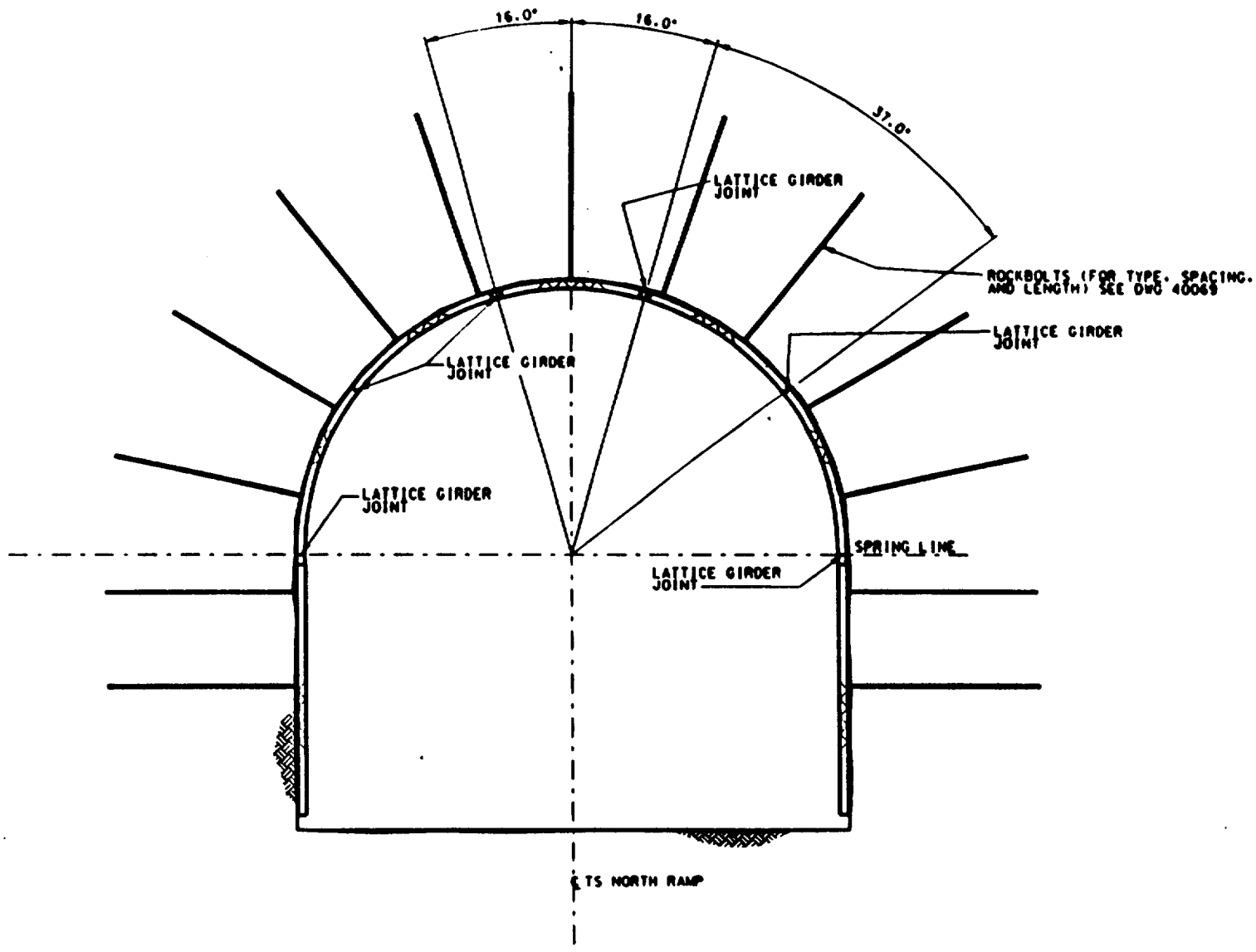
Preliminary Draft

B & W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services



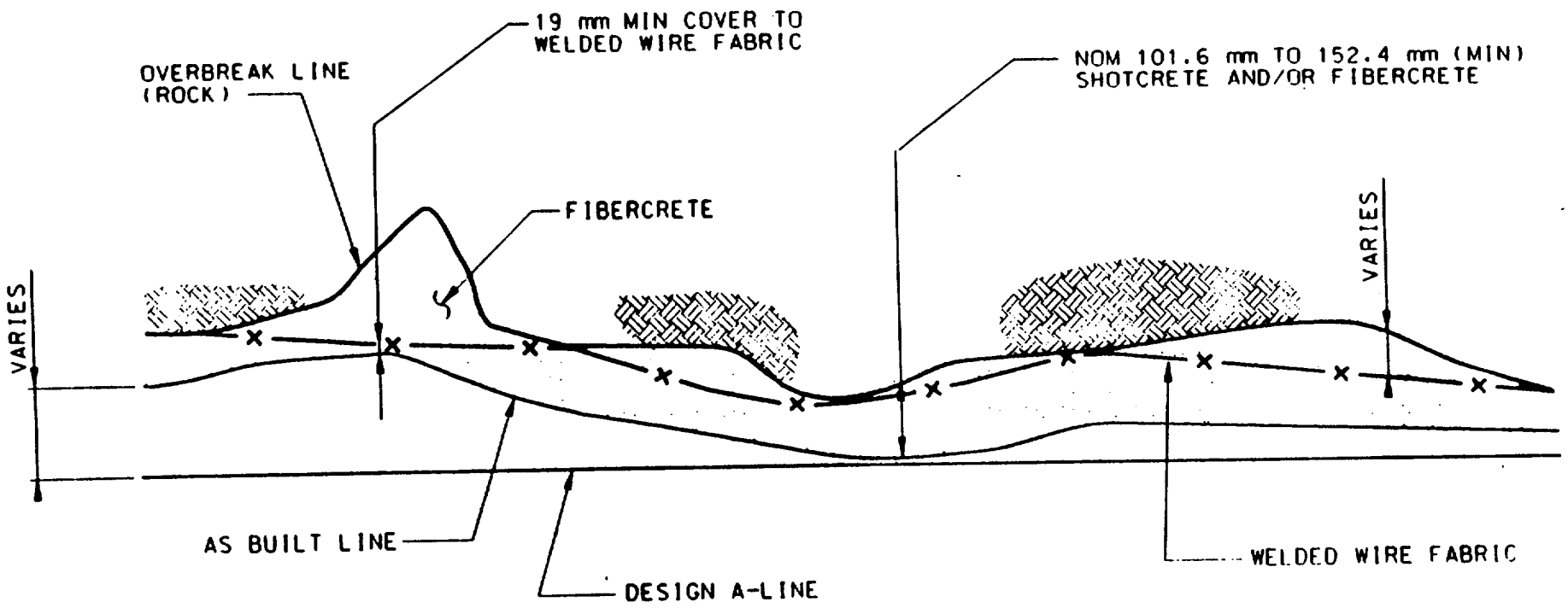
LATTICE GIRDER DETAIL

/proj/esf_ss/stru/sketch/sk005.dgn



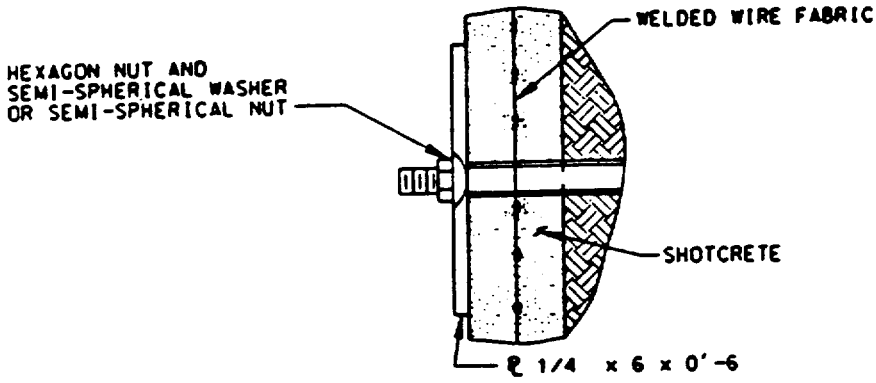
LATTICE GIRDER JOINTS

/proj-ecf_ce/strw/sketch/sk005.dgn

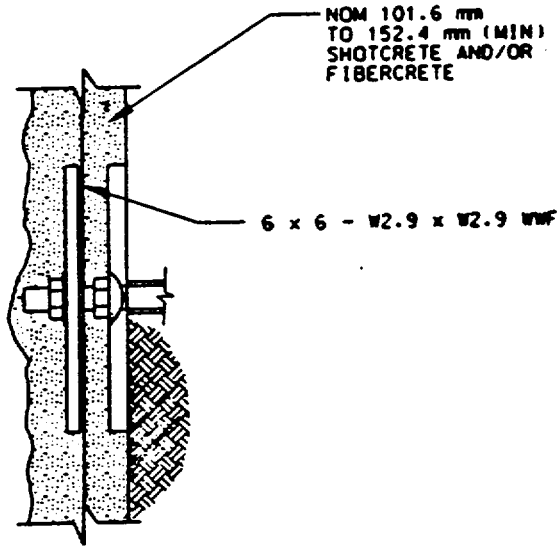


TUNNEL BACK
FIBERCRETE APPLICATION

/proj/esf_ss/etrw/sketch-sh005.dgn



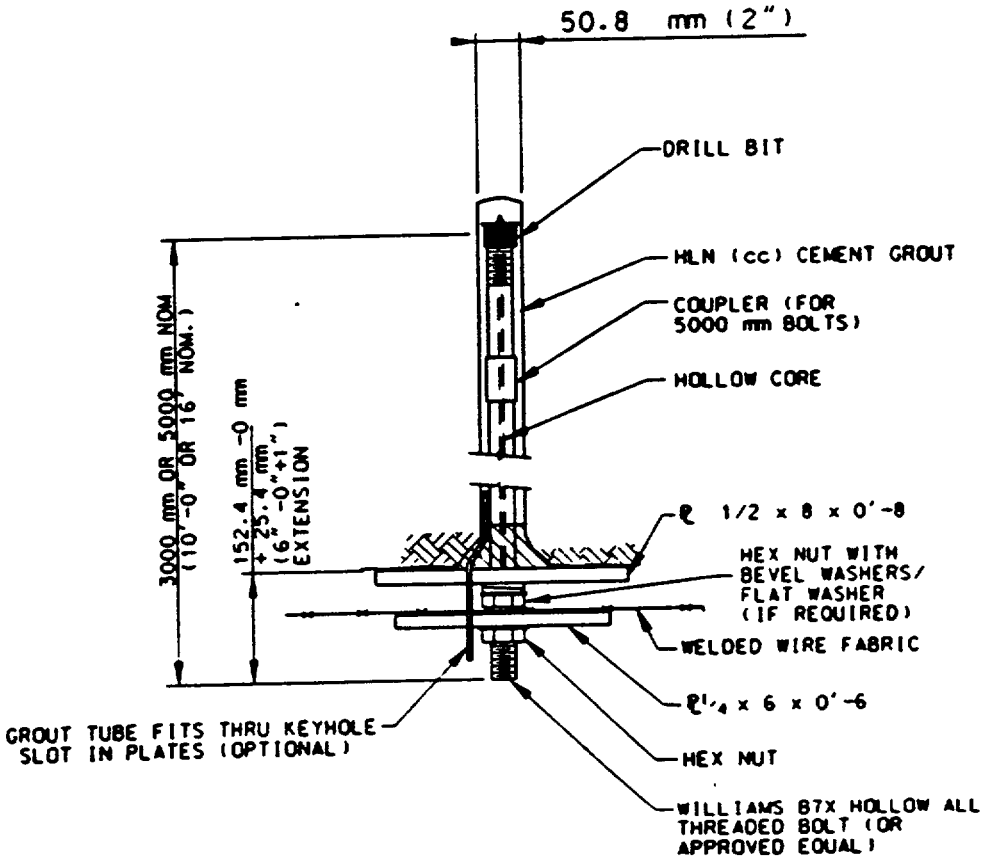
OPTIONAL CEMENT GROUTED ROCKBOLT
AFTER PERSONNEL SAFETY SUPPORT



TYPICAL ROCKBOLT
INSTALLATION

ROCKBOLTS AND FIBERCRETE

prep/esf_sm/strw/sketch/sk005.dgn



TYPICAL HOLLOW GROUTED 3000 mm OR 5000 mm ROCKBOLT

proj/esf_sa/stru/sketch/sk005.dgn

Ground Support For Balance of ESF Design (1)

- Ground Support Design Will Continue To Evolve
- Developing a Menu of Ground Support Methods For Drill and Blast and TBM Excavation Methods
- Design Will Indicate Appropriate Ground Support Methods For Expected Ground Conditions

Preliminary Draft

Ground Support For Balance of ESF Design (2)

- Appropriate Ground Support Method(s) Will Be Selected From Menu Based On Rock Mass Quality Support Categories and Site Conditions
- Ground Support Systems Will Be Adjusted and Supplemented As Conditions Demand
- Test Alcove Support Will be Modified To Comply With Test Design Requirements and Test Interference Constraints

Preliminary Draft

Ground Support For Balance of ESF Design (3)

- The Starter Tunnel Test Alcove Ground Support Is Classified Non Quality Affecting
- Ground Support Quality Classification For Other Alcoves Will Be Determined On A Case By Case Basis
- More Stringent Determination of Importance (DIE) Requirements Closer To Repository Block

Preliminary Draft

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

ESF CONSTRUCTION

M. Lee Renegar

October 5, 1993

B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.

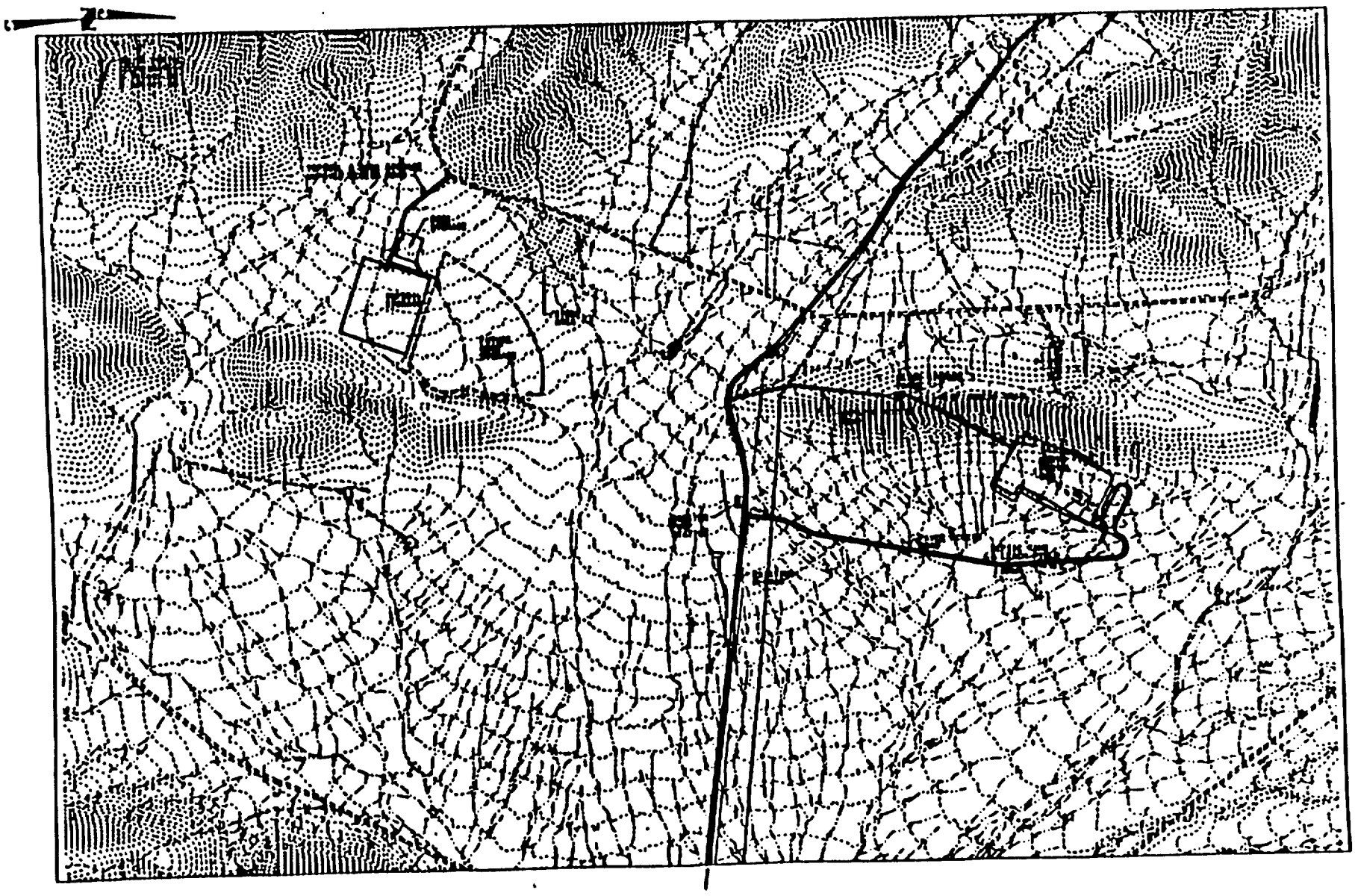
INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.

Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services

PRELIMINARY DRAFT

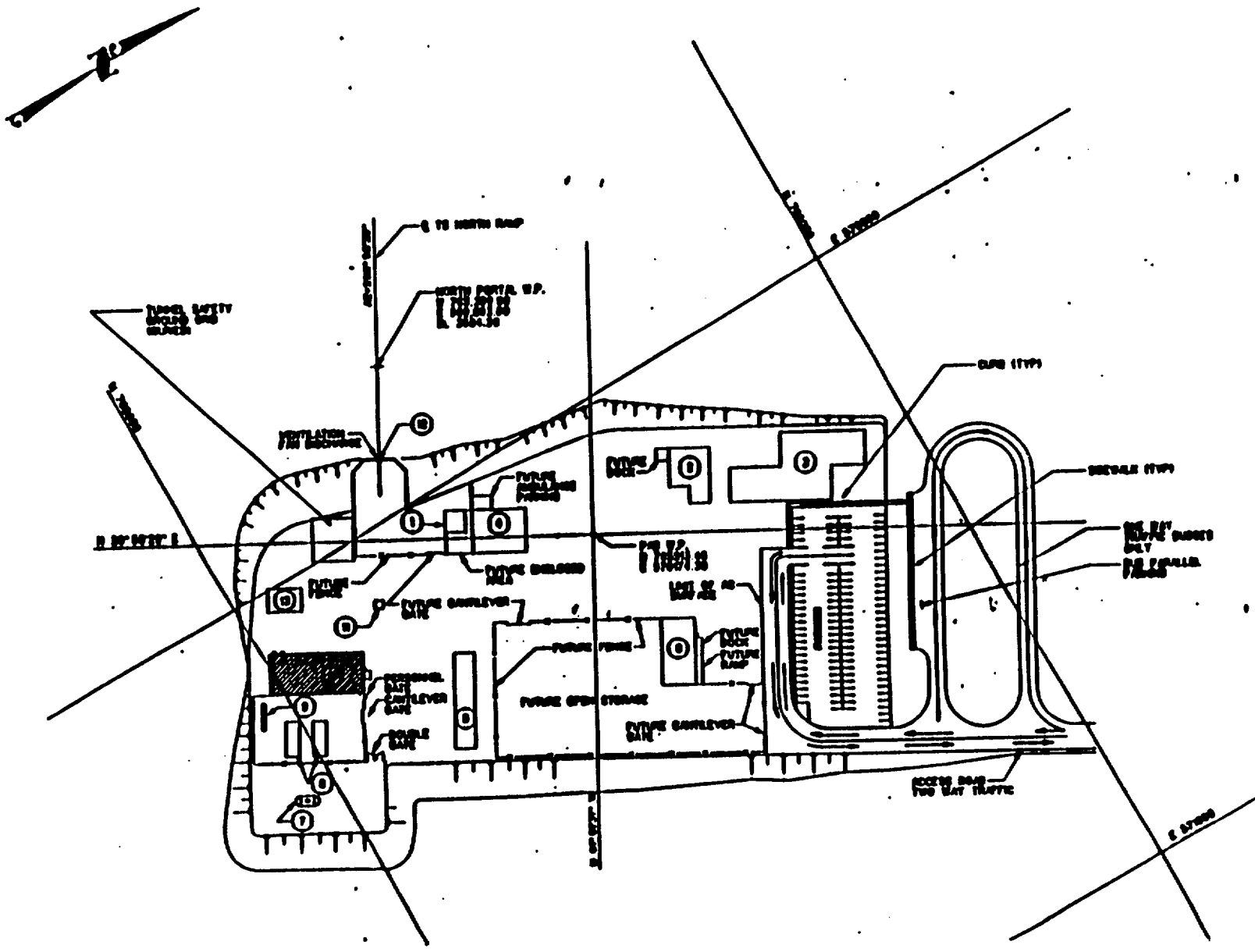
ATTACHMENT #19

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



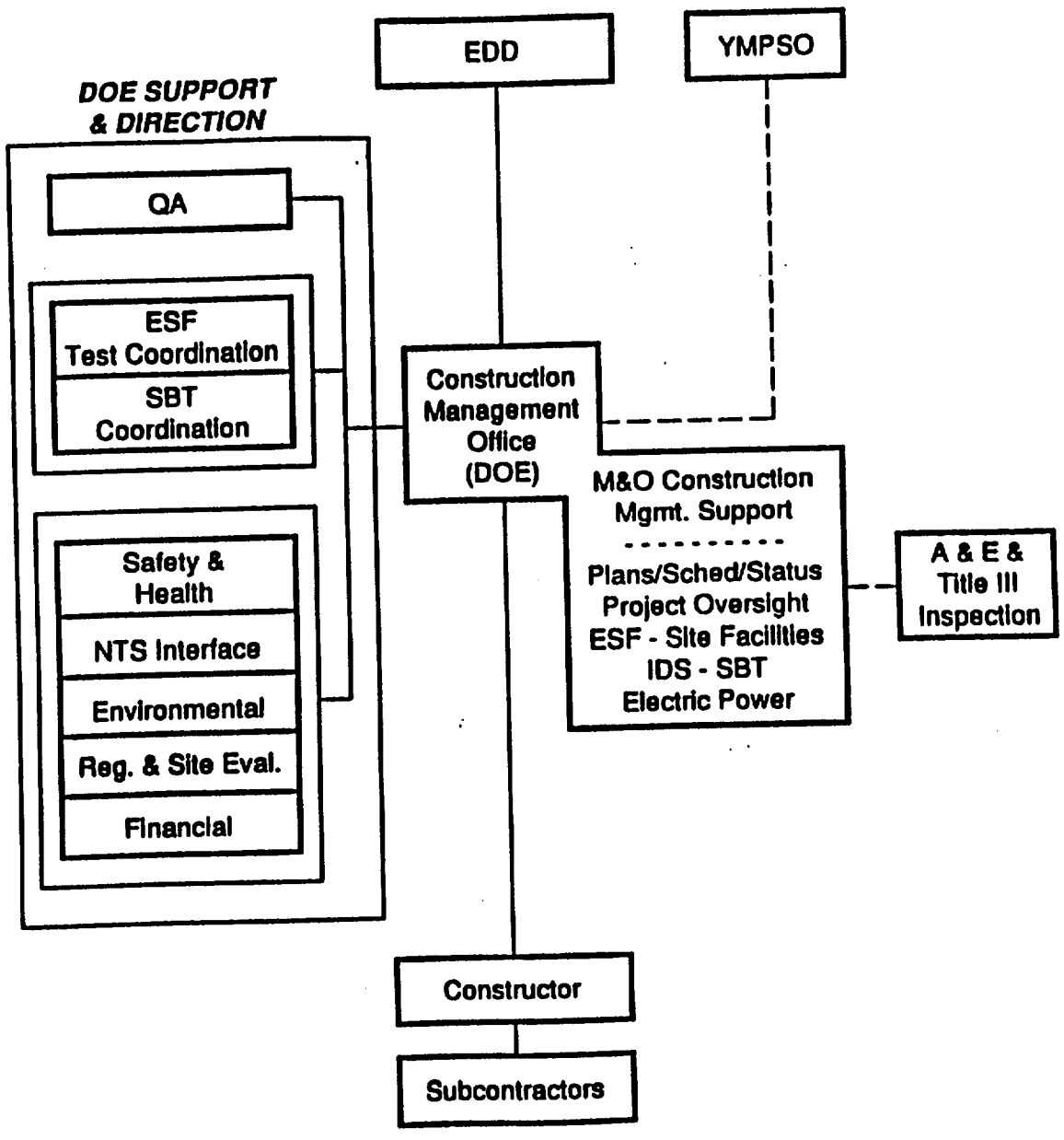
PRELIMINARY DRAFT

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



PRELIMINARY DRAFT

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



PRELIMINARY DRAFT

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

NEW AUSTRIAN TUNNELING METHOD (NATM)

NATM IS A SYSTEMATIC EXCAVATION METHOD HAVING THE FOLLOWING FEATURES:

- LARGE OPENINGS ARE DEVELOPED SEQUENTIALLY, WITH A SMALL "PILOT DRIFT" DRIVEN AND STABILIZED INITIALLY. THE OPENING IS THEN ENLARGED BY "SLASHING" AND "BENCHING" UNTIL THE FINAL CONFIGURATION IS ACHIEVED.

- SENSITIVE MONITORING EQUIPMENT IS INSTALLED TO DETECT SMALL GROUND MOVEMENTS. SUCH MOVEMENT IS OFTEN A PRECURSOR OF ROOF FAILURE.

- THE DESIGNED GROUND CONTROL SYSTEM IS MODIFIED, AS NECESSARY, TO ADAPT TO THE ACTUAL GROUND CONDITIONS ENCOUNTERED. THE GROUND CONTROL SYSTEM MAY INCLUDE ONE OR MORE OF THE FOLLOWING:

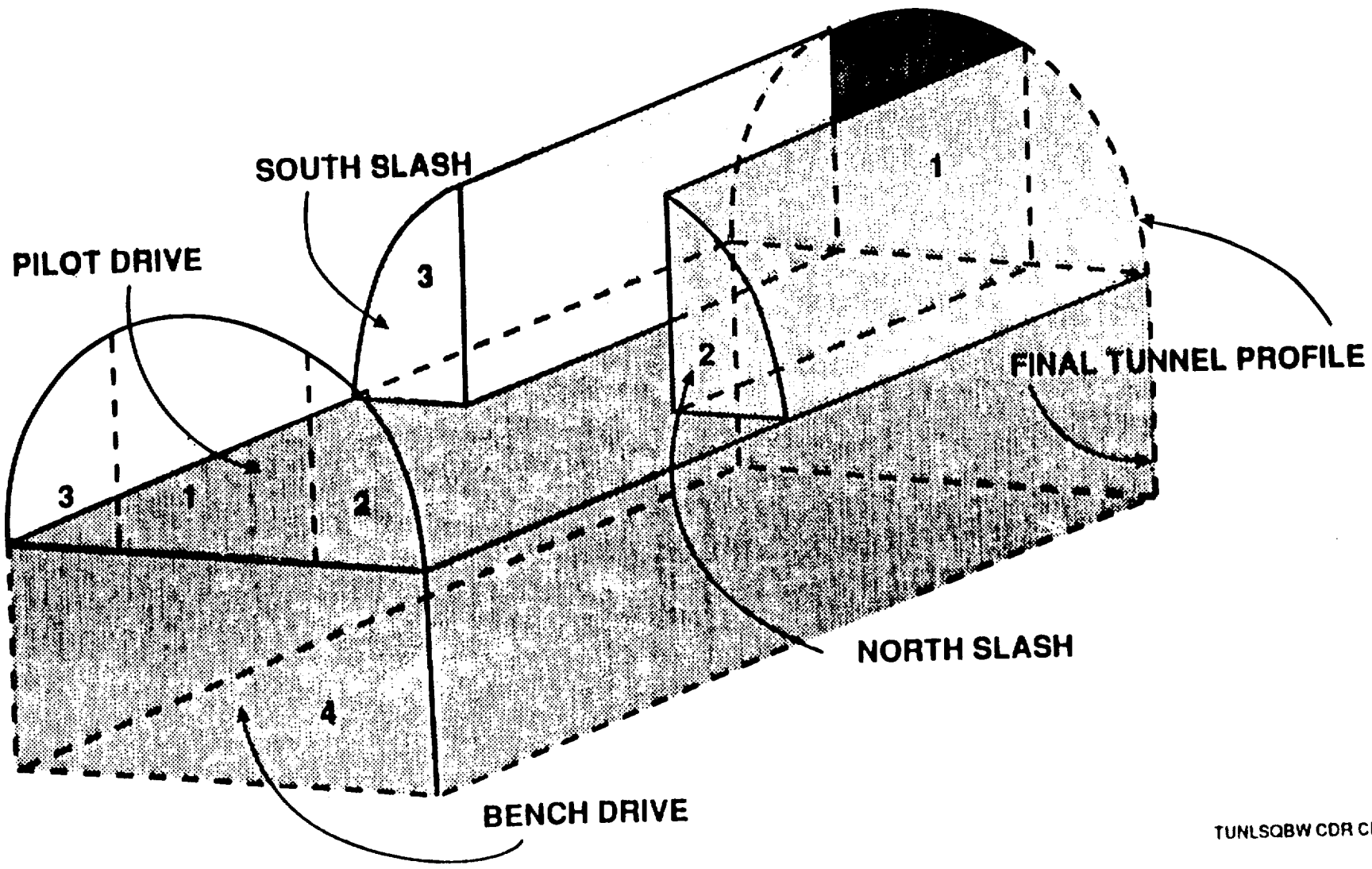
  * LATTICE GIRDERS
  * PATTERN ROCK BOLTS
  * SPLIT SET ROCK BOLTS
  * FIBERCRETE
  * WOVEN WIRE MESH (WWF)

PRELIMINARY DRAFT

DOE-NRC TECHNICAL EXC NGE ON THE EXPLORATORY STUDIES FACILITY TITLE II DESIGN

ESF Starter Tunnel Excavation Sequence

(New Austrian Tunneling Method - NATM)



TUNLSQBW CDR CPG/5 28 93

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

- CONSTRUCTION BEGAN ON THE ACCESS ROAD AND NORTH PORTAL PAD ON NOVEMBER 30, 1992

  PHOTO: TAKEN NOVEMBER 30, 1992; ESF PAD AREA -FROM EXILE HILL LOOKING SOUTHEAST IN THE DIRECTION OF THE FIELD OPERATIONS CENTER

  PHOTO: TAKEN JANUARY 28, 1993; ESF PAD MIDWAY THROUGH CONSTRUCTION -FROM EXILE HILL LOOKING SOUTHEAST

  PHOTO: TAKEN FEBRUARY 4, 1993; ESF PAD AREA UNDER CONSTRUCTION -FROM PAD LOOKING NORTH

PRELIMINARY DRAFT

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

- CONSTRUCTION ON BOX CUT BEGAN ON JANUARY 4, 1993

  PHOTO: TAKEN JANUARY 14, 1993; BOX CUT IN EARLY STAGES OF CONSTRUCTION- FROM MIDWAY VALLEY CAMERA STAND LOOKING NORTHWEST

- CONSTRUCTION ON THE ESF PILOT DRIFT BEGAN ON APRIL 2, 1993

  PHOTO: TAKEN APRIL 9, 1993; BOX CUT/PILOT DRIFT-FROM MIDWAY VALLEY CAMERA STAND LOOKING NORTHWEST

- NORTH PORTAL PAD COMPLETED TO SUB BASE ON APRIL 9, 1993

  PHOTO: TAKEN APRIL 30, 1993; ESF PAD-FROM EXILE HILL LOOKING SOUTHEAST

- NORTH PORTAL ACCESS ROAD COMPLETED TO BASE COURSE JULY 13, 1993

  PHOTO: NO PHOTO AVAILABLE

PRELIMINARY DRAFT

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

- ESF BOX CUT COMPLETED:
  - EXCAVATION AND WIRE MESH COMPLETED ON MARCH 24, 1993
  - ROCK BOLTS INSTALLED TO SPRING LINE ON APRIL 13, 1993

PHOTO: TAKEN MARCH 30, 1993; BOX CUT- FROM ESF PAD LOOKING NORTHWEST TOWARDS EXILE HILL

PHOTO: TAKEN APRIL 16, 1993; BOX CUT AND STARTER TUNNEL- FROM ESF PAD LOOKING SOUTHWEST

PHOTO: TAKEN APRIL 19, 1993; BOX CUT AND STARTER TUNNEL- FROM ESF PAD LOOKING NORTHWEST

PRELIMINARY DRAFT

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

- ESF EXCAVATION BEGAN ON APRIL 2, 1993

- ESF PILOT DRIFT COMPLETED TO STATION APPROX. 1 + 98 (APPROX. 60 METERS) ON JULY 14, 1993

  PHOTO: TAKEN APRIL 30, 1993; BOX CUT AND STARTER TUNNEL- FROM STARTER TUNNEL TEMPORARY RAMP LOOKING NORTHWEST

  PHOTO: TAKEN MAY 7, 1993; BOX CUT AND STARTER TUNNEL WITH FIRST LATTICE GIRDER INSTALLED. ALSO PICTURED IS DRILL JUMBO- FROM STARTER TUNNEL TEMPORARY RAMP LOOKING NORTHWEST

- ESF SIDE SLASHES COMPLETED TO STATION APPROX. 1 + 98 (APPROX. 60 METERS) ON JULY 15, 1993

  PHOTO: TAKEN JUNE 16, 1993; ESF STARTER TUNNEL (PILOT DRIFT AND SIDE SLASH ADVANCEMENT)- FROM PORTAL TO STATION 1+00

PRELIMINARY DRAFT

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

- ESF BOTTOM BENCH EXCAVATION BEGAN ON JULY 31, 1993
- ESF BOTTOM BENCH WAS COMPLETED ON SEPTEMBER 9, 1993

PHOTO: NO PHOTO AVAILABLE

PRELIMINARY DRAFT

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

SAFETY

DURING CONSTRUCTION AND TESTING, SAFETY IS OF PARAMOUNT IMPORTANCE.

STANDARDS WORKED TO:

- OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (PRIMARY)
- STATE OF NEVADA (OSHA)
- CALIFORNIA STATE TUNNELING STANDARDS
- MINE SAFETY AND HEALTH ADMINISTRATION

PRELIMINARY DRAFT

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

- **WASTE ISOLATION:**

  THE APPROVED DRAWINGS AND SPECIFICATIONS DICTATE WHETHER CONSTRUCTION ITEMS ARE IMPORTANT TO SAFETY AND/OR IMPORTANT TO WASTE ISOLATION. THE CONSTRUCTION MANAGER'S RESPONSIBILITIES INCLUDE INSURING THAT THE CONSTRUCTOR PERFORMS TO THE PLANS AND SPECIFICATIONS IN ALL INSTANCES.

PRELIMINARY DRAFT

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

TESTING/CONSTRUCTION INTERFACE

THE PURPOSE OF THE EXPLORATORY FACILITIES CONSTRUCTION PROGRAM IS TO ACCOMMODATE TESTING OF THE GEOLOGY FOR SITE CHARACTERIZATION. THESE TWO ACTIVITIES ARE INTEGRATED AND SCHEDULED IN ORDER TO MINIMIZE ANY CONFLICTS OR ANY DELAYS TO TESTING.

PRELIMINARY DRAFT

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

- ESF CONSTRUCTION INSPECTIONS (REECo)
  - 1ST LINE QC INSPECTION PERFORMED BY REECo QC
  - REECo QC PROVIDES CONFIRMATION INDEPENDENT OF THE CONSTRUCTION OPERATION THAT THE WORK PERFORMED BY REECo IS IN ACCORDANCE WITH M&O SPECIFICATIONS AND DRAWINGS
  - REECo SUBMITS INSPECTION RECORDS TO M&O FOR TITLE III REVIEW

PRELIMINARY DRAFT

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

- TITLE III INSPECTIONS (M&O)
  - MONITOR/VERIFY CONSTRUCTION ACTIVITIES ARE IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS
  - PERFORM FINAL DOCUMENTATION REVIEW FOR TURNOVER:
    - » REVIEW REECo QC INSPECTION DOCUMENTATION
    - » REVIEW NCRs FOR CLOSURE
    - » FURNISH "AS-BUILT" DRAWINGS AND SPECIFICATIONS
      - INCORPORATION OF FCRs AND CRs
      - PERFORM WALK THRU (PUNCH LISTS)
      - ISSUE ACCEPTANCE DOCUMENTATION

PRELIMINARY DRAFT

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

- M&O QA PROGRAM
  - PERFORM (TITLE III) INSPECTIONS THAT REQUIRE INSPECTORS CERTIFIED TO M&O QA PROGRAM
  - PERFORM (TITLE III) INSPECTIONS IN ACCORDANCE WITH M&O QA PROGRAM PROCEDURES
  - PROCESS NON-CONFORMANCE REPORTS
    - » VALIDATION OF NCR
    - » VERIFICATION OF DISPOSITION FOR CLOSURE

PRELIMINARY DRAFT

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

DOE YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION (YMQAD)

- OVERVIEW OF REECo QC AND M&O TITLE III INSPECTION ACTIVITIES
- PERFORM SURVEILLANCES/AUDITS OF ESF CONSTRUCTION ACTIVITIES

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

- INSPECTION DOCUMENTATION

  REECo:

  - » CONSTRUCTION INSPECTION PLAN (CIP)
  - » INSPECTION CHECK LIST
  - » INSPECTION REPORT
  - » TECHNICAL CONTROL PROCEDURES

  M&O TITLE III:

  - » QA INSPECTIONS (QLP 10-1A)
    - – MONITOR FIRST LINE QC ACTIVITIES
    - – MONITOR/TEST INSPECTION REPORTS
  - » NON-CONFORMANCE REPORTS

PRELIMINARY DRAFT

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

M&O CONTRACTOR SUBMITTALS & REVIEW

- SUBMITTAL & NOTIFICATION REQUIREMENTS
- TRANSMITTAL SHEET
- SUPPLIER DOCUMENT EVALUATION RECORD

THESE DOCUMENTS, UPON COMPLETION, WILL FORM PART OF A RECORDS TURNOVER PACKAGE.

PRELIMINARY DRAFT

SUBMITTAL AND NOTIFICATION REQUIREMENTS

SHEET OF

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 02313

TITLE: Drilling & Blasting (Subsurface)

REQUIREMENTS PARAGRAPH	STATUS: INFORMATION	STATUS: APPROVAL	STATUS: CERTIFICATION	STATUS: RECORD	STATUS: REVIEW		TIMING: PRIOR TO BLASTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE	TIMING: EACH BLAST		NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Contractor Info																					
Contr. Blasting																					
Plan 1-04 A1		X					X												5		
Sample Form 1-04 A2		X					X												5		
Drill Water Plan 1-04 A3		X					X												5		
Contractor Info 1-04 B	X																				
Blasting Log 3-04 B3																X			2		

COMMENTS:

*** END OF SECTION ***

YMP-080-R0
12/26/91

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE (SDT)

Date 04/01/93 | ☒ New Submittal ☐ Resubmittal | PAGE 1 OF 1

Section I. REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)

To: ANGIE RUST
M&O TECHNICAL DOCUMENT CONTROL M/S 403

From: JIM ARNOLD
REECO CONTROL DEPARTMENT M/S 408

Design Package: 1A

Transmittal No.: 1A-2-CLD015

Previous Trans. No. (if any): N/A

Specification Sec. No. (cover only one section with each transmittal): SEC 02313
YMP-025-1-SP09 REV 1

Project Title and Location: SUBSURFACE DRILL AND BLAST EXPLOSIVES AND ACCESSORIES

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED (Type, size, model number, etc.) b.	MFG. OR CONTR. CALCS. DRAWING OR BROCHURE NO. SAMPLE OR CERTIFICATE c.	NO. OF COPIES d.	DESIGN PACKAGE REFERENCE DOCUMENT: SPEC. PARA. NO. e.	DESIGN PACKAGE REFERENCE DOCUMENT: DRAWING SHEET NO. f.	VARIATION g.	ACTION CODE h.
1	MANUFACTURER'S TECHNICAL INFORMATION - EMULSION	POWERMITE	10	1.04B		N/A	D
2	MANUFACTURER'S TECHNICAL INFORMATION - DETONATORS	PRIMADET	10	"		N/A	D
3	MATERIAL SAFETY DATA SHEET - EXPLOSIVE	#1030	10	"		N/A	D
4	MATERIAL SAFETY DATA SHEET - DETONATOR	PRIMADET	10	"		N/A	D
5	MATERIAL SAFETY DATA SHEET - SHOCK TUBE	NONEL	10	"		N/A	D

Remarks
PLEASE EXPEDITE REVIEW OF THIS SUBMITTAL PACKAGE. REECO IS REQUESTING A ONE DAY TURN-AROUND. A/E APPROVAL IS REQUIRED PRIOR TO INSTALLATION OF THESE ITEMS UNDERGROUND.

PLEASE CALL JIM ARNOLD AT 4-7258 WITH ANY QUESTIONS.

(Indicate any variation from Technical Requirements)

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawing and specifications except as otherwise stated.

James M. Arnold
Name and Signature of Contractor's Representative

Section II.

Enclosures Returned (List by Item No.)

Name, Title and Signature of AE's TPO: LARRY ENGWALL, PSF SURFACE FACIL. SUPERVISOR
Larry Engwall

DATE: 4/5/93

AP-5.26

Civilian Radioactive Management System

Management & Operating Contractor

Supplier Document Evaluation Record

Complete only applicable items.

Document Identification:

YMP-025-1-SP 09-02313 VD- 1 -0

Supplier Identification:

Name: Reynolds Electrical & Engineering Co.

Address: P.O. Box 98521 Mail Stop 408

Telephone: (702) 794- 7561 Prospective Work Location:

Evaluation Criteria:

Evaluate in accordance with the appropriate specification.

Summary of Evaluation Results:

Satisfactory for Technical specification. However Heat of explosion and Volume of gas at STP, are in incorrect units of Measure, but can be converted to correct units, Therefore all information has been supplied.

QA: QA. **Needed for Construction? Yes** ✓ **No** ___ **Action Code:** ~~B~~ D 4-2-93

Subject document has been evaluated to meet the criteria above, and is found acceptable for the identified procurement.

Jerald E Kefer — Signature

Lead Mining Engineer — Title

4-2-93 — Date

This form may be reproduced locally.

YMP-080-R0
12/26/91

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE (SDT)

Date 06/10/93 | ☒ New Submittal ☐ Resubmittal | PAGE 1 OF 2

Section I. REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)

To: ANGIE RUST, M&O TECHNICAL DOCUMENT CONTROL M/S 403
From: JIM ARNOLD, RECO CONTROL DEPARTMENT M/S 408
Design Package: 1A
Transmittal No. 1A-2-CLD039
Previous Trans. No. (If any) N/A
Specification Sec. No. (cover only one section with each transmittal) SEC 02165 YMP-025-1-SP09 REV 1
Project Title and Location: HOLLOW CORE ROCKBOLTS & ACCESSORIES - STARTER TUNNEL

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED (Type, size, model number, etc.) b.	MFG. OR CONTR. CALCS. DRAWING OR BROCHURE NO. SAMPLE OR CERTIFICATE c.	NO. OF COPIES d.	DESIGN PACKAGE REFERENCE DOCUMENT: SPEC. PARA. NO. e.	DESIGN PACKAGE REFERENCE DOCUMENT: DRAWING SHEET NO. f.	VARIATION g.	ACTION CODE h.
1	INSTALLATION DRAWING 44-0 45-0 46-0 43-0	1B-JR-1291	4	2.02B	MING-	N/A	A
2	CATALOG CUTS PAGES 8, 33, 38 & 39 (VARIOUS ITEMS)	WILLIAMS	"	"	MG142	"	A A A
3	CERTIFICATE OF CONFORMANCE - NUTS AND WASHERS 47-0	05/13/93	"	"	AND	X	B
4	CERTIFICATE OF CONFORMANCE - BOLTS AND ACCESSORIES 48-0	05/24/93	"	"	MG143	X	B
5	SUBSTITUTE NUT AND WASHER LETTER 49-0	06/02/93	"	"	"	X	D
6	MATERIAL SAFETY DATA SHEET 50-0	KWIK SET	"	"	"	N/A	D
7	CERTIFIED MILL TEST REPORT - HEX NUT 51-0	JERGENSEN	"	"	"	X	D

Remarks: PLEASE EXPEDITE REVIEW OF THIS SUBMITTAL PACKAGE. A/E APPROVAL IS REQUIRED PRIOR TO USE OF THESE ITEMS AT THE STARTER TUNNEL. SAMPLE ROCKBOLTS AND ACCESSORIES ARE AVAILABLE FOR INSPECTION.

VARIATIONS: SUBSTITUTE NUT MEETS ASTM A-311, AND EXCEEDS BOLT CATALOG STRENGTH. SUBSTITUTE WASHER MEETS A-536, AND EXCEEDS THE A-47 WASHER STRENGTH.

PLEASE CALL JIM ARNOLD AT 4-7258 WITH ANY QUESTIONS.
(Indicate any variation from Technical Requirements)

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawing and specifications except as otherwise stated.

James M. Arnold
Name and Signature of Contractor's Representative

Section II.
Enclosures Returned (List by Item No.)
Name, Title and Signature of AEs TPO
DATE: 6-22-93

AP-5.26

SUBMITTAL AND NOTIFICATION REQUIREMENTS

SHEET OF

NLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 02165

TITLE: Rock Bolts and Accessories

Requirements	Paragraph	STATUS: INFORMATION	APPROVAL	CERTIFICATION	RECORD	REVIEW		TIMING: PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED		PRIOR TO RECEIPT		NOTIFICATIO: WITNESS (DAYS)	HOLD (DAYS)	
Receipt Verification	4.01A.1		X														X				
Materials Samples of																					
Bolts	4.01A.3		X										X								
Copies of Mfg's Instr.																					
for Patented Bolts	4.01A.4					X							X								
Proposed Dimensions of Bolts																					
and Accessories	4.01A.2		X										X								
Procedure for Rock Bolt																					
Installation	4.01A.5		X										X							20	
ndure for Load																					
est	4.01A.7		X					X												5	
Borehole Inspection	4.01A.6		X																1		
Borehole Location																					
Inspection	4.01A.8		X										X						1		
Rock Bolt Test Results	4.01A.9		X										X						1 - 3	10	
Installation Inspection	4.01A.10		X														X		1		
Marking and Storage																					
Procedures	4.01A.11		X								X										

COMMENTS:

* * * END OF SECTION * * *

YMP-080-R0
12/26/91

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE (SDT)

Date 06/10/93 ☒ New Submittal ☐ Resubmittal

Section I. REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)

To: ANGIE RUST
M&O TECHNICAL DOCUMENT CONTROL M/S 403

From: JIM ARNOLD
REECO CONTROL DEPARTMENT M/S 408

Design Package 1A

Transmittal No. 1A-2-CLD039

Previous Trans. No. (if any) N/A

Specification Sec. No. (cover only one section with each transmittal) SEC 02165
YMP-025-1-SP09 REV 1

Project Title and Location
HOLLOW CORE ROCKBOLTS & ACCESSORIES - STARTER TUNNEL

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED (Type, size, model number, etc.) b.	MFG. OR CONTR. CALCS. DRAWING OR BROCHURE NO. SAMPLE OR CERTIFICATE c.	NO. COPIES d.	DESIGN PACKAGE REFERENCE DOCUMENT: SPEC. PARA. NO. e.	DESIGN PACKAGE REFERENCE DOCUMENT: DRAWING SHEET NO. f.	VARIATION g.	ACTION CODE h.
8	CERTIFIED MILL TEST REPORT - BEVELLED WASHER	QUINCY	4	2.02B	MING-	X	D
					MG142		
					AND		
					MG143		

Remarks
PLEASE EXPEDITE REVIEW OF THIS SUBMITTAL PACKAGE. A/E APPROVAL IS REQUIRED PRIOR TO USE OF THESE ITEMS AT THE STARTER TUNNEL. SAMPLE ROCKBOLTS AND ACCESSORIES ARE AVAILABLE FOR INSPECTION.

VARIATIONS: SUBSTITUTE WASHER MEETS ASTM A-536, AND EXCEEDS THE A-47 WASHER STRENGTH.

PLEASE CALL JIM ARNOLD AT 4-7258 WITH ANY QUESTIONS.
(Indicate any variation from Technical Requirements)

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawing and specifications except as otherwise stated.

SEE PAGE 1
Name and Signature of Contractor's Representative

Section II.
Enclosures Returned (List by Item No.)

Name, Title and Signature of AEs TPO
SEE page 1

DATE:

AP-5.26

Civilian Radioactive Waste Management System

Management & Operating Contractor

Supplier Document Evaluation Record

Complete only applicable items.

Document Identification:

YMP-025-1-SP09-02165-VD-430

Supplier Identification:

Name: Reynolds Electrical & Engineering Co.

Address: P.O. Box 98521 Mail Stop 408

Telephone: (702) 794- 7561 Prospective Work Location:

Evaluation Criteria:

Evaluate in accordance with the appropriate specification.

Summary of Evaluation Results:

Meets Both drawing + Spec.

QA: QA. **Needed for Construction? Yes** ✓ **No** ___ **Action Code:** A

Subject document has been evaluated to meet the criteria above, and is found acceptable for the identified procurement.

Signature	Title	Date
Gerald W Kifer	Staff Mining Eng.	6-21-93

DOE-NRC EXPLORATORY STUDIES FACILITY
TECHNICAL EXCHANGE

ESF/GEOLOGIC REPOSITORY OPERATION AREA INTERFACES

PRESENTED BY
DANA ROGERS
REPOSITORY SUBSURFACE DESIGN GROUP
M&O/MK

LAS VEGAS, NEVADA
OCTOBER 4-5, 1993

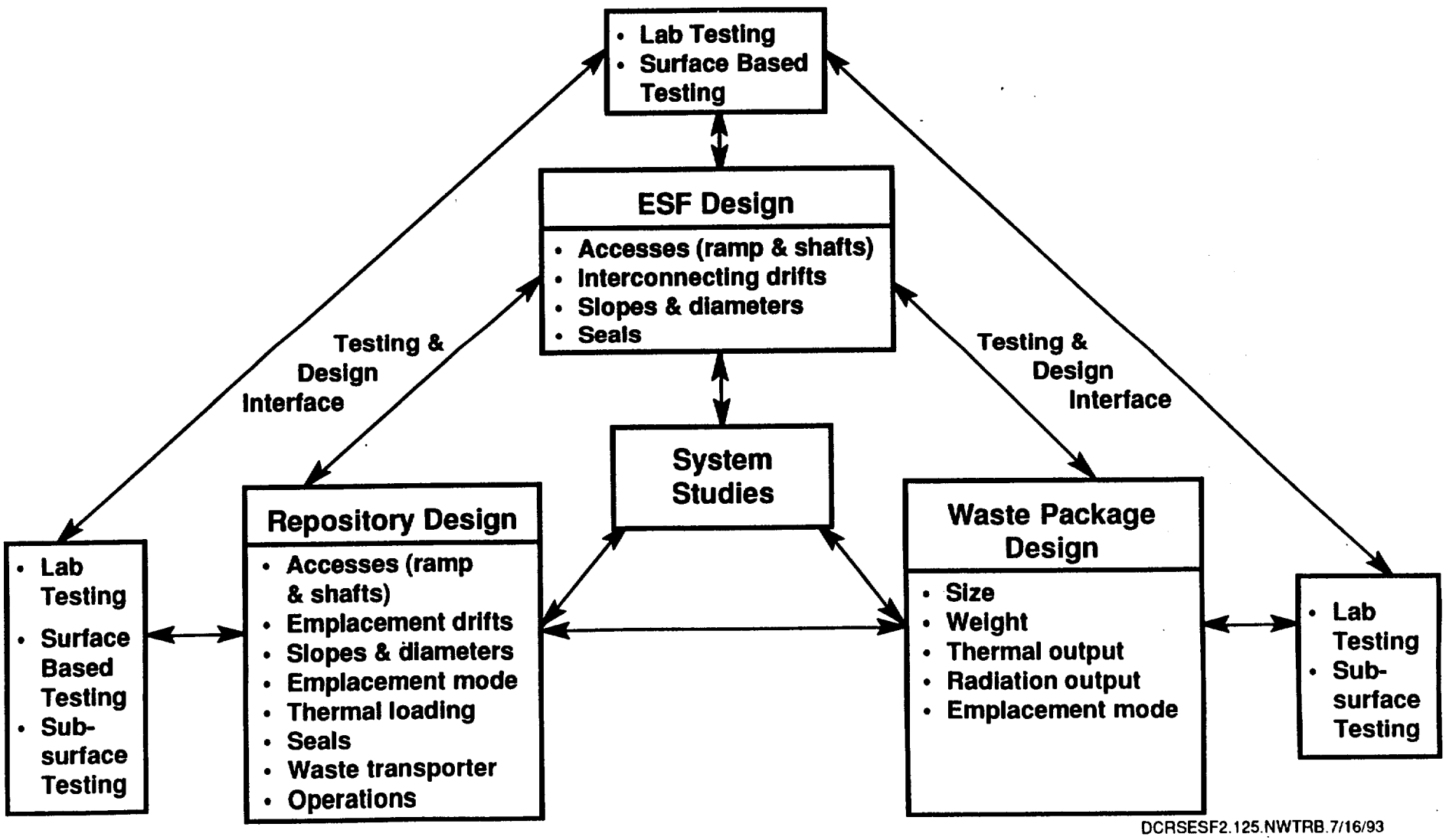
ATTACHMENT # 20

ESF/GEOLOGIC REPOSITORY OPERATION AREA INTERFACES

- In accordance with NUREG 1439, major features of the GROA that are being considered in the ESF/Repository design include:
  - Waste emplacement depth
  - Underground facility boundary
  - Location, size, number of shafts/ramps
  - Excavation methods
  - Drainage design
  - Sealing methods
- Other features being considered in the ESF/Repository interface:
  - Ground support methods
  - Gradients of ramps and drifts
  - Potential transportation systems
  - Flexibility for alternative repository designs

PRELIMINARY DRAFT

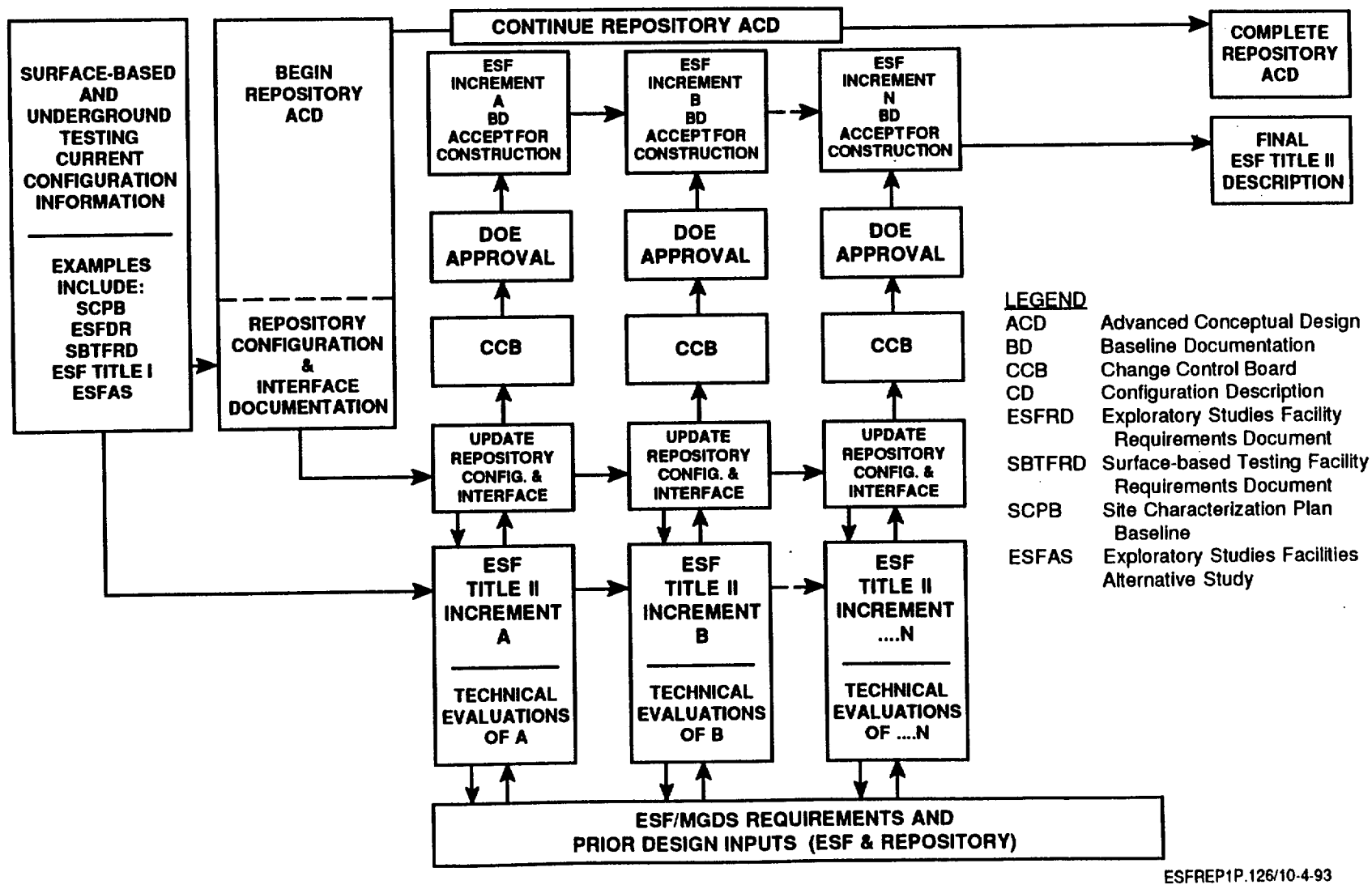
ESF/REPOSITORY/WASTE PACKAGE DESIGN INTEGRATION PROCESS



DCRSESF2.125.NWTRB.7/16/93

PRELIMINARY DRAFT

INCREMENTED DEVELOPMENT OF ESF/REPOSITORY CONFIGURATION BASELINES



ESFREP1P.126/10-4-93

PRELIMINARY DRAFT

ELEMENTS OF ESF/REPOSITORY/WASTE PACKAGE DESIGN INTEGRATION

- System and Design Requirements
- Technical Baseline and Change Control
- Design Reviews
- System Studies
- Communication and Team Work

ESF Design Interfaces with Surface-Based Testing and In-situ Testing

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

Martha W. Pendleton
October 4-5, 1993

B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services

ATTACHMENT #1

10 CFR 60 Requirements

- The requirements of 10 CFR 60 are implemented through the Project technical baseline and supporting plans
  - Site Design and Test Requirements Document (SDTRD)
    - -- Exploratory Studies Facilities Design Requirements (ESFDR)
    - -- Surface-Based Testing Facilities Requirements Document (SBTFRD)
    - -- Study Plans
  - Exploratory Studies Facility Technical Baseline

SCP Testing Needs

- Site, design, and performance assessment requirements for site characterization data were defined in the SCP
  - These requirements for testing were baselined in the SCP baseline
- Specific site characterization studies are described in more detail in study plans

ESF Design Interface with Surface-Based Testing

Requirements Flowdown

- "To the extent practical, exploratory boreholes and shafts in the geologic repository operations area shall be located where shafts are planned for underground facility construction and operation or where unexcavated pillars are planned" (10 CFR Part 60)
- This requirement is contained in the SDTRD and flows down to the ESFDR and to the SBTFRD
- Boreholes planned in the surface-based testing program are located using ESF design drawings to limit the number of borehole locations along ramp and drift alignments

ESF Design Interface with Surface-Based Testing

- Surface-based testing to support ESF design
- Study Plan 8.3.1.14.2: Soil and rock properties of potential Locations of Surface and Subsurface facilities
  - Provides North and South Ramp Boreholes and associated rock properties testing
- Study Plan 8.3.1.4.2.1, Stratigraphic Features
  - Provides geologic cross-sections
- Study Plan 8.3.1.4.3.1, Systematic Drilling
  - Provides additional stratigraphic control and rock properties data for the design of subsurface facilities

ESF Design Interface with Surface-Based Testing

- **Feedback from Surface-Based Testing to ESF design**
  - Test results available through participant and project technical data bases
- **Feedback from design to the site program**
  - Revised drilling program to accommodate additional boreholes for ESF design under Study Plan 8.3.1.14.2 to better locate the top of the Tiva Canyon

ESF Design Interfaces with Underground Testing

- Initially defined in the Site Characterization Plan, Section 8.4
- Section 8.4 contains
  - ESF design concept
  - Description of the planned in situ tests
  - Constraints imposed on ESF design by in situ tests
- These requirements from Section 8.4 are baselined in the SCP Baseline
- These requirements in turn flow down to the ESFDR

ESF Design Interfaces with Underground Testing
continued

- Four Study Plans were approved and in place prior to start of ESF construction to allow for testing as construction proceeds
  - Structural Features in the Site Area which Includes Geologic Mapping in the ESF
  - Characterization of Percolation in the ESF which Includes Perched Water Testing and Sampling in the ESF
  - Water Movement Tests which Includes Monitoring of Underground Openings
  - In Situ Design Verification which Includes Monitoring of Underground Openings

ESF Design Interfaces with Underground Testing
continued

- The ESFDR defines constraints on ESF design that are imposed by each ESF test
  - Space
  - Sequencing
  - Test-to-test interference
  - Construction-to-test interference

Examples of Constraints on ESF Design and Construction:

- Sequencing of ESF construction and underground testing allows for blasting, then geologic mapping, followed by emplacement of initial ground support
  - To the extent practicable
- For the perched water test, the ESFDR requires that sampling of perched water be initiated as soon as it is encountered

DOE - NRC

Technical Exchange

October 4-5, 1993

ESF Surface Water Systems

Larry Engwall
October 5, 1993

B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.

INTERA Inc.
JK Research Associates, Inc.
E. R. Johnson Associates, Inc.

Logicon RDA
Morrison Knudsen Corporation
Woodward-Clyde Federal Services

ATTACHMENT (22)

ESF Surface Water Systems

SCA Question 55:

- **Concerns the water tanks, the septic leach field, and the waste water lagoon.**
- **Analyses for test interferences have not determined potential for test interference or impacts on post-closure performance.**

ESF Surface Water Systems Include:

- **Water Storage Tanks**
  - **200,000 gal construction & fire water**
  - **50,000 gal potable water**
- **Septic Leach Field**
- **"Subsurface Waste Water" Pond**
  - **150,000 gal**
- **Other Sources of Waste Water to be treated similarly.**

Present Status

- Performed Test Interference & Waste Isolation Impact Analysis & Determination of Importance Evaluation (DIE) for Water Supply System.
- It was determined that the Water Supply System, which includes storage tanks, must be monitored for leakage.
- Leakage is not to exceed 350 gal/day averaged over 6-month period.
- Leakage in excess of 2000 gal in one week required shut down of system until repaired.
- Recommendation has been incorporated into design.

Present Status (con't)

- Sewer Sytem & Leach Field:
  - Preliminary test interference analysis recommendations monitoring well (30' - 40' deep) in center of field.
  - Waste isolation analysis in progress, but will have to move the leach field further down hill to prevent water migration into Paintbrush Canyon Fault.
  - DIE due shortly after analyses are completed.
- "Subsurface Waste Water" Pond:
  - Test interference & waste isolation analyses in progress.
  - DIE due shortly after analyses are completed.

Conclusion

- Upon completion, the above analyses should resolve SCA Q55.

FLEXIBILITY OF ESF DESIGN TO ACCOMMODATE IN SITU TESTING

PRESENTED BY

Ned Z. Elkins
Deputy Technical Project Officer
Los Alamos National Laboratory
ESF Test Coordination Office

DOE-NRC ESF TITLE II TECHNICAL EXCHANGE
October 4-5, 1993

ATTACHMENT (23) Postponed

ESF DESIGN/TESTING FLEXIBILITY

The Primary Objective of the Current ESF Design and Test Planning Efforts is to Implement a Fully Integrated Underground Testing and Construction Program, Supported by an ESF Design Process that is both Flexible and Responsive to Field Conditions and to Results from Previous and Ongoing Test and Monitoring Activities.

An Important Example of ESF Flexibility in Design and Test Planning is Provided by the DOE Consideration and Response to SCA Question 58, related to ESF Design Flexibility for Accommodating In Situ Waste Package Testing.

ESF FLEXIBILITY FOR IN SITU WASTE PACKAGE TESTING

- DOE currently considers that it is neither desirable nor necessary to peform in situ waste package testing, using live waste, in the ESF.

- The planned program of ESF testing utilizes an integrated sequence of laboratory, large-block, and in situ testing in the ESF to evaluate coupled process thermal effects and radiologic effects on the host rock and waste package environment. Based on test results, DOE may consider revisions to ESF and/or confirmation testing plans.

- The current ESF design is specifically being developed to insure flexibility and not preclude possible test program modifications which might require in situ waste package testing.

ESF FLEXIBILITY FOR IN SITU WASTE PACKAGE TESTING, cont'd

- Current ESF design features include:

  1) Ramp accesses specifically classified and designed as important to radiological worker safety which are capable of handling most currently conceived waste packages.

  2) A significantly increased dedicated test area (over 370,000 square meters) at the main test level which can accommodate increased or expanded ESF testing and future confirmation testing.

  3) Extensive on-block drifting and perimeter drifting at the potential repository horizon.

- Total program of design, testing, and construction is mutually integrated with inputs, controls, and ongoing feedback.

CURRENT STATUS

- Initial Test Planning has defined 42 ESF test activities ranging from Design Verification and Excavation Monitoring, through Sampling and Small-Scale Test Activities, to Large-Scale In Situ Testing.

- Results of initial ESF Test Planning is fully consistent with and represented by current Site Characterization Program Baseline (SCPB).

- ESF Test Program Objectives and Scope have been provided to the NRC in Semi-Annual Progress Report #4.

- Current ESF Testing Status:

  - Five Test Activities are in the ESF (SCP Activities 8.3.1.4.2.2.4; 8.3.1.3.2.1, 2.2; 8.3.1.15.1.8.1, 8.2; 8.3.1.2.2.4.7; 8.3.4.2.4.4).

  - Two In Situ Test Activities are fully planned and ready to implement in ESF North Ramp Alcove #1 (SCP Activities 8.3.1.2.2.4.4; 8.3.1.2.2.4.8).

  - Three Construction-Phase Tests first appearing in North Ramp at or beyond the Bow Ridge Fault are scheduled for Planning Completion by the Fall of 1993 (Package 2C) (SCP Activities 8.3.1.2.2.4.10; 8.3.1.15.1.1, 1.2, 1.3, 1.4; 8.3.1.15.1.5.1).