E.7 Integrated Planning Committee

Enhanced Characterization of the Repository Block
Integrated Planning Committee meeting
3/17/97 4:00pm-5:00pm
Room 1275

Meeting Minutes

The meeting was held for the purpose off kicking off the planning effort for the Enhanced Characterization of the Repository Block. Those in attendance are listed on the two attached sign-in sheets.

The following material was distributed those present:

- 'Plan for 90 Day Planning Effort'
- 'Draft Notes on a Process to Evaluate the Location and Scope of Enhancements to the Site Characterization Program incorporating an East-West Drift'(copy attached)
- Briefing entitled 'A Discussion of Options for the Enhancement of Repository Block Characterization Data' dated 3/5/97 (copy attached)
- White Paper on Data Enhancement for Repository Block Characterization Prior to License Application (copy attached)
- White Paper to discuss two options for the Construction of an Exploration Drift Across the Repository Block (copy attached)

Bob Sandifer went over the Plan for the 90 Day Planning Effort with particular emphasis on the task descriptions and schedule.

Representatives from Institutional, Project Control, QA, and MTS contractor have not been named. Jerri Adams agreed to coordinate.

There was discussion regarding appropriate time to brief Lake Barrett, NRC, NWTRB, and Repository Board of Consultants. No specific times were determined but the committee will monitor and determine appropriate time.

Minutes recorded by James R. Beyer.

KICK-OFF MEETING
ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
MARCH 17, 1997 4:00 pm
CONF RM 1275

ATTENDEE	ORG	PHONE
Ralph Rogers	SPO	55785
CANDACE LUGO	SPO	5-3560
IVAN COTTLE		5-5724
BILL KENNEDY	DESIGN	5-4240
NED Z. ELKINS	TCO	5-3403
D.R. Chandler	Support Ops.	5-5603
RM Sandifer	SC&O	55504
K.W. Cline	MTS	45481

KICK-OFF MEETING
ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
MARCH 17, 1997 4:00 pm
CONF RM 1275

ATTENDEE	ORG	PHONE
Jim Beyer	M&O C&O PE	5-5395
Vincent F Iorii	DOE/AMAAM	4-1470
Jerri Adams	DOE/AMAAM	4-1481
Mark VanDerPing	DOE/AMESH	4-5563
Ken Ashe	M&O/Lic.	5-5563
Michael Voegele	M&O	5-5520
Peter Hastings	M&O/SE	5-3961
Jim Houseworth	M&O/PA	5-4638
Jean Younker	Reg Ops	5-
Dick Snell	M&O/E&I	5-5601
Stephen Brown	DOE/AML	4-1359

March 17, 1997 mdv
Rev 1 (Rogers, Kalia)CRIT1.WPD

Draft Notes on a
Process to Evaluate the Location and Scope of Enhancements
to the Site Characterization Program Incorporating an East-West Drift:

In the development of the 1996 and 1997 Long Range Plans, site characterization workscope was prioritized, based on performance assessment, model development, and design needs. While an east-west drift through the block was recognized as having the potential to provide valuable information, the project technical staff considered the information that could be provided by this drift to be of less value to the development of the Viability Assessment Products than that which could be obtained through other tests. Given limited funding, the decision was made to delay the east-west drift until after the Viability Assessment. The Project scientists have understood that given constant and limited funding, certain lower priority activities could only be undertaken at the expense of the higher priority activities. Despite ongoing criticism from the NWTRB, the Project scientists have consistently maintained that the work comprising the current test program was providing data of higher priority than that which could be obtained from an east-west drift. Recently, the repository Consulting Board expressed a position favoring multiple drifts to establish the western boundary of the potentail repository block.

The DOE finds itself in a position to be able to expend additional funds to enhance the site characterization program. A study has been authorized to initiate the required planning activities to implement an enhanced characterization of the repository block that addresses a new drift within the ESF traversing the block in an east-west orientation.

Objective:

Develop a recommended approach for the enhanced site characterization effort incorporating an east-west drift. The approach should address work that will enhance scientific understanding of the behavior of the site, as well as enhance understanding of engineering; construction, health and safety; cost; and regulatory and performance aspects of the potential repository. The study should consider the relationship between ongoing characterization activities, particularly how the current programs could complement and be complemented by the enhanced characterization effort. It should also address potential efficiencies in the enhanced program by combining the drift with other characterization efforts. It should reflect the latest scientific understanding of the behavior of the site. The extent to which enhancements in the program can strengthen the data supporting the Viability Assessment also should be considered; the enhanced characterization program cannot constrain the date for Viability Assessment.

It is critical that the project be able to articulate the basis for selection of the preferred alternative

Evaluation Criteria:

To select the appropriate location, work scope and relationship to other associated site characterization tests, the project will evaluate the benefits of alternatives against a set of criteria that address importance of information that could be gained from an E-W drift and other tests. These draft criteria presented here are drawn from or adapted from previous evaluations of enhanced characterization efforts. It is proposed that the Working Groups evaluate these criteria, modify or add to the set as appropriate, and reach consensus on a set of evaluation criteria that can then be used as the basis for determining a project position on the appropriate location and work scope for an east-west drift. Unless there are compelling reasons to move to a finer resolution scale, it is suggested that the discrimination be no finer than north, middle, or southern end of the block, and above, within, or below the potential repository horizon.

a) Scientific Criteria:

1. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to evaluation of variations in the Topopah Spring member TSw2, sufficient to allow characterization of spatial variability of hydrologic properties?

2. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to evaluation of variations in the Topopah Spring member TSw3, sufficient to allow characterization of spatial variability of hydrologic properties.

3. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to greater likelihood of obtaining information regarding hydrologic or mechanical effects of unexpected formation heterogeneity or structural features, such as faults or shear zones that exhibit no surface expression?

4. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better opportunity to observe and sample environmental isotopes (including chlorine-36 and tritium) in below zones of high infiltration flux or saturation associated with stratigraphic contacts in the lower Tiva Canyon member and the Paintbrush nonwelded unit?

5. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better

opportunity to observe, monitor and sample (including chlorine-36 and tritium) (perhaps episodically) evidence for percolating water in the Topopah Spring member?

6. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better opportunity to observe and sample (including chlorine-36 and tritium) within and beneath stratigraphic contacts in the lower Topopah Spring member and the Calico Hills tuff?

7. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better opportunity to observe differences in fault or fracture patterns, persistence, and properties within stratigraphically continuous welded and nonwelded units?

8. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better opportunity to observe and measure fault and fracture characteristics, and to characterize and sample moisture, in the vitric Calico Hills tuff?

9. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better opportunity to observe fault displacement, distributed faulting and rupture of datable fracture fillings that may indicate the timing or extent of future faulting which might cause the direct failure of canisters due to fault displacement or possible changes in groundwater depth or flow patterns?

10. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to better information to characterize the physical boundaries of the Calico Hills barrier, especially the nature of the vitric to zeolitized transition, structural and lithologic features, and chemical or physical process affecting flow or causing lower retardation, in that unit or potential changes resulting from repository heat?

11. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better opportunity to obtain information regarding faulting and other structural features (such as the Solitario Canyon fault) that may affect the area available for the repository (including potential extensions and abandonments)?

12. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better opportunity to observe and sample exposures that may help to resolve the question of whether open and connected fractures systems can exist/persist in

the softer, generally nonwelded stratigraphic intervals at Yucca Mountain, and to detect direct evidence regarding flow and the interaction of fractures and matrix?

13. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to a better opportunity to obtain information regarding the rock quality or excavation drift stability to be anticipated within the Topopah Spring member in the main repository region?

14. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the hydrologic properties of faults (especially the Solotario Canyon fault) and the impacts of those faults on the unsaturated and saturated zone flow systems?

b) Engineering

1. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to integration into repository emplacement operations?

2. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to integration of the drift into repository performance confirmation activities?

c) Construction Criteria (including Health and Safety Criteria)

1. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to cristobalite concentrations and safety issues?

2. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to enhanced dust control in construction activities?

3. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to enhanced excavation performance?

4. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to alcove excavation methodologies and equipment?

d) Cost Criteria

1. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to repository construction costs?

e) Regulatory and performance Criteria

1. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to the 200 meter overburden disqualifying condition of 10 CFR Part 960?

2. Are there location, layout, or test program specific considerations for an east-west drift that can enhance the understanding of the site relative to necessary controls to limit impacts to the waste isolation characteristics of the site?

Civilian Radioactive Waste
Management System

Management & Operating
Contractor

TRW Environmental Safety
Systems Inc.

A DISCUSSION OF OPTIONS FOR THE ENHANCEMENT OF REPOSITORY BLOCK CHARACTERIZATION DATA

Robert M. Sandifer
Larry R. Hayes
March 5, 1997

B&W Federal Services
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
Framatome Cogema Fuels
Integrated Resources Group
INTERA, Inc.
JAI Corporation
JK Research Associates, Inc.
Lawrence Berkeley Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory
Morrison-Knudsen Corporation
Science Applications International Corporation
Sandia National Laboratories
TRW Environmental Safety Systems Inc.
Woodward-Clyde Federal Services
Winston & Strawn
Cooperating Federal Agency:
U.S. Geological Survey

PRESENTATION INDEX

- Background
- Objective of Presentation
- Data that can be enhanced
- Analysis of options
- Conclusions
- Cost/Schedule Impacts

BACKGROUND

- "Adequate" repository block characterization is needed for LA
- Sufficient data is currently available or planned to meet this objective
- Additional repository block characterization is not technically required for VA and LA
- The LRP includes a East-West Drift to address programmatic concerns

OBJECTIVE OF PRESENTATION

- Address The Following Questions:
  - Validate previous conclusion that East-West Drift is not required
  - If the E-W Drift is not a Technical Requirement, what other justification can be provided?

OBJECTIVE OF PRESENTATION

- Two options were considered:
  - Accelerated (Do as soon as possible, complete excavation mid-summer, 1998)
  - Longer Term (complete excavation May, 1999)
- Do both options provide all the data that are required to support the technical enhancement

OBJECTIVE OF PRESENTATION

- When is the latest date the E-W Drift can be completed and still provide all the benefits?
- What are the other advantages and disadvantages of the two options?
- Present a conclusion
- Discuss cost/schedule impacts of the most viable option

DATA THAT CAN BE ENHANCED BY A CROSS DRIFT INVESTIGATION

- DATA FOR TSPA/LA (Const - May99, Data - May00)

  - Fracture /Fault Distributions

  - Repository Horizon Properties

  - Solitario Canyon Fault Testing

  - Environmental Isotope Distribution

DATA THAT CAN BE ENHANCED BY A CROSS DRIFT INVESTIGATION

- **DATA FOR LA DESIGN** (Const - May99, Data - May00)

  - Environmental Conditions

  - Geologic Data

  - Geoengineering Data

  - Engineering Cost Estimates

DATA THAT CAN BE ENHANCED BY A CROSS DRIFT INVESTIGATION

- DATA FOR REPOSITORY CONSTRUCTION PLANNING (Const - May99, Data - May00)

  - Cristobalite Correlation

  - Enhanced Dust Control

  - Enhanced Excavation Performance

  - Alcove Excavator

  - Reduced Risk of Constructability

ANALYSIS OF OPTIONS

- The Accelerated EWD for VA:

Attributes:

- Implement the LRP mandated commercial
- "buy a hole approach" as soon as possible

- The ESF constructor would lease a TBM internally or externally and modify as necessary to meet spill control and other DIE related requirements

ANALYSIS OF OPTIONS

- Estimated duration to completion is 15 months from Notice to Proceed

- The observation drift will not be used for the passage or storage of waste, therefore, Non-Q ground support is assumed, Q controls from DIE Evaluations will be required

- Aligned to a planned repository observation drift

ANALYSIS OF OPTIONS

- Advantages:

  . Least cost as compared to the long term option due to the TBM acquisition strategy, reduced enhancement, and less escalation

  . Shortest duration to enhanced data (with limitations)

ANALYSIS OF OPTIONS

Disadvantages

- Need the funding sooner
- Excavated diameters may differ from the size of the planned repository emplacement drift
- Data enhancements for Repository Construction Planning (Dust control, Costs) will be limited

ANALYSIS OF OPTIONS

- Provides only a limited opportunity to modify the M&O relationship with the constructor

- The maturity of the repository design is less mature with the earlier option, thereby, potentially reducing the enhancement of data

ANALYSIS OF OPTIONS

- The TBM will be de-mobilized at the completion of the E-W Drift. Any additional (currently unplanned) excavation after E-W Drift completion would require time for another TBM lease, rehabilitation, and mobilization

- Human resource limitations

- Potential impact to planned testing activities

THE LONGER TERM OPTION FOR LA

Attributes:

- Utilized a more deliberate approach for planning and implementation to assure all requirements are considered

THE LONGER TERM OPTION FOR LA

- Required the acquisition of a government owned or leased TBM at the repository emplacement drift diameter to assure that the latest unique requirements for water control, spill control, and dust control are incorporated into the design to advance the knowledge of the specialized systems

THE LONGER TERM OPTION FOR LA

- The observation drift will not be used for the passage or storage of waste, therefore, Non-Q ground control is assumed, Q controls for DIE Evaluations will be required
- Estimated duration to completion is 27 months from Notice to Proceed
- Aligned to a planned repository observation drift

THE LONGER TERM OPTION FOR LA

- Excavations will conform to the planned dimensions of the emplacement drifts thereby providing the opportunity to accurately model repository conditions

- TBM will be available for additional excavations if required, thereby minimizing mobilization durations

THE LONGER TERM OPTION FOR LA

- All identified data enhancements will be achieved
- Allows time to implement unique incentives for the constructor's productivity
- Meets recommendations for the timing of enhanced data

THE LONGER TERM OPTION FOR LA

Disadvantages:

- Cost of the investigation will be higher (ROM $10M) for the TBM acquisition with state of the art dust control and additional scientific interfaces. However more data is enhanced and there is more flexibility

- Potential impact to planned testing activities

CONCLUSIONS

- There is still no requirement for a cross-drift either for VA or LA
- After considering all factors, the Longer Term Option provides a better solution for enhancing design, construction, and science
- Limited Detailed Planning for the initial cross block excavation should begin near term

COST/ SCHEDULE CONSIDERATIONS OF THE LONGER TERM OPTION

- WBS 1.2.6. COST IMPACTS (OTHER ELEMENTS TBD)

  - FY97

    Additional activities will include TBM specifications and acquisition planning. Procurement funds may not be required until FY98. ROM cost is $300K

COST/ SCHEDULE CONSIDERATIONS OF THE LONGER TERM OPTION

- FY98

  Current projections indicate that the WBS 1.2.6 FY 98 budgetary requirements would be less than the LRP projection. (ROM -$5M) This planned reduction will be offset by the addition of TBM procurement activities during FY98

COST/ SCHEDULE CONSIDERATIONS OF THE LONGER TERM OPTION

- FY99

  The ROM projection for the increase in the LRP budget is $5M

WHITE PAPER ON DATA ENHANCEMENT FOR REPOSITORY BLOCK CHARACTERIZATION PRIOR TO LICENSE APPLICATION (East-West Drift)

FOREWORD and OBJECTIVE

The OCRWM Program is required to adequately characterize the potential repository block and the surrounding environment prior to License Application. Typical issues that must be addressed in order to accomplish this mission include: What data is required? How much data is required? When is it required? and What is the appropriate strategy for data collection? Project staff has been struggling with these issues for years. These issues are particularly difficult for the proposed repository block because 10CFR60 has required the minimization of penetrations into the block from surface. Therefore, the investigations accomplished to date, have focused on the perimeter of the block. The location of surface boreholes and the excavation of the ESF main drift are reflective of this constraint. In a sense, the repository block is typical of a commercial mining property in which the "ultimate" geological characterization is accomplished by extensive excavations and drilling at depth and is a process that takes many years. The key issue for the YMP is "When" are these cross block excavations required to support the scientific, engineering, and programmatic considerations on the YMP?

The objective of this white paper is to develop a recommendation on "when" the YMP should begin the initial cross block excavations in the repository block. The YMP has determined, as part of the development of the Long Range Plan, that cross block excavation excavations are not required for the Viability Assessment (VA). Therefore this white will focus on how a cross- block excavation may support the development of License Application (LA). There is currently sufficient data to support the development of the LA. However there is a potential issue during LA review as to whether the repository block data collected to date is fully representative of the total repository horizon. Therefore the data developed as a result the initial cross block excavation will tend to enhance and verify the accuracy of the current data. The assessment of the recommended timing for this activity must consider the quantity and importance of the data that will be enhanced by the initial cross drift and the potential impact on the LA process of any data that falls outside the projected bounding limits.

The development of the cross drift recommendation will consider the following:

- o Background on the development of the current LRP East- West Drift
- o A matrix that identifies the data that will be enhanced during the initial cross block investigation
- o An evaluation of the options identified in an earlier FEB97 White Paper. (Attached)
- o A summary level integrated network that shows the interrelationships and timing of the key ESF, Repository, Scientific, and Regulatory activities.

There are two other important references that address the initial cross block excavation:

The first is the assumptions and the Basis of Estimate that support the ESF portion of the Long Range Plan (LRP) that was developed in FY96. The LRP guidance required a commercial "buy a hole in the ground" implementing strategy. The LRP develops a design in FY98, but delayed TBM acquisition, set up, and excavation until the beginning of FY99 when additional funding was available.

The second reference is an M&O white paper entitled "Two Options for the Construction of an Exploration Drift Westward Across the Potential Repository Block" that was developed in early FEB97. This paper began with the assumption that the cross block excavation was required and defined two somewhat bounding construction scenarios. One, an accelerated option that can be completed prior to Viability Assessment (VA) and a second, longer term option that would be started after VA, with a completion date supportive of License Application (LA). A review of this white paper lead to a request to evaluate the potential for data enhancement prior to LA and provide recommendation for the timing of the cross block excavation which is the subject of this paper. This white paper contains several implementing assumptions not repeated herein, but is attached for information.

BACKGROUND

Since 1990, when the ESF Alternative Studies were completed, it has been recognized that excavations across the repository block were necessary for adequate characterization. In fact, every major plan for site characterization, since that time, has included one or more drifts extending between the Ghost Dance and Solitario Canyon faults. The current baseline consists of the Long Range Plan (LRP), which includes a 2600 meter East-West Drift (EWD) across the North end of the block. The LRP was started in the fall of 1995 and was completed about a year ago. During the development of the LRP it was determined that the data obtained from the EWD was necessary to support LA but would not be required for VA. The following studies formed the basis for these decisions.

1. <u>The ESF Alternatives Study - 1990</u> - established the main TBM excavated loop similar to the current configuration. Additionally there were two ramps to the Calico Hills and an extension of the North and South Ramps to the west across the block. A total of seventeen excavation options were considered in this study.

2. <u>Description and Rationale for Enhancement to the Baseline ESF Configuration - 1993</u> - This formed much of the basis for the current configuration of the ESF, and recommended two cross-drifts as part of an adequate site characterization program.

3. <u>North Ramp Extension Evaluation - Spring 94</u> - Thirteen characterization and excavation

options were identified and studied in detail shortly after the Program Plan was issued.

4. The Calico Hills System Study - FEB95 - evaluated some additional characterization and excavation options. It raised questions on the cost/benefit ratio of excavation in the Calico Hills to obtain the required data.

5. Calico Hills Access Study - JUL95 - Four characterization and excavations options were studied in detailed. An "off the block" shaft with a roader header drift to the Solitario Canyon Fault was recommended.

DATA THAT WILL BE ENHANCED BY THE INITIAL CROSS BLOCK INVESTIGATION

During the year since the LRP has been completed, the repository design has advanced beyond the conceptual stage and there is a better understanding of the activities preceding LA. This work has led to the following summary of Repository Block Data Requirements that will be enhanced with the initial cross block excavation.

The following tables were developed as a result of integrated efforts between Scientific Investigations, Repository Design, and ESF Construction. Each type of data identified is unique and not overlapping as each data field is used for a specific purpose. The timing recommended for the enhanced data was developed from input from the study participants and will be reflected in a network in the final section of this white paper.

SCIENTIFIC DATA THAT CAN BE ENHANCED BY A CROSS DRIFT INVESTIGATION			
ITEM NO.	TITLE	ENHANCED DATA	RECOMMENDED TIMING FOR ENHANCED DATA
A1.	Fracture/ Fault Distributions	Verify the presence or absence of any Pre-Tiva Canyon Faults. If present, determine the distribution and offset. Record data on the orientation, abundance and physical characteristics of repository level fractures to supplement data from surface and other ESF studies.	Data enhancement will be complete about one year after the completion of excavation and should be available for incorporation into "LA preparation and review activity by MAY 2000 - 22 months prior to LA
A2.	Repository Horizon Rock Properties	Bounding values on the variation in lithologic/mechanical/hydrologic properties in the repository horizon (TSW2) are currently available. Additional data characterizing this variation in the repository block is useful for enhancing hydrologic modeling and repository design.	Data enhancement will be complete about one year after the completion of excavation and should be available for incorporation into "LA preparation and review activity by MAY 2000 - 22 months prior to LA
A3.	Solitario Canyon Fault Testing	The hydrologic properties and the physical characteristics of the Solitario Canyon Fault can be bounded with existing data. In-situ data will allow us to improve our understanding of the fault and parameter bounds. The data should include: Thermal and saturation profiles, sampling for environmental isotopes, air permeability, hydrochemistry testing, mapping of fracture distributions and physical characteristics	Data enhancement will be complete about one year after the completion of excavation and should be available for incorporation into "LA preparation and review activity by MAY 2000 - 22 months prior to LA
A4.	Environmental Isotope Distribution	Determine the concentrations of environmental isotopes such as CL -36 to support the determinations residence times for in-situ water and the identification of potential fast flow paths. Water, rock, and mineral samples will allow us to evaluate the vertical and horizonal distributions of the isotopes under a high infiltration zone and improve our hydrologic flow models.	Data enhancement will be complete about one year after the completion of excavation and should be available for incorporation into "LA preparation and review activity by MAY 2000 - 22 months prior to LA

A5.	Moisture Distributions	Determine saturation profiles and fluid potentials at locations within the block to allow evaluation of flow and transport properties and constrain percolation flux below a zone of high surface infiltration, improving confidence in our flow models and our bounds on parameter values.	MAY 2000

DATA FOR LA DESIGN THAT CAN BE ENHANCED BY A CROSS DRIFT INVESTIGATION			
ITEM NO.	**TITLE**	**ENHANCED DATA**	**RECOMMENDED TIMING FOR ENHANCED DATA**
B1	Environmental Conditions	Data Needs **Water-Quality/Quantity** -underground (Some data are currently available. Additional data would reduce uncertainty if it is confirmed that west block conditions are similar to those observed on the east side)	Data enhancement will be complete at the completion of excavation. Any enhanced data should be developed by the end of Phase two repository design - JULY 1999
B2	Geologic Data	Data Needs **Stratigraphy** - Rock Stratigraphic Units **Structure** - Bedding Structure - Faults - Joints **Groundwater Hydrology** - Ground Elevation - Perched Ground water locations /elev- Geochemistry - Mineralogy - Geochemical effects (Some data are currently available. Additional data would reduce uncertainty if it is confirmed that west block conditions are similar to those observed on the east side)	Data enhancement will be complete at the completion of excavation. Any enhanced data should be developed by the end of Phase two repository design - JULY 1999

B3.	Geoengineering Data	Data Needs: **In situ Rock Mass Conditions** - Degree of Saturation - In Situ Rock Stress - In Situ Rock Temperature **Rock Index Properties** - Density - Porosity **Joint Parameters** - Joint Strength - Joint deformability - Joint Characteristics **Rock Mass Quality Parameters** **Rock Mass Mechanical Properties** - Intact Rock compressive Strength - Rock Mass Strength - Rock Mass Tensile strength - Intact Rock Deformability - Rock Mass Deformability **Rock Thermal and ThermoMechancial Parameters** - Rock Mass Thermal Expansion - Rock Mass Thermal Conductivity - Rock Mass Heat Capacitance **Rock Dynamic Properties** - Wave Velocity - Dynamic Deformability	Data enhancement will be complete at the completion of excavation. Any enhanced data should be developed by the end of Phase two repository design - JULY 1999

3B Cont.	Geoengineering Data	**Rock Mass Performance Parameters** - Deformation Around Openings - Convergence of Openings - Ground Support Load and Deformation - Rock Temperature Change - Mechanical Excavation Parameters (Some data are currently available from the ESF. Additional data would reduce uncertainty if it is confirmed that west block conditions are similar to those observed on the east side)	Data enhancement for repository will be complete at the completion of excavation. Any enhanced data should be developed by the end of Phase two repository design - JULY 1999

REPOSITORY CONSTRUCTION PLANNING ENHANCED BY A CROSS DRIFT INVESTIGATION			
ITEM NO.	TITLE	ENHANCED DATA	RECOMMENDED TIMING FOR ENHANCED DATA
C1.	Cristobalite Correlation	Perform field testing during excavation to correlate crystobalite concentrations in the rock mass to the levels of hazardous dust levels during TBM operations	Before LA as necessary to support the Total Life Cycle Cost Estimate
C2.	Enhanced Dust Control	Provide the cross drift TBM and associated equipment with state of the art dust control equipment with the goal to perform TBM excavation without respirators	Before LA as necessary to support the Total Life Cycle Cost Estimate
C3.	Alcove Excavator	Design, develop and test prototype alcove and launch chamber excavation equipment to increase current levels of productivity, minimize interference with TBM operations, and minimize the development of dust.	Before LA as necessary to support the Total Life Cycle Cost Estimate
C4.	Enhanced Excavation Performance	Develop data for repository productions rates. All the previous "Lessons Learned" that are applicable to the expected conditions in the repository block will incorporated into the second generation YMP TBM design. The resulting production data will improve the accuracy of the projected life cycle cost for the repository	Before LA as necessary to support the Total Life Cycle Cost Estimate

COMPARISON OF OPTIONS FROM THE INITIAL WHITE PAPER

The initial white paper was developed in early FEB. It analyzed two somewhat bounding schedule options for the implementation of the initial repository cross block drift. This white paper is attached for information. The assumptions that applicable to each option are presented in detail in the initial white paper, however the following is a summary of the key characteristics:

The Accelerated EWD for VA:

Attributes:

o Implemented the LRP mandated commercial "buy a hole approach" as soon as possible.

o The ESF constructor would lease a TBM internally or externally and modify as necessary to meet spill control and other DIE related requirements.

o Estimated duration to completion is 15 months from Notice to Proceed.

o Non-Q ground support is assumed, Q controls from DIE evaluations will be required.

o Aligned to a planned repository observation drift

Advantages:

o Least cost, due to "buy the hole approach" and less escalation.

o Shortest duration to enhanced data (with limitations)

Disadvantages

o Need the funding sooner.

o Excavated diameters may differ from the size of the planned repository emplacement drift.

o Maturity of the repository design is much less than it will be in several years.

o Data enhancements for Repository Construction Planning will not be fully achieved.

o Provides only a limited opportunity to modify the M&O relationship with the constructor.

o Any additional unplanned excavation prior to CA would require duration for another

TBM lease, rehabilitation, and mobilization.

o Human resource limitations

o Potential impact to planned testing activities.

The Longer Term Option for LA

Attributes:

o Utilized a more deliberate approach for planning and implementation to assure all requirements are considered.

o Requires the acquisition of a government owned or leased TBM at the repository emplacement drift diameter to assure that the latest unique strategies for meeting water control, spill control, and dust control requirements are incorporated into the design to advance the knowledge of the specialized systems.

o Non-Q ground support is assumed, Q controls from DIE evaluations will be required.

o Estimated duration to completion is 27 months from Notice to Proceed.

o Aligned to a planned repository observation drift

Advantages:

o Excavations will conform to the planned dimensions of the emplacement drifts thereby providing the opportunity to accurately model repository conditions.

o TBM will be available for additional excavations if required, thereby minimizing mobilization durations.

o All identified data enhancements will be achieved.

o Allows time to implement unique incentives for the constructor's productivity.

o Meets recommendations for the timing of enhanced data.

Disadvantages:

o Cost of the investigation will be higher (ROM - $10M) for the TBM acquisition with state of the art dust control, increased level of QA requirements, and additional scientific interfaces. (However more data is enhanced and there is more flexibility to perform future excavations that may be required.)

o Potential impact to planned testing activities.

RECOMMENDATION

After considering all factors, the M&O has concluded:

o There is still no requirement for a cross drift either for VA or LA

o The Longer Term Option provides a better solution for enhancing design, construction, and science.

o There is no advantage for any further consideration of the Accelerated option.

o Limited detailed planning for the initial cross block excavation should begin in the near term.

The impacts on the current WBS 1.2.6. cost/ schedule baseline and LRP are approximated below. Impacts in the other WBS elements are not projected at this time.

FY97

Additional activities will include TBM specifications and acquisition planning. Procurement funds may not be required until FY98. ROM cost is $300K.

FY98

Current projections anticipates that the WBS budgetary requirements will be less than the LRP projection. (ROM -$5M). This reduction will be offset by the addition of cross block activities for FY98.

FY99

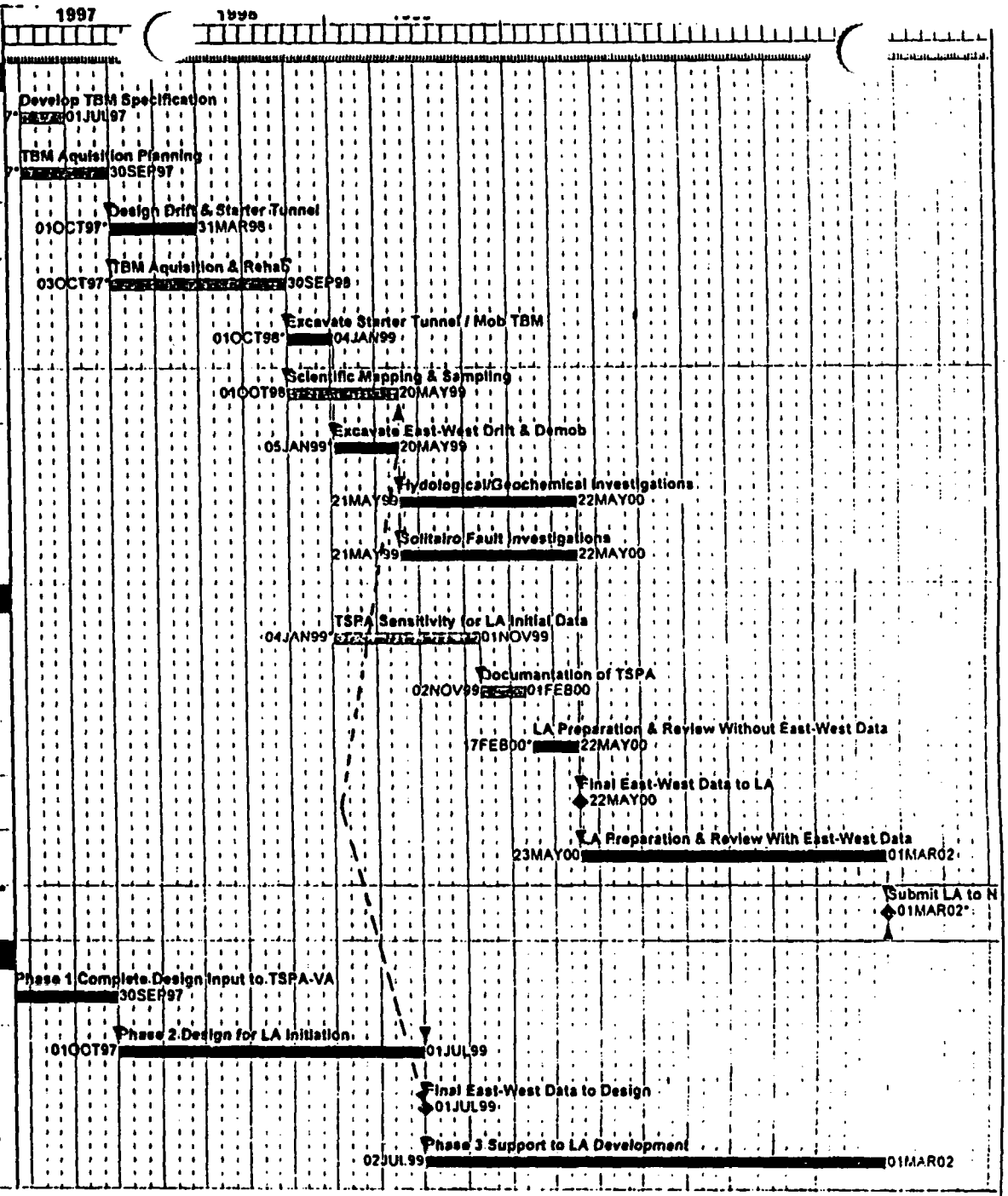
The ROM projection for the increase in the LRP budget is $5M.

A SUMMARY LEVEL NETWORK OF ESF, REPOSITORY, SCIENTIFIC, AND REGULATORY ACTIVITIES.

The following Network that was developed as an aid to determining the recommended completion date for the enhancement of the Repository Block Characterization data. It indicates that these

dates are achievable utilizing the Longer Term option provided the TBM acquisition process begins shortly.

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Cross Drift Investigations				
265	Develop TBM Specification	66	01APR97*	01JUL97
275	TBM Aquisition Planning	131	01APR97*	30SEP97
260	Design Drift & Starter Tunnel	130	01OCT97*	31MAR98
270	TBM Aquisition & Rehab	259	03OCT97*	30SEP98
250	Excavate Starter Tunnel / Mob TBM	68	01OCT98*	04JAN99
230	Scientific Mapping & Sampling	166	01OCT98	20MAY99
240	Excavate East-West Drift & Demob	98	05JAN99*	20MAY99
210	Hydological/Geochemical Investigations	262	21MAY99	22MAY00
220	Solitairo Fault Investigations	262	21MAY99	22MAY00
Performance Assessment & License Application				
130	TSPA Sensitivity for LA Initial Data	216	04JAN99*	01NOV99
120	Documantation of TSPA	66	02NOV99	01FEB00
115	LA Preparation & Review Without East-West Data	68	17FEB00*	22MAY00
310	Final East-West Data to LA	0		22MAY00
110	LA Preparation & Review With East-West Data	464	23MAY00	01MAR02
100	Submit LA to NRC	0		01MAR02*
Repository Design				
140	Phase 1 Complete Design Input to TSPA-VA	154	27FEB97	30SEP97
150	Phase 2 Design for LA Initiation	457	01OCT97	01JUL99
300	Final East-West Data to Design	0		01JUL99
160	Phase 3 Support to LA Development	696	02JUL99	01MAR02



Project Start 27FEB97
Project Finish 01MAR02
Data Date 27FEB97
Plot Date 03MAR97

Early Bar
Progress Bar
Critical Activity

EWP2

Sheet 1 of 1

Enhanced Data

for LA Design & TSPA / LA

Primavera Systems, Inc.

WHITE PAPER TO DISCUSS TWO OPTIONS FOR THE CONSTRUCTION OF AN EXPLORATION DRIFT ACROSS THE REPOSITORY BLOCK

FEB97

OBJECTIVE

The objective of this white paper is to consider two approaches for the development of excavations to the west of the ESF main drift. There has been a general acceptance of the need to further investigate this area prior to LA as this activity is part of the Long Range Plan. However, the selection of "how" and "when" this work should be performed has been more varied among the various project interests. The options presented in this white paper will attempt to define two somewhat bounding scenarios, one, an accelerated option that can be completed prior to Viability Assessment (VA) and a second longer term option that would be started after VA, with a completion date supportive of License Application (LA). The primary purpose of each option is to provide a verification that the "as excavated" conditions in the repository block are consistent with the current scientific projections. However, the implementation of the two options vary in concept. Other options that fall between these two scenarios are conceivable but are not discussed. The focus of this white paper will be on planning and implementation to provide the basis for future discussions. The scientific and engineering justification for the benefits of a drift across the potential repository block are not featured in the discussions of the implementation concepts. However, this white paper does include some draft discussions in the appendix for information and background. This paper is organized as follows:

The initial section of this white paper will provide a brief summary of some historical options that extend excavation beyond the current ESF five mile main loop. This includes options below the repository in the Calico Hills and various cross block excavations. Elements of many of the past concepts may be applicable in the future and it is important not to repeat past work.

A conceptual layout of a proposed configuration will be presented that is considered applicable to both options.

The Accelerated option which would be completed prior to VA will be presented by providing the current assumptions associated with the East-West Drift (EWD) that is currently part of the Long Range Plan. This option conforms to the LRP guidance to utilize a "commercial approach." The presentation of this option will include: a conceptual layout of the EWD line and grade relative to the repository; a description of the data collection activities prior to VA; an expansion of the current LRP schedule to show additional detail and interfaces; and an ESF cost summary of the activity.

The Longer Term option will be presented as a concept to provide a foundation for additional discussions and considerations. If it is determined that this option has merit, a detailed, integrated planning activity would be required to determine the FY98 activities necessary for implementation after VA.

A draft repository design view of the benefit of addition repository block investigation is included as Appendix A, for information. This section discusses the need to further investigate the repository horizon prior to the completion of the Repository design. This discussion is applicable to both EWD options presented herein. However, the timing of the required data will bear on the repository design process. Additionally a collection of discussion memos written by various Principal Investigators are included for information and background.

BACKGROUND

Historically there has been a wide variation in the amount of underground excavation required for Site Characterization. The following is a brief chronological summary of some of the variations.

1. In the early years of the project the ESF consisted of two shafts with horizontal excavations less than one half mile.

2. In 1990 the project initiated the ESF Alternatives Study which established the main TBM excavated loop similar to the current configuration. Additionally there were two ramps to the Calico Hills and an extension of the North and South Ramps to the west across the block. A total of seventeen options were considered in this study.

3. In 1993 the "Description and Rationale for Enhancement to the Baseline ESF Configuration" was developed to form much of the basis for the current configuration of the ESF, and recommended two cross-drifts as part of an adequate site characterization program.

4. In DEC94 the Program Plan was issued. It contained the completion of the main loop, a North Ramp Extension beginning in Jun98, and a TBM excavation into the Calico Hills starting in early Oct97.

5. Shortly after the Program Plan was issued, a "North Ramp Extension Evaluation" was initiated. Thirteen options were identified and studied in detail.

6. In Jul95, a study was initiated to determine a recommended method for Calico Hills Access. Four options were studied in detailed. An "off the block" shaft with a roader header drift to the Solitario Canyon Fault was recommended.

7. In Feb95, The Calico Hills System Study evaluated some additional excavation options. It raised questions on the scientific value of data from Calico Hills drifting.

8. In FY96 the Long Range Plan was developed. It included the completion of the main loop and the 2600 meter East- West drift excavation to be started in FY99. The design of this

configuration was scheduled in FY98. Excavation to the Calico Hills was not included. The LRP guidance required a "commercial approach" for the EWD excavation.

THE ACCELERATED CASE TO BE COMPLETED PRIOR TO VA

THE ACCELERATED EWD FOR VA

FOREWORD

The primary objective of this option is excavating across the repository block prior to VA to confirm that the current Site characterization data is generally representative of "as found conditions." As noted in the background section, the EWD excavation has been included in the Long Range Plan. Due to funding constrains, the start of construction was planned for FY99. When the EWD was planned in the LRP, the guidance was to utilize a "commercial" approach for this activity. This approach was embodied into the cost estimate and schedule back up for the LRP. The "Accelerated EWD Case" will be utilized in the LRP EWD plan, but will assume an FY97 initiation to facilitate a completion of construction prior to VA. Additionally the assumptions, the network and the potential repository interface will be presented with a greater level of detail and will reflect the most current implementation concepts.

ASSUMPTIONS FOR THE ACCELERATED CASE

1. The assumed average production rate for the TBM excavation is 30 meters per day. The current LRP assumes a "commercial approach" for this activity. This assumption is a driver in the implementation schedule that presented in the next section.

2.The working relationship between the M&O and the construction subcontractor and the contractual format and requirements will be reviewed and modified as necessary to improve the effectiveness of ESF construction phase operations. The time constraints for this accelerated case does not permit any flexibility in the choice of constructors. Therefore, it is assumed that PK will perform the work.

3.The ESF AE will develop and issue phased design products to facilitate an accelerated start of construction. The first will be a brief TBM specification which identifies any unique project TBM requirements (i,e, spill control) and an envelope for acceptable tunnel diameters. The second design product will be a basic launch chamber ground control and dimensional design which will accommodate the constructors planned operations. The final product will be the line and grade of the EWD with ground support requirements along with the acceptance criteria for submittals that will document the constructors designed products and operational parameters.

4.. The unique safety requirements for the construction of the EWD will be developed with a Job Safety Analysis.

5. The TBM for the East-West drift will be provided by the construction contractor (PK). The constructor will select a machine from internal or external sources and refurbish the equipment to meet project DIE and safety requirements developed by the AE. TBM selection will be performed

concurrent with the EWD design effort. Close integration between these efforts will be required.

7. Site Characterization data collection that will be performed concurrently with TBM operation will include Geologic Mapping, Sampling and analysis, and Rock Quality Determination and Thermal Mechanical Properties. These activities will not be conducted as part of the TBM operations at the tunnel face. The testing approach, methodology, and equipment will be configured to minimize any impact on construction completion. After TBM demobilization, additional testing activities will be considered

8. Ventilation will be provided with a tube extended to the TBM working face that will connect into the duct system in the North Ramp which will exhaust at the North Portal. The main ESF loop will be ventilated by the flow through system establish by the bulkhead and fan in the South Ramp. Therefore, fresh air is currently assumed to enter from the North portal. However this will be evaluated during the detailed design when the control of underground dust will be a key issue.

9.The South Ramp portal will be used to provide access to the main drift test areas during TBM set up and operations to minimize interfaces between testing, loop construction completion, and EWD excavation. However, North portal access will be maintained for the North Ramp test areas and any utility maintenance.

10. Elements of the configuration and construction methodology include:

o The drift is assumed to be 5.0 meters in diameter but may vary as a function of the TBM proposed by the constructor. The limits of the diameter variation will be specified by the AE early in the design phase.

o The tunnel length will be 2600 meters to extend to the Solitario Canyon Fault

o Steel sets will be required for 20% of the total length, the remaining ground support will consist of wire mesh, steel channels, and 3 meter swellex rock bolts. All ground support will be non-Q.

o Transportation will be on a single track with steel ties resting on the tunnel invert.

o Muck removal is assumed to be by rail haulage from the face to a conveyor transfer point in the North Ramp in the LRP estimate. However, the construction contractor will be provided the flexibility to implement any other least cost option.

o The permanent drift utilities will consist of: power distribution; water; compressed air; vent tube; waste water line; lighting; and communications.

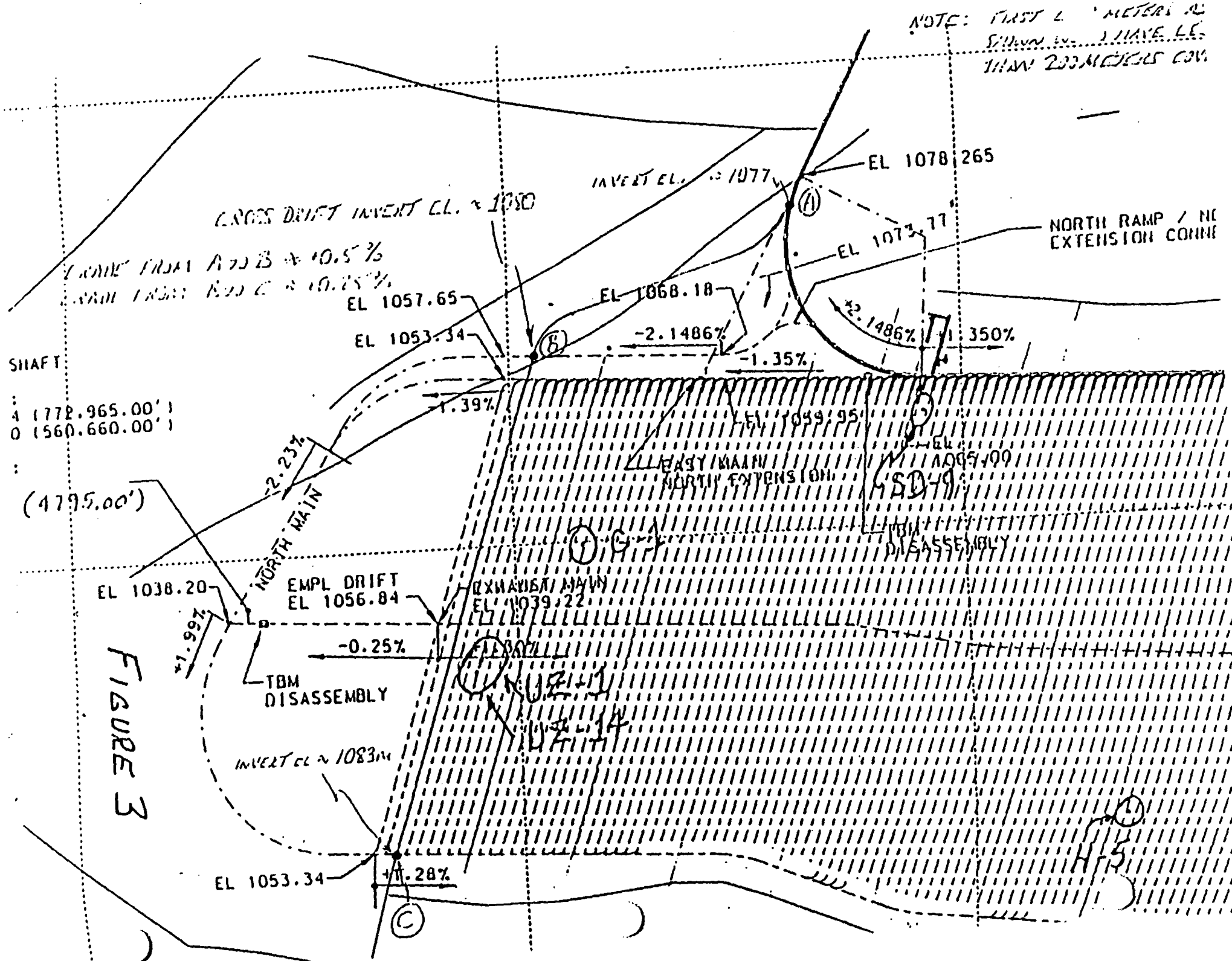
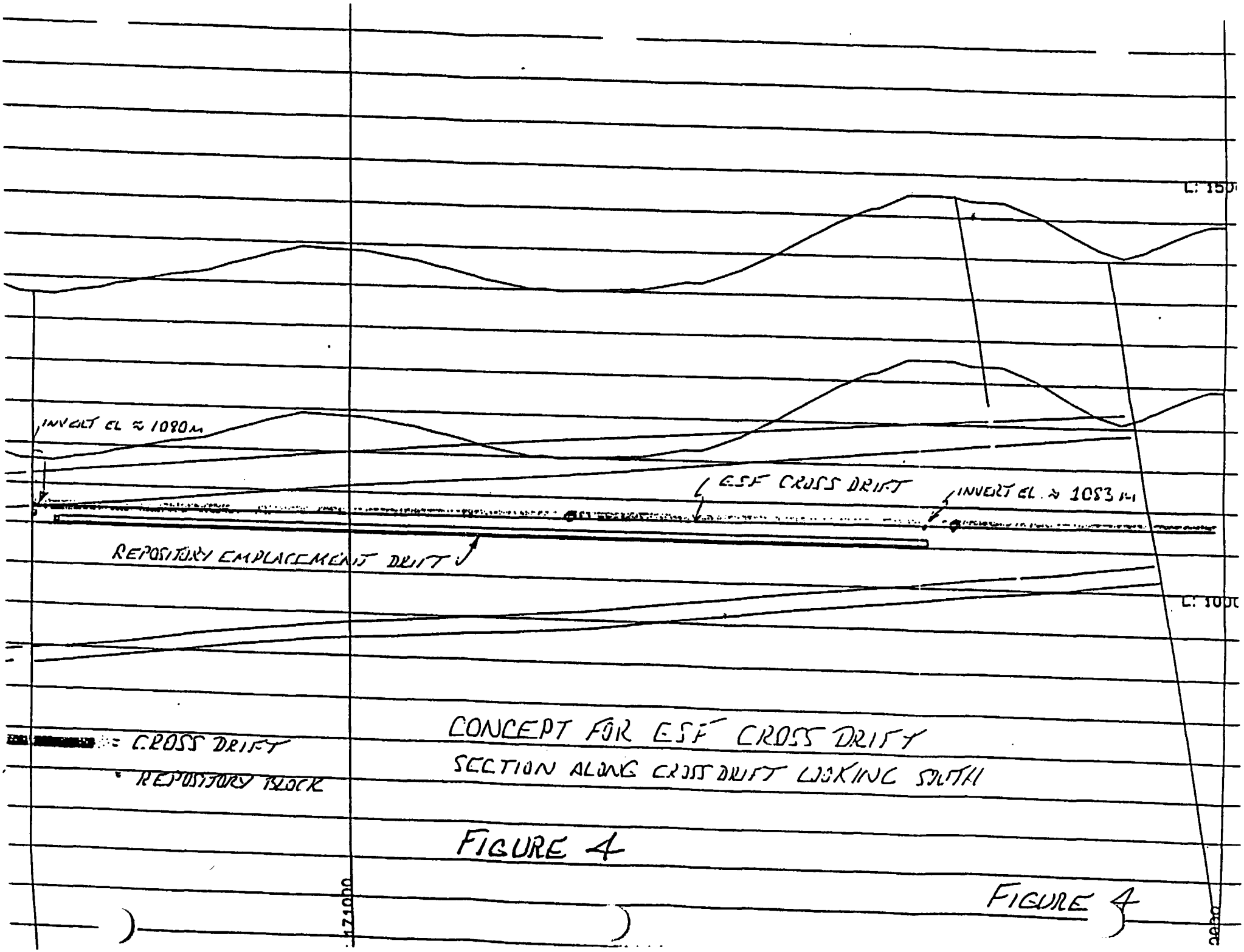
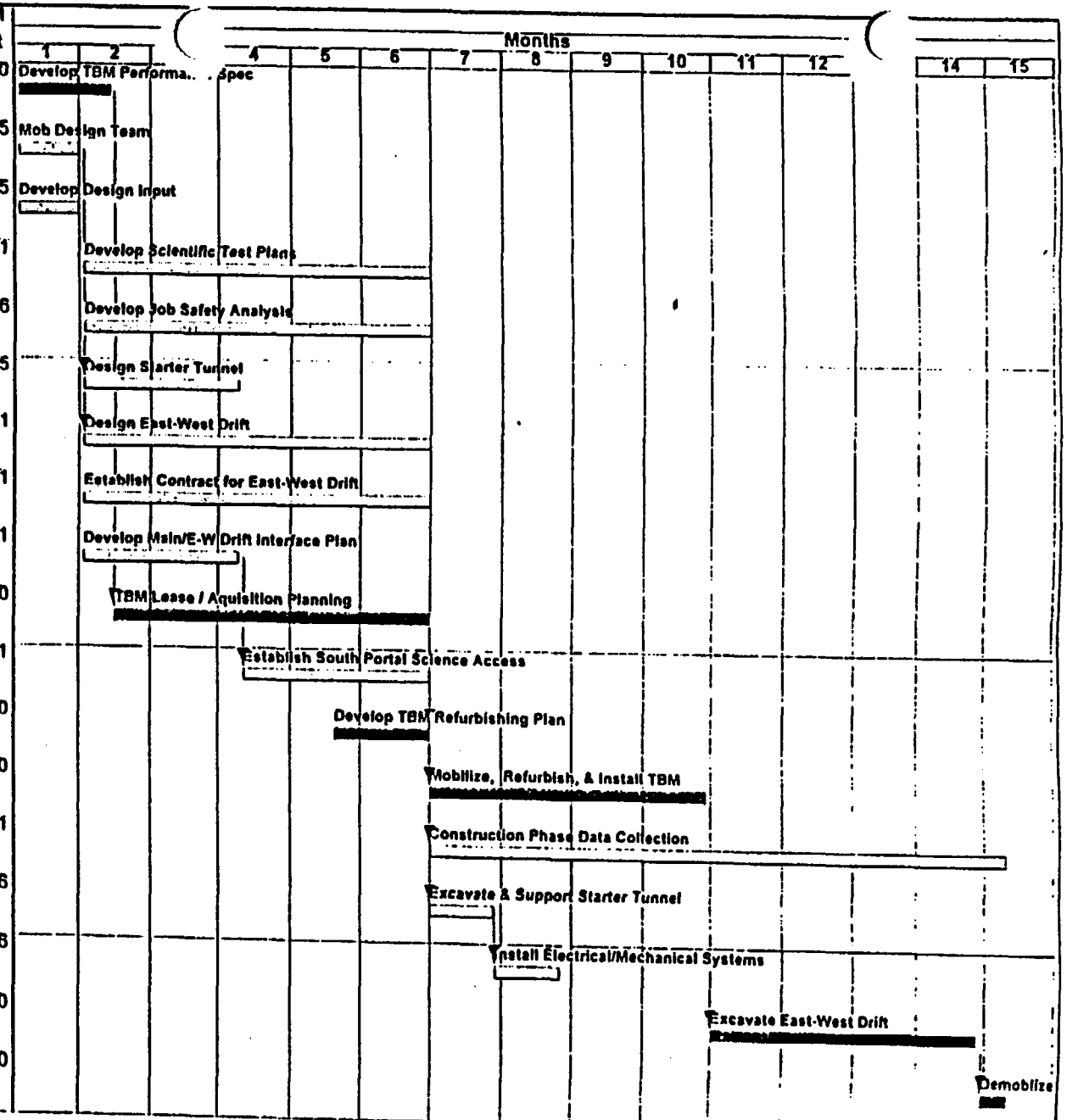

EL 1078.265
INVERT EL. ≈ 1077
CROSS DRIFT INVERT EL. ≈ 1080
NORTH RAMP / NE
EXTENSION CONNE
EL 1073.77
EL 1068.18
EL 1057.65
EL 1053.34
-2.1486%
+2.1486%
+1.350%
-1.35%
+1.39%
SHAFT
4 (772.965.00')
0 (560.660.00')
(4795.00')
-2.23%
NORTH MAIN
EL 1038.20
EMPL DRIFT
EL 1056.84
EXHAUST MAIN
EL 1039.22
+1.99%
-0.25%
TBM
DISASSEMBLY
INVERT EL ≈ 1083m
EL 1053.34
+11.28%
EXHAUST MAIN
NORTH EXTENSION
TBM
DISASSEMBLY

FIGURE 3


EL. 150
INVERT EL ≈ 1080m
ESF CROSS DRIFT
INVERT EL. ≈ 1083 m
REPOSITORY EMPLACEMENT DRIFT
EL. 100
= CROSS DRIFT
= REPOSITORY BLOCK
CONCEPT FOR ESF CROSS DRIFT
SECTION ALONG CROSS DRIFT LOOKING SOUTH
FIGURE 4
FIGURE 4

Activity ID	Activity Description	Orig Dur	Total float
120	Develop TBM Performance Spec	30	0
100	Mob Design Team	20	105
110	Develop Design Input	20	105
250	Develop Scientific Test Plans	109	1
200	Develop Job Safety Analysis	109	46
210	Design Starter Tunnel	50	105
220	Design East-West Drift	109	181
240	Establish Contract for East-West Drift	109	181
260	Develop Main/E-W Drift Interface Plan	50	181
230	TBM Lease / Aquisition Planning	99	0
270	Establish South Portal Science Access	59	181
300	Develop TBM Refurbishing Plan	30	0
320	Mobilize, Refurbish, & Install TBM	86	0
330	Construction Phase Data Collection	180	1
310	Excavate & Support Starter Tunnel	20	46
340	Install Electrical/Mechanical Systems	20	46
350	Excavate East-West Drift	85	0
360	Demoblize	10	0



Project Start 01FEB97
Project Finish 16APR99
Data Date 01FEB97
Plot Date 17FEB97

Early Bar
Progress Bar
Critical Activity

EW01

Sheet 1 of 1

East-West Drift Acceleration
Rev 1

East - West Drift Estimated Costs (Escalated)

/17/97
01:30 PM

Activity Description	Cost
Design East-West Drift & Starter Tunnel	$394,764
Excavate East-West Drift Starter Tunnel	$2,725,024
Excavate East-West Drift & Demob	$9,957,405
Constructors Supervision and Engineering EW	$2,415,441
Power Usage - EW Drift	$115,747
Muck Handling - EW Drift	$205,863
Underground Transportation - EW Drift	$1,015,456
Construction Management - EW Drift	$1,268,623
Title III - EW Drift	$773,640
Ground Control Design Conformation - EW Drift	$76,997
WBS 1.2.6 Total	$18,948,959

ROM Estimate for Associated Costs	
WBS 1.2.3	$3,250,000
WBS 1.2.8	$400,000

Note: Includes Escalation to FY99 Dollars & Projected PM&I

Data/Excel/eastwest.xls

A LONGER TERM OPTION TO BE EXCAVATED AFTER VA, BUT SUPPORTIVE OF LA

THE LONGER TERM APPROACH FOR LA

FOREWORD

The primary objective of this option is the same as the accelerated option. That is, to provide a verification that the "as excavated" conditions in the repository block are consistent with the current scientific projections. However the characteristics of this option will support the following secondary objectives not provided by the Accelerated option:

- o Provide testing of the key elements of the proposed repository configuration
- o Provide testing of proposed repository construction methodologies.

ASSUMPTIONS FOR THE LONGER TERM APPROACH

1. The currently assumed line and grade of the excavations are the same as the one assumed in Accelerated option. However, the later start of excavation will permit the incorporation of more advanced repository design concepts, thereby providing greater assurance that the excavation of the observation drift will be more functional.

2. The initiation of any excavation beyond the current ESF loop will not occur until after VA. The basic planning for these activities will begin in FY97 However design and any other necessary preparatory activities will begin in FY98.

3.A TBM specification will be developed in FY98 the AE and the Constructor to guide the acquisition process. It is expected that the TBM would have the following attributes:

- o Repository diameter
- o Advanced dust control system
- o Ground control features based on the YMP experience
- o Configuration to facilitate underground relocations

4. The TBM for this work will be government owned or leased to provide a tool for any repository sized excavation required before LA. Additional is not anticipated until CA, however if a scientific issue did arise, the response time for any required mobilization would be mobilized.

5. Excavation at the repository diameter will provide an opportunity to test and evaluate some repository design concepts for ground control and tunneling support systems. Additionally it permits the use the conveyor for muck removal thereby enhancing productivity.

6. Alternate contractual methodologies could be developed and tested to improve the effectiveness of the construction management program for the repository.

8. New methodologies for alcove construction could be developed and tested to improve productivity beyond that provided by the current road header.

9. An average productivity of 30 meters per day was incorporated into the conceptual schedule presented in the next section.

10. Ventilation will be provided with a tube extended to the TBM working face that will connect into the duct system in the North Ramp which will exhaust at the North Portal. The main ESF loop will be ventilated by the flow through system establish by the bulkhead and fan in the South Ramp. Therefore, fresh air is currently assumed to enter from the North portal. However this will be evaluated during the detailed design when the control of underground dust will be a key issue.

11.The South Ramp portal will be used to provide access to the main drift test areas during TBM set up and operations to minimize interfaces between testing, loop construction completion, and EWD excavation. However, North portal access will be maintained for the North Ramp test areas and any utility maintenance.

12. The TBM configuration will be subjected to a Systems Safety Analysis. Other operations will be addressed with a Job Safety Analysis. This safety related studies will be fully integrated.

13. As a minimum, Site Characterization data collection during construction will include Geologic Mapping, Sampling and analysis, and Rock Quality Determination and Thermal Mechanical Properties. Other more "late breaking" issues may be addressed as well.

10. Elements of the configuration and construction methodology include:

o The cross drift is assumed to be 5 or 6 meters in diameter. This is the currently proposed size of the emplacement drifts. The main access drifts and the primary ventilation drifts are in the 7 to 8 meter range.

o The tunnel length will be 2600 meters to extend to the Solitario Canyon Fault

o Steel supports will be required for 20% of the total length, the remaining ground support will consist of combinations of wire mesh, steel channels, and rock bolts. The details will be consistent with the current repository concept. Ground support may be considered Q

o Muck removal will be by the most economical means

o The permanent drift utilities will consist of: power distribution; water; compressed air; vent

tube; waste water line; lighting; and communications.

PROPOSED DEVELOPMENT PROCESS FOR THE LONGER TERM APPROACH

This approach has a significantly different concept than many of the options summarized in the background discussions. Past studies have focused primarily on site characterization activities. Now that the repository design and concepts are being advanced in support of VA, there is an opportunity to integrate some emerging repository requirements into the continuation of field activities. Additionally, to date, there has been only limited focus on the planning for repository construction which will be a significant line item in the total life cycle cost. If Construction Authorization is received, the YMP will be the site of one of the largest civil underground excavation projects in the world. Additionally it must be managed with a unique set of administrative and quality requirements. Therefore it will be very beneficial to study and test the various repository construction options that relate to both the physical configuration and available techniques of construction management.

Therefore, an integrated planning action is recommended to include site characterization, repository design, repository construction, and ESF considerations. The first step in this activity would be to establish a set of guiding principles to focus the efforts of the planning team. The development of these guiding principles would begin by considering and enhancing the foregoing assumptions. If this option receives tentative approval, this planning activity would start as soon as possible to assure that any necessary activities are selected for FY98.

POTENTIAL COST DIFFERENCES BETWEEN THE OPTIONS

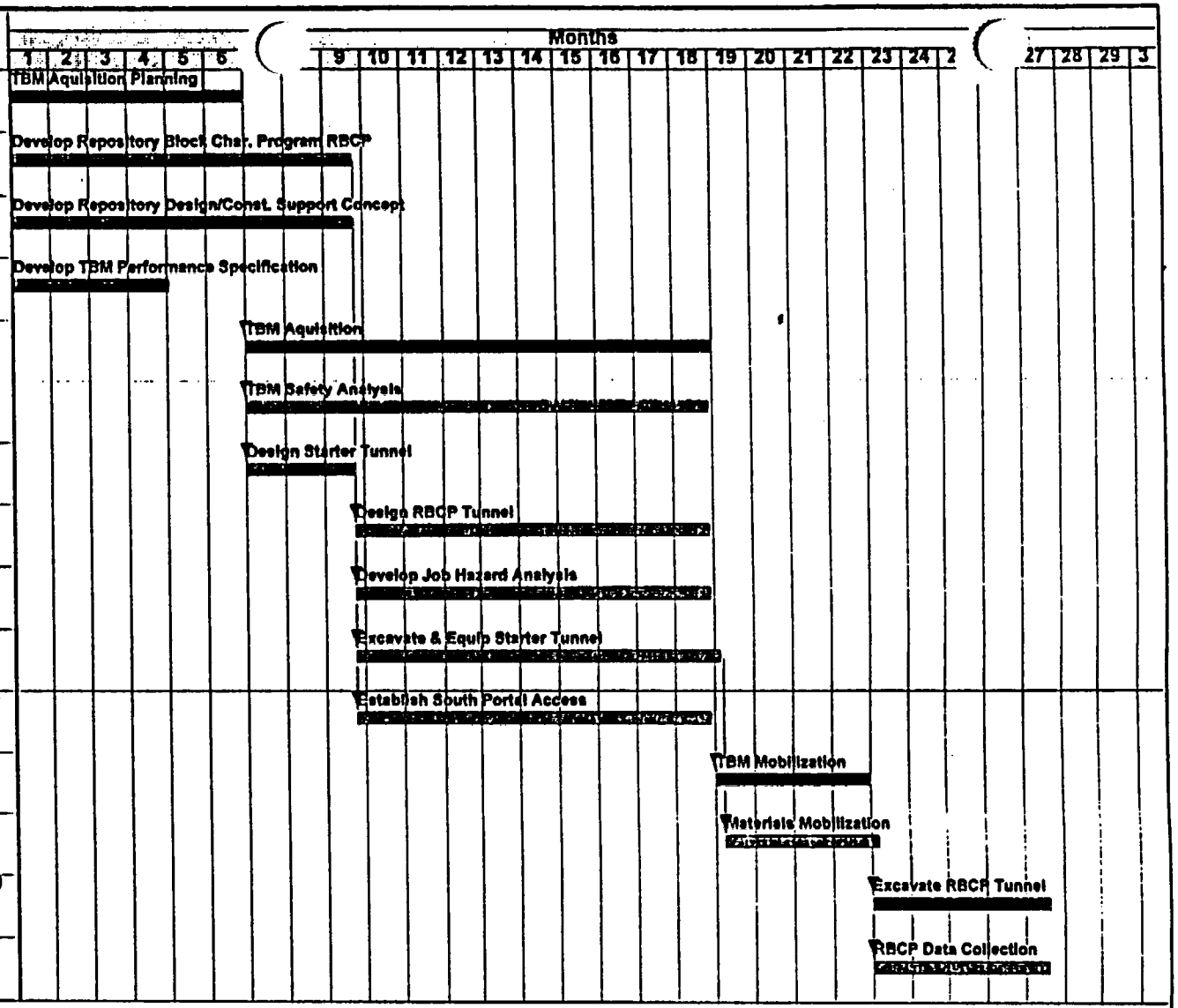
The longer term concept is not developed to the extent to support an initial cost estimate. However it is fair to project that the cost of the longer term option will be higher. Factors that will drive this increase include:

- o TBM acquisition
- o Larger diameter
- o Potential for Q elements
- o Repository features

THE SCHEDULE FOR THE LONGER TERM OPTION

The schedule that follows is very conceptual in nature. The critical path will clearly go through TBM acquisition. The TBM could be new or used and refurbished. This would be driven by the technical TBM requirements and machine availability in the commercial market. As the various requirements become defined in the planning process discussed above, the schedule will be revised.

Activity ID	Activity Description	Orig Dur
110	TBM Aquisition Planning	130
200	Develop Repository Block Char. Program RBCP	190
210	Develop Repository Design/Const. Support Concept	190
100	Develop TBM Performance Specification	88
120	TBM Aquisition	261
130	TBM Safety Analysis	260
140	Design Starter Tunnel	60
220	Design RBCP Tunnel	200
230	Develop Job Hazard Analysis	200
150	Excavate & Equip Starter Tunnel	205
240	Establish South Portal Access	200
160	TBM Mobilization	88
180	Materials Mobilization	88
170	Excavate RBCP Tunnel	100
190	RBCP Data Collection	99



Project Start	01MAR97	Early Bar
Project Finish	21JUL99	Progress Bar
Data Date	01MAR97	Critical Activity
Plot Date	03MAR97	

EWD2

Sheet 1 of 1

Conceptual Schedule
Longer Term Option

APPENDIX A

SOME DRAFT SCIENTIFIC AND ENGINEERING DISCUSSIONS THAT DISCUSS THE BENEFITS OF ADDITIONAL INVESTIGATIONS IN THE POTENTIAL REPOSITORY BLOCK

EVALUATION OF EAST-WEST DRIFT OPTIONS

There are two options to be considered. The ASAP option assumes that we start now and excavate across the block with an available machine (proposed completion date: 8/98). The Longer Term Option assumes that we address VA concerns with boreholes and plan repository block characterization in an orderly and productive timeframe.

An east-west drift could potentially address issues related to rock characteristics in the potential repository block and issues related to the hydrologic properties of the UZ. Rock characteristics issues include the presence or absence of faults, the distribution and abundance of fractures and the distribution of lithologic units. An important feature of an east-west drift for LA is that the drift would begin near the top of TSw2 and would traverse nearly the entire thickness of TSw2 as the drift was excavated toward the west. Hydrologic issues include the presence or absence of fast paths (as identified by environmental isotopes), effects of high surface infiltration rates, and the hydrologic characteristics of the Solitario Canyon fault (assuming that the drift could be constructed in such a way as to access the fault in a number of locations). It is also important to remember that many of the unresolved questions relating to the WIS hypotheses require vertical information above and below the potential repository horizon. An east-west drift is only one part of a confirmatory testing program for LA.

ASAP Option

Advantage:

Preliminary information on fracture distributions and rock characteristics for VA.

Disadvantages:

No documentation available for VA.
No hydrologic information available for VA.
Insufficient time and preliminary data for planning focused scientific program.

Discussion:

The ASAP option provides very few opportunities to strengthen the science program for VA. The drift would be completed essentially concurrently with the issuance of the VA. The preparation and analysis of samples for the hydrology program, and most others, commonly takes several months. The construction of the drift is planned for approximately 6 months. Consequently, there will not be enough time to collect and analyze samples and interpret results for samples from the drift before VA. It will be even more hopeless to try and produce documentation of sample results to be incorporated into the VA. It would be possible to take a preliminary look at rock characteristics, such as fractures and faults, and evaluate predictions from the 3D geologic model. However, it would not be possible to produce documentation of these evaluations in time for incorporation into the VA.

Longer Term Option

Advantages:

Well planned and focused program to address hydrologic and geologic issues.
Preliminary data available to clarify hydrologic issues and assist in location of the drift.
Complete documentation available for LA.

Disadvantage:

Only borehole data available for VA from potential repository block.

Discussion:

The Longer Term Option provides more opportunities to strengthen the science program for VA, assuming that money is available to fund boreholes in FY 97 and early FY 98. One or two boreholes drilled west of the Ghost Dance fault, perhaps on the crest of Yucca Mountain, could provide important information. The boreholes could directly address questions related to the response of the UZ hydrologic system to high surface infiltration rates, and preliminary rock quality data. These questions could be addressed by analyzing for environmental isotopes, moisture distributions, in-situ water potentials, and fracture distributions. It should be noted that environmental isotopes and fracture distributions may be sampled from cuttings or logging of completed boreholes, but moisture distribution, in-situ water potential, and min/pet samples would require core, which is not part of the current DOE drilling program. These data would provide important confirmatory information for VA and would allow us to develop much more sophisticated plans for drifts that will be developed for repository block characterization. In particular, the initial borehole data would allow us to develop a focused plan for studying the hydrologic system at the repository level and the hydrologic characteristics of the Solitario Canyon fault. We would be in a position to recommend with confidence the best location for the drift(s) and sampling and monitoring programs that should be initiated to use the drift(s). This plan would delay the acqusition of detailed information on fracture distributions and rock properties at the repository level. However, this information is not required for VA and would be collected at a later date.

DRAFT

E-W Cross-Drift
Repository Design View

There are two cases to be made indicating the desirability of having an E-W cross-drift. They deal with examination of the vertical heterogeneity of the TSw2 ("Vertical Argument") and the potential extent of lateral discontinuities ("Horizontal Argument").

VERTICAL ARGUMENT

The TSw2 is a compound stratigraphic unit. That is; it is not uniform over its thickness. It is composed of at least four identifiable "sub-units."

Upper Lithophysal
Middle Non-Lithophysal
Lower Lithophysal
Lower Non-Lithophysal

The "Loop" being excavated now will remain entirely within the two upper-most of these sub-units. The repository, in contrast, will be required to utilize parts of all four of these sub-units. These four sub-units may exhibit reasonably wide variability in mechanical, thermomechanical, and hydrologic properties. It will be important to show that the repository can be constructed, and will perform well, within the range of variability expected within the TSw2. Cross-drifting would help provide the assurance needed that the range of conditions to be encountered have been seen. The attached Figure 1 shows the Repository Host Horizon, the location of the ESF Main Drift, and the lower limit of repository development.

HORIZONTAL ARGUMENT

The Solitario Canyon Fault (SCF) is a major bounding feature of the upper block, but we will not know much about it unless a cross drift is constructed, and penetrates the fault. Depending on the character of the SCF, we could realize either an increase or a decrease in the amount of usable area. We have two drift penetrations of the Ghost Dance Fault (GDF) planned by mid-FY1997. Understanding the GDF is probably no more or less critical than knowledge of the SCF, yet no one will get a look at the SCF unless a cross drift is driven. Figure 2 shows a generally east-west cross-section of the repository block, with the view to the north. It shows the location of the ESF Main Drift high in the TSW2 unit, and on the extreme east edge of the block.

While it is not likely that there are major undiscovered north-south trending structures between the Ghost Dance Fault (GDF) and the Solitario Canyon Fault (SCF), the only real way to know this is by cross-block drifting. There are no surface indications of major structures, but the

February 12, 1997

DRAFT

possibility of a pre-Tiva Canyon fault which intersects the TSw2 cannot be ruled out.

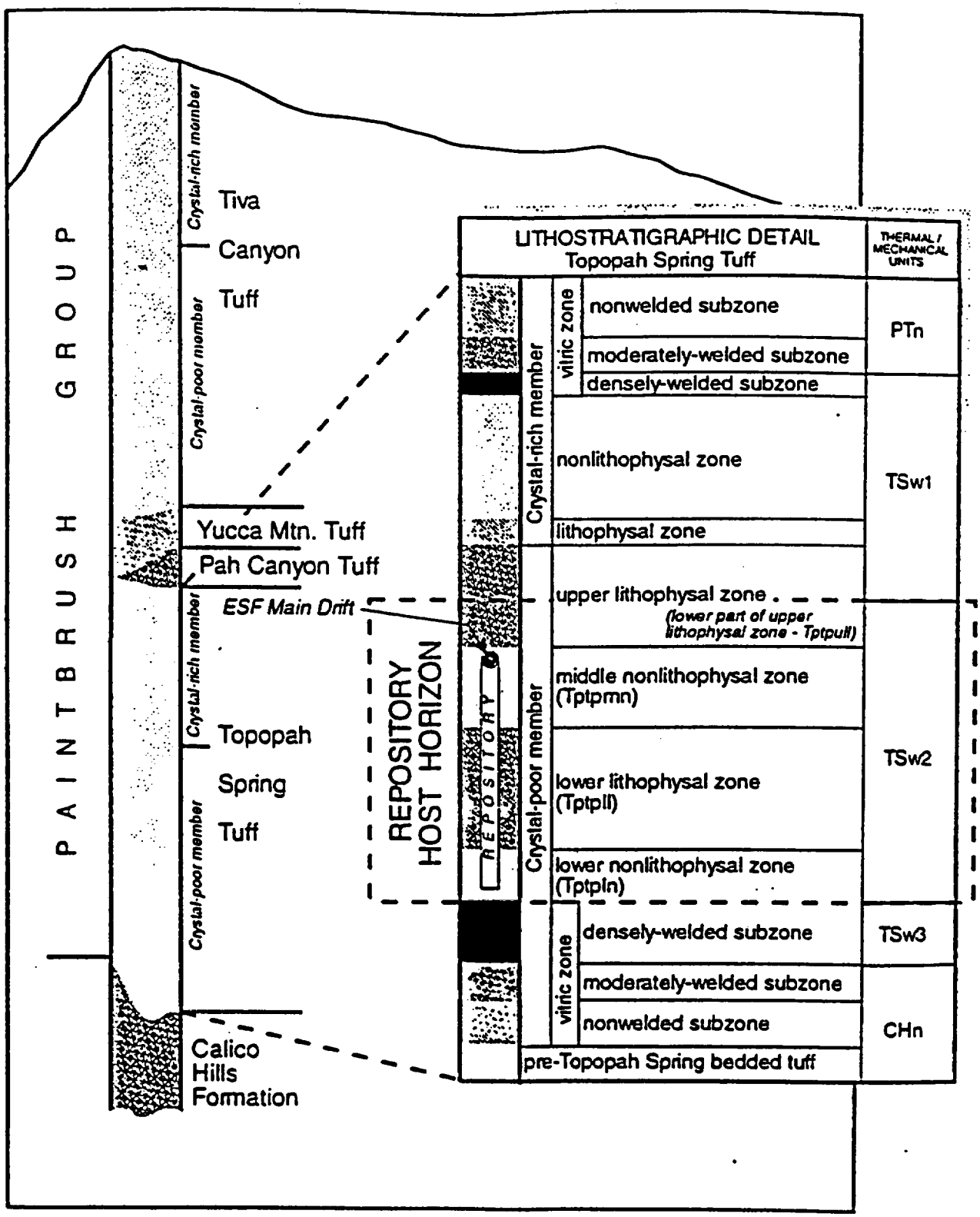
An E-W cross-drift would provide information about the SCF at the repository level, and would also be the means to discover any currently unknown north-south trending structures in the upper block.

GENERAL DISCUSSION

The 1993 document which laid out the reasoning for going to the current layout, and provided the basis for baselining the ESF/GROA concept, emphasized the idea of cross-block drifting. *(Description and Rationale for Enhancement to the Baseline ESF Configuration, B00000000-01717-0200-00089, Rev 01)* There were cross drifts at both the north and south ends of the block in recognition that conditions may be different at these extremes. We don't know any more about the west side of the block now than we did in 1993. A single cross drift, though not as effective as the two cross drifts, will provide significant information regarding conditions on the west side of the block.

Reasons for cross-drifting:

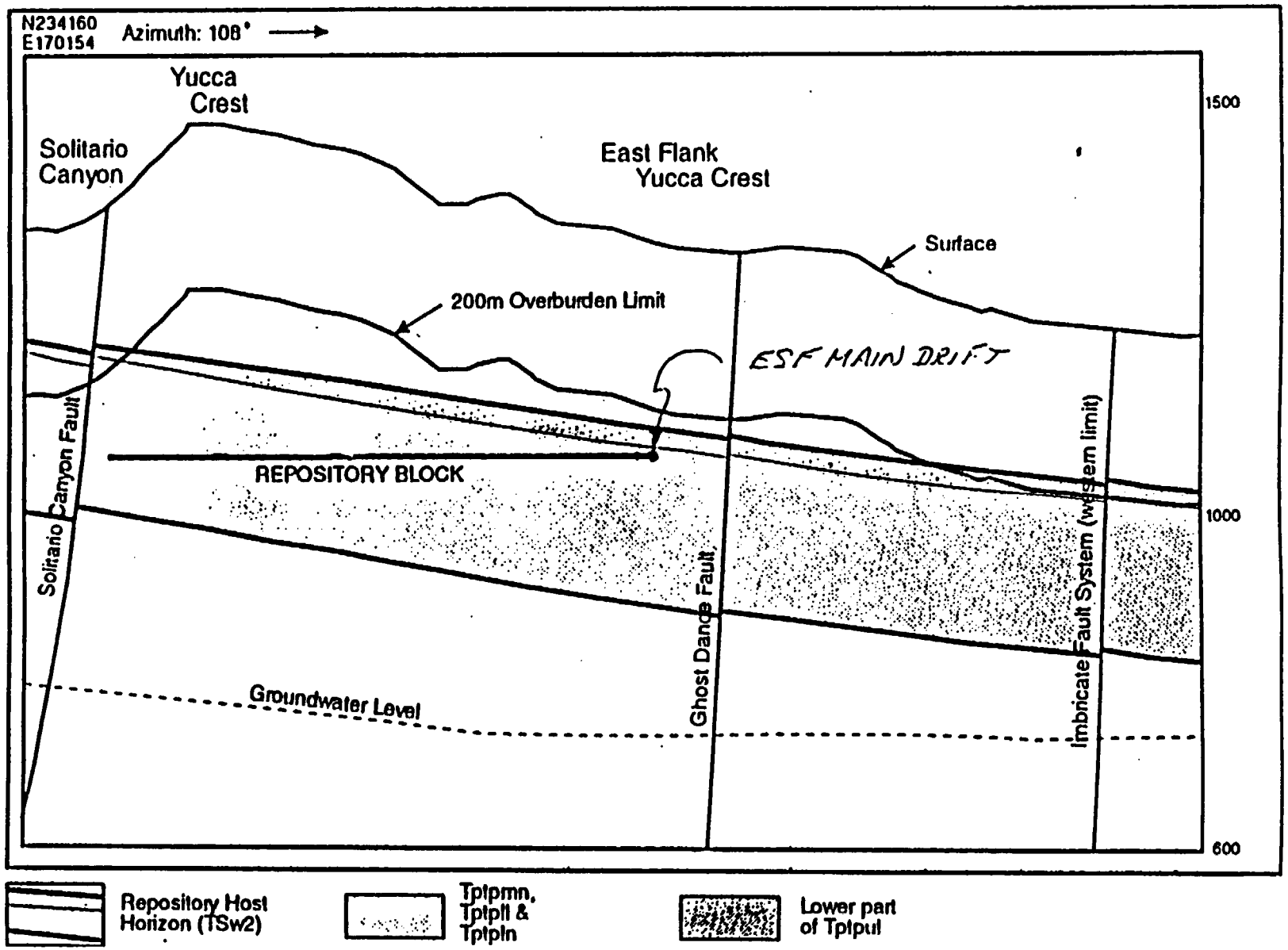
- Cross-drifting in the upper block would increase confidence because the repository LA design would be based, at least in part, on actual, as opposed to anticipated, conditions.
- The cross-drift could allow examination of/tunneling in all sub-units of the TSw2
- Discovery of north-south trending features, if any, would be enabled by the cross-drift
- The drift would allow characterization of the SCF, and a second penetration of the Drill Hole Wash Structure
- A cross-drift (particularly in the north end), if properly placed, sized, and constructed, could subsequently be used as a primary Performance Confirmation (PC) monitoring drift.



STRATIGRAPHIC NOMENCLATURE

FIGURE 1

FIGURE 2



REPOSITORY CROSS SECTION

Enhanced Characterization of the Repository Block
Integrated Planning CommitteeMeeting
3/24/97 8:00am-9:00am
Room 1275

Meeting Minutes

The meeting was held for the purpose of validating the Objective Statement for the Enhanced Characterization of the Repository Block. Those in attendance are are listed on the two attached sign-in sheets. The following draft objective statement was distributed and discussed.

Objective:

Develop a recommended approach for the enhanced site characterization effort incorporating the appropriate drifting, test alcoves, and subsurface boreholes, surface boreholes, and other investigations. The approach should address work that will enhance scientific understanding of the behavior of the site, as well as enhance understanding of engineering; construction, health and safety; cost; and regulatory and performance aspects of the potential repository. The study should consider the relationship between ongoing characterization activities, particularly how the current programs could complement and be complemented by the enhanced characterization effort. The approach should identify data needs that would support more rigorous compliance demonstrations for the siting criteria, design criteria, performance objectives, and Safety Analysis Report content requirements in the disposal regulations (10 CFR Part 60), while avoiding limitations on characterization activities listed in 10 CFR 60.15(c). It should also address potential efficiencies in the enhanced program by providing for additional or subsequent characterization efforts. It should reflect the latest scientific understanding of the behavior of the site. The extent to which enhancements in the program can confirm the data supporting the Viability Assessment also should be incorporated into the prioritization of integrated activities.

The discussion yielded the revised Objective statement below.

Objective:

The objective of the enhanced site characterization effort is to enhance scientific understanding of the behavior of the site, as well as enhance understanding of: engineering; construction, health and safety; cost; and regulatory and performance aspects of the potential repository.

A planning effort will develop a recommended integrated functional approach for an enhanced site characterization effort incorporating the appropriate drifting, test alcoves and subsurface boreholes, surface boreholes, and other investigations. The planning approach will consider the relationship between ongoing characterization activities, particularly how the current programs could complement and be complemented by the enhanced characterization effort. The approach should identify data needs that would strengthen the licensing basis for the siting criteria, design criteria, performance objectives, and Safety Analysis Report content requirements in the disposal regulations (10 CFR Part 60), while avoiding limitations on characterization activities listed in

Enhanced Characterization of the Repository Block
Integrated Planning CommitteeMeeting
3/24/97 8:00am-9:00am
Room 1275

Meeting Minutes(cont)

10CFR60.15(c). It should also address any potential efficiencies that could be gained from the enhanced program to support future activities. It will reflect the latest scientific understanding of the behavior of the site. The extent to which enhancements in the program can confirm the data supporting the Viability Assessment will be incorporated into the prioritization of integrated activities.

Vince Iorii indicated that a Level 1 Baseline Change Proposal had been approved which moved the completion date of the East-West drift from 1999 to 1998 in the Long Range Plan.

Minutes recorded by James R. Beyer JRBeyer

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
INTEGRATED PLANNING COMMITTEE MEETING
MARCH 24, 1997
8:00 - 9:00AM, Rm 1275

NAME	ORG	PHONE
JIM BEYER	M&O SC&O PE	5-5395
Michael Voegele	M&O	5-5520
Bob Sandifer	M&O SC&O	55504
Mark VanDenPlas	DOE AMESH	45563
Vincent F Iorii	DOE/AMMAM	4-1470
DENNIS R. WILLIAMS	DOE/AML	4-1417
RICHARD D SNELL	M&O/E&I	5-5601
NED Z. ELKINS	M&O SPO	5-3403
Ken Ashe	M&O Licensing	5-5563

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
INTEGRATED PLANNING COMMITTEE MEETING
MARCH 24, 1997
8:00 - 9:00AM, Rm 1275

NAME	ORG	PHONE
JEFFREY M. SKOV	M&O/SA/DIE	5-4205
BILL KENNEDY	MK-ESF DESIGN	5-4240
Ralph Rogers	M&O/SPO	5-5785
MARSHALL Bishop	MTS	4-1389
D.R. Chandler	M&O Support Ops	5-5603
JERRI ADAMS	DOE/AMAAM	4-1481
Tim Houseworth	M&O/PA	5-4638
Dick Spence	DOE/OPC	4-1436

Enhanced Characterization of the Repository Block
Integrated Planning CommitteeMeeting
3/27/97 3:00pm-5:00pm
Room 1257

Meeting Minutes

The meeting was held for the purpose of beginning the validation process of the criteria/assumptions for the Enhanced Characterization of the Repository Block. Those in attendance are are listed on the two attached sign-in sheets.

A compiled list of the criteria developed by each working group was distributed to the committee(preliminary draft copy attached dated 3/26/97, 1:30pm). There was concern raised by several committee members regarding the initial number of criteria and whether this was a managable number.

Jim Houseworth indicated that the Performance Assessment criteria were prioritized.

Mike Voegele indicated that he felt there was considerable overlap between the criteria of the various working groups. It was agreed that we would have one consolidated criteria list to continue with the planning. A draft of a consolidated criteria list by working group was distributed by Lotus Notes (copy attached Lotus Notes dated 3/27/97, 4:58pm, criteria dated 3/27/97, 4:30 pm mdv consolidation no. 2). Mike also attempted to remove any bias as to the ultimate architecture or final solution.

No assumptions were presented and it was restated that any assumptions should be associated with the process not the architecture.

Ralph Rogers (Testing Working Group) indicated he would send out a list of testing priorities.

Comments from the committee were requested tobe submitted by COB 3/31/97 and a followon meeting would be scheduled.

Minutes recorded by James R. Beyer James R Beyer

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
INTEGRATED PLANNING COMMITTEE MEETING
CRITERIA/ASSUMPTIONS VALIDATION
MARCH 27, 1997
3:00 - 5:00 pm, RM 1257

NAME	ORG	PHONE
JIM BEYER	M&O C&O PE	5-5395
ROBERT WEMHOFER	M&O SAFETY ASSURANCE	5-3966
BILL Kennedy	M&O MGDS Design	5-4240
Ken Ashe	M&O Licensing	5-5563
JERRI ADAMS	DOE/AMAAM	4-1483
Jim Houseworth	M&O/PA	5-4638
Ralph Rogers	M&O/SPO	5-5785
Mike Lugo	M&O/Reg.	5-4761
Bob Sandifer	M&O/SC&O	55504

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
INTEGRATED PLANNING COMMITTEE MEETING
CRITERIA/ASSUMPTIONS VALIDATION
MARCH 27, 1997
3:00 - 5:00 pm, RM 1257

NAME	ORG	PHONE
Vincent F. Iorii	DOE/RAMAAM	4-1470
Mark E. Van De Pay	DOE/AMESH	45563
Dennis R. Williams	DOE/AML	4-1417
Michael D Voegele	M&O	5-5520
Richard D Snell	M&O/E&I	5-5601
Larry Hayes	M&O/SPO	5-5604
Marshall C Bishop	BAH/MTS	4-1389

PRELIMINARY DRAFT

3/26/97
1:30PM

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK CONSOLIDATED CRITERIA/ASSUMPTIONS LIST

Testing Working Group

Criteria

Are there location or layout specific considerations, including appropriate drifting, test alcoves, and subsurface boreholes, surface boreholes, and other investigations, that can enhance the scientific understanding of the site relative to:

1) fracture variability.

2) unexposed faults.

3) hydrologic properties, fracture properties and geotechnical properties in and near faults.

4) the characterization of the spatial distribution of moisture tension and saturation.

5) the age and distribution of perched water.

6) alternative conceptual models of perched water formation.

7) the distribution and mineralogy of fracture fillings.

8) the age and genesis of fracture filling minerals.

9) the distribution of environmental isotopes from systematic and feature based samples.

10) the spatial distribution of percolation flux.

11) fracture and matrix components of flow.

12) flow into openings.

13) temperature gradients in the repository block.

14) gas ages and flow patterns/distribution of gaseous environmental isotopes.

15) infiltration and percolation in and around faults.

16) pressure and chemical gradients and flow in the SZ in and around faults.

17) flow patterns in the UZ below the repository horizon.

18) the distribution and continuity of zeolitization in the Calico Hills Tuff.

19) the hydrochemistry of the UZ below the repository horizon.

20) the location and origin of the LHG north of the repository block.

21) dilution, mixing and flux distribution in the SZ.

22) the hydrochemistry of the SZ.

23) the spatial distribution of thermal and geomechanical properties of the repository horizon.

24) the location and continuity of stratigraphic contacts in the expanded repository block.

25) the distribution of hazardous minerals in ventilation, air and the rock mass.

Assumptions

Performance Assessment Working Group

Criteria

Are there location, layout, or test program specific considerations for enhanced characterization that can enhance the understanding of the site relative to:

1) water seepage into drifts to better define the mode of water contact with waste packages and the mode of potential radionuclide transport?

2) the distribution and concentration of environmental tracers in the PTn to better define the extent of fast transport pathways through the PTn?

3) the flux distribution, hydrogeologic and transport properties, and chemical and isotopic composition of the saturated zone?

4) the distribution and concentration of environmental tracers (perhaps traced construction water also), hydrogeologic properties, and fracture/matrix flow distribution in the CHnv (and CHnz if possible) to better define fast pathways for radionuclide movement below the repository horizon?

5) transport through a perforated waste package to see if radionuclide releases from waste packages can occur through the initial pinhole perforations?

6) in-drift water movement in the presence of a drip shield to better define the effects of such a barrier on water contact with waste packages and its potential effect on radionuclide releases?

7) cathodic protection to better define the effects on waste package corrosion?

8) the geochemical environment in the drifts (including the interaction with cement) to better define conditions affecting radionuclide solubilities and waste package corrosion?

9) water and tracer movement through welded and nonwelded tuff containing natural fractures to better define fracture/matrix interaction?

10) the geochemical and isotopic water composition along stratigraphic contacts to help bound the potential for lateral diversion of water and/or radionuclide pathways in the unsaturated zone?

11) the effects of EBS materials and waste heat on the geochemical environment outside the drift to better define the influence of the altered zone on radionuclide transport characteristics (solubilities, sorption, colloidal interactions) in the unsaturated zone?

12) the distribution of vitric/zeolitic rocks in the south and west portions of the block to better define potential for radionuclides to bypass zeolites?

13) the large hydraulic gradient, including distinguishing between perched water and the water table, and hydrogeologic properties in this area?

14) the unsaturated and saturated zone flow in and around Solitario Canyon Fault to better define the role of the fault as a potential pathway for radionuclides in the unsaturated zone and its role in the saturated zone relative to the moderate hydraulic gradient?

15) the identification and characterization of any pre-Tiva Canyon faults as potential fast pathways through nonwelded units?

<u>Assumptions</u>

Licensing/Regulatory Working Group

Criteria

1) **Are there location, layout, or test program specific considerations for ~~an east-west drift~~ enhanced characterization ~~that can enhance understanding of the site relative to~~ to ensure that additional drifts or excavations do not violate the 200 meter overburden disqualifying condition of 10 CFR Part 960? [960.4-2-5(d)]** [Note: There should be no need to enhance understanding relative to this condition; we know the surface topography. This criterion should only make sure that the project is careful to keep any new diggings below 200m. Compare underground surveying data to surface elevations. Shafts, boreholes, and their seals are excluded from this condition.]

2) **Are there location, layout, or test program specific considerations ~~for an east-west drift~~ that can enhance the understanding of the site relative to necessary controls to limit impacts to the waste isolation characteristics of the site?**

3) Are there location, layout, or test program specific considerations for an enhanced program that could strengthen the understanding of the site relative to the performance confirmation requirements in 10 CFR Part 60 to show that conditions have not varied beyond the limits assumed for design and to show that conditions are within the limits assumed for design? [The notion is to determine whether construction of the enhanced characterization facility(s) could provide facilities or opportunities to collect additional baseline data that could be used in compliance demonstrations for the performance confirmation requirements.]

4) Are there location, layout, or test program specific considerations for an enhanced program that can strengthen the understanding of the site relative to the requirements for underground records in 10 CFR 60.72 such that construction of another drift during site characterization could fulfill level of detail requirements (TBD) needed to satisfy some of the construction records requirements?

5) Are there location, layout, or test program specific considerations for the enhanced program that might compromise the ability to demonstrate compliance with the requirements of 10 CFR 60.15 regarding minimization of disturbances that could compromise repository system performance?

6) Could the additional data collected from the enhanced program compromise the ability to

demonstrate compliance with the siting criteria in 10 CFR 60.122 that require demonstrations that potentially adverse conditions that are present have been adequately investigated and adequately evaluated. [The point here is that data that has not been fully evaluated and integrated into descriptions and models of site features and processes could provide the basis for regulatory agencies or intervenors to question the adequacy and sufficiency of evaluations supporting the VA or the site recommendation, or of compliance demonstrations provided in the License Application.]

7) Are there location, layout, or test program specific considerations for the enhanced program that might be considered as beginning construction of the geologic repository operations area without a construction authorization as identified in 10 CFR Part 60.3? [The point here is that we can not begin "construction on the repository" until we get a Construction Authorization.]

8) Are there location, layout, or test program specific considerations for enhanced characterization to minimize any significant adverse environmental impacts identified in comments on the Site Characterization Plan or in the Environmental Assessment? [NWPA Sec. 113(a)]

9) Are there location, layout, or test program specific considerations for enhanced characterization that demonstrate that the data are required for evaluation of the suitability of the site for an application to be submitted to the NRC for a construction authorization or for compliance with NEPA? [NWPA Sec. 113(c)(1)]

10) Are there location, layout, or test program specific considerations for enhanced characterization to ensure that radioactive materials will not be used at the site without the NRC's concurrence that the use is necessary? [NWPA Sec. 113(c)(2)]

11) Are there location, layout, or test program specific considerations for enhanced characterization such that projected environmental impacts in the affected area can be mitigated to an acceptable degree, taking into account programmatic, technical, social, economic, and environmental factors? [960.5-2-5(a) and (d)]

Assumptions

James Beyer
03/27/97 04:58 PM

To: Robert Sandifer, Richard Snell, Larry Hayes, Jean Younker, Doug Chandler, Jerri Adams, Vince Iorii, Mark VanDerPuy, Dennis Williams, Marshall Bishop, Mike Cline, Ken Ashe, Jim Houseworth, Ned Elkins, William Kennedy, Robert Wemheuer
cc: Peter Hastings, Ralph Rogers, Jeff Skov
Subject: ECRB Criteria

Attached is the consolidated list of criteria that was discussed in the 3:00 meeting today. Please review this list and determine if we have any items missing or items that need clarification and provide me with your comments by COB Monday, 3/31/97. Please remember that this was Mike's attempt to remove any bias as to the ultimate architecture or final solution. Items associated with architecture or the final solution will be addressed as part of the evaluation of benefits and optimize configuration steps.

I will set up a followon meeting for Tuesday or Wednesday next week.

If you have any questions, please call Bob Sandifer, Mike Voegele or myself.

To: James Beyer
cc:
From: Michael Voegele
Date: 03/27/97 04:42:06 PM
Subject:

CRIT3272

3/27/97 4:30 pm
mdv consolidation no. 2

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK CONSOLIDATED CRITERIA/ASSUMPTIONS LIST

Are there location or layout specific considerations, including appropriate drifting, test alcoves, and subsurface boreholes, surface boreholes, and other investigations, that can enhance the scientific understanding of the site relative to:

1) fracture variability?

2) unexposed faults?

3) hydrologic properties, fracture properties and geotechnical properties in and near faults?

4) the characterization of the spatial distribution of moisture tension and saturation?

5) the age and distribution of perched water?

6) alternative conceptual models of perched water formation?

7) the distribution and mineralogy of fracture fillings?

8) the age and genesis of fracture filling minerals?

9) the distribution of environmental isotopes from systematic and feature based samples?

10) the spatial distribution of percolation flux?

11) fracture and matrix components of flow?

12) flow into openings?

13) temperature gradients in the repository block?

14) gas ages and flow patterns and distribution of gaseous environmental isotopes?

15) infiltration and percolation in and around faults?

16) pressure and chemical gradients and flow in the saturated zone in and around faults?

17) flow patterns in the unsaturated zone below the repository horizon?

18) the distribution and continuity of zeolitization?

19) the hydrochemistry of the unsaturated zone below the repository horizon?

20) the location and origin of the large hydraulic gradient north of the repository block?

21) dilution, mixing and flux distribution in the saturated zone?

22) the hydrochemistry of the saturated zone?

23) the spatial distribution of thermal and geomechanical properties of the repository horizon?

24) the location and continuity of stratigraphic contacts in the expanded repository block?

25) the distribution of hazardous minerals in ventilation, air and the rock mass?

26) transport through a perforated waste package to see if radionuclide releases from waste packages can occur through the initial pinhole perforations?

27) in-drift water movement in the presence of a drip shield to better define the effects of such a barrier on water contact with waste packages and its potential effect on radionuclide releases?

28) cathodic protection to better define the effects on waste package corrosion?

29) the geochemical environment in the drifts (including the interaction with cement) to better define conditions affecting radionuclide solubilities and waste package corrosion?

30) the effects of EBS materials and waste heat on the geochemical environment outside the drift to better define the influence of the altered zone on radionuclide transport characteristics (solubilities, sorption, colloidal interactions) in the unsaturated zone?

31) maintaining emplacement drift orientation flexibility?

32) confirming a preferred emplacement drift orientation?

33) demonstrating a cost effective construction approach?

34) demonstrating effective ventilation and dust control?

35) demonstrating an integrated environment, safety and health approach?

36) implementing a performance based approach to design and construction. including a construction based TBM configuration?

37) testing "state of the art" mechanical excavators?

38) traffic problems that could occur with other operational drifts?

39) the ventilation system, including potential connections to the current system?

40) muck handling, including direct connection to current system?

41) storage location and reclamation of the mine muck removed from the drifts?

42) ensuring that additional drifts or excavations do not violate the 200 meter overburden disqualifying condition of 10 CFR Part 960? [960.4-2-5(d)]?

43) enhancing the understanding of the site relative to necessary controls to limit impacts to the waste isolation characteristics of the site?

44) the performance confirmation requirements in 10 CFR Part 60 to show that conditions have not varied beyond the limits assumed for design and to show that conditions are within the limits assumed for design?

45) the requirements for underground records in 10 CFR 60.72 such that construction of another drift during site characterization could fulfill level of detail requirements needed to satisfy some of the construction records requirements?

46) the ability to demonstrate compliance with the requirements of 10 CFR 60.15 regarding minimization of disturbances that could compromise repository system performance?

47) enhancing the ability to demonstrate compliance with the siting criteria in 10 CFR 60.122 that require demonstrations that potentially adverse conditions that are present have been adequately investigated and adequately evaluated?

48) beginning construction of the geologic repository operations area without a construction authorization as identified in 10 CFR Part 60.3?

49) minimizing any significant adverse environmental impacts identified in comments on the Site Characterization Plan or in the Environmental Assessment? [NWPA Sec. 113(a)]

50) projected environmental impacts in the affected area that can be mitigated to an acceptable degree, taking into account programmatic, technical, social, economic, and environmental factors? [960.5-2-5(a) and (d)]

Enhanced Characterization of the Repository Block
Integrated Planning Committee meeting
4/01/97 2:30pm-4:00pm
&
4/02/97 8:30am-10:00am
Room 1257

Meeting Minutes

These meetings were held to continue validating the criteria/assumptions for the Enhanced Characterization of the Repository Block. Those in attendance are listed on the two attached sign-in sheets. Because of committee member's schedules, two meetings were held to allow everyone to address their comments on the criteria.

During the 4/01 meeting, an updated copy of the consolidated criteria list was distributed(copy attached dated 4/1/97, 1:30pm). It was requested that a crosswalk be provided between the consolidated criteria list and the original working group criteria. Jim Beyer agreed to provide this crosswalk. Dick Snell had several comments that were addressed to his satisfaction requiring no changes to the criteria. All present indicated their acceptance of the criteria list as presented. Bob Sandifer then handed out a revised draft of the ECRB Report outline and an example Development Summary (copies attached).

During the 4/02 meeting, the criteria list as agreed to during the 4/01 meeting with the crosswalk to the working group criteria was distributed (copy attached dated 4/2/97, 8:00am). Bob Sandifer handed out the revised draft of the ECRB Report outline and the example Development Summary. Several committee members had comments:

> Vince Iorii - Need more specificity on trying potential repository construction techniques. Can we modify Criteria 33 or 36 or do we need a new criteria? Response - add the following sentence to the end of this criteria "Full consideration is to be given to constructability, operability, and maintainability issues associated with a potential storage facility."
>
> Dennis Williams - Criteria 15 needs some clarification. Response - insert the words "throughout the UZ" after percolation.
>
> Scott Wade - Criteria 34 needs some clarification. Response - change "dust control" to "hazardous minerals/dust control".
>
> Dennis Williams - Criteria 43 needs clarification of the term "major feature". Response - add the word "natural" between major and feature.

All members present were in agreement on the revised criteria. The updated version is to be sent out for final committee concurrence(copy attached dated 4/2/97, 11:00am).

Enhanced Characterization of the Repository Block
Integrated Planning Committee meeting
4/01/97 2:30pm-4:00pm
&
4/02/97 8:30am-10:00am
Room 1257

Meeting Minutes(cont)

A discussion was then held concerning the development of the list of configuration elements that would satisfy the various criteria. Jerri Adams brought up the issue of prioritization of the work. Bob Sandifer indicated that the configuration needs to tie back to Waste Isolation Strategy and the Customer Defined Needs List for WBS 1.2.3.

Bob Sandifer stated that we need to be very crisp and conclusive in describing what data will be available from the ECRB in support of the Viability Assessment.

ECRB
INTEGRATED PLANNING COMMITTEE
CRITERIA/ASSUMPTIONS VALIDATION
APRIL 1, 1997
2^{30} - 4^{00} Rm 1257

NAME	ORG	PHONE
JIM BEYER	M&O C&O PE	5-5395
Dick Spence	DOE/OPC	4-1346
DICK SNELL	M&O/E&I	5-5601
JEFF SKOV	M&O/SAFETY ASSURANCE	5-4205
BILL KENNEDY	M&O/EST DESIGN	5-4240
MITCH BRODSKY	DOE/AML	4-5437
Bob Sandifer	M&O/SC&O	55504
Ken Ashe	M&O/Licensing	5-5563
NED Z. ELKINS	M&O/LANL	5-3403
Ralph Rogers	M&O/SPO	5-5785

ECRB
INTEGRATED PLANNING COMMITTEE
CRITERIA VALIDATION
April 2, 1997
8:30 - 10:00 am

NAME	ORG	Phone
Jim Beyer	M&O C&O PE	5-5395
Vincent F Iorii	DOE/AMAAM	4-1470
Scott Wade	DOE/AMESH	4-5459
JERRI J ADAMS	DOE/AMAAM	4-1481
Jim Houseworth	M&O/PA	5-4638
Ralph Rogers	M&O/SPO	5-5785
DENNIS R WILLIAMS	DOE/AML	4-1417
MARSHALL Bishop	BAH/MTS	4-1389

4/1/97 1:30 pm

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
CONSOLIDATED CRITERIA/ASSUMPTIONS LIST

Are there location or layout specific considerations, including appropriate drifting, test alcoves, and subsurface boreholes, surface boreholes, and other investigations, that can enhance the scientific understanding of the site relative to:

		Working Group Criteria
1)	fracture variability?	TS1,
2)	unexposed faults?	TS2, PA15,
3)	hydrologic properties, fracture properties and geotechnical properties in and near faults?	TS3, PA14, D3
4)	the characterization of the spatial distribution of moisture tension and saturation?	TS4,
5)	the age and distribution of perched water?	
6)	alternative conceptual models of perched water formation?	
7)	the distribution and mineralogy of fracture fillings?	
8)	the age and genesis of fracture filling minerals?	
9)	the distribution of environmental isotopes from systematic and feature based samples?	
10)	the spatial distribution of percolation flux?	
11)	fracture and matrix components of flow and transport?	

12) flow into openings?

13) temperature gradients in the repository block?

14) gas ages and flow patterns and distribution of gaseous environmental isotopes?

15) infiltration and percolation in and around faults?

16) pressure and chemical gradients and flow in the saturated zone in and around faults?

17) flow patterns in the unsaturated zone below the repository horizon?

18) the distribution and continuity of zeolitization?

19) the hydrochemistry of the unsaturated zone below the repository horizon?

20) the location and origin of the large hydraulic gradient north of the repository block?

21) dilution, mixing and flux distribution in the saturated zone?

22) the hydrochemistry of the saturated zone?

23) the spatial distribution of thermal and geomechanical properties of the repository horizon?

24) the location and continuity of stratigraphic contacts in the expanded repository block?

25) the distribution of hazardous minerals in ~~ventilation, air and~~ the rock mass?

26) transport through a perforated waste package to see if radionuclide releases from waste packages can occur through the initial pinhole perforations?

27) in-drift water movement in the presence of a drip shield to better define the effects of such a barrier on water contact with waste packages and its potential effect on radionuclide releases?

28) cathodic protection to better define the effects on waste package corrosion?

29) the geochemical environment in the drifts (including the interaction with cement) to better define conditions affecting radionuclide solubilities and waste package corrosion?

30) the effects of EBS materials and waste heat on the geochemical environment outside the drift to better define the influence of the altered zone on radionuclide transport characteristics (solubilities, sorption, colloidal interactions) in the unsaturated zone?

47) collecting further data to enhance~~ing~~ the ability to demonstrate compliance with ~~the siting criteria in~~ 10 CFR 60.122 that require demonstrations that potentially adverse conditions that are present have been adequately investigated and adequately evaluated?

50) projected environmental impacts in the affected area that can be mitigated to an acceptable degree, taking into account programmatic, technical, social, economic, and environmental factors? [960.5-2-5(a) and (d)]

48) beginning construction of the geologic repository operations area without a construction authorization as identified in 10 CFR Part 60.3?

44) the performance confirmation requirements in 10 CFR Part 60 to show that conditions have not varied beyond the limits assumed for design and to show that conditions are within the limits assumed for design?

45) the requirements for underground records in 10 CFR 60.72 such that construction of another drift during site characterization could fulfill level of detail requirements needed to satisfy some of the construction records requirements?

Are there location or layout specific considerations associated with any drifting, test alcoves and subsurface boreholes, surface boreholes, or other investigations, that must be examined relative to:

31) maintaining emplacement drift orientation flexibility?

32) confirming a preferred emplacement drift orientation?

33) demonstrating a cost effective construction approach?

34) demonstrating effective ventilation and dust control?

35) demonstrating an integrated environment, safety and health approach?

36) implementing a performance based approach to design and construction, including a construction based TBM configuration?

37) testing "state of the art" mechanical excavators?

38) traffic problems that could occur with other operational drifts?

~~39) the ventilation system, including potential connections to the current system?~~
Included in 34

40) muck handling, including direct connection to current system?

41) storage location and reclamation of the mine muck removed from the drifts?

43) ~~enhancing the understanding of the site relative to necessary controls to limit impacts to the waste isolation characteristics of the site?~~
Limiting impacts to major features that may be important to site performance?

51) limiting impacts to availability of alternatives to design features to waste isolation, and promote ultimate compliance with the 10CFR60.21(c)(1)(ii)(D) requirement to provide a comparison of these alternatives.

46) ~~the ability to demonstrate compliance with the requirements of 10 CFR 60.15 regarding minimization of disturbances that could~~

45)	limiting impacts to availability of alternatives to design features to waste isolation, and promote ultimate compliance with the 10CFR60.21(c)(1)(ii)(D) requirement to provide a comparison of these alternatives?	NEW
46)	limiting, during site characterization, impacts to waste isolation, construction-to-test and test-to-test interference, and other requirements derived from 10CFR60.15(c)?	LR5
47)	ensuring that additional drifts or excavations do not violate the 200 meter overburden disqualifying condition of 10 CFR Part 960? [960.4-2-5(d)]?	LR1, D8
48)	the requirements for underground records in 10 CFR 60.72 such that construction of another drift during site characterization could fulfill level of detail requirements needed to satisfy some of the construction records requirements?	LR4
49)	beginning construction of the geologic repository operations area without a construction authorization as identified in 10 CFR Part 60.3?	LR7
50)	minimizing any significant adverse environmental impacts identified in comments on the Site Characterization Plan or in the Environmental Assessment? [NWPA Sec. 113(a)]	LR8

INTERIM REPORT ON THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

TABLE OF CONTENTS

Outline for Section 4.0

4.0 BENEFITS AND CONFIGURATION ANALYSIS

4.1 Testing

4.1.2 Criteria ...

4.1.2.1 Summary
4.1.2.2 Benefits
4.1.2.3 Sources of Data/Information
4.1.2.4 Rationale
4.1.2.5 Risks

4.1.3 Criteria ...

4.1.4 Criteria ...

4.2 Performance Assessment

4.3 Licensing/Regulatory

4.4 Design/Construction

4.5 Design, Construction & Testing Controls and Requirements

Enhanced Repository Block Characterization
Example of Development Summary

Criteria		Benefits	Preferred Source, Alternative Sources	Rational	Risks
No.	Description				
36	Implementing a performance based approach to design and construction, including a construction based TBM Configuration.	Provide an advance rate projection for the future repository TBM excavation work that is more aggressive (thus, less expensive) than what will be assumed based on the 5-mile loop excavation experience. Dust control requirements/ concerns fully addressed prior to any repository construction. Increased confidence in the repository TSLCC.	Preferred Source - TBM Excavation in repository block (not required to be in emplacement horizon) with TBM configured to YMP needs. Alternative Sources - Use data from 5-mile loop excavation experience. - Use data from other similar excavations on other tunnel projects.	Excavated Ground should be as close as possible to the ground expected in the repository excavation. This will assure that the machine configuration that would maximize the advance rate for the repository excavation is clearly defined. Also the dust control features would similarly be optimized.	Schedule imposed on the enhanced repository block characterization will require that the TBM acquisition/ upgrading/mobilization be done in approximately 7 months. This will likely preclude a contractor from acquiring a new machine built specifically to our requirements. Rather, a used machine probably currently under the control of the contractor will be modified as much as practical to meet our requirements. The risk is that the machine may not totally meet all our requirements. However, it is more likely that the modified machine will be close enough to get the vast majority of confirmatory information needed.

NOTE: This is a summary presentation for the ultimate review and closure with the IP Committee and Senior Management. It is assumed more detail is provided elsewhere in our documentation which would be cross referenced on these summary sheets.

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
CONSOLIDATED CRITERIA LIST
CROSSWALK TO WORKING GROUP CRITERIA

Are there location or layout specific considerations, including appropriate drifting, test alcoves, and subsurface boreholes, surface boreholes, and other investigations, that can enhance the scientific understanding of the site relative to:

		Working Group Criteria
1)	fracture variability?	TS1, D5C
2)	unexposed faults?	TS2, PA15, D3
3)	hydrologic properties, fracture properties and geotechnical properties in and near faults?	TS3, PA14, D3, D5B
4)	the characterization of the spatial distribution of moisture tension and saturation?	TS4,
5)	the age and distribution of perched water?	TS5,
6)	alternative conceptual models of perched water formation?	TS6,
7)	the distribution and mineralogy of fracture fillings?	TS7,
8)	the age and genesis of fracture filling minerals?	TS8,
9)	the distribution of environmental isotopes from systematic and feature based samples?	TS9, PA4
10)	the spatial distribution of percolation flux?	TS10,

11)	fracture and matrix components of flow and transport?	TS11, PA9
12)	flow into openings?	TS12, PA1
13)	temperature gradients in the repository block?	TS13,
14)	gas ages and flow patterns and distribution of gaseous environmental isotopes?	TS14,
15)	infiltration and percolation in and around faults?	TS15,
16)	pressure and chemical gradients and flow in the saturated zone in and around faults?	TS16,
17)	flow patterns in the unsaturated zone below the repository horizon?	TS17, PA10
18)	the distribution and continuity of zeolitization?	TS18, PA12, D2
19)	the hydrochemistry of the unsaturated zone below the repository horizon?	TS19, PA10
20)	the location and origin of the large hydraulic gradient north of the repository block?	TS20, PA13, D5A
21)	dilution, mixing and flux distribution in the saturated zone?	TS21, PA3
22)	the hydrochemistry of the saturated zone?	TS22, PA3
23)	the spatial distribution of thermal and geomechanical properties of the repository horizon?	TS23, D1, D4
24)	the location and continuity of stratigraphic contacts in the expanded repository block?	TS24, D1, D4
25)	the distribution of hazardous minerals in ~~ventilation, air and~~ the rock mass?	TS25,
26)	transport through a perforated waste package to see if radionuclide releases from waste	

packages can occur through the initial pinhole perforations? PA5,

27) in-drift water movement in the presence of a drip shield to better define the effects of such a barrier on water contact with waste packages and its potential effect on radionuclide releases? PA6

28) cathodic protection to better define the effects on waste package corrosion? PA7

29) the geochemical environment in the drifts (including the interaction with cement) to better define conditions affecting radionuclide solubilities and waste package corrosion? PA8

30) the effects of EBS materials and waste heat on the geochemical environment outside the drift to better define the influence of the altered zone on radionuclide transport characteristics (solubilities, sorption, colloidal interactions) in the unsaturated zone? PA11

47) collecting further data to enhance~~ing~~ the ability to demonstrate compliance with ~~the siting criteria in~~ 10 CFR 60.122 that require demonstrations that potentially adverse conditions that are present have been adequately investigated and adequately evaluated? LR6

50) projected environmental impacts in the affected area that can be mitigated to an acceptable degree, taking into account programmatic, technical, social, economic, and environmental factors? [960.5-2-5(a) and (d)] LR11

44) the performance confirmation requirements in 10 CFR Part 60 to show that conditions have not varied beyond the limits assumed for design and to show that conditions are within the limits assumed for design? LR3

Are there location or layout specific considerations associated with any drifting, test alcoves and subsurface boreholes, surface

boreholes, or other investigations, that must be examined relative to:

31)	maintaining emplacement drift orientation flexibility?	D6
32)	confirming a preferred emplacement drift orientation?	D7
33)	demonstrating a cost effective construction approach?	C1
34)	demonstrating effective ventilation and dust control?	C2, CR12
35)	demonstrating an integrated environment, safety and health approach?	C3
36)	implementing a performance based approach to design and construction, including a construction based TBM configuration?	C4
37)	testing "state of the art" mechanical excavators?	C5
38)	traffic problems that could occur with other operational drifts?	CR11
~~39)~~	~~the ventilation system, including potential connections to the current system?~~ Included in 34	
40)	muck handling, including direct connection to current system?	CR13
41)	storage location and reclamation of the mine muck removed from the drifts?	CR15
43)	~~enhancing the understanding of the site relative to necessary controls to limit impacts to the waste isolation characteristics of the site?~~ Limiting impacts to major features that may be important to site performance?	LR2
51)	limiting impacts to availability of alternatives to design features to waste isolation, and	

	promote ultimate compliance with the 10CFR60.21(c)(1)(ii)(D) requirement to provide a comparison of these alternatives?	NEW
46)	~~the ability to demonstrate compliance with the requirements of 10 CFR 60.15 regarding minimization of disturbances that could compromise repository system performance?~~ limiting, during site characterization, impacts to waste isolation, construction-to-test and test-to-test interference, and other requirements derived from 10CFR60.15(c)?	LR5
42)	ensuring that additional drifts or excavations do not violate the 200 meter overburden disqualifying condition of 10 CFR Part 960? [960.4-2-5(d)]?	LR1, D8
45)	the requirements for underground records in 10 CFR 60.72 such that construction of another drift during site characterization could fulfill level of detail requirements needed to satisfy some of the construction records requirements?	LR4
48)	beginning construction of the geologic repository operations area without a construction authorization as identified in 10 CFR Part 60.3?	LR7
49)	minimizing any significant adverse environmental impacts identified in comments on the Site Characterization Plan or in the Environmental Assessment? [NWPA Sec. 113(a)]	LR8

To:	Robert Sandifer, Richard Snell, Jean Younker, Larry Hayes, Doug Chandler, Michael Voegele, Jerri Adams, Vince Iorii, Dennis Williams, Scott Wade, Marshall Bishop, Mike Cline, Ken Ashe, Ned Elkins, Peter Hastings, Jim Houseworth, William Kennedy
cc:	Mark VanDerPuy, Jeff Skov, Ralph Rogers
From:	James Beyer
Date:	04/02/97 11:20:20 AM
Subject:	ECRB Criteria Validation

The attached file contains the latest on the ECRB Criteria List as a result of this morning's Committee meeting. For those of you who attended yesterday's meeting, several comments were made this morning. These comments resulted in the redlines you now see in the list. I have also done the cross-walk back to the original compiled Working Group lists.

If you have any further comments, questions or concerns related to the attached criteria list, please let me know by 8:00am tomorrow (4/3). If I have not received any comments by that time, the criteria list will be considered final.

CRITCRWK.

4/2/97 11:00 am

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
CONSOLIDATED CRITERIA LIST
CROSSWALK TO WORKING GROUP CRITERIA

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10)	the spatial distribution of percolation flux?	TS10

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12)	flow into openings?	TS12, PA1
13)	temperature gradients in the repository block?	TS13
14)	gas ages and flow patterns and distribution of gaseous environmental isotopes?	TS14
15)	infiltration and percolation throughout the UZ in and around faults?	TS15
16)	pressure and chemical gradients and flow in the saturated zone in and around faults?	TS16
17)	flow patterns in the unsaturated zone below the repository horizon?	TS17, PA10
18)	the distribution and continuity of zeolitization?	TS18, PA12, D2
19)	the hydrochemistry of the unsaturated zone below the repository horizon?	TS19, PA10
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	packages can occur through the initial pinhole perforations?	PA5,
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47)	collecting further data to enhance the ability to demonstrate compliance with 10 CFR 60.122 that require demonstrations that potentially adverse conditions that are present have been adequately investigated and adequately evaluated?	LR6
50)	projected environmental impacts in the affected area that can be mitigated to an acceptable degree, taking into account programmatic, technical, social, economic, and environmental factors? [960.5-2-5(a) and (d)]	LR11
44)	the performance confirmation requirements in 10 CFR Part 60 to show that conditions have not varied beyond the limits assumed for design and to show that conditions are within the limits assumed for design?	LR3

Are there location or layout specific considerations associated with any drifting, test alcoves and subsurface boreholes, surface

boreholes, or other investigations, that must be examined relative to:

31)	maintaining emplacement drift orientation flexibility?	D6
32)	confirming a preferred emplacement drift orientation?	D7
33)	demonstrating a cost effective construction approach?	C1
34)	demonstrating effective ventilation and hazardous minerals/dust control?	C2, CR12
35)	demonstrating an integrated environment, safety and health approach?	C3
36)	implementing a performance based approach to design and construction, including a construction based TBM configuration? Full consideration is to be given to constructability, operability, and maintainability issues associated with a potential storage facility.	C4
37)	testing "state of the art" mechanical excavators?	C5
38)	traffic problems that could occur with other operational drifts?	CR11
39)	Included in 34	
40)	muck handling, including direct connection to current system?	CR13
41)	storage location and reclamation of the mine muck removed from the drifts?	CR15
43)	Limiting impacts to major natural features that may be important to site performance?	LR2
51)	limiting impacts to availability of alternatives to design features to waste isolation, and promote ultimate compliance with the 10CFR60.21(c)(1)(ii)(D) requirement to provide a comparison of these alternatives?	NEW

46)	limiting, during site characterization, impacts to waste isolation, construction-to-test and test-to-test interference, and other requirements derived from 10CFR60.15(c)?	LR5
42)	ensuring that additional drifts or excavations do not violate the 200 meter overburden disqualifying condition of 10 CFR Part 960? [960.4-2-5(d)]?	LR1, D8
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Enhanced Characterization of the Repository Block
Integrated Planning CommitteeMeeting
4/09/97 3:00am-4:30am
&
4/14/97 11:00am-12:30pm
Room 1257

Meeting Minutes

These meetings were held to discuss and utimately validate the benefits for the Enhanced Characterization of the Repository Block. Those in attendance are are listed on the three attached sign-in sheets. Distributed the attached flowchart describing the process for reaching an optimum configuration and the DRAFT Benefits compilation.

We discussed the need to make sure we appropriately address the priority of items not just the number of criteria satisfied.

A discussion occurred regarding the benefits section related to the control/requirements criteria. It was agreed to change the heading title to Benefits/Constraints to more accurately reflect the impact associated with each criteria.

The Testing & PA WGs indicated that they would resubmit their benefits statements on Friday, 4/11 with appropriate clarifications regarding timing of information related to VA and LA. It was agreed that we would reconvene on Monday, 4/14 to review the revised benefits.

Meeting was reconvened at 11:00am, Monday, 4/14. Discussed a new proposed criteria requested by the PA Working Group. The criteria and benefits statement follow:

> New) the effects of cladding on radionuclide dissolution and mobilization?
>
> Benefit: Estimate the effectiveness of cladding for reduction in radionuclide dissolution and mobilization. This is very important to PA. Recent performance assessment calculations have shown that cladding may have an important role in reducing the rate of radionuclide dissolution and mobilization. However, existing data to support cladding degradation models primarily rely on results from short-term dry storage conditions which lack the environmental conditions that the cladding may encounter for longer times in the potential repository environment.

The group agreed to add this criteria. It will become criteria number 26A.

Handed out the revised Testing and PA Working Group benefits (copy dated April 14, 1997) and discussed. No comments. Benefits approved as final.

Minutes recorded by James R. Beyer. JRB

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
INTEGRATED PLANNING COMMITTEE
BENEFITS VALIDATION
APRIL 9,1997, 3:00 - 4:00
RM 1257

NAME	ORG	PHONE
Jean Younker	Reg.	5 - 5497
Bob Sandifer	SC&O	55504
Ralph Rogers	SPO	55785
[illegible]	DOE/OPC	4-1436
[illegible]	DOE/AMAAM	4-1483
Marshall Bishop	MTS	4-1389
Tommy Touchstone	SC&O	5-5592
Ken Ashe	M&O/Licensing	5-5563
K. Michael Cline	MTS	4 5481

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK
INTEGRATED PLANNING COMMITTEE
BENEFITS VALIDATION
APRIL 9,1997, 3:00 - 4:00
RM 1257

NAME	ORG	PHONE
Jim Beyer	M&O C&O PE	5-5395
Vincent F Iorii	DOE/AMAAM	4-1470
Michael Voegele	M&O	5-5520
Bill Kennedy	M&O	5-4240
Jim Houseworth	M&O/PA	5-4638
Peter Hastings	M&O/SA	5-3961
Scott Wade	DOE/AMESH	4-5459
Dennis R. Williams	DOE/AML	4-1417
Richard Crowe	DOE/AMVA	4-1488

INTEGRATED PLANNING COMMITTEE
4/14/97
11:00 - 12:30

JIM Beyer	M&O C&O PE	5-5395
VINCENT Iorii	DOE	4-1470
Jim Hauseworth	M&O / PA	5-4638
DICK SAELL	M&O / E&I	5-5601
Jean Younker	M&O	5-5497
BILL KENNEDY	M&O	5-4240
Michael Voegele	M&O	5-5520
Bob Barton	DOE	4-1455
Dick Spence	DOE/OPC	4-1436
Ralph Rogers	M&O/SPO	5-5785
Peter Hastings	M&O/SC	5-3961
Bob Smalifat	M&O/SC&O	5-5504
NED Z. ELKINS	M&O / LANL	5-3403
Larry Hayes	M&O/SFO	5-5009
Ker Asre	M&O	5-5563
Raymond Melc (for Cline & Crann)	MTS/BAH	4-5579
JACK NESBITT	M&O/PROD CONTROL	5-5485

Individual Working Group
Criteria Listings

Testing

1) Fracture variability

Design/Construction

5c) ---------

Consolidated Criteria List

	Ind. Working Group Cross Ref.
1) Fracture variability	TS1, D5C
2) ----------	

Guidance on timing for data to support VA and for data to support LA

Individual Working Group Development Summary - Working Group: Testing

Consol. Criteria List Ref. No.	Description	Benefits	For Investigative Criteria Preferred Source, Alternative Source(s)	For Controls/Req's Criteria Affected Investigative Criteria	*Rationale	Risks
1)	Fracture variability		Preferred source - Borehole, Loc. XYZ	N/A		

1 A

A

Optimization of Configuration
Initial Compilation

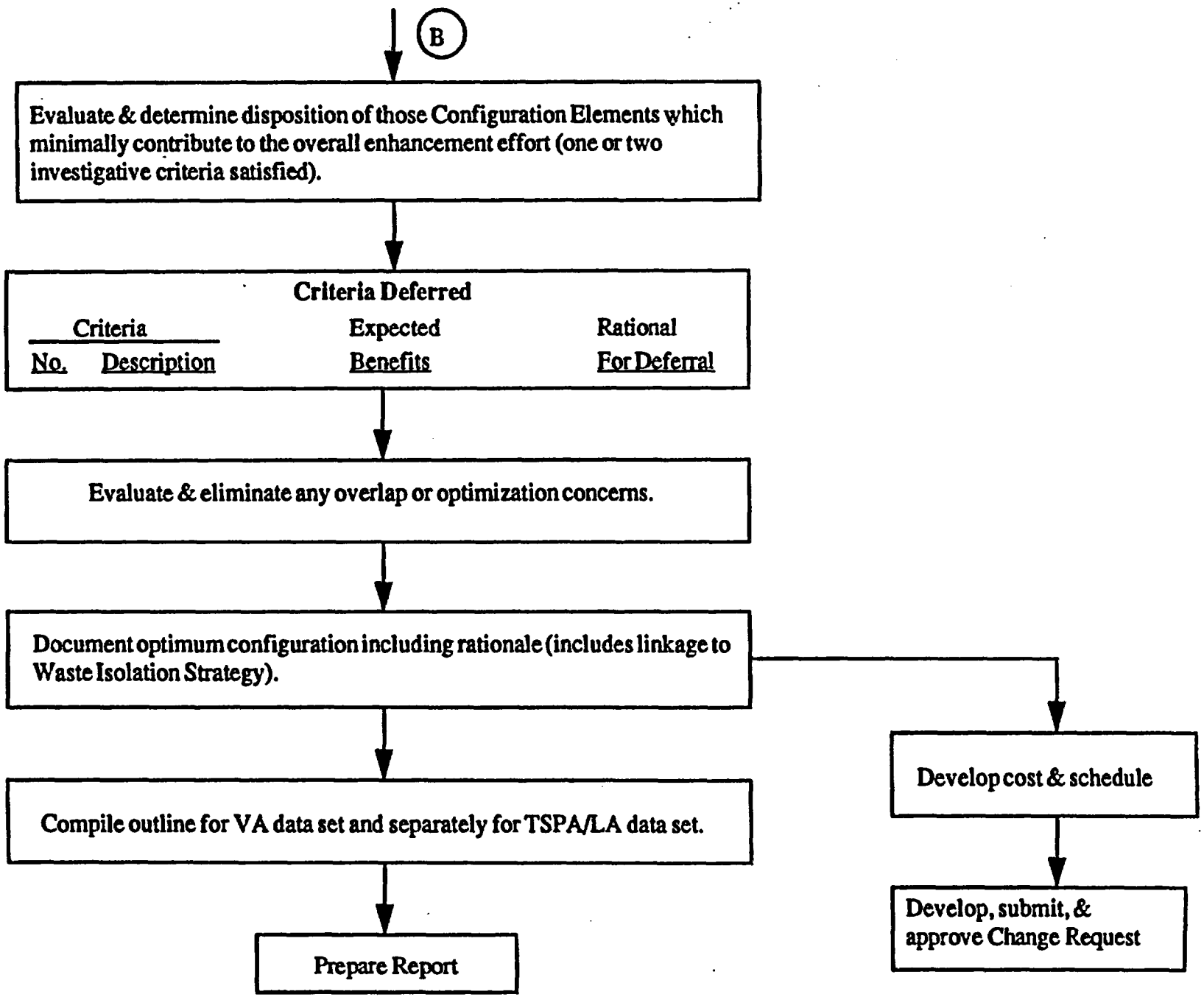
Config. Element	Investigative Criteria Satisfied: Pref. Source Avail./ Indiv. WG Dev. Summary Cross Ref.	Investigative Criteria Satisfied: Alt. Source Avail./ Indiv. WG Dev. Summary Cross Ref.	Applicable Controls & Req's Criteria/WG Dev. Summary Cross Reference: No.	Sheet No.	Description	*Rationale Summary
Borehole, Loc. XYZ	1 (sheet 1)	29 (sheet 12)	43	37	Limiting impacts to major features	---------
	6 (sheet 13)	40 (sheet 31)				---------
	18 (sheet 20)	41 (sheet 32)				---------

Rank order Configuration Elements according to how many investigative criteria are satisfied. Retabulate listing in rank order.

Evaluate controls/requirements for disqualifiers and re-rank.

B

* Includes linkage to Waste Isolation Strategy.


B
Evaluate & determine disposition of those Configuration Elements which minimally contribute to the overall enhancement effort (one or two investigative criteria satisfied).
Criteria Deferred
Criteria
No.
Description
Expected
Benefits
Rational
For Deferral
Evaluate & eliminate any overlap or optimization concerns.
Document optimum configuration including rationale (includes linkage to Waste Isolation Strategy).
Compile outline for VA data set and separately for TSPA/LA data set.
Prepare Report
Develop cost & schedule
Develop, submit, & approve Change Request

DRAFT

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

BENEFITS

APRIL 9, 1997

DRAFT

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

BENEFITS

TABLE OF CONTENTS

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
1) fracture variability	Repository Design 3-D Rock Characteristics Models Mechanical stability and engineering design of drifts (10)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
2) unexposed faults	Repository Design 3-D Geologic Model UZ Flow Model Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
3) hydrologic properties, fracture properties and geotechnical properties in and near faults.	Repository Design UZ Flow Model SZ Flow Model Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3) Mechanical stability and engineering design of drifts (10)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
4) the characterization of the spatial distribution of moisture tension and saturation.	UZ Flow Model Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
5) the age and distribution of perched water.	UZ Flow Model Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3) UZ fracture/matrix flow and advective and diffusive transport at and below the repository horizon. (5)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

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6) alternative conceptual models of perched water formation.	UZ Flow Model UZ fracture/matrix flow and advective and diffusive transport at and below the repository horizon. (5)				

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DEVELOPMENT SUMMARY TESTING WORKING GROUP

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7) the distribution and mineralogy of fracture fillings.	UZ Flow Model Long-term seepage into drifts and in-drift humidity in the post thermal phase; etc. (1) Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
8) the age and genesis of fracture filling minerals.	UZ Flow Model Long-term seepage into drifts and in-drift humidity in the post thermal phase; etc. (1) Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3)				

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9) the distribution of environmental isotopes from systematic and feature based samples	UZ Flow Model UZ Transport Model Long-term seepage into drifts and in-drift humidity in the post thermal phase; etc. (1) Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3)				

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ENHANCED REPOSITORY BLOCK CHARACTERIZATION
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CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
11) fracture and matrix components of flow and Transport.	UZ Flow Model UZ Transport Model Long-term seepage into drifts and in-drift humidity in the post thermal phase; etc. (1) Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
12) flow into openings.	Near Field Environment Models Long-term seepage into drifts and in-drift humidity in the post thermal phase; without perturbations due to heat but considering future climate change and permanent changes due to repository heat release (variable in space and time). (1) Environmental conditions in the drifts (pH, Eh, temperature, chemistry, relative humidity, radiation, and nutrients). (4)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
13) temperature gradients in the repository block.	UZ Flow Model Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
14) gas ages and flow patterns/distribution of gaseous environmental isotopes.	UZ Flow Model Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
15) infiltration and percolation throughout the UZ in and around faults.	UZ Flow Model Percolation flux in the unsaturated zone at the site scale, from land surface to the water table; including temporal and spatial variability, fracture/matrix interactions, and definition of fast and preferential flow pathways. (3) UZ fracture/matrix flow and advective and diffusive transport at and below the repository horizon. (5)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
16) pressure and chemical gradients and flow in the SZ in and around faults.	SZ Flow Model SZ Transport Model SZ flux distribution - spatial and temporal - for regional and site-scale transport models. (6) SZ fracture/matrix flow and advective and diffusive transport. (7)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
17) flow patterns in the UZ below the repository horizon.	UZ Flow Model UZ Transport Model UZ fracture/matrix flow and advective and diffusive transport at and below the repository horizon. (5)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
18) the distribution and continuity of zeolitization.	3-D Mineralogy Model UZ Transport Model UZ fracture/matrix flow and advective and diffusive transport at and below the repository horizon. (5) UZ and SZ solubility and retardation of key radionuclides (such as Np, Pu) and colloids. (9)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
19) the hydrochemistry of the UZ below the repository horizon.	UZ Flow Model UZ Transport Model UZ fracture/matrix flow and advective and diffusive transport at and below the repository horizon. (5) UZ and SZ solubility and retardation of key radionuclides (such as Np, Pu) and colloids. (9)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
20) the location and origin of the Large Hydraulic Gradient north of the repository block.	SZ Flow Model SZ flux distribution - spatial and temporal - for regional and site-scale transport models. (6)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
21) dilution, mixing and flux distribution in the SZ.	SZ Flow Model SZ Transport Model SZ flux distribution - spatial and temporal - for regional and site-scale transport models. (6) SZ fracture/matrix flow and advective and diffusive transport. (7)				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
22) the hydrochemistry of the SZ.	SZ Flow Model SZ Transport Model SZ flux distribution - spatial and temporal - for regional and site-scale transport models. (6) SZ fracture/matrix flow and advective and diffusive transport. (7)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
23) the spatial distribution of thermal and geomechanical properties of the repository horizon.	3-D Rock Characteristics Models Repository Design 3-D Mineralogy Model Mechanical stability and engineering design of drifts. (10)				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
24) the location and continuity of stratigraphic contacts in the expanded repository block.	3-D Geologic Model 3-D Mineralogy Model				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY TESTING WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
25) the distribution of hazardous minerals in the rock mass.	ES&H Repository Design 3-D Mineralogy Model				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY PERFORMANCE ASSESSMENT WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
2) unexposed faults? (15)	Identification and characterization of potential fast pathways.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
3) hydrologic properties, fracture properties and geotechnical properties in and near faults? (14)	Bound the role of faults as potential pathways for radionuclides in the unsaturated zone and their role in the saturated zone as preferential pathways or barriers to flow and transport.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
5) the age and distribution of perched water?	Determine transport rate and direction through the unsaturated zone.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
6) alternative conceptual models of perched water formation?	Determine if perched water bodies grow or deplete under future climate conditions and the transport characteristics for radionuclides migrating through perched water bodies.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
8) the age and genesis of fracture filling materials?	Provides information on past flow paths through the unsaturated zone.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
9) the distribution of environmental isotopes from systematic and feature based samples? (2,4)	Determine the extent of fast transport pathways through nonwelded units. Estimate the potential for lateral diversion of water and/or radionuclide pathways in the unsaturated zone.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
10) spatial distribution of infiltration flux?	Incorporate the spatial variability of percolation flux in flow and transport modeling for performance predictions.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
11) fracture and matrix components of flow and transport? (9)	Determine fracture/matrix interaction for water flow and aqueous radionuclide transport in the UZ.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
12) flow into openings? (1)	Define the likelihood of water contact modes with waste packages and the likelihood of advective radionuclide transport through the engineered barrier system.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
15) infiltration and percolation throughout the UZ in and around faults?	Provide estimates for levels of percolation flux and radionuclide transport parameters along faults.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
17) flow patterns in the unsaturated zone below the repository horizon? (10)	Estimate the potential for lateral diversion of water and/or radionuclide pathways in the unsaturated zone.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
18) the distribution and continuity of zeolitization? (12)	Estimate the potential for aqueous radionuclide transport through the unsaturated zone to bypass zeolites.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
19) the hydrochemistry of the unsaturated zone below the repository horizon? (10)	Estimate chemical transport parameters (e.g. adsorption and matrix diffusion) and fracture/matrix interaction.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
20) the location and origin of the large hydraulic gradient north of the repository block? (13)	Distinguish between conceptual models for the large hydraulic gradient.				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY PERFORMANCE ASSESSMENT WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
21) dilution, mixing and flux distribution in the saturated zone? (3)	Estimate physical transport parameters, including flow rate, velocity, and dispersion, for the saturated zone.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
22) the hydrochemistry of the saturated zone? (3)	Estimate chemical transport parameters (e.g. adsorption and matrix diffusion), mineral distribution, and fracture/matrix interaction for the saturated zone. Determine sources of water and flow paths throughout the saturated zone.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
26) transport through a perforated waste package to see if radionuclide releases from waste packages can occur through the initial pinhole perforations? (5)	Bound the potential for radionuclide releases from waste packages through the initial pinhole perforations.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
27) in-drift water movement in the presence of a drip shield to better define the effects of such a barrier on water contact with waste packages and its potential effect on radionuclide releases? (6)	Estimate the effectiveness of such a barrier on water contact with waste packages and its potential effect on radionuclide releases.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
28) cathodic protection to better define the effects on waste package corrosion? (7)	Bound the potential improvement for waste package corrosion.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
29) the geochemical environment in the drifts (including the interaction with cement) to better define conditions affecting radionuclide solubilities and waste package corrosion? (8)	Bound the geochemical conditions that may affect radionuclide solubilities and waste package corrosion.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
30) the effects of EBS materials and waste heat on the geochemical environment outside the drift to better define the influence of the altered zone on radionuclide transport characteristics (solubilities, sorption, colloidal interactions) in the unsaturated zone?(11)	Bound changes to radionuclide transport characteristics (solubilities, sorption, colloidal interactions) in the unsaturated zone due to repository-perturbed conditions.				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY CONTROLS/REQUIREMENTS WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
29) the geochemical environment in the drifts (including the interaction with cement) to better define conditions affecting radionuclide solubilities and waste package corrosion?	Enhanced understanding of the geochemical environment in the drifts (including the interaction with cement) would benefit the development of the controls and requirements that will be established for repository drift excavation associated with preserving the waste isolation capabilities of the site.				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY CONTROLS/REQUIREMENTS WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
32) projected environmental impacts in the affected area that can be mitigated to an acceptable degree, taking into account programmatic, technical, social, economic, and environmental factors? [960.5-2-5(a) and (d)]	Enhanced understanding of projected environmental impacts in the affected area would benefit the development of the controls and requirements that will be established for repository drift excavation associated with preventing/minimizing such impacts, and ensuring environmental permit compliance.				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY CONTROLS/REQUIREMENTS WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
33) the performance confirmation requirements in 10 CFR Part 60 to show that conditions have not varied beyond the limits assumed for design and to show that conditions are within the limits assumed for design?	Enhanced understanding of the site would benefit the development of the controls and requirements that will be established for repository drift excavation associated with ensuring Part 60 performance confirmation requirements are satisfied.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
34) maintaining emplacement drift orientation flexibility?	Preserving emplacement drift orientation flexibility would enhance the number of design options available to repository designers, and help ensure that the total maximum volume available for waste emplacement is not reduced.				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY CONTROLS/REQUIREMENTS WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
36) demonstrating a cost effective construction approach?	The costs to develop and implement controls and requirements for repository excavation will be prominent components of the overall per-foot excavation cost of the repository. Additional ECRB excavation experience would thus provide an opportunity to examine these activities, evaluate alternative concepts, and potentially reduce the associated costs.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
37) demonstrating effective ventilation and hazardous minerals/dust control?	There is significant benefit in demonstrating effective ventilation and hazardous minerals/dust control, using minimal amounts of water, prior to full-scale repository excavation efforts. Successes in this regard could both significantly reduce the overall per-foot excavation cost of the repository, and reduce worker health concerns. One significant consideration in this regard is the avoidance during excavation of volumes of rock containing erionite.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
38) demonstrating an integrated environment, safety (including fire safety and evacuation preparedness) and health approach?	Benefits associated with this criterion are related to those for Criteria 36 and 37 above. That is, any successes in enhancing the integration of environment, safety and health programs would translate into a reduction in the overall per-foot excavation cost of the repository, and reduce potential worker health and safety concerns.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
39) implementing a performance based approach to design and construction, including a construction based TBM configuration? Full consideration is to be given to constructability, operability, and maintainability issues associated with a potential storage facility.	The principal benefit to be derived from establishing a performance based approach to design and construction (from the perspective of controls and requirements implementation) would come from identifying the critical performance parameters to be included in the contract such that the implementation of applicable controls and requirements (e.g., controls associated with water use minimization) are appropriately addressed and incentivized.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
40) testing "state of the art" mechanical excavators?	The benefits to be derived from testing "state of the art" mechanical excavators would be (1) the potential identification of more effective ways to control dust while simultaneously minimizing water use, and (2) the potential demonstration of better line and grade performance.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
41) traffic problems that could occur with other operational drifts?	There are potential controls that may be required to ensure worker (and visitor) safety in high-traffic areas or at the junctions of high-traffic routes. Understanding traffic patterns and problems in multiple-drift scenarios would enhance the development of such controls when required later for full-scale repository excavation.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
42) muck handling, including direct connection to current system?	There are potential design requirements that may be necessary with respect to muck handling. Understanding the relative effectiveness of muck handling approaches in multiple-drift scenarios would enhance the development of such requirements when required later for full-scale repository excavation.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
43) storage location and reclamation of the mine muck removed from the drifts?	There are requirements for muck storage that restrict the maximum height of muck piles, restrict the areas on the surface where muck piles can be located (based on state land-use permits), require muck from different geologic units to be segregated in some cases, and require muck piles containing hazardous materials (e.g., erionite) to be treated as hazardous waste. Understanding the different potential approaches to muck storage in multiple-drift scenarios would enhance the development of such requirements when required later for full-scale repository excavation.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
44) Limiting impacts to major natural features that may be important to site performance?	Limiting, during site characterization, any impacts to major natural features that may be important to site performance is a requirement from 10CFR Part 60. Additional excavation would be expected to enhance future development of controls in this regard; in particular, those controls that will be required to ensure the actual excavation of the repository does not diminish or destroy the intended waste isolation capabilities of the repository.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
45) limiting impacts to availability of alternatives to design features to waste isolation, and promote ultimate compliance with the 10CFR60.21(c)(1)(ii)(D) requirement to provide a comparison of these alternatives?	The benefit of not precluding potential waste isolation alternatives is that enhanced flexibility is afforded to repository designers				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
46) limiting, during site characterization, impacts to waste isolation, construction-to-test and test-to-test interference, and other requirements derived from 10CFR60.15(c)?	See benefits associated with Criterion 44 above.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
47) ensuring that additional drifts or excavations do not violate the 200 meter overburden disqualifying condition of 10 CFR Part 960? [960.4-2-5(d)]?	Preserving the 200-meter overburden requirement would enhance the number of design options available to repository designers, and help ensure that the total maximum volume available for waste emplacement is not reduced.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
48) the requirements for underground records in 10 CFR 60.72 such that construction of another drift during site characterization could fulfill level of detail requirements needed to satisfy some of the construction records requirements?	The QA Program implements requirements for records retention. Conformance with these requirements will be a component of the per-foot cost to excavate the repository. Additional ECRB excavation could provide an opportunity to evaluate ways to reduce these costs; e.g., through process streamlining or automation initiatives.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
49) beginning construction of the geologic repository operations area without a construction authorization as identified in 10 CFR Part 60.3?	The benefit of restricting ECRB excavations to areas not currently intended for waste emplacement is that such restrictions would limit the potential for ambiguity that may arise with respect to this criterion. That is, there would be less basis for contentions that repository construction was in fact proceeding prior to receipt of the construction authorization required by 10 CFR Part 60.3.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
50) minimizing any significant adverse environmental impacts identified in comments on the Site Characterization Plan or in the Environmental Assessment? [NWPA Sec. 113(a)]	The benefit to minimizing any significant adverse environmental impacts identified in comments on the Site Characterization Plan or in the Environmental Assessment, as mandated in Section 113(a) of the NWPA, is to ensure proper consideration is preserved for local area residents.				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY LICENSING/REGULATORY WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
31: Collecting further data to enhance the ability to demonstrate compliance with 10 CFR 60.122 which requires demonstrations that potentially adverse conditions that are present have been adequately investigated and adequately evaluated.	• Increase confidence in representativeness of site characterization data.• Provide additional data to characteriza the site features and processes. • Corroborate site characterization data. • Collect data that was excluded by focused program. • Characterize pathways away from repository.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
32: Projected environmental impacts in the affected area that can be mitigated to an acceptable degree, taking into account programmatic, technical, social, economic, and environmental factors [960.5-2-2(a) & (d)].	None. Further characterization can only increase, not decrease impacts. However, impacts appear to be negligible.				

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REQ'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
33: The performance confirmation requirements in 10 CFR Part 60 to show that conditions have not varied beyond the limits assumed for design and to show that conditions are within the limits assumed for design.	• Compliance with requirements. • Increased data for performance confirmation baseline. Potentially easier to show that conditions are within limits assumed for design. Contradictory or inconsistent data could be used to advantage because it would be identified, described, and evaluated prior to performance confirmation. • Increased confidence in performance confirmation program and demonstrations. • The applicability of this item is questionable since the data from the enhanced program would likely be limited to development of the performance confirmation baseline.				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
DEVELOPMENT SUMMARY LICENSING/REGULATORY WORKING GROUP

CRITERIA	BENEFITS	FOR INVESTIGATIVE CRITERIA PREFERRED SOURCE, ALTERNATIVE SOURCES	FOR CONTROLS/REO'S CRITERIA AFFECTED INVESTIGATIVE CRITERIA	RATIONALE	RISKS
44: Limiting impacts to major natural features that may be important to site performance	None. Further excavation or drilling can only increase impacts, however small they may be.				

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46: Limiting, during site characterization, impacts to waste isolation, construction-to-test and test-to-test interference, and other requirements derived from 10 CFR 60.15(c)	None. Further excavation or drilling can only increase impacts, however small they may be.				

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47: Ensuring that additional drifts or excavations do not violate the 200 m overburden disqualifying condition of 10 CFR 960.4-2-5(d).	None.				

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48: The requirements for Underground records in 10 CFR 60.72 such that construction of another drift during site characterization could fulfill level of detail requirements needed to satisfy some of the construction records requirements.	None. Regulatory requirement applies to construction phase not site characterization phase. This item should be deleted.				

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49: Beginning construction of the geologic repository operations without a construction authorization as required in 10 CFR 60.3(b)	None.				

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50: Minimizing any significant adverse environmental impacts identified in comments on the Site Characterization Plan or in the Environmental Assessment [NWPA Sec. 113(a)].	None. Further excavation or drilling can only increase environmental impacts.				

ENHANCED REPOSITORY BLOCK CHARACTERIZATION
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Criteria #36 [C1] ...demonstrating a cost effective construction approach	Will provide experience base for alternative approaches Can maintain ECRB schedule for VA support Will improve "fidelity" of some attributes of the TSLCC for repository Should result in lower unit excavation costs with attendant political benefits				

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Criteria #37 [C2] ...demonstrating effective ventilation and hazardous minerals/dust control	May show that effective dust mitigation measures obviate need for respirators Provide confidence that repository can be constructed within compliance limits Effective dust control will be strongly tied to overall cost-effectiveness of the operation Provides opportunity to try alternative dust control methodologies				

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Criteria #38 [C3] ...demonstrating an integrated environment, safety and health approach	An integrated ES&H approach will lead to a safer workplace and a more cost-effective operation Increased confidence & "baseline" information will be obtained regarding the development of a repository approach to ES&H.				

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Criteria #39 [C4] ...implementing a performance based approach to design and construction, including a construction based TBM configuration	Provide an advance rate projection for the future repository TBM excavation work that is more aggressive (thus, less expensive) than what will be assumed based on the 5-mile loop excavation experience. Dust control requirements/concerns fully addressed prior to any repository construction. Increased confidence in the repository TSLCC. Opportunity available for a more effective, construction-based Hazards Analysis	Preferred Source: -TBM Excavation in repository block (not required to be in emplacement horizon) with TBM configured to YMP needs. Alternative Sources: -Use data from 5-mile loop excavation experience. -Use data from other similar excavation on other tunnel projects.		Excavated ground should be as close as possible to the ground expected in the repository excavation. This will assure that the machine configuration that would maximize the advance rate for the repository excavation is clearly defined. Also, the dust control features would similarly be optimized.	Schedule imposed on the enhanced repository block characterization will require that the TBM acquisition, upgrading, and mobilization be done in approximately 7 months. This will likely preclude a contractor from acquiring a new machine built specifically to our requirements Rather, a used machine probably currently under the control of the contractor will be modified as much as practical to meet our requirements. The risk is that the machine may not totally meet all our requirements. However, it is more likely that the modified machine will be close enough to get the vast majority of confirmatory information needed.

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Criteria #40 [C5] ...testing "state of the art" mechanical excavators	May increase confidence in the applicability of various non-TBM mechanical excavation processes in TSw2. Current repository concept involves some amount of non-TBM mechanical excavation. Could provide a better basis for estimating costs for repository development				

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Criteria #23, #24 [D1] ...the spatial distribution of thermal and geomechanical properties of the repository horizon ...the location and continuity of stratigraphic contacts in the expanded repository block	Provide a better definition of TSw3 location and character, particularly in the southwest quadrant of the repository block. TSw3 bounds the repository layout in the SW. Better definition would help reduce uncertainty as to actual amount of usable area Could provide additional information on the presence / amount of Erionite in lower reaches of TSw2				

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Criteria #18 [D2] ...the distribution and continuity of zeolitization	Provide a better definition of structure and thickness of underlying zeolitized units. Zeolite distribution (location, thickness, and depth below repository) can influence repository design (heat distribution and magnitude) Zeolites are a potentially significant natural barrier, and better definition may lead to reduced reliance upon Engineered Barriers				

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Criteria #2 [D3] ...unexposed faults Criteria #3 [D3, D5B] ...hydrologic properties, fracture properties and geotechnical properties in and near faults	Will reduce uncertainty regarding the overall repository layout. (Current layout assumes no major structure between the Ghost Dance Fault and the Solitario Canyon Fault Location of SCF and its splays currently forms the boundary of the repository block in the NW. More accurate location information at repository depth will reduce uncertainty Examination of splay(s) may result in addition (or reduction) of suitable emplacement area First penetration of Drill Hole Wash structure showed little impact to design. A second penetration could confirm, or alter, this finding				

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Criteria #23 [D4] ...the spatial distribution of thermal and geomechanical properties of the repository horizon	Only the top of the TSw2 has been seen in the ESF. Cross-block information would yield design information on the construct ability of the lower sub-units. Design parameters regarding the behavior of the rock mass in the lower sub-units will reduce uncertainty in the design				

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DEVELOPMENT SUMMARY DESIGN/CONSTRUCTION WORKING GROUP

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Criteria #20 [D5A] ...the location and origin of the large hydraulic gradient north of the repository block	Significant additional emplacement area may be available to the north of the current layout. The presence/nature of the large hydraulic gradient must be investigated to allow this area to be considered as usable emplacement space				

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Criteria #1 [D5C] ...fracture variability	Emplacement drift orientation may be driven, at least in part, by the fracture orientation. No information is currently in hand regarding orientation and spacing of dominant fracture sets in the lower sub-units				

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Criteria #34 [D6] ...maintaining emplacement drift orientation flexibility	Maintenance of repository flexibility regarding emplacement drift orientation is critical until data are available on which to base a decision on orientation. A CD would contribute significantly to the required data base, but could itself destroy flexibility if placed within the plane of the repository. Primary benefit is the continued ability to utilize all potentially available emplacement area, without characterization-induced area losses				

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Criteria #35 [D7] ...confirming a preferred emplacement drift orientation	Observation of dominant fracture spacings and orientations will allow a more solid basis for drift orientation decisions Fracture data in lower sub-units will confirm, or provide a basis to change, the current drift orientation. Current data are limited to upper-most repository sub-unit Drift orientation decision could impact repository costs related to TBM productivity				

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Criteria #47 [D8] ...ensuring that additional drifts or excavations do not violate the 200 meter overburden disqualifying condition of 10 CFR Part 960 [960.4-2-5(d)]	Project position is needed on the applicability of the 200 meter cover criterion to non-emplacement areas A defined criterion is needed to allow siting of the cross-drift				

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ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

BENEFITS

APRIL 14, 1997

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