U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

PRESENTATION TO THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: POTENTIAL IMPACTS OF REVISED EXPLORATORY STUDIES (ESF) DESIGN ON REPOSITORY INTERFACES

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PRESENTER'S TITLE AND ORGANIZATION: DEPUTY PROJECT MANAGER, TECHNICAL PROGRAMS
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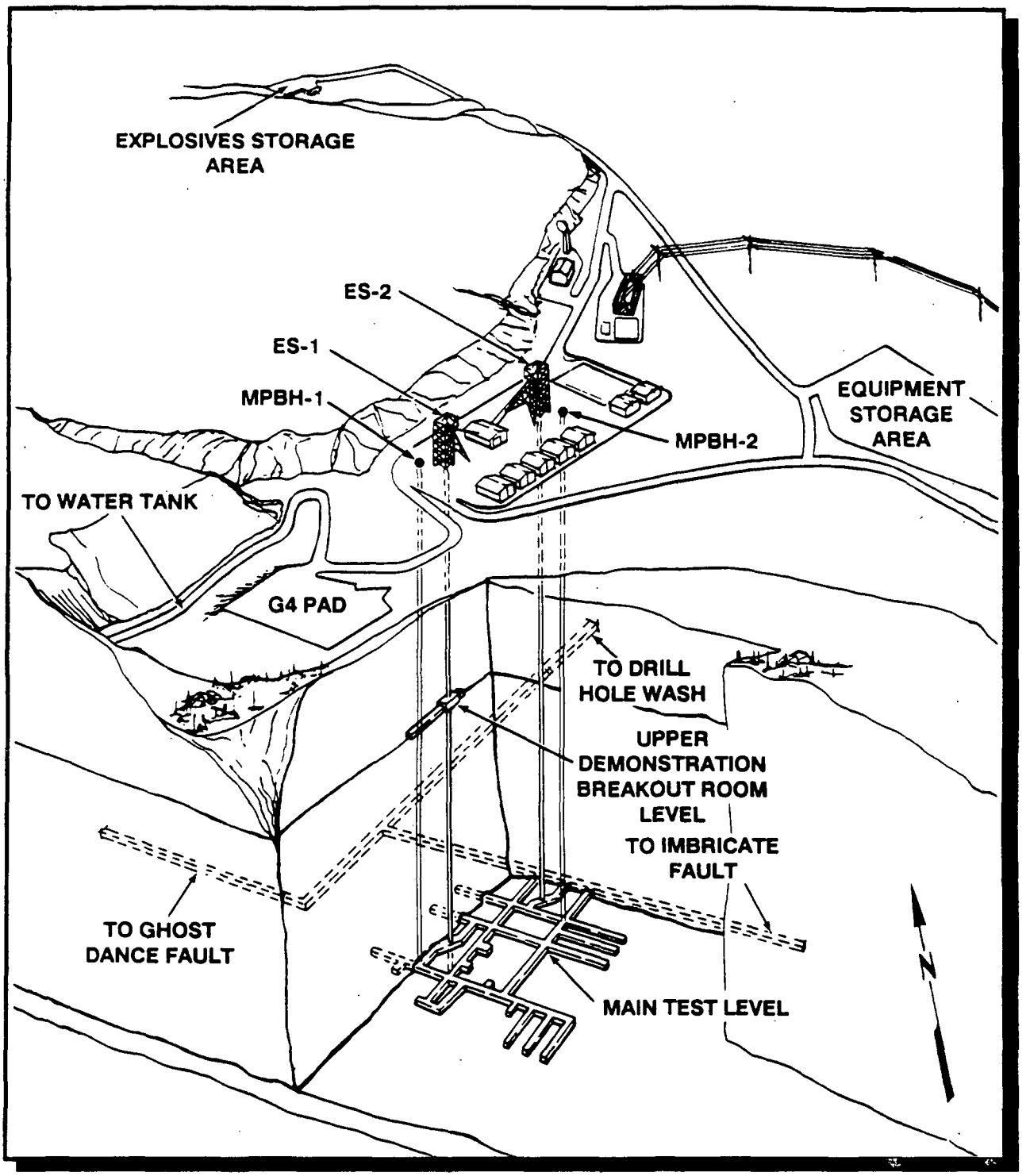
REPOSITORY DESIGN CONSIDERATIONS

- SCP-ESF DESIGN: REPOSITORY INTERFACES
- RESUMPTION OF ESF DESIGN ACTIVITIES
- COMPARATIVE EVALUATION OF ALTERNATIVES TO MAJOR REPOSITORY DESIGN FEATURES (10 CFR 60.21)
- REPOSITORY DESIGN REFERENCE CASE CHANGES NEEDED

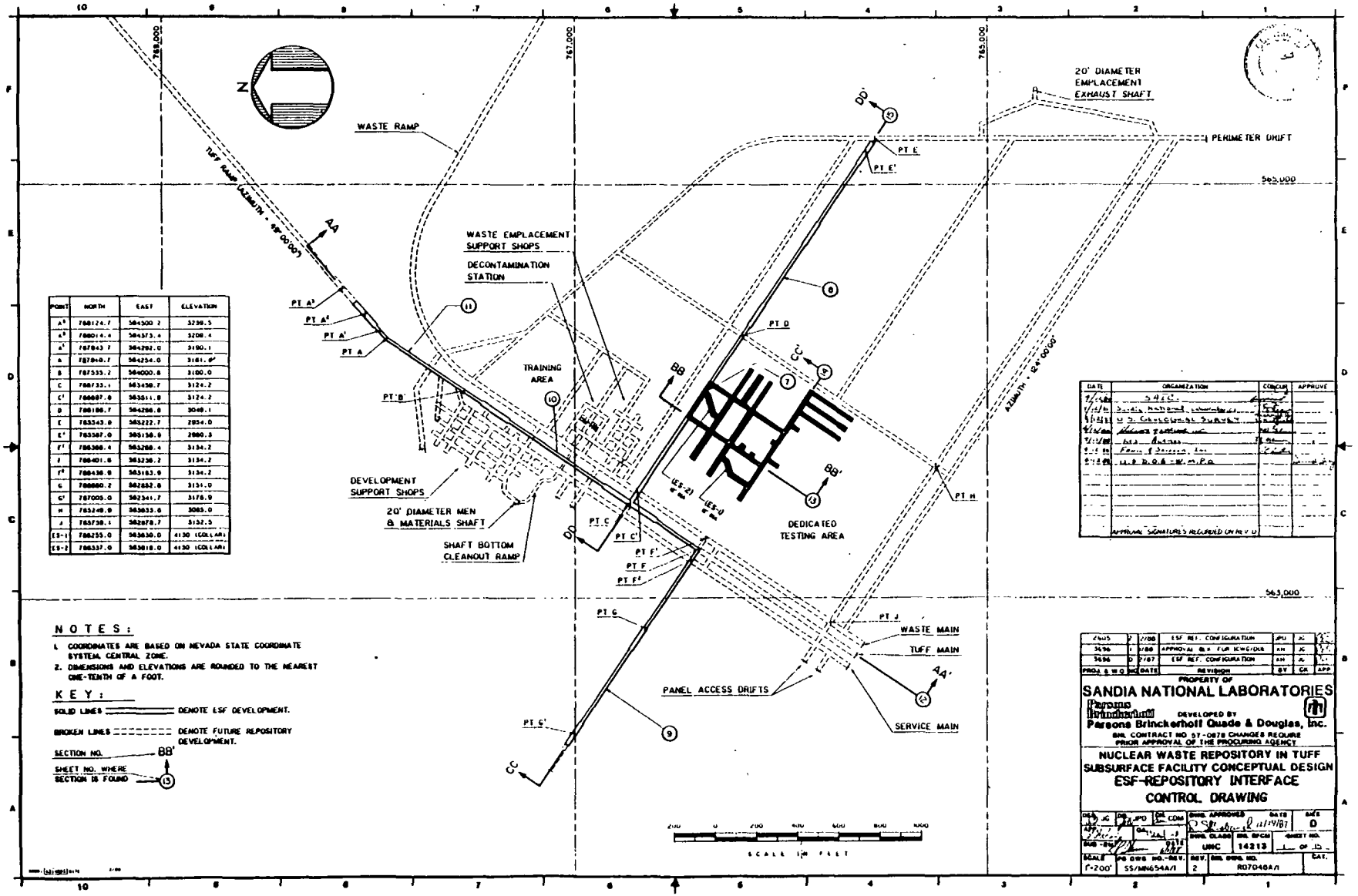


CONCEPTUAL ILLUSTRATION OF THE EXPLORATORY SHAFT FACILITY

ESF/REPOSITORY CONTROLLED DRAWINGS: SCP & DESIGN

- ESF/REPOSITORY INTERFACE CONTROL DRAWING
- ESF MAIN TEST LEVEL (MTL) (2)
- MAIN TEST LEVEL SECTION
- ESF DRAINAGE
- UPPER AND LOWER TEST LEVELS
- IMBRICATE FAULT EXPLORATORY DRIFT PLAN AND CROSS SECTION (2)
- GHOST DANCE FAULT EXPLORATORY DRIFT PLAN AND CROSS SECTION
- DRILL HOLE WASH EXPLORATORY PLAN AND CROSS SECTION (2)
- CROSS SECTIONS (4)

INTERFACE CONTROL DRAWING



POINT	NORTH	EAST	ELEVATION
A³	768124.7	564300.2	3239.5
A²	768014.4	564373.4	3208.4
A¹	767843.7	564292.0	3190.1
A	767840.7	564254.0	3181.8
B	767535.2	564000.8	3100.0
C	766733.1	563450.7	3124.2
C'	766687.6	563511.8	3124.2
D	766186.7	564286.8	3048.1
E	765343.8	565222.7	2954.0
E'	765367.0	565158.8	2980.3
F'	766388.4	565288.4	3134.2
F	766401.8	565238.2	3134.2
F²	766438.8	565183.9	3134.2
G	766860.2	562652.8	3131.0
G'	767005.0	562341.7	3178.9
H	765249.8	565633.6	3085.0
J	765738.1	562878.7	3132.5
ES-1	766255.0	563630.0	4130 (COLLAR)
ES-2	766337.0	563818.0	4130 (COLLAR)

DATE	ORGANIZATION	CONCUR	APPROVE
7/1/88	S.N.L.		
7/14/88	Sandia National Laboratories		
7/15/88	U.S. Geological Survey		
7/14/88	Reynolds Electrical & Engineering Co.		
7/14/88	M.A.S. Nevada		
7/15/88	Fenix & Scisson, Inc.		
7/15/88	U.S. D.O.E. - N.V.O.		
	APPROVAL SIGNATURES REQUIRED ON REV 0		

NOTES:

1. COORDINATES ARE BASED ON NEVADA STATE COORDINATE SYSTEM, CENTRAL ZONE.
2. DIMENSIONS AND ELEVATIONS ARE ROUNDED TO THE NEAREST ONE-TENTH OF A FOOT.

KEY:

SOLID LINES ——— DENOTE ESF DEVELOPMENT.

BROKEN LINES - - - - DENOTE FUTURE REPOSITORY DEVELOPMENT.

SECTION NO. BB'

SHEET NO. WHERE SECTION IS FOUND 13

PROJ. & W.O. NO.	REV.	DATE	REVISION	BY	CK	APP.
2605	2	7/88	ESF REF. CONFIGURATION	JPU	JC	
3496	1	7/88	APPROVAL BY FOR KOHGOLK	KH	JC	
3496	0	7/87	ESF REF. CONFIGURATION	KH	JC	

PROPERTY OF
SANDIA NATIONAL LABORATORIES
Parsons Brinckerhoff
DEVELOPED BY
Parsons Brinckerhoff Quade & Douglas, Inc.
BNL CONTRACT NO. 07-0879 CHANGES REQUIRE PRIOR APPROVAL OF THE PROCURING AGENCY

NUCLEAR WASTE REPOSITORY IN TUFF
SUBSURFACE FACILITY CONCEPTUAL DESIGN
ESF-REPOSITORY INTERFACE
CONTROL DRAWING

DES. JC | DR. JPD | CK. COM | DWG. APPROVED | DATE 11/29/87 | SIZE D
APP. | DATE | DWG. CLASS | BNL DFCM 14213 | SHEET NO. 1 OF 15
SUB-SYS. | DWG. CLASS | BNL DFCM | SHEET NO.
SCALE 1"=200' | PS DWG NO.-REV. SS/MN654A/1 | REV. 2 | BNL DWG. NO. R07048A/1 | DAT.

RESFMV5P.125.NWTRB/9-18/19-91

REPOSITORY DESIGN CONSIDERATIONS

- SCP-ESF DESIGN: REPOSITORY INTERFACES
- RESUMPTION OF ESF DESIGN ACTIVITIES
- COMPARATIVE EVALUATION OF ALTERNATIVES TO MAJOR REPOSITORY DESIGN FEATURES (10 CFR 60.21)
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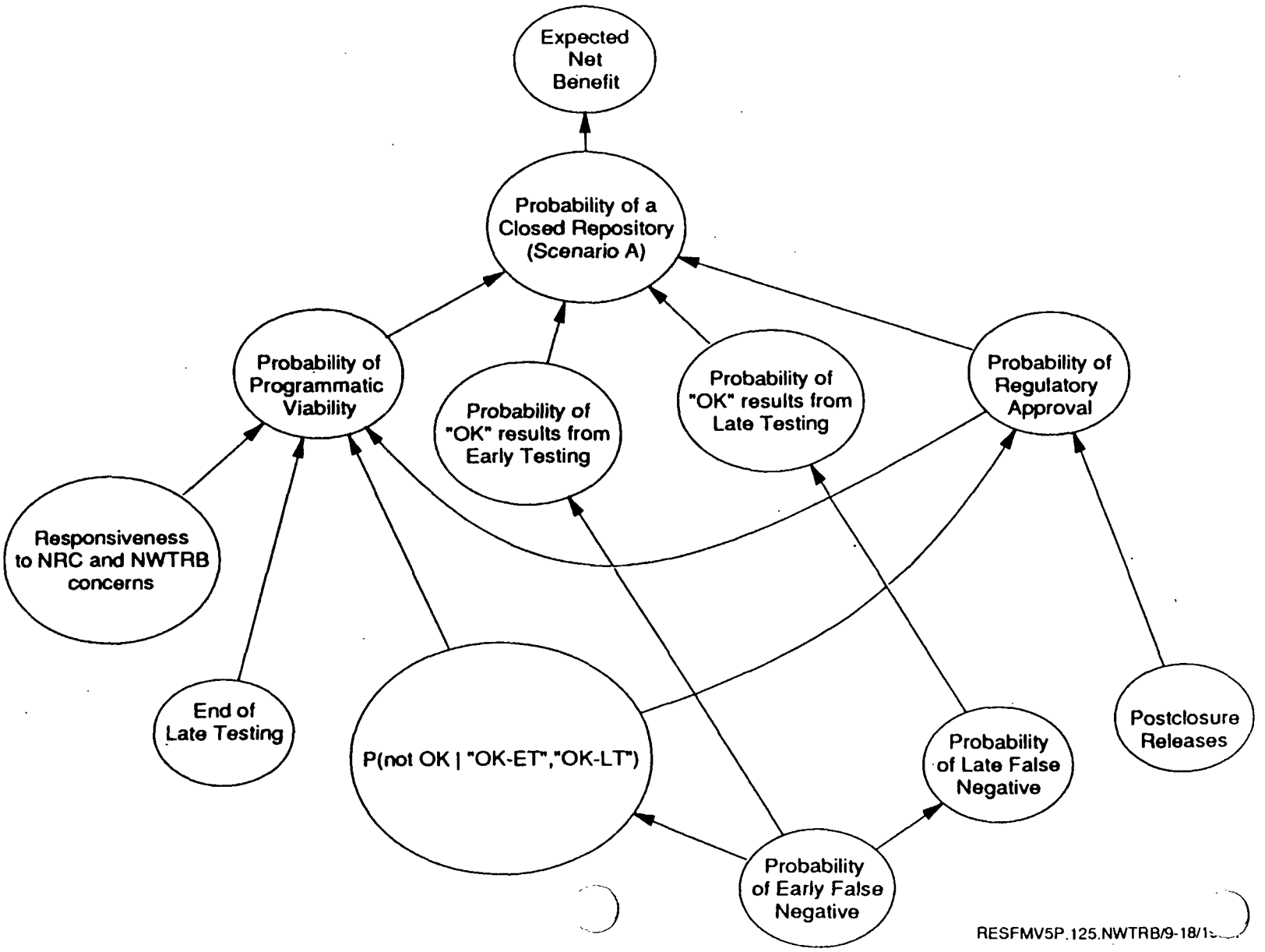
INFLUENCE DIAGRAM SHOWING THE MOST SIGNIFICANT FACTORS IN THE ESFAS



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POTENTIALLY FAVORABLE DESIGN FEATURES

Feature Number	Description	Source Descriptor
1	Inclusion of a Ramp(s)	MF
2	Inclusion of a Shaft(s)	MF
3	Minimization Repository Accesses (including ESF openings)	MF
4	Flexibility of MTL Location (NE or S)	MF
5	Emphasis on Mechanical Excavation of Accesses and Drifts	MF
6	No Direct "Gravity Line" Between Emplacement Area (TSw2) and the CH Unit	P
7	Maximization of Distance Between Repository and Water Table (a repository feature)	P
8	Avoidance of Emplacement Drifts Intersecting Ghost Dance Fault (a repository feature)	P
9	Large Exposure of Rock	R, T
10	Flexibility to Drift Early in Either the TSw2 or CH	T, V
11	Inclusion of Major Features Identified From SCA and NWTRB First Report: a. Two Intercepts of Ghost Dance Fault at Repository Horizon b. E-W Drift Across Block at Repository Horizon c. Larger Dedicated MTL for Avoidance of Interference and to Allow Possible Replication and Confirmation Testing	G

NOTE: Descriptors are:
Major Feature - MF
Postclosure Panel - P
Testing Panel - T
Programmatic Viability Panel - V
Regulatory Panel - R
Design Guidance - G

BASIS FOR SELECTION OF THE REFERENCE DESIGN CONCEPT

HIGHEST RANKING OPTIONS OF ESFAS INFLUENCED BY SEVERAL DESIGN FEATURES

- MTL LOCATION FLEXIBILITY
- MECHANICALLY MINED ACCESSES
- NO GRAVITY FLOW PATHWAY FROM TS TO CHn
- MAXIMUM DISTANCE FROM EMPLACEMENT LEVEL TO WATER TABLE
- AVOID EMPLACEMENT DRIFTS CROSSING GHOST DANCE FAULT
- MAXIMIZE EXPOSED ROCK ON AND OFF BLOCK
- FLEXIBILITY FOR EARLY DRIFTING IN TS OR CH OR BOTH
- TWO INTERCEPTS OF GHOST DANCE FAULT IN TS
- MINIMUM NUMBER OF ACCESSES

BASIS FOR SELECTION OF THE REFERENCE DESIGN CONCEPT

(CONTINUED)

- OPTION 30 HIGHEST RANKED
  - ONLY OPTION WITHOUT DIRECT GRAVITY CONNECTION
  - RESPONSIVE TO NRC AND NWTRB CONCERNS
- OPTION 30 DID NOT HAVE ALL FAVORABLE FEATURES
  - LOCATION OF MUCK PILE VISIBLE FROM HIGHWAY (DESIGN STUDY)
  - DISTANCE ABOVE WATER TABLE NOT ELEVATED (TITLE II DESIGN)
  - AVOIDING EMPLACEMENT DRIFTS CROSSING GHOST DANCE FAULT (REPOSITORY DESIGN)
  - LOCATION OF MTL - EARLIER PREFERENCE (DESIGN STUDY)

SELECTION OF THE REFERENCE DESIGN CONCEPT

PROCEED WITH OPTION 30, ENHANCED BY:

- THE MTL LOCATED IN THE NORTHERN PART OF THE POTENTIAL REPOSITORY BLOCK
- EXCAVATED ROCK SHOULD BE TRANSPORTED AND DISPOSED OF IN AN AESTHETICALLY MORE ACCEPTABLE MANNER
- AN OPTIONAL VERTICAL SHAFT SHOULD BE INCLUDED TO FACILITATE ACQUISITION OF SCIENTIFIC INFORMATION IF NEEDED IN THE FUTURE

TITLE I DESIGN SUMMARY REPORT INTERFACE DRAWINGS

- REPOSITORY/MAIN TEST AREA BOUNDARY INTERFACE - PLANS AND CROSS SECTIONS
- REPOSITORY GENERAL LAYOUT AND PLAN
- TS NORTH RAMP/MAIN DRIFT PLAN AND SECTION
- TS SOUTH RAMP/MAIN DRIFT PLAN AND SECTION
- REPOSITORY MAIN DRIFTS AND TS EAST/WEST DRIFTS - PLAN VIEW
- REPOSITORY/MAIN TEST AREA BOUNDARY INTERFACE - PLANS AND CROSS SECTION

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COMPARATIVE EVALUATION OF ALTERNATIVES TO MAJOR REPOSITORY DESIGN FEATURES

- PARTICULAR ATTENTION TO LONGER RADIONUCLIDE CONTAINMENT AND ISOLATION - 10 CFR 60.21(c)(1)(ii)(D)

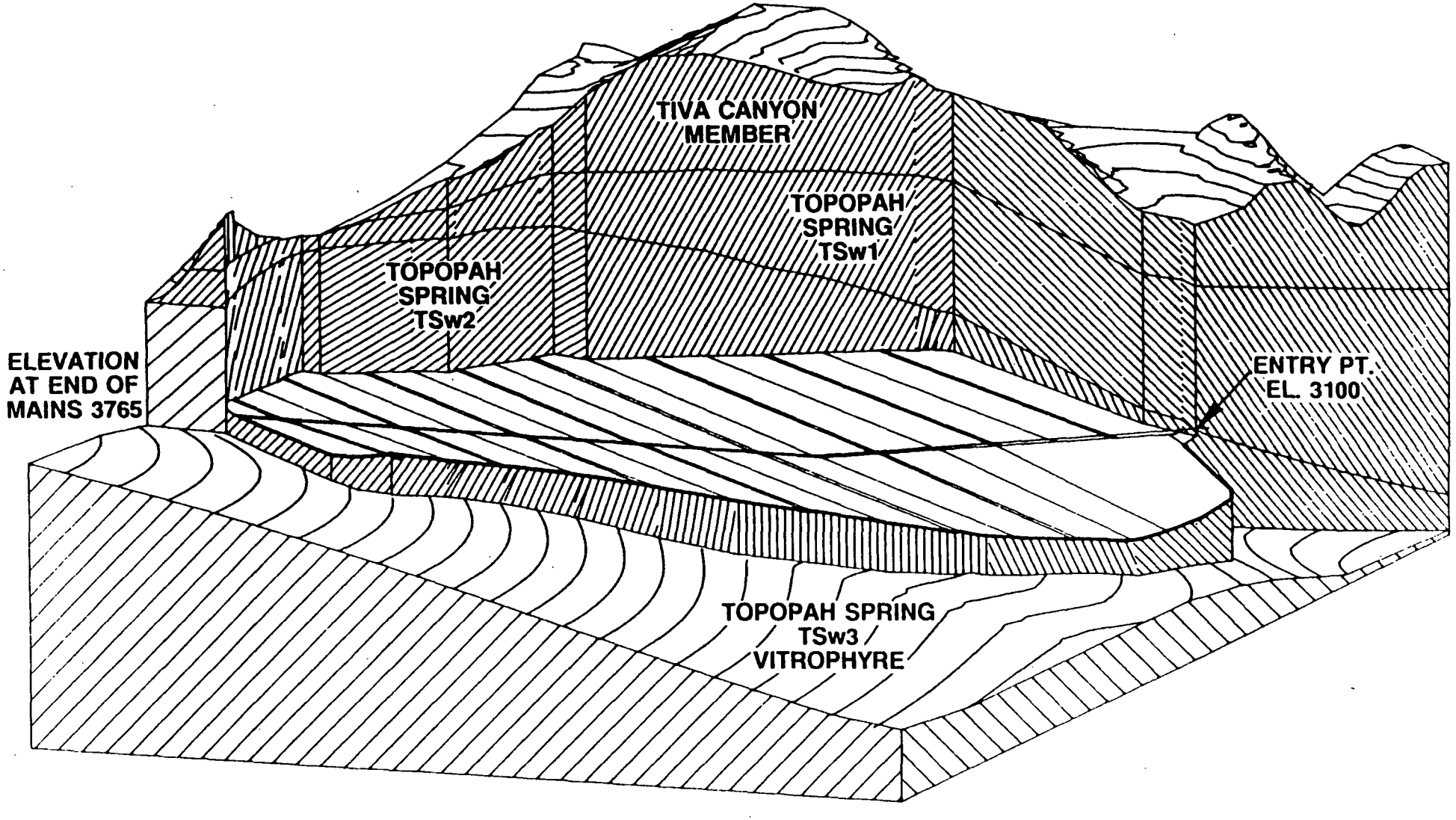
- SIGNIFICANT CONSIDERATION IN SCOPE OF ESFAS
  - ALTERNATIVE FEATURES AND ISOLATION IMPACTS CONSIDERED
  - REPOSITORY FEATURES IMPORTANT TO SELECTION OF CONCEPT FOR STARTING ENGINEERING STUDIES FOR ESF

- RELEVANT TO DEFINITION OF TRADE STUDIES FOR ESF TITLE II DESIGN

IDENTIFICATION OF FAVORABLE FEATURES IN HIGHLY RATED OPTIONS

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

CONCEPTUAL REPOSITORY HORIZON



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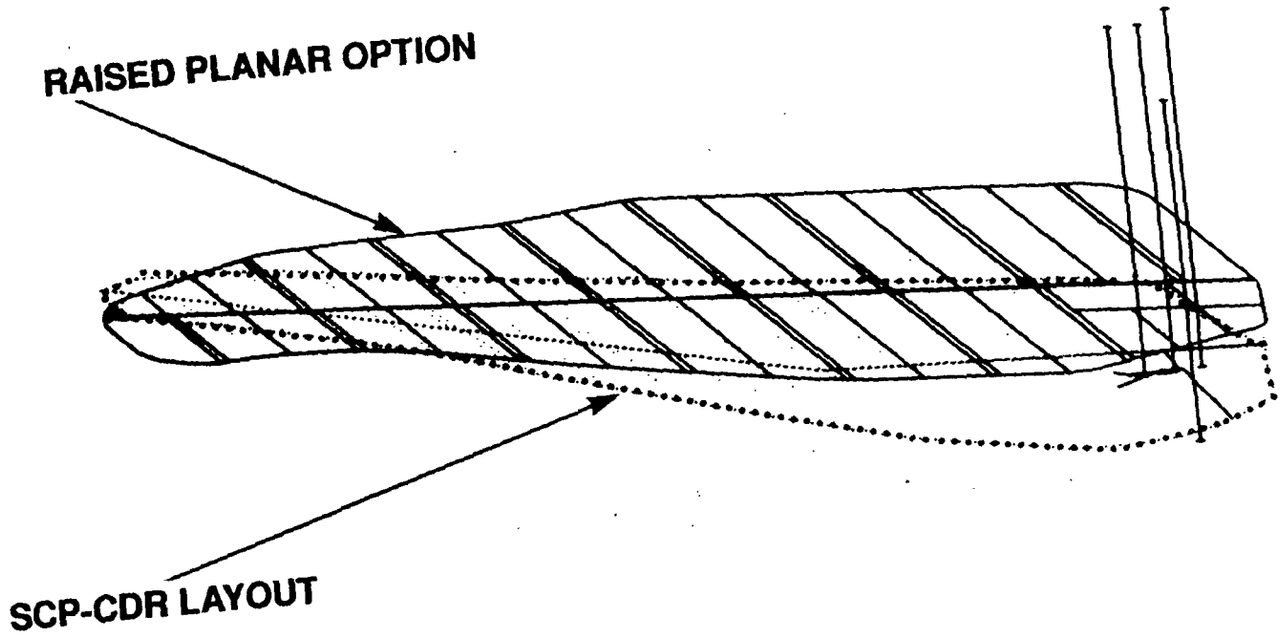
POTENTIAL REPOSITORY HORIZON ALTERNATIVE



IMPACT OF POTENTIAL INCREASE IN UNIT CONTACT ON DESIGN

- MAY ALLOW REDUCTION IN GRADE BY CHANGING INCLINATION OF REPOSITORY PLANE
- MAY ALLOW INCREASE IN PRIMARY AREA AND EXPANSION AREAS
- MAY BETTER FACILITATE SOME ALTERNATIVE CONCEPTS, e.g., A STEPPED DESIGN

HOWEVER, DESIGN STUDIES HAVE NOT BEEN PERFORMED

SCP-ESF DESIGN FEATURES THAT MAY CONTRIBUTE TO REPOSITORY PERFORMANCE

- SEPARATION OF ESF TESTS FROM POTENTIAL EMPLACEMENT DRIFTS
- CONTROL OF DRAINAGE DIRECTION
- LOW FLOOD POTENTIAL
- LOCATION AND NUMBER OF BOREHOLES
- ESF TEST LOCATION
- CONTROL OF WATER USE
- LIMIT BLAST DAMAGE - ESF DRIFTS
- WATER REMOVAL BY VENTILATION SYSTEMS
- USE OF SEALS
- AVOID SURFACE-WATER IMPOUNDMENT
- USE OF CONTROLLED BLASTING
- REMOVABLE SHAFT LINER

SCP-CDR GROUND SUPPORT SYSTEM FEATURES

- COMPATIBILITY WITH EXCAVATION METHODS AND SEQUENCE OF CONSTRUCTION
- RELATIVE FLEXIBILITY TO CONFORM WITH THERMALLY AND SEISMICALLY INDUCED DEFORMATION
- MINIMAL SITE-SPECIFIC PREFABRICATION
- INSTALLATION METHODS OR UPGRADING AS NEEDED TO DEAL WITH ANOMALOUS CONDITIONS
- INSTALLATION THAT MINIMIZES WORK IN UNSUPPORTED OPENINGS
- ADAPTABILITY TO ACCOMMODATE VARYING SHAPES OF OPENINGS AND INTERSECTIONS
- DURABILITY TO WITHSTAND ELEVATED TEMPERATURES AND THE POSSIBLE PRESENCE OF WATER FOR 100 YR
- COST-EFFECTIVENESS FOR THE SUPPORT OBTAINED
- CHEMICAL COMPONENTS THAT ARE COMPATIBLE WITH WASTE PACKAGE ISOLATION AND CONTAINMENT STRATEGIES

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REPOSITORY DESIGN REFERENCE CASE CHANGES NEEDED

- UPDATE CONFIGURATION TO REFLECT
  - CHANGES IN REPOSITORY ACCESS NUMBER LOCATION AND CHARACTERISTICS
  - CHANGES IN CONSTRUCTION METHOD
  - MTL CONFIGURATION
  - SURFACE AND SUBSURFACE INTERFACES
  - REPOSITORY HORIZON CHARACTERISTCS
  - REQUIREMENTS DOCUMENTS NEED TO BE UPDATED
- TITLE II ESF INTERFACE DEFINITION REQUIRES SUPPORTING REPOSITORY DESIGN STUDIES
  - VENTILATION
  - THERMAL CONSIDERATIONS
  - DEVELOPMENT AND SEQUENCING OF THE REPOSITORY
  - ISOLATION/CONTAINMENT IMPACT ASSESSMENTS
  - RAMP SIZE
  - FLUID/MATERIAL USAGE
  - SAFETY ANALYSIS REPORT

CONCLUSIONS

- REPOSITORY CONSIDERATIONS WERE IMPORTANT IN THE ESFAS
- THE ESF TITLE II DESIGN WILL ADDRESS RADIONUCLIDE CONTAINMENT AND ISOLATION
  - TESTING RELATED IMPACTS
  - ALTERNATIVES TO MAJOR REPOSITORY DESIGN FEATURES
- POTENTIAL REPOSITORY TRADE STUDIES HAVE BEEN IDENTIFIED TO SUPPORT ESF TITLE II DESIGN
- REPOSITORY CONCEPTUAL DESIGN WILL BE UPDATED TO INCORPORATE ESF TITLE II DESIGN