



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

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M E M O R A N D U M

DATE: May 28, 1991  
FOR: Joseph Holonich, Acting Director, HLPD  
FROM: Paul T. Prestholt, Sr. OR - YMP  
SUBJECT: YMP Site Report

I. EXPLORATORY STUDIES FACILITY (ESF) ACTIVITIES

The major technical activity being conducted by the Yucca Mountain Site Characterization Project (YMP) at the present time pertains to the Exploratory Studies Facility (old name - Exploratory Shaft Facility). The following information was supplied by Edgar H. (Ted) Petrie, Acting Director, Engineering and Development Division, YMPD.

A. ESF Baseline

At present, the ESF baseline configuration consists of two 12 foot shafts, both excavated to the Topopah Spring:

- ◆ ESF access number 1 - surface to Topopah Spring - 12 ft. diameter approximately 1055 feet deep.
- ◆ ESF access number 2 - surface to Topopah Spring - 12 ft. diameter approximately 1055 feet deep.

Exploratory drifts in the Topopah Spring (TS) to reach Drill Hole Wash, the Ghost Dance Fault and the Imbricate Fault zone:

102  
WM-11  
NH03 1/1

0

- ◆ TS level, approximately 5000 ft. of drift to the above features.
- ◆ Main test area in the TS to contain approximately 4000 ft. of drifts.

#### B. ESF Alternatives Studies

The decision by DOE to revisit the ESF configuration came about due to:

- ◆ Comments on the SCP received by DOE from the NRC and other external parties in 1989.
- ◆ The NWTRB Structural Geology and Geoengineering Panel offered suggestions on ESF testing and construction.
- ◆ The NRC concern that alternate configurations had not been compared with respect to waste isolation.

The DOE evaluated the NRC-NWTRB suggestions during the summer of 1989 and DOE-Hq. issued guidance, based on the above concerns, to YMPO to implement a study for evaluation of ESF design alternatives. This study was to be accomplished under a 10 CFR 60 Subpart G QA program.

Guidance from DOE-Hq. required that the evaluation:

- ◆ Respond to the issues expressed by the NRC, the NWTRB and other parties external to the DOE; and
- ◆ Consider alternate ESF configurations that evaluate, at a minimum:
  - location and means of access to the ESF,
  - strategy for tests and their sequencing,
  - construction technique.

DOE-Hq. sent the Project a letter that included:

- ◆ DOE-Hq. acceptance of the Preliminary Findings Report (see Site Report dated March 19, 1991).
- ◆ Direction to proceed with the design study focusing on the favorable features of the highest ranked alternatives.
- ◆ Direction to proceed with a design study based on post-1988 data, the ESF Alternatives Study and the Calico Hills Study, thus providing the flexibility to penetrate the Calico Hills (CH) unit in the first phase as an aid to evaluating site suitability as soon as possible.
- ◆ Direction to prepare plans for a phased approach to design development and ESF implementation preserving flexibility; also to take advantage of findings as data acquisition proceeds.

The general approach to the ESF Alternatives Study included:

- ◆ Five major design features were identified for specific inclusion in the options in various alternative ways and combinations;
- ◆ All existing ESF and repository configurations were combined with a number of new configurations to form an initial pool of options;
- ◆ New configurations were specifically created to:
  - have various combinations of alternative design features,
  - incorporate a number of features that were identified by NRC and the NWTRB concerns;
- ◆ The initial screening process was designed to ensure that the proper range of alternative major features were incorporated in the set of options to be evaluated;

◆ A detailed comparative evaluation of options was performed, considering a number of dimensions:

- post closure performance
- characterization testing
- regulatory approval
- programmatic viability
- etc. - - -

Five major design features were considered:

<u>MAJOR DESIGN FEATURE</u>	<u>ALTERNATIVES</u>
1. Means of access	Shafts only Ramps only Shaft-Ramp combo
2. Location of access	All in northeast All in south Combination of locations
3. Location of main test level (MTL) core area in Topopah Spring (TS)	Northeast South
4. Excavation method of openings	shafts - Drill & blast - Shaft boring - Blind hole drill - V-mole - Raise bore ramps - Tunnel boring machine - Road header - Drill & blast
MTL (TS) core area	- Drill & blast - Mobile miner - Tunnel boring machine (TBM)

MAJOR DESIGN FEATURE (Cont'd)

ALTERNATIVES

- |                             |  |
|-----------------------------|--|
| 5. Total number of accesses | - Exploratory drifting in TS & CH<br>- Drill & blast<br>- Mobile miner<br>- TBM<br>- Road header<br>ESF accesses are an integrated subset of the total number of accesses for the repository |
|-----------------------------|--|

The methodology for evaluating the various alternatives was:

◆ Technical Panels - Professional Judgement

◆ Formal Decision Analysis Logic

- Decision tree (scenarios)
- Multiattribute utility analysis

All top ranked options share the following features:

◆ Ability to meet data acquisition mission:

- Capability to support extensive drifting in the Calico Hills
- Multiple intercepts of structural features at both stratigraphic levels (TS & CH)
- E-W drifts across repository horizon in Topopah Spring (TS)

◆ Primary reliance on mechanized mining techniques

◆ Ramp access from the east

The six top ranked options are:

- |              |         |             |
|--------------|---------|-------------|
| 1. Option 30 | Access: | ramp, ramp  |
| 2. Option 23 | Access: | ramp, ramp  |
| 3. Option 24 | Access: | ramp, shaft |
| 4. Option 13 | Access: | ramp, ramp  |
| 5. Option 6  | Access: | ramp, ramp  |
| 6. Option 7  | Access: | ramp, shaft |

It is expected that the final design will be a combination of the best features of a number of options. Such enhancement of ESF design will be subject to the design control process. Selected key features will be subject to engineering trade-off studies during the design phase and engineering design methodologies will be used to refine or improve all features of the baselined option.

#### C. ESF Reference Design Concept

The current ESF reference design concept configuration consists of:

- ◆ 2 - 25 foot diameter ramps
- 2 - 16 foot diameter ramps
- 1 - 12 foot shaft (optional)
  
- ◆ Expanded acreage for testing facilities
  
- ◆ Expanded acreage for surface facilities because of the greater distance between portals.

The major differences between the baselined design (2 shafts) and the design study are:

<u>CONSTRUCTION</u> <u>TECHNIQUE</u>	<u>BASELINE</u> <u>DRILL &amp; BLAST</u>	<u>DESIGN STUDY</u> <u>4 TBMs</u>
Drift/ramp/shaft length	2 miles	13 miles
Muck removed	130,000 cu.yds.	900,000 cu.yds.
Surface facilities area	20 acres	70 acres
Test drift area	27 acres	92 acres

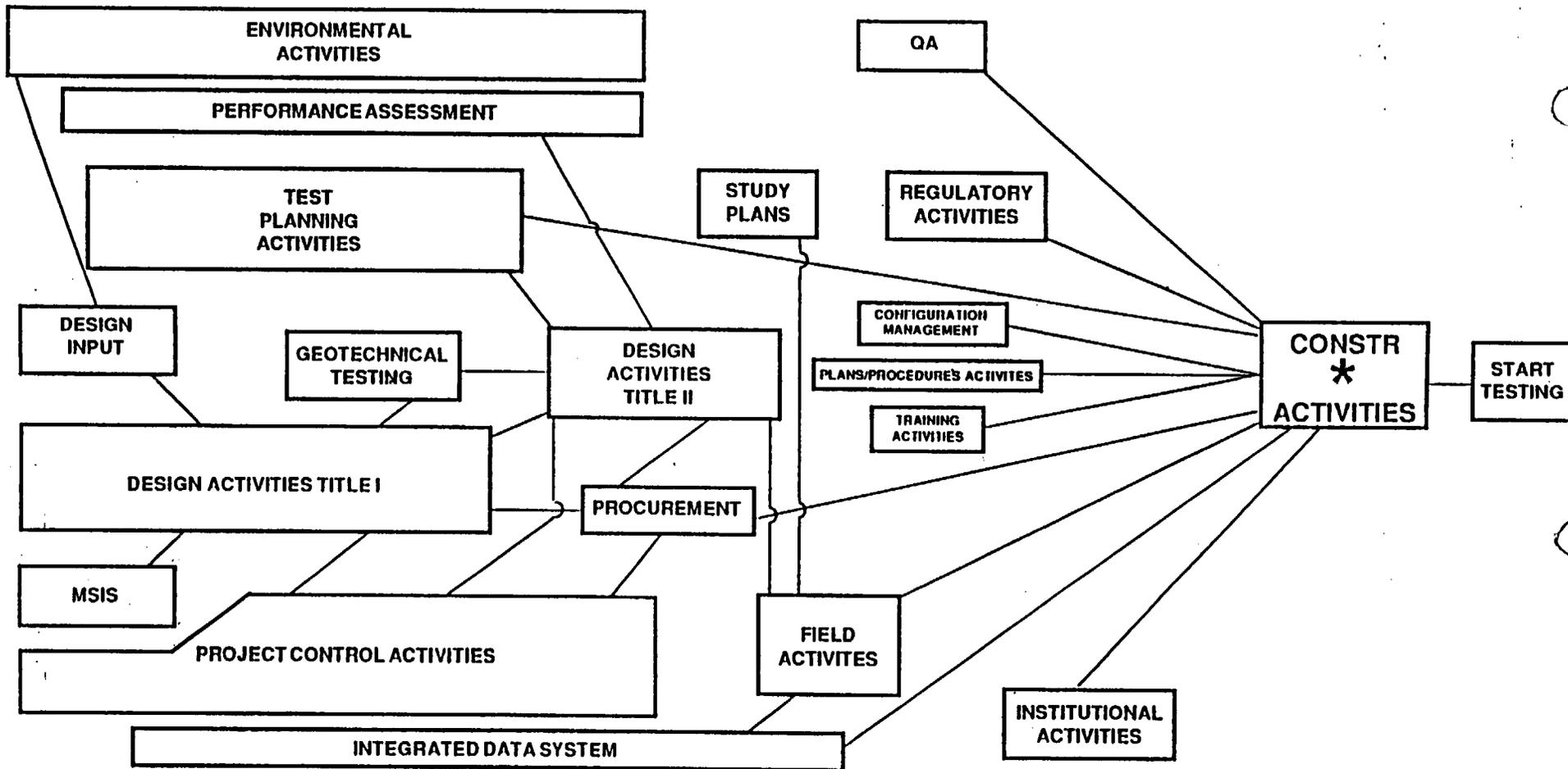
Design milestones are:

Milestone/activity

E0	◆ ESF Alt. Study Findings	1-23-91
E4	◆ ESF Alt. Study Findings Final Report to OCRWM	6-30-91
E2	◆ OGD Completes Phased Approach to ESF Design Plan	3-15-91
E7	◆ Complete Title I Design Review	8-30-91
C4	◆ Issue Engineering Plan	
C6	◆ Initiate Design Study	
C8	◆ Prepare G/A Drawings & General Specifications	
H8	◆ OCRWM Reviews & Accepts Revised Design Summary Report	9-6-91
C12	◆ OGD Reviews & Accepts Title I Design Summary Report	
C21	◆ RSN Starts Title II Design Activities	10-1-91

Inserted is an "ESF Event Logic Flow Diagram" (Insert A). Insert B is a diagram showing the "Transition of Requirements for ESF Design (draft)". The dates shown on this diagram are considered reasonable and doable. I've added a box and date titled "NRC Observation of the North Area Design Review, June 17, 1991". This review is for the northern ramp and facility design. It is expected that a similar review will be held for the south area design study in July. Insert C shows the status of the various design activities with dates. This information is current as of May 21, 1991.

# ESF EVENT LOGIC FLOW DIAGRAM

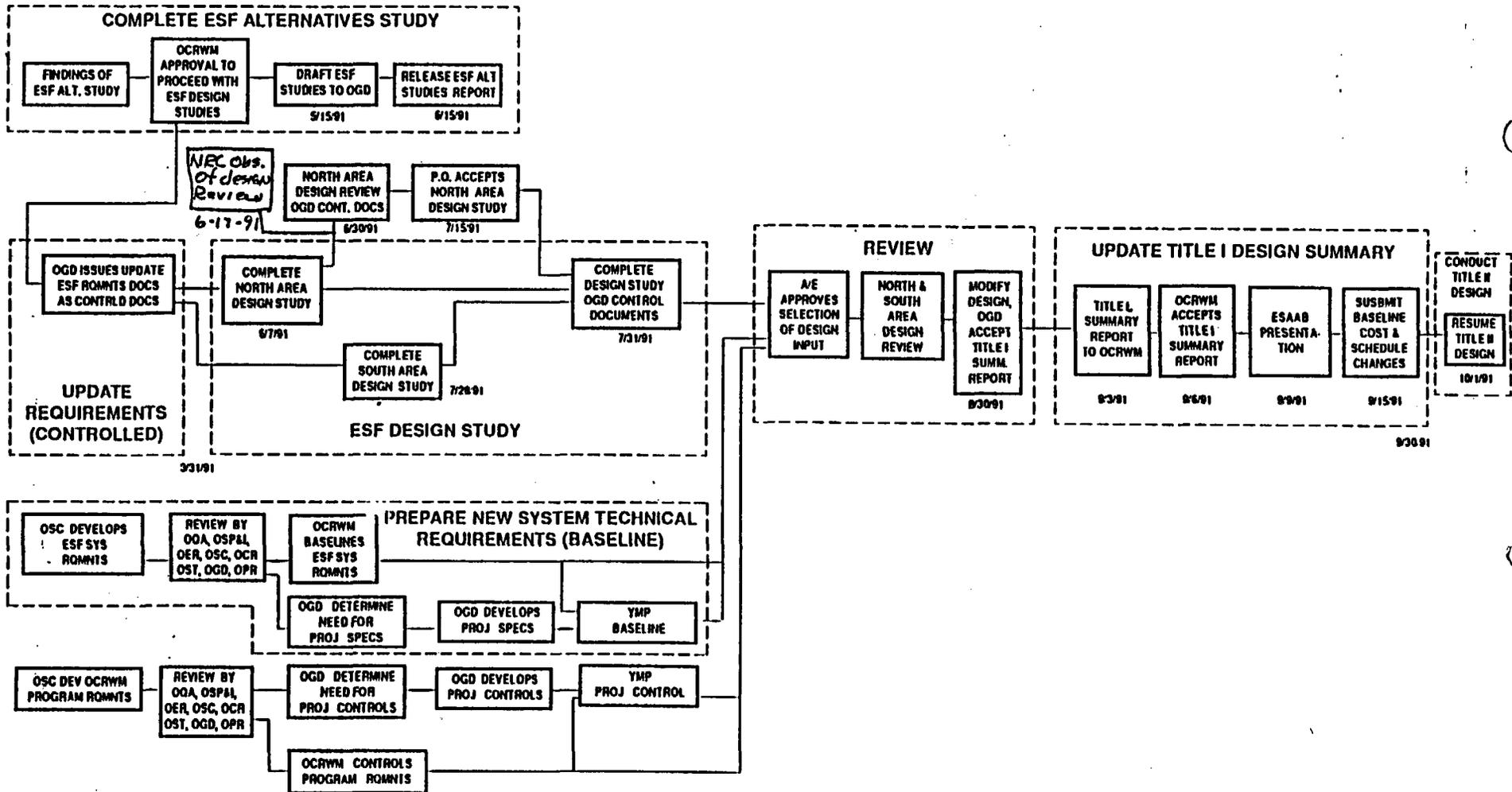


Insert A

\*START RAMP/PORTAL CONSTRUCTION

# TRANSITION OF REQUIREMENTS FOR ESF DESIGN

(DRAFT)



Insert B

# DESIGN ACTIVITIES STATUS

MILE- STONE ID	PRODUCT	PLANNED COMPLETION DATE	EXPECTED DATE
RSN 1	TITLE I ENGINEERING PLAN (REVIEW DRAFT) (C.4) - REVIEW & COMMENT (C.5) REVIEW 06-04 (2ND) - COMMENT INCORPORATION - FINAL DRAFT TO PROJECT OFFICE (C.7)	COMPLETE COMPLETE COMPLETE	
RSN 2	NORTH AREA (QUANTITY 81) DELIVERABLES - MOCK UP (C.6, C.8, C.13) 81 - CADD 69 - CHECK 52 - INTERDISCIPLINE REVIEW 30 - QA SIGN-OFF --	06/02/91	06/02/91
RSN 3	SOUTH AREA (QUANTITY 86) DELIVERABLES - MOCK UP (C.6, C.8, C.13) 47 - CADD 11 - CHECK 6 - INTERDISCIPLINE REVIEW -- - QA SIGN-OFF --	07/28/91	07/28/91

Insert C (1)

# DESIGN ACTIVITIES STATUS

(CONTINUED)

MILE-STONE ID	PRODUCT	PLANNED COMPLETION DATE	EXPECTED DATE	
RSN4	<b>TRADE STUDIES (C.6) (C.8) C.13)</b> <u>IN HOUSE</u>			
	1. PORTAL SITING	IN CHECKING	06/02/91	06/02/91
	2. CH RAMP SIZING	IN CHECKING	06/02/91	06/02/91
	3. VENTILATION SIZING	15%	06/02/91	06/02/91
	4. FAN SIZING	15%	06/28/91	06/28/91
	5. TRANSPORTATION METHODS	IN CHECKING	06/02/91	06/02/91
	6. UG NORTH RAMP SIZING	IN CHECKING	06/02/91	06/02/91
	7. SHAFT SIZING STUDY	IN CHECKING	06/02/91	06/02/91
	8. ELECTRICAL SYSTEM STUDIES	90%	06/02/91	06/02/91
	<u>OUT HOUSE</u>			
RSN 5	PRELIMINARY SITING REPORT	DELIVERABLES		
	- INPUT FROM PARTICIPANTS - COMPLETE REVIEW DRAFT	-- IN CHECKING	COMPLETE 05/31/91	05/31/91

Insert C (2)

# DESIGN ACTIVITIES STATUS

(CONTINUED)

MILE-STONE ID	PRODUCT	PLANNED COMPLETION DATE	EXPECTED DATE
RSN 6	MODIFICATION OF PB QA PLAN 88-9 TO QARD REVIEW AND APPROVAL  PREPARE SIX NEW INTERFACE DRAWINGS AND REPORT  INTERFACE DISCUSSIONS	COMPLETE  07/31/91  ONGOING	07/31/91

Insert C (3)

#### D. Summary

- ◆ ESF activities are on schedule for November 1992 portal construction start.
- ◆ Equitable treatment of permit grants by the State of Nevada is a major DOE concern.
- ◆ The DOE commitment to meeting the above timetable and conducting an environmentally safe and quality managed project is steadfast.

The above information was presented by Ted Petrie, Acting Director, Engineering and Development Division, YMPO. The presentation stressed the Project's desire to do the job right, both technically and in the regulatory arena. There are new players in the program, Raytheon and TRW, and some roles aren't well defined as yet. There is a feeling of optimism that the new schedules are doable and that the program will move forward. There are serious concerns over budget and the possibility of staff reductions.

Remember, there is a north area design review on June 17. There will probably be a south area design review in July.

## II. GENERAL

### A. Elevations

The following coordinates and elevations were supplied by Sandia National Laboratory from the IGIS:

#### 1.1 Surface Elevations at Easternmost Point of Repository

Boundary: (although it is not a point but a line between these two points)

East 565220.00 North 765955.415 Elevation 4000.3833912

East 565220.00 North 763652.8782 Elevation 3997.2968823

1.2 Repository Floor Elevations at Easternmost Point of Repository Boundary: (although it is not a point but a line between these two points)

East 565220.00 North 765955.415 Elevation 2976.20

East 565220.00 North 763652.8782 Elevation 2953.83

1.3 Water Table Elevations at Easternmost Point of Repository Boundary: (although it is not a point but a line between these two points)

East 565220.00 North 765955.415 Elevation 2395.0214008

East 565220.00 North 763652.8782 Elevation 2396.00

2.1 Maximum Elevation of Yucca Mountain within Repository Boundary:

East 558000.00 North 759750.00 Elevation 4945.70

2.2 Elevation of Point on Repository Floor Beneath Maximum Elevation of Yucca Mountain (see 2.1):

East 558000.00 North 759750.00 Elevation 3680.5780

2.3 Elevation of Point on Water Table Beneath Maximum Elevation of Yucca Mountain (see 2.1):

East 558000.00 North 759750.00 Elevation 2428.00

3.1 Elevation of Borehole G-4 at Surface:

East 563081.62 North 765807.07 Elevation 4163.8552383

3.2 Elevation of Borehole G-4 at Repository Floor:

East 563081.62 North 765807.07 Elevation 3136.4213046

3.3 Elevation of Borehole G-4 at Water Table:

East 563081.62 North 765807.07 Elevation 2397.00

4.1 Surface Elevation at Westernmost Point of Repository Boundary:

East 557194.4647 North 761349.125 Elevation 4324.8523925

4.2 Repository Floor Elevation at Westernmost Point of  
Repository Boundary:

East 557194.4647 North 761349.125 Elevation 3682.85

4.3 Water Table Elevation at Westernmost Point of Repository  
Boundary:

East 557194.4647 North 761349.125 Elevation 2466.2750506

B. Counties Granted Affected Status

Inyo County, California; Esmeralda County and White Pine County, Nevada have been granted affected status by DOE. Lincoln, Clark and Nye Counties, Nevada have had affected status for some time. The U. S. Court of Appeals ruled that Counties contiguous to Nye County will be granted affected status.

Mineral, Churchill, Lander and Eureka Counties, Nevada are also contiguous to Nye County and have been informed that they, too, are eligible. This will reduce the amount of money available to each affected unit of local government unless the pot is sweetened.

C. Organization charts

Two organization charts are attached:

- ◆ Nuclear Waste Repository Technology Department, Sandia National Laboratory
  
- ◆ Raytheon Services, Nevada

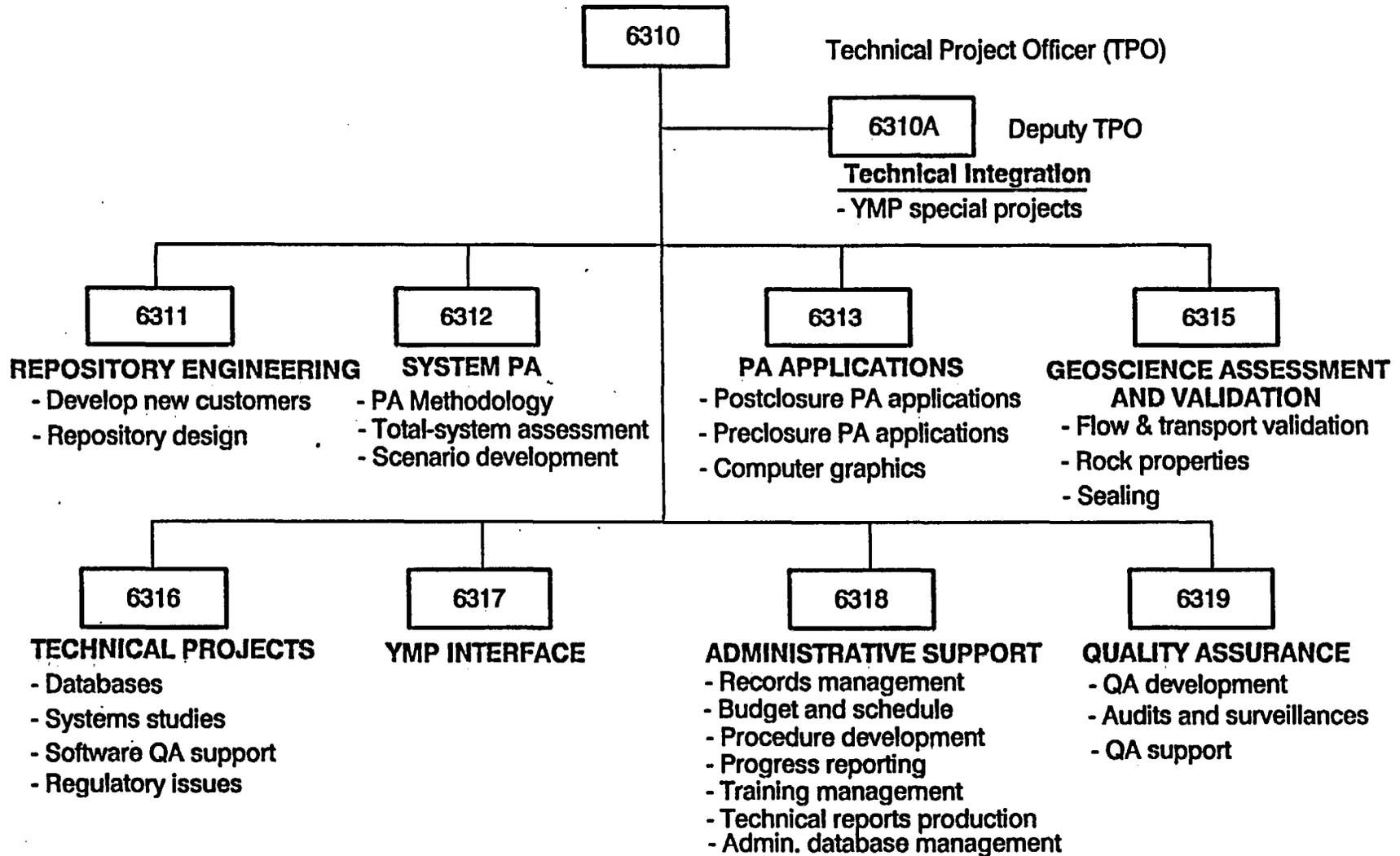
There are no new issues that this office has identified that have not been brought to management's attention.

cc w/encs.: K. Stablein, 4H3; J.E. Latz

cc w/o encs.: D. Shelor, C.P. Gertz, R.E. Loux, M. Glora,  
J. Martin, G. Cook, D.M. Kunihiro, D. Weigel, J. Linehan, 4H3;  
B.J. Youngblood, 4H3; R. Bernero, 6A4; H. Thompson, 17G21;  
H. Denton, 17F2; S. Gagner, 2G5; E. O'Donnell, NLS 260

Enclosures: Response to GAO Testimony Readiness to Start New  
Work; DOE's Response to the GAO Testimony on DOE's Readiness to  
Start New Work at Yucca Mountain, Letter to Governor Miller from  
C. Gertz (4/25/91); New Raytheon Services Nevada Organization  
(Amendment); Ramp Information; ESF Alternatives Evaluation (SNL);  
MSIS Overview (E. Petrie, May TPO Meeting); Early Site  
Suitability Evaluation Task (C. Herrington, May TPO Meeting)

# NUCLEAR WASTE REPOSITORY TECHNOLOGY DEPARTMENT



**NUCLEAR WASTE MANAGEMENT  
AND TRANSPORTATION DIRECTORATE 6300**  
**T. O. Hunter, Acting**

**NUCLEAR WASTE REPOSITORY  
TECHNOLOGY DEPARTMENT 6310**  
**T. E. Blejwas, Acting  
Technical Project Officer**

**TECHNICAL INTEGRATION  
DIV. 6310A**  
**L. E. Shephard  
Deputy TPO**

**REPOSITORY ENGINEERING  
DIV. 6311**  
**A. L. Stevens**

**SYSTEM PERFORMANCE  
ASSESSMENT DIV. 6312**  
**F. W. Bingham**

**PERF. ASSESSMENT  
APPLICATIONS  
DIV. 6313**  
**L. S. Costin**

**GEOSCIENCE ASSESSMENT  
AND VALIDATION  
DIV. 6315**  
**F. B. Nimick, Actg.**

**TECHNICAL PROJECTS  
DIV. 6316**  
**R. P. Sandoval**

**YUCCA MOUNTAIN PROJECT  
INTERFACE  
DIV. 6317**  
**S. Sinnock**

**ADMINISTRATIVE SUPPORT  
DIV. 6318**  
**S. E. Sharpton**

**QUALITY ASSURANCE  
DIV. 6319**  
**R. R. Richards**

## Raytheon Services Nevada

<b>President, General Manager</b> <b>B. W. Colston</b>	
<b>Vice President, Dep. Gen. Manager</b> <b>R. Nilsen</b>	
<b>Exec. Secretary</b> <b>L. Cook</b>	<b>Exec. Secretary</b> <b>B. Edler</b>

<b>Contracts</b> Manager - G. Moore Admin. Asst. M. Pratt
<b>External Affairs</b> Manager - N. Gindrat Secretary M. Babin De Olsen
<b>Employee Compliance Programs</b> Manager - E. Dawson Clerk L. Lopez**
<b>Controller</b> G. Schuhmacher* Sr. Admin. Asst. O. Cole*
<b>Classification Officer</b> F.T. Beers III*

<b>Env., Safety &amp; Health</b> Manager - W. Wegst Dep. Mgr. - G. (Mike) Dix
---

<b>Quality Assurance</b> Manager - G. Pratt
--

<b>Yucca Mountain Project</b> Mgr. - R.L. Bullock Dep. Mgr. - J.C. Calovini
---

<b>Defense &amp; Spec. Energy Ops</b> Manager - A. C. Hollins
--

<b>Pacific Programs</b> Manager - W. McSpadden
---

<b>Johnston Atoll Operations</b> Manager - T. Tessem
---

<b>Program Support</b> Manager - D. Lockwood Dep. Mgr. - G. Schuhmacher*
--

<b>NTS Operations</b> Mgr. - T. W. Yelvington Dep. Mgr. - R. M. Ivy*
--

<b>Engineering</b> Manager - B. F. Johnson Dep. Mgr. - R.S. Ziegenbein*
---

**YUCCA MOUNTAIN OPS**  
Project Mgr.- R.L. Bullock  
Deputy Mgr. - J.C. Calovini\*

Valley Bank Center

**Field Operations  
Department**

Act. Manager J.C. Calovini\*

Valley Bank Center

**Systems Engineering  
Department**

Manager R.L. Schreiner

Valley Bank Center

**Site Characterization  
Design Department**

Manager B.R. Chytrowski

Valley Bank Center

**Project Administration  
Department**

Manager M.H. Wilson

Valley Bank Center

**Field Operations Department  
Acting Manager - J.C. Calovini\***

Valley Bank Center

**Field Exploration Drilling  
Chief - E.L. Wright**

Sr. Project Eng. B.B. Garms  
Sr. Drilling Eng. J.F. McCormick  
Sr. Drilling Eng. (V)  
Tech. Writer (V)  
Geophysical Logging  
Engineer (V)

Valley Bank Center

**Field Engineering  
Chief - J.E. McNeely**

Eng. Spec. R.E. Davis  
Sr. Eng. II A.L. Bessent  
Proj. Coord. N.J. Sanchez  
Comp. Analyst S.J. Loftfield

Valley Bank Center &  
Area 25

**Geologist/Hydrologist**

Listed under  
NTS Operations

**Site Characterization Design  
Manager - B.R. Chytrowski**

**Valley Bank Center**

**Design Engineering  
Chief - J.D. Grenia**

**See Next Page**

**Valley Bank Center**

**Design Control  
Chief - R.G. Musick**

Proj. Estimator	G.D. Woodard
Sr. Min. Eng./Spec.	J.D. Scott
Tech. Writer	(V)
Sr. Proj. Eng. I	R.C. Grtenwold
Sr. Proj. Eng. I	R. Haak

**Valley Bank Center**

**Design Engineering  
Chief - J.D. Grenia+**

Valley Bank Center

**Electrical  
Lead - T.D. Greiner**

Sr. Eng. II/E	J.A. Dumas
Sr. Designer II	M.S. Foszcz

Valley Bank Center

**Mechanical  
Lead - B.H. Anzai**

Sr. Mech. Eng.	(V)
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Valley Bank Center

**Mining  
Lead - B.T. Stanley**

Sr. Min. Eng./Spec.	R.L. Coppage
Sr. Min. Eng./Spec.	R.S. Jurani
Sr. Min. Eng./Spec.	M.J. Mrigala+
Sr. Min. Eng./Spec	W.R. Kennedy
Eng. Tech Anal./Spec.	S. Bonabian

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**Graphic/CAD  
Lead - J.A. Hill**

Draft Coord	J.M. Kennedy
Sr.Dsgnr. II	M.J. Heiner
Dsgnr	R.f. Chestney
Sr. Dsgnr III	D.R. Trujillo

Valley Bank Center

**Civil  
Lead - S.W. Williams**

Prin. Dsgnr	(V)
Prin. Dsgnr	R.I. Lucero
Prin. Dsgnr	C. Pierce
Specs.	H. Montalvo

Valley Bank Center

**Structural/Architectural  
Lead - N.B. Tamondong+**

Sr. Civ/Struct. Eng.	S.A. Nordick+
Struct. Dsgnr	P.A. Zizka+

Valley Bank Center

**+Subcontract Employees**

Note: Ten additional Design Engineers will be added as soon as the ESF alternative studies define what facilities are to be designed and what disciplines will be needed.

**Systems Engineering  
Manager - R.L. Schreiner**

Valley Bank Center

**Quality Compliance  
Chief - R.C. Deklever**  
Interface Ctl. Spec. (V)

Valley Bank Center

**Configuration Management  
Chief - M.B. Mirza**  
Conf. Ctl. Spec. R.J. Hilsinger+

Valley Bank Center

**Quality Engineering Procedures  
Chief - J.L. Rue**  
Sr. Q. Eng. Proced. Spec. H.W. Booth  
Sr. Pln. Coord A. Kalia  
Admin. Asst./Train. A.C. O'Donnell

Valley Bank Center

**Project Administration  
Manager - M.H. Wilson**  
Secretary J. McKee

Valley Bank Center

**Records  
Chief - J.E. Ferguson**  
(See Next Page)

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**Project Control  
Chief - M. Madison**  
Bud./Perf. Meas. Anal. (V)  
Pln. Coord. (V)

Valley Bank Center

**Clerical  
Chief - R.D. Drake**  
Recpt. Clerk S.E. Fielder  
Receptionist (V)  
Clerk II C. Bautista  
Clerk II J. Chappell  
Clerk II K.D. Kirwan  
Jr. Clerk K.E. Johnson

Valley Bank Center

**Engineering Control  
Chief - D.W. Thomas**  
Cost & Sch. Eng. (V)  
Cost & Sch. Eng. (V)  
Cost & Sch. Eng. (V)

Valley Bank Center

**Records  
Chief - J.E. Ferguson**

**Valley Bank Center**

**Design Eng. Records  
Des. Rec. Adm. - J.C. Douglas**  
Des. Rec. Mgt. Clerk J. Zimmerman

**Valley Bank Center**

**RSN Records Center  
Clerk II - T.D. Smith**  
Record Clerk (V)

**Valley Bank Center**

**Prj Microfilm Center  
Sr. Micro. Oper II - S. L. Moore**

Micro Oper	M.E. Aguire
Micro Oper	N.C. Chaffin
Micro Oper	C. Cummings
Micro Oper	G. Poole
Micro Oper	A.L. Roybal
Clerk II	M.C. Ishii
Clerk II	J.M. Peterson
Clerk	T. Burke

**Valley Bank Center**

**RESPONSE TO GAO TESTIMONY**  
**READINESS TO START NEW WORK**

DOE was ready to begin new studies in early 1990. This position is supported by the following facts:

At that time, all the requirements needed to start new site work in Midway Valley had been met. In February of 1990, DOE issued a news release stating that the U.S. Fish and Wildlife Service had concurred that the Yucca Mountain site studies are not likely to jeopardize the endangered desert tortoise. Other requirements completed included meeting land access requirements (10/89); U.S. Nuclear Regulatory Commission (NRC) review of the Site Characterization Plan (7/89); and NRC acceptance of appropriate detailed study plans (12/89).

In addition, the following QA Program issues had been addressed: (a) the DOE/HQ had reviewed and approved participant Quality Assurance (QA) Programs prior to early 1990, (b) the NRC had reviewed and accepted participant QA Programs and subsequently issued NRC Safety Evaluation letters in October 1989, (c) qualification audits were conducted by the DOE QA organization of selected participants to review QA program implementation prior to the start of specific new activities, and (d) the NRC participated in the DOE audits as observers. It should be noted that neither the respective DOE audit reports nor the NRC audit observation reports identified issues that would have prevented the DOE's start of new site characterization activities. The successful completion of these activities was accomplished prior to early 1990.

Thus, the two organizations conducting the field work at Midway Valley and Trench 14, the U.S. Geological Survey and Sandia National Laboratories, had quality assurance programs that had been accepted by the NRC. Also, DOE had conducted audits of both organizations with NRC participating as observers, to determine effectiveness of program implementation.

A prototype drilling program which was conducted in Utah in 1989 and Arizona in 1990 to test equipment, methods and procedures that will eventually be used during site characterization could have been done at a location near Yucca Mountain if state permits have been obtained. The Project had specifically asked the Governor's office to issue permit amendments to allow this equipment development and personnel training to take place in Nevada near Yucca Mountain, but was specifically denied; as a result these activities took place in Utah and Arizona.

It should also be noted that if permits had been obtained, a number of necessary support activities could have begun in early 1990. These activities would not have resulted in the collection of data for the License Application but are necessary to the performance of site characterization activities. These activities include:

- o Soil boring for borrow pits, foundation design and environmental studies
- o Road construction
- o Water pipeline construction
- o Area 25 water system improvements
- o Administrative building construction (ESF location)
- o Borrow pit construction
- o Pad construction for the Information Data Acquisition System

DOE'S RESPONSE TO  
THE GOVERNMENT ACCOUNTING OFFICE (GAO) TESTIMONY ON  
DOE'S READINESS TO START NEW WORK AT YUCCA MOUNTAIN

IN THE SUNDAY MAY 12, 1991 LAS VEGAS REVIEW-JOURNAL SCOTT CRAIGIE, CHIEF OF STAFF FOR NEVADA GOVERNOR BOB MILLER IS QUOTED AS SAYING PERMIT PROCESSING BY NEVADA "HAS NOT CAUSED ONE DAY'S DELAY. IF THEY (DOE) HAD THE PERMITS IN HAND TODAY, THEY WOULD NOT BE READY."

THE ARGUMENT THAT DOE WAS NOT READY TO START WORK UNTIL FEBRUARY 1991 IS BASED ON THE PREMISE THAT SURFACE DISTURBING SCIENTIFIC WORK AT YUCCA MOUNTAIN COULD NOT COMMENCE UNTIL DOE HAD A FULLY QUALIFIED QUALITY ASSURANCE (QA) PROGRAM IN PLACE. WHILE IT IS TRUE THAT THE DOE PASSED IT'S "GOLD STAR" QA AUDIT IN LATE 1990, IT IS ALSO TRUE THAT MOST OF THE SCIENTIFIC WORK ASSOCIATED WITH THE CHARACTERIZATION OF YUCCA MOUNTAIN IS DONE BY THE SCIENTIFIC PARTICIPANTS AND NOT BY DOE. THESE PARTICIPANTS INDIVIDUALLY HAD THEIR QA PROGRAMS APPROVED MANY MONTHS PRIOR TO LATE 1990 BUT WERE NOT ABLE TO PROCEED WITH THEIR SCIENTIFIC WORK BECAUSE THE STATE REFUSED TO ISSUE THE NECESSARY PERMITS.

IN POINT OF FACT HOWEVER, DOE'S QA PROGRAM WOULD HAVE ALLOWED WORK TO COMMENCE IN TWO KEY AREAS AS EARLY AS FEBRUARY, 1990. "SAFETY REPORTS" IN CONJUNCTION WITH "STUDY PLANS" HAD RECEIVED REQUISITE APPROVAL FOR WORK TO COMMENCE AT MIDWAY VALLEY AND TRENCH 14 FOR SPECIFIC STUDIES BY THAT DATE.

FURTHER, THERE IS WORK THAT DOE COULD HAVE DONE AT AND AROUND YUCCA MOUNTAIN THAT DID NOT REQUIRE A QUALIFIED QA PROGRAM. FOR EXAMPLE, DURING 1990 DOE DID PROTOTYPE DRILLING TO PERFECT DRILLING METHODS TO RETRIEVE CORE SAMPLES FROM DEPTH WITHOUT THE USE OF DRILLING FLUIDS WHICH MIGHT CONTAMINATE OTHERWISE PRISTINE CORE SAMPLES. THIS EXTENSIVE PROTOTYPE DRILLING AND TESTING OF EQUIPMENT AND PROCEDURES DID NOT REQUIRE A QUALIFIED QA PROGRAM AND WOULD HAVE BEEN MORE EFFECTIVE HAD DOE BEEN ABLE TO DO IT NEAR YUCCA MOUNTAIN. HOWEVER, BECAUSE OF THE LACK OF PERMITS THE DRILLING AND TESTING WAS DONE IN UTAH AND ARIZONA.

IT IS IMPORTANT TO UNDERSTAND THAT THE ONLY WORK WHICH REQUIRES A QUALIFIED QA PROGRAM IS WORK WHICH WILL BE USED AS EVIDENCE IN THE LICENSING PROCESS BEFORE THE NUCLEAR REGULATORY COMMISSION. THIS FIRST OF A KIND PROGRAM DOES AND WILL REQUIRE MUCH RESEARCH AND PROTOTYPE TESTING AND CALIBRATION IN THE PROCESS OF THE SCIENTIFIC INVESTIGATIONS. MUCH OF THAT WORK, WHILE IT MUST BE DONE UNDER EXTREMELY STRICT CONDITIONS, CAN BE DONE OUTSIDE THE SCOPE OF QA QUALIFICATION.

NEVADA HAS CAUSED MANY MONTH'S DELAY IN THE SCIENTIFIC STUDY OF YUCCA MOUNTAIN BY PARTICIPANTS WHICH WERE QA QUALIFIED PRIOR TO DOE. FURTHER, DOE IS AND HAS BEEN READY TO DO SCIENTIFIC WORK UNDER A LIMITED QA PROGRAM SINCE DECEMBER, 1989 AND A MORE FULLY QUALIFIED QA PROGRAM SINCE DECEMBER 1990.



Department of Energy  
Washington, DC 20585

91-3433

WBS 1.2.5  
QA: N/A

APR 25 1991

The Honorable Bob Miller  
Governor of the State of Nevada  
Capitol Complex  
Carson City, NV 89710

Dear Governor Miller:

On February 28, 1990, the Secretary of Energy responded to your letter of November 14, 1989, in which the State identified several concerns related to the geotechnical suitability of the Yucca Mountain candidate site for development of a geologic repository. At that time, the Secretary recognized the importance of the State's concerns, along with others that have been raised, and stressed the need to conduct the planned scientific studies to determine whether any of these concerns are a valid basis for declaring the site to be unsuitable. The U.S. Department of Energy (DOE) has recently conducted an additional assessment of the State's letter in light of testimony by State representatives at the March 21, 1991, oversight hearing of the Senate Energy and Natural Resources Committee on the Yucca Mountain Site Characterization Project. Dr. John W. Bartlett, Director of the Office of Civilian Radioactive Waste Management, has asked me to transmit the enclosed assessment for your information.

The technical issues addressed by the State of Nevada in the letter of November 14, 1989, are among the acknowledged uncertainties concerning the characteristics of the Yucca Mountain candidate site. These uncertainties will be addressed and resolved when the relevant studies defined in the Site Characterization Plan (SCP) are completed.

Based on current information, there is, at present, no evidence to support a finding that the site should be disqualified. This view is supported by both the presidentially-appointed Nuclear Waste Technical Review Board (NWTBR), and the U.S. Nuclear Regulatory Commission (NRC); most recently in testimony at the March 21, 1991, Senate Committee hearing. Specifically, representatives of both the NWTBR and the NRC testified that they knew of no scientific reason to disqualify the Yucca Mountain candidate site. Both representatives further testified that the DOE was ready to proceed with new surface-disturbing site characterization activities in an effort to obtain the information needed to ascertain whether or not the candidate site is suitable.

APR 25 1991

The Honorable Bob Miller

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As the Secretary stated in his letter of February 8, 1990, if at any time scientific investigations support a finding that the Yucca Mountain candidate site is unsuitable, the DOE will stop all work at the site, and will notify the Congress, and the Governor and the legislature of the State of Nevada, in accordance with the provisions of the Nuclear Waste Policy Act, as amended.

As further information about the site is collected, it will be made available to all interested parties, including the State of Nevada, the NWTB, and the NRC. In addition, we continue to review and evaluate the evidence collected by scientists working for the State of Nevada regarding the issues you have cited (tectonics and volcanism, human intrusion, and groundwater travel time). We anticipate and welcome further interactions with those scientists, and we would be pleased to discuss their analyses with them when they are provided to us. The DOE encourages discussions of these topics and suggests that holding a joint workshop with your scientists in the future may significantly aid resolution of technical issues concerning the Yucca Mountain candidate site.

Sincerely,



Carl P. Gertz, Acting Associate Director  
Office of Geologic Disposal

OGD:CPG-3433

Enclosure:  
Assessment of the State of Nevada  
Letter of November 14, 1989

cc w/encl:  
R. R. Loux, Carson City, NV

ASSESSMENT OF THE STATE OF NEVADA  
LETTER OF NOVEMBER 14, 1989

On February 28, 1990, the Secretary of Energy responded to a letter of November 14, 1989, in which the State identified several concerns related to the geotechnical suitability of the Yucca Mountain candidate site. As a result of testimony by State representatives at the March 21, 1991, oversight hearing of the Senate Energy and Natural Resources Committee on the Yucca Mountain site characterization program, the Office of Geologic Disposal has been requested by the Director of the Office of Civilian Radioactive Waste Management to conduct a further assessment of the information presented by the State of Nevada in the November 14, 1989, letter from the governor to the Secretary of Energy. This letter included a description of three factors relating to the geotechnical suitability of the Yucca Mountain candidate site, where the State concludes that the current information should cause the site to be disqualified from further consideration. The three technical factors or areas of concern are: the potential for human intrusion, tectonics (the possibility of both faulting and volcanism), and groundwater travel time. The DOE's present technical assessment of these three issues is presented below and preceded by some general observations regarding the State's comments.

The evaluations performed by the DOE have consistently indicated that the State's conclusions about disqualifying the Yucca Mountain candidate site are not valid. The available evidence does not support a finding in accordance with 10 CFR Part 960 that the site should be disqualified. The DOE has concluded that additional data from site characterization are necessary to further address these issues.

The assertions presented by the State in the letter of November 14, 1989, are similar to concerns expressed in comments on the Environmental Assessment, the Site Characterization Plan/Consultation Draft (SCP/CD) and the Site Characterization Plan (SCP). These concerns were considered in preparation of the SCP. The DOE's most recent responses to such concerns were provided in October 1989, as specific responses to the State's comments on the SCP/CD, and in December 1990, as responses to the State's comments on the SCP that were related specifically to studies of faulting and the significance of calcite-silica deposits (the first field studies to be conducted once permits are received). Responses to the remainder of the State's detailed comments on the SCP are scheduled to be completed by late 1991. A further assessment of the issues raised in the November 14, 1989, letter is presented here in light of the State's testimony at the March 21, 1991 hearing. In all cases, the DOE has acknowledged the legitimacy of the concerns expressed by the State and others, and believes that the site investigation program defined in the SCP will provide the information needed to determine the validity and significance of the concerns. It is important to note that, while other parties (U.S. Nuclear Regulatory Commission, Edison Electric Institute [EEI],

Enclosure

Department of Interior-U.S. Geological Survey, Nuclear Waste Technical Review Board) have raised technical issues in reviewing the DOE's plans, no other organization has come to the conclusion that the Yucca Mountain candidate site should be disqualified based on the information currently available. The NRC, NWTRB, Environmental Protection Agency (EPA), and EEI have specifically stated that the site characterization program should proceed with those studies necessary to evaluate whether or not the site is suitable. In fact, in response to a question from the NRC/ACNW (7th Meeting, February 23, 1989, meeting transcript), Carl Johnson, the State's Administrator of Technical Programs stated, "I don't think we have sufficient data by which we can conclude right now that the site should be disqualified but we certainly have sufficient data to point in the direction of possible fatal flaws with the site."

Under the Nuclear Waste Policy Act (NWPA), as amended, and the siting guidelines developed by DOE in response to the NWPA, the DOE has the responsibility for determining whether the Yucca Mountain candidate site is suitable for repository development. In its discussion of potential disqualifying conditions, the State appears to have interpreted the guidelines in 10 CFR Part 960 inappropriately. The State focuses on three disqualifying conditions of the siting guidelines in 10 CFR Part 960, two of which (those related to human intrusion and tectonics) are linked to an evaluation of the potential for loss of waste isolation. In order to determine whether these disqualifying conditions exist at the site, it must be determined that the potential for loss of waste isolation exists as a result of the presence of natural resources or tectonic activity. This requires that a performance assessment be completed and that the results of this assessment indicate the likelihood of noncompliance with the isolation requirements. The State has not provided such an assessment to support its argument. The State's argument for disqualification does not address performance, merely the possible presence of features that may be relevant to disqualification. The third disqualifying condition cited by the State addresses the time required for transport along likely and significant radionuclide travel paths. The State's assertion does not recognize the constraints on the identification of likely and significant pathways or demonstrate that groundwater transport along such pathways fails to meet the requirements. The State bases its assertion not on likely and significant radionuclide travel paths, which are performance related, but simply on the fastest possible path of water travel. Further, the NRC has supported the DOE interpretation in both concurrence with 10 CFR Part 960 and a later letter to DOE (Browning, 1985). Although the DOE recognizes the importance of the State's concerns, the Department finds, on the basis of assessments performed to date, that the State's conclusions about disqualification of the site are not appropriate and not correct given the current data.

The State also concludes that, in general, existing DOE technical assumptions are unconservative, particularly where uncertainty exists in the data available. In terms of the disqualifying conditions of the siting guidelines, whether an assumption is conservative or not depends on the impact of the assumption on waste isolation or radionuclide transport, and the specific application in terms of the overall siting process. Neither of

these issues is addressed by the State. At the current stage of the site characterization process, the siting guidelines only require DOE to have confidence, considering existing uncertainties, that the technical evidence does not support a finding of disqualification. Before the site can be found to be suitable, however, the DOE must have adequate confidence that the technical evidence not only supports a finding that the site is not disqualified on the basis of that evidence, but that it is not likely to be disqualified based on additional evidence. The State appears to have interpreted the requirements of the guidelines incorrectly, particularly as they relate to the use of existing information early in the program to demonstrate that the site is not "unsuitable," as well as the need to explicitly consider the relationship between site conditions and the potential for loss of waste isolation, as noted above.

#### Human Interference Concerns

The State's basic assertion is that Yucca Mountain is in a rich mining district, and that the site contains common geologic features that are associated with numerous ore deposits. The State also concludes that DOE must assume that future exploration will take place to recover valuable natural resources outside of the controlled area, and that those activities should be expected to lead to some inadvertent loss of waste isolation. With respect to the presence of mineral resources at Yucca Mountain, a recent evaluation (December 1989) has been completed by S. Castor and J. Tingley (Nevada Bureau of Mines and Geology) and S. Feldman (Desert Research Institute). This evaluation concludes that there are no identified mineral resources in an area termed the Yucca Mountain Addition, a requested land withdrawal of approximately 4250 acres bordering the western edge of the Nevada Test Site and the southern edge of the Nellis Air Force Range, and that the potential for mineral deposits or energy resources in this area is low to very low. This evaluation is generally consistent with the information presented in the SCP and the current DOE view that the available data suggest that the mineral potential at Yucca Mountain is not significant.

The SCP also identifies current mines and exploration targets as well as abandoned mines and prospects that are present in the site region. In addition, the U.S. Bureau of Mines has recently completed a series of reports for the NRC related to the potential for natural resources occurring near or at the Yucca Mountain candidate site. Two of those reports are surveys of mines, prospects and mineral locations (Raney, February 1989, August 1990). A third report (Raney, June 1990) is a review of statements contained in the State's letter of November 14, 1989, regarding the occurrence of natural resources and the potential for human intrusion. This report provides detailed information on recently developed mines and reiterates information concerning the geology in the site vicinity. The above references reinforce the DOE's view that the available data suggest that the mineral potential at Yucca Mountain is not significant. Considering other natural resources, including hydrocarbons, the most thorough assessment of this potential has been presented in Section 1.7 of the SCP and concludes the potential for oil and gas is also very low (DOE, 1988).

The important issue in terms of the potential for future exploration and resource recovery in the region is not whether such activities would occur, but rather whether the impact of such activities on waste isolation would be significant. The U.S. Bureau of Mines has addressed the possible postclosure effects of surface and underground mining near a potential repository at the Yucca Mountain candidate site (Raney, October 1990). This report considered six mining scenarios and concluded three would have "no appreciable effect on a closed repository" and the fourth (mining using nuclear explosives) was highly unlikely. Two methods were dropped from consideration because either the method was infeasible or impacts were mitigated by topography (Raney, 1990b, p. 12). As discussed in SCP Section 8.3.5.13, the DOE has identified numerous natural resource exploration and development scenarios that will be evaluated during site characterization to determine if there are any credible extraction scenarios that result in a significant impact on waste isolation.

It is important to note that both the EPA Standard (40 CFR Part 191) and the NRC regulations (10 CFR Part 60) include specific language regarding how human intrusion should be considered in evaluating radionuclide release. Two points are worth noting. First, the regulations recognize that estimating human intrusion probabilities is different from estimating other scenario probabilities involving natural events and processes. The NRC, in the 10 CFR Part 60 Statements of Consideration (NRC, 1983, 48 FR 28194), states that the ". . . rule now incorporates a definition of unanticipated processes and events which are reviewable in a licensing proceeding, such processes and events expressly include intrusion scenarios that have a sufficiently high likelihood and potentially adverse consequence [emphasis added] to exceed the threshold for review." The NRC, in the 10 CFR Part 60 Statements of Consideration, states also that ". . . there would be no value in speculating on the virtual infinity of human intrusion scenarios and whether they will or will not result in violation of the EPA Standard." Second, the EPA standard discusses the frequency and severity of inadvertent human intrusion into geologic repositories. This guidance suggests an upper bound on the number of boreholes per square kilometer per 10,000 years (40 CFR Part 191, Appendix B). Neither of these considerations is discussed by the State. However, both of these considerations were included in the DOE's evaluation concerning whether Yucca Mountain should be considered for characterization (May 1986). No new information has been developed since that time to change DOE's overall conclusion.

Lastly, DOE notes that the State's concerns regarding mineral potential are being addressed. Study Plan 8.3.1.9.2.1 "Natural Resource Assessment of Yucca Mountain, Nye County, Nevada" is scheduled to be completed during fiscal year 1991. As additional drilling, geophysics, and sample collection is undertaken, analyses will be completed to determine if these data suggest that the potential for extraction of minerals at Yucca Mountain is higher than currently thought and sufficiently high to represent a significant risk to waste isolation.

## Tectonics Concerns

The State's basic contention regarding tectonics is that DOE cannot provide reasonable assurance that future faulting or volcanism will not cause a loss of waste isolation. As with the State comments on human intrusion, no specific data are provided that support a conclusion regarding a significant impact on waste isolation. The State also concludes that DOE has not demonstrated that there is reasonably available technology to deal with faulting and ground motion problems in terms of repository design to satisfy preclosure regulatory requirements.

From a regulatory perspective, the State's contention that the faulting around Yucca Mountain cannot be sufficiently well described to achieve reasonable assurance is premature in that reasonable assurance is a licensing issue within the purview of the NRC and cannot be fully evaluated until after the results of site characterization have been presented to the NRC. At this time, the DOE believes that the focus of the site characterization program on early determination of site suitability will provide the data and analyses necessary for the DOE to make findings with confidence on the suitability (or unsuitability) of the Yucca Mountain candidate site with respect to tectonic issues.

Since the DOE started investigating the Yucca Mountain candidate site, the tectonics program has been a high priority. In numerous documents, the DOE has recognized that the Southern Great Basin is an active tectonic area, and has stated that because of uncertainties in evaluating the potential for future faulting and volcanism, additional data collection is needed. Brief examples are provided below that address the issues of faulting (including the potential for ground motion) and volcanism.

The potential for future faulting will be evaluated to determine the potential impacts on waste isolation during the postclosure period (see SCP Section 8.3.5.13). Based on current information, faulting (and associated strain) is not expected to alter the hydrologic system to such a degree that waste isolation could be significantly affected. Specific assessments were included in the Environmental Assessment (EA) and the DOE Analysis of Sites Nominated for Characterization published in May 1986. As discussed in the EA and the SCP, there is no evidence to suggest that the water table has been as high as the potential repository horizon during the Quaternary Period (the last 1.8 million years), suggesting that tectonic events during this period have not significantly affected the position of the water table. However, uncertainties in assessing the past water table positions will be addressed by the site investigation program.

The issue of the potential for ground motion from earthquakes during the preclosure period has also been assessed in several DOE documents (EA, SCP, SAND 86-7013). The DOE recently completed a seismic design cost/benefit assessment (SAND 88-1600) which in part addressed the question of design feasibility given expected seismic events. This study supports past DOE assessments that the seismic design will be well within reasonably

available technology. This conclusion is further supported by the fact that some nuclear reactors, e.g., San Onofre in Southern California and Diablo Canyon in Central California, operate in seismic environments more severe than that at Yucca Mountain (Algermissan, et al., 1982). The site investigation program continues to place a high priority on studying the recurrence intervals of movement on the local and regional faults to determine if the DOE assessment on the seismic hazard should change. These studies include very detailed field work associated with the potential location for surface facilities. Study Plan 8.3.1.17.4.2, "Location and Recency of Faulting near Prospective Surface Facilities," passed the NRC acceptance review on November 24, 1989. The NRC technical review was completed on March 16, 1990.

In addition, the NWTRE's Second Report to Congress (November 1990), recommends that the determination of site suitability should not (emphasis added) be based on the occurrence of seismic ground motion or fault displacement alone. Rather, it is the likelihood of adverse consequences and the ability of DOE to design the repository system that should decide whether the site is suitable. Earthquakes of various magnitudes are naturally occurring events and can be anticipated during the Yucca Mountain potential repository's operational and postclosure periods. A repository at Yucca Mountain would be designed conservatively to resist the effects of earthquakes that could occur during these periods. It is the consequences of these seismic events to public health and safety and to waste isolation that are of concern, not the determination that such events will occur.

The DOE has taken seriously the concerns regarding the potential for future volcanic activity expressed by the State of Nevada and the NRC. Postclosure volcanism scenarios will be evaluated during the site investigation program. Current estimates of the probability of volcanism indicate that the regulatory release limits will not be exceeded (EA and SCP). Field studies related to volcanism have been ongoing for a number of years, and updates to estimates of the probability of volcanic activity will be contained in an early report in the site program. Two relevant study plans were identified as having high priority with regard to ongoing field activities. Study Plan 8.3.1.8.5.1, "Characterization of Volcanic Features" (primarily a data collection study) passed the NRC acceptance review on August 20, 1990. Study Plan 8.3.1.8.1.1, "Probability of Magmatic Disruption of the Repository" (primarily a data analysis study) was transmitted to the NRC and the State of Nevada on March 15, 1991. The NWTRE has participated in a field trip to the Yucca Mountain area to discuss studies of volcanism. The NWTRE's First Report to Congress (March 1990) states that the "Board finds that the DOE and its contractors . . . are pursuing a well-conceived volcanism study program."

#### Groundwater Travel Time Concerns

The State contends that the DOE's conceptual model for groundwater flow is simplistic and nonconservative in nature. The State also concludes that fracture flow should be assumed to exist, and that the current data

demand a finding of disqualification. In its discussions on the finalization of the siting guidelines (10 CFR 960), the DOE stated that site characterization studies are necessary prior to groundwater travel time calculations since, prior to these studies, "the pathways, rates, and amounts of groundwater travel [will not be known] in sufficient detail to know precisely whether the site complies with the 1000-year travel time" (Fed Reg. Vol. 49, No. 236, page 47733). Also, in its Statement of Considerations, the NRC stated that "the Commission concludes that groundwater travel time calculations can be determined in the unsaturated zone . . . provided that the proper level of site characterization analysis is conducted . . . the Commission believes it is feasible for DOE to demonstrate compliance with the groundwater travel time provision using existing field and laboratory experiments" (NRC, 1985, 60-SC-31).

The disqualifying condition of the siting guidelines addresses groundwater travel time "along any pathway of likely and significant radionuclide travel" rather than along any pathway, as the State assumes. The wording of the guideline requires that a pathway be both likely and that it allow "significant" quantities of radionuclides to travel along it. The State considered neither of these details. Both the EA and the SCP include groundwater travel time estimates, which range from about 9,000 to 80,000 years (mean of about 43,000 years), far in excess of the regulatory requirement of 1,000 years.

DOE's current representation is that groundwater flow occurs in both the matrix and in fractures but that flow in the matrix predominates over flow in fractures. This is based on observations that the matrix is less than fully saturated, estimates of pore and aperture sizes, and the hypothesis of matrix-potential equilibrium between fractures and the matrix. The SCP explicitly acknowledges the potential for flow in fractures and faults, and recognizes the need to obtain data to understand the factors controlling fracture flow. Indeed, the current conceptual model for unsaturated flow is that groundwater flow is partitioned between the matrix and fractures, and includes the dependency of the flow on flux magnitude and the relative conductivities of matrix and fractures.

As discussed in SCP sections 8.3.5.12 and 8.3.1.2, an extensive site investigation program is planned to study the hydrologic flow processes at Yucca Mountain. These studies include tests to specifically investigate fracture flow and to thoroughly understand the occurrence of any flowing water that is encountered within the unsaturated zone.

An independent Unsaturated Zone Hydrology Peer Review Team (PRT) was established by the DOE to evaluate work done by the Yucca Mountain Site Characterization Project participants in developing an understanding of unsaturated zone hydrology at the Yucca Mountain site (DOE, 1991). The PRT agreed with investigators that the potential for lateral flow and the concentration of flux down fault zones need to be investigated before the issue of groundwater travel time is resolved. The PRT supported DOE's use of a probabilistic approach and encouraged investigators to refine the models of site hydrology by incorporating site data.

In its First Report to Congress (March, 1990, p. 18) the NWTRB states that the Board "believes that DOE research on the rate and distribution of recharge to the unsaturated zone within the Yucca Mountain geologic block is well conceived and well planned."

#### Summary

In summary, the concerns raised by the State of Nevada are not new. These concerns have been raised in the past, and have been addressed by the DOE in the development of the plans for site characterization presented in the SCP. The technical issues raised by the State represent acknowledged areas of uncertainty that will be addressed by future site investigations. Based on current information, the DOE concludes that, at present, there is no evidence to suggest that the site should be disqualified. This view is supported by both the NWTRB and the NRC, most recently in testimony before the Senate Energy and Natural Resources Committee on March 21, 1991. They stated that there is no technical basis at this time to disqualify the Yucca Mountain candidate site, and that the DOE is ready to proceed with the site investigations that are directed at determining whether or not the site is suitable for development of a repository. If, at any time in the future, technical data support a finding that this conclusion should change, the DOE will stop site investigations at Yucca Mountain, and notify the Congress, and the Governor and the legislature of Nevada as required by law.

## References

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This constitutes a formal amendment to the minutes of the Project Manager-Technical Project Officer meeting held on March 22, 1991, in Las Vegas, Nevada.

Section E. YMP Information Items, New Raytheon Services Nevada Organization, was amended to read as follows:

#### NEW RAYTHEON SERVICES NEVADA ORGANIZATION

Joseph C. Calovini, Raytheon Services Nevada, (RSN), presented an overview of RSN roles and responsibilities. Several organizational flow charts were presented (see Enclosure 8). There are four departments: (1) field operations, (2) systems, (3) site characterization design, and (4) administration. Joseph C. Calovini serves in a dual position, as Deputy Manager to RSN Yucca Mountain Operations Project Manager Richard L. Bullock, and as Manager of the Field Operations Department. Field Operations supports both the exploratory drilling and the field engineering. In addition, RSN employs 5 Geologists/Hydrologists attached to the United States Geological Survey (USGS).

An effort is underway to ensure that all procedures are in place to cover all engineering work for Title II design. The Design department has been divided into two sections, Design Engineering, with 6 disciplines, and Design Control. Project Administration includes Project records and clerical support. The Records System consists of design engineering records, which are the ones currently being produced, and a Project microfilm center to process all proof of records.

The total number of RSN personnel involved with the YMP is 84. Globally, RSN employs approximately 1,350 people. It is anticipated that approximately 35 more mining engineers and civil engineers will be added to the staff to participate in the design process. Later, the personnel focus will shift to field engineers and field inspectors, with personnel requirements remaining stationary.

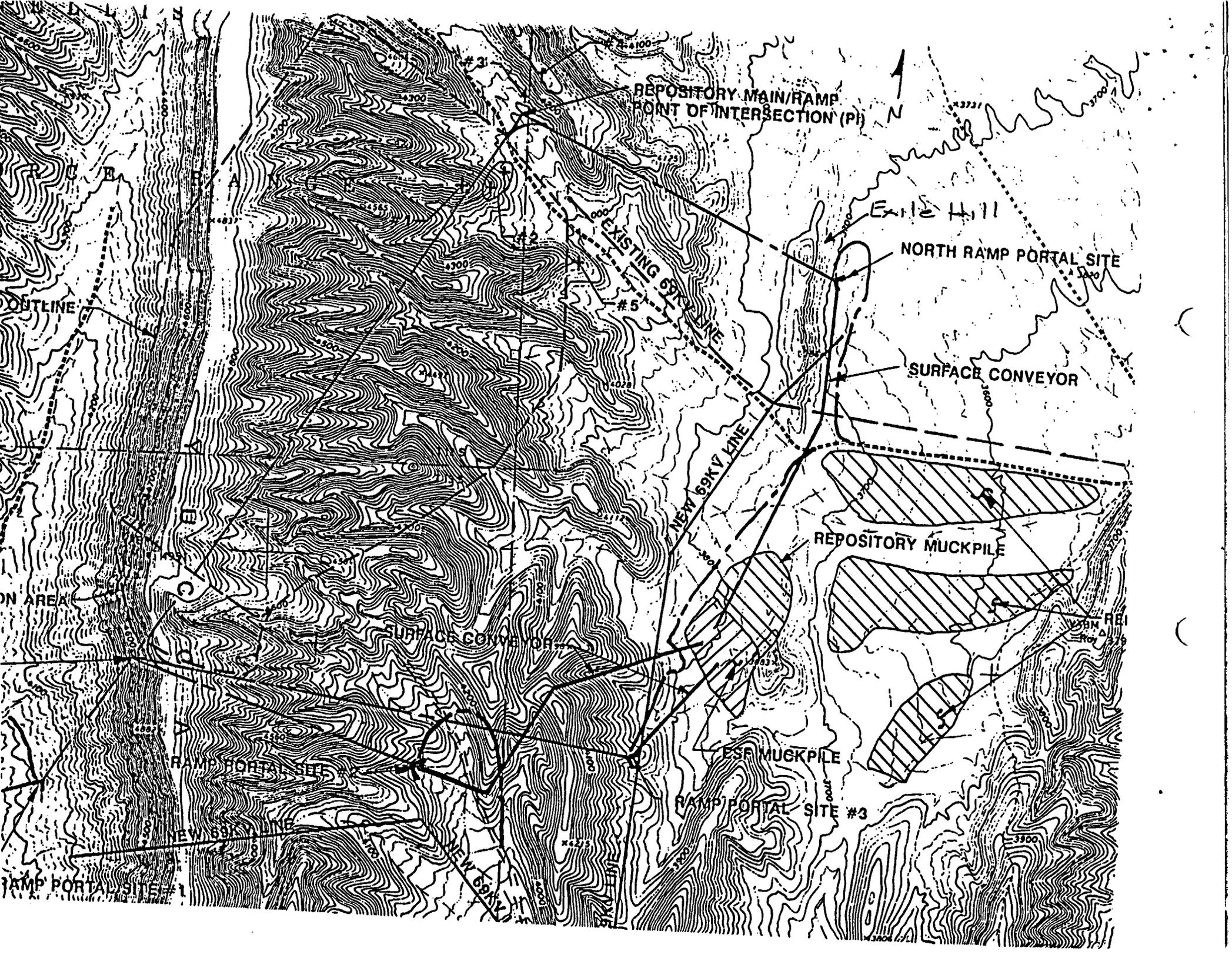


TABLE 1  
SOUTH RAMP PORTAL SITING-ENGINEERING EVALUATION RESULTS

EVALUATION FACTOR	WEIGHTING FACTOR VALUE W	SITE 1-SOLITARIO		SITE 2-GHOST DANCE		SITE 3-BOUNDARY RIDGE	
		*RATING V	WTG. VAL. WV	*RATING V	WTG. VAL. WV	*RATING V	WTG. VAL. WV
1. PORTAL ACCESS ROAD CONSTRUCTION	7	1.00	7.00	3.75	26.25	3.50	24.50
2. PORTAL PAD/HIGHWALL CONSTRUCTION	8	2.00	16.00	3.25	26.00	3.25	26.00
3. PORTAL CONSTRUCTION	7	2.25	15.75	3.50	24.50	3.25	22.75
4. RAMP CONSTRUCTION	10	2.50	25.00	3.75	37.50	3.00	30.00
5. RAMP LENGTH	9	4.50	40.50	3.50	31.50	1.75	15.75
6. RAMP GRADIENT	8	3.00	24.00	3.75	30.00	5.00	40.00
7. REPOSITORY INTEGRATION IMPACTS	6	3.25	19.50	3.50	21.00	3.25	19.50
8. ESF/REPOSITORY LOGISTICS	8	2.00	16.00	3.25	26.00	4.00	32.00
WEIGHTED VALUE			163.75		222.75		210.50
WEIGHTED VALUE AS PERCENT OF TOTAL			27.43%		37.31%		35.26%

\*RATING VALUE V=AVERAGE RATING

TABLE 2

SOUTH RAMP PORTAL SITING-PERFORMANCE ASSESSMENT EVALUATION RESULTS

DISCRIMINATOR	WEIGHT W	SITE 1-SOLITARIO		SITE 2-GHOST DANCE		SITE 3-BOUNDARY RIDGE	
		*RATING V	WTG. VAL. WV	*RATING V	WTG. VAL. WV	*RATING V	WTG. VAL. WV
1. LIQUID REACHING REPOSITORY HORIZON	0.7	4	2.8	3	2.1	3	2.1
2. GAS ESCAPING FROM REPOSITORY HORIZON	0.3	1	0.3	2	0.6	3	0.9
WEIGHTED VALUE			3.1		2.7		3.0
WEIGHTED VALUE AS PERCENT OF TOTAL			35.23%		30.68%		34.09%

\*RATING VALUE V=AVERAGE RATING

TABLE 3

SOUTH RAMP PORTAL SITING-UNDERGROUND TESTING EVALUATION RESULTS

DISCRIMINATOR	WEIGHT W	SITE 1-SOLITARIO		SITE 2-GHOST DANCE		SITE 3-BOUNDARY RIDGE	
		*RATING V	WTG. VAL. WV	*RATING V	WTG. VAL. WV	*RATING V	WTG. VAL. WV
1. REPRESENTATIVENESS	0.5	1	0.5	3	1.5	5	2.5
2. COMPLEMENTARY INFORMATION	0.4	2	0.8	3	1.2	4	1.6
3. INTERFERENCE	0.1	3	0.3	3	0.3	4	0.4
WEIGHTED VALUE			1.6		3.0		4.5
WEIGHTED VALUE AS PERCENT OF TOTAL			17.58%		32.97%		49.45%

\*RATING VALUE V=AVERAGE RATING

TABLE 4

SOUTH RAMP PORTAL SITING-SURFACE-BASED TESTING EVALUATION RESULTS

DISCRIMINATOR	WEIGHT W	SITE 1-SOLITARIO		SITE 2-GHOST DANCE		SITE 3-BOUNDARY RIDGE	
		*RATING V	WTG. VAL. WV	*RATING V	WTG. VAL. WV	*RATING V	WTG. VAL. WV
1. INTERFERENCE	0.55	2.00	1.10	3.00	1.65	3.33	1.83
2. COMPLEMENTARY INFORMATION	0.40	2.33	0.93	3.00	1.20	3.67	1.47
3. MUCK PILE LOCATION	0.05	3.00	0.15	3.00	0.15	3.00	0.15
WEIGHTED VALUE			2.18		3.00		3.45
WEIGHTED VALUE AS PERCENT OF TOTAL			25.28%		34.76%		39.96%

\*RATING VALUE V=AVERAGE RATING

TABLE 5

SOUTH RAMP PORTAL SITING-COMBINED EVALUATION RESULTS

EVALUATION CONSIDERATION	WEIGHTING FACTOR W	SITE 1-SOLITARIO CANYON		SITE 2-GHOST DANCE		SITE 3-BOUNDARY RIDGE	
		RATING V	WTG. VAL. WV	RATING V	WTG. VAL. WV	RATING V	WTG. VAL. WV
ENGINEERING	0.25	0.274	0.06850	0.371	0.09325	0.353	0.08825
PERFORMANCE ASSESSMENT	0.35	0.352	0.12320	0.307	0.10745	0.341	0.11935
UNDERGROUND TESTING	0.35	0.176	0.06160	0.330	0.11550	0.494	0.17290
SURFACE BASED TESTING	0.05	0.253	0.01265	0.348	0.01740	0.400	0.02000
TOTAL WEIGHTED VALUE			0.26595		0.33360		0.40050

TABLE 10  
OPTIONAL SHAFT SITING-ENGINEERING EVALUATION RESULTS

EVALUATION FEATURE	WEIGHTING FACTOR VALUE W	SITE 1-ABOVE COYOTE WASH		SITE 2-RS-2 VICINITY		SITE 3-D. H. WASH		SITE 4-ABOVE D. H. WASH		SITE 5-EAST EDGE EST BLOCK	
		*RATING V	WTG. VAL. WV	*RATING Y	WTG. VAL. YV	*RATING Y	WTG. VAL. YV	*RATING Y	WTG. VAL. YV	*RATING Y	WTG. VAL. YV
1. COLLAR ACCESS ROAD CONSTRUCTION	1	2.50	20.00	4.00	32.00	3.00	24.00	1.75	14.00	2.75	22.00
2. SHAFT SITE PAD CONSTRUCTION	1	2.75	22.00	3.75	30.00	2.75	22.00	2.50	20.00	2.75	22.00
3. COLLAR CONSTRUCTION	6	3.50	21.00	3.50	21.00	3.50	21.00	3.25	19.50	3.00	18.00
4. SHAFT GEOLOGY	10	2.75	27.50	3.50	35.00	3.00	30.00	2.50	25.00	2.75	27.50
5. REPOSITORY INTEGRATION IMPACTS	9	2.25	20.25	2.50	22.50	3.00	27.00	2.75	24.75	3.25	29.25
6. RST/REPOSITORY LOGISTICS	7	2.50	17.50	3.50	24.50	3.25	22.75	3.00	21.00	3.00	21.00
7. SHAFT DEPTH	5	2.25	11.25	3.00	15.00	3.50	17.50	2.75	13.75	3.00	15.00
WEIGHTED VALUE			139.50		180.00		164.25		130.00		154.75
WEIGHTED VALUE AS PERCENT OF TOTAL			17.57%		23.18%		21.15%		17.77%		19.91%

\*RATING VALUE W-AVERAGE RATING

TABLE 11

OPTIONAL SHAFT SIZING-PERFORMANCE ASSESSMENT EVALUATION RESULTS

DISCRIMINATOR	WEIGHT	SITE 1-ABOVE COYOTE WASH		SITE 2-NS-2 VICINITY		SITE 3-D. N. WASH		SITE 4-ABOVE D. N. WASH		SITE 5-EAST EDGE ESP BLOCK	
		*RATING	WTG. VAL.	*RATING	WTG. VAL.	*RATING	WTG. VAL.	*RATING	WTG. VAL.	*RATING	WTG. VAL.
	W	V	WV	V	WV	V	WV	V	WV	V	WV
1. LIQUID BRACING REPOSITORY HORIZON	0.7	2	1.4	2	1.4	4	2.8	3	2.1	3	2.1
2. GAS ESCAPING FROM REPOSITORY HORIZON	0.3	2	0.6	2	0.6	3	0.9	4	1.2	2	0.6
WEIGHTED VALUE			2.0		2.0		3.7		4.7		2.7
WEIGHTED VALUE AS PERCENT OF TOTAL			11.25%		11.25%		24.50%		31.13%		17.88%

\*RATING VALUE V-AVERAGE RATING

TABLE 12

OPTIONAL SHAFT SITING-UNDERGROUND TESTING EVALUATION RESULTS

DISCRIMINATOR	WEIGHT W	SITE 1-ABOVE COYOTE WASH		SITE 2-ES-2 VICINITY		SITE 3-O. H. WASH		SITE 4-ABOVE O. H. WASH		SITE 5-EAST EDGE ESP BLOCK	
		*RATING V	WTC. VAL. WV	*RATING V	WTC. VAL. WV	*RATING V	WTC. VAL. WV	*RATING V	WTC. VAL. WV	*RATING V	WTC. VAL. WV
1. REPRESENTATIVENESS	0.20	3	3.30	3	3.30	3	0.70	3	0.70	2	1.40
2. INTERFERENCE	0.15	4	0.60	3	0.45	5	0.75	5	0.75	5	0.75
3. ISOLATION	0.15	3	0.45	3	0.45	4	0.60	4	0.60	4	0.60
WEIGHTED VALUE			3.15		3.00		2.05		2.05		2.75
WEIGHTED VALUE AS PERCENT OF TOTAL			24.23%		23.08%		15.77%		15.77%		21.15%

\*RATING VALUE W-AVERAGE RATING

TABLE 13

## OPTIONAL SWAPT SITING-SURFACE-BASED TESTING EVALUATION RESULTS

DISCRIMINATOR	WEIGHT W	SITE 1-ABOVE COYOTE WASH		SITE 2-BS-3 VICINITY		SITE 3-D. R. WASH		SITE 4-ABOVE D. R. WASH		SITE 5-EAST EDGE EST BLOCK	
		*RATING V	WTC. VAL. WV	*RATING V	WTC. VAL. WV	*RATING V	WTC. VAL. WV	*RATING V	WTC. VAL. WV	*RATING V	WTC. VAL. WV
1. INTERFERENCE	0.50	2.67	1.34	3.00	1.50	3.00	1.50	3.00	1.50	3.33	1.67
2. COMPLEMENTARY INFORMATION	0.50	2.67	1.34	3.00	1.50	2.00	1.00	2.00	1.00	3.00	1.50
WEIGHTED VALUE		2.67		3.00		2.30		2.30		3.17	
WEIGHTED VALUE AS PERCENT OF TOTAL		19.30%		21.61%		18.07%		18.07%		22.84%	

\*RATING VALUE V=ATSIAGE RATING

TABLE 14

OPTIONAL SHAFT SITING-COMBINED EVALUATION RESULTS

EVALUATION CONSIDERATION	WEIGHTING FACTOR	SITE 1-ABOVE COYOTE WASH		SITE 2-ES-2 VICINITY		SITE 3-DRILL HOLE WASH		SITE 4-ABOVE D.N. WASH		SITE 5-EAST EDGE ESP BLOCK	
		RATING	WTG. VAL.	RATING	WTG. VAL.	RATING	WTG. VAL.	RATING	WTG. VAL.	RATING	WTG. VAL.
	W	V	WV	V	WT	V	WV	V	WV	V	WT
ENGINEERING	0.30	0.100	0.05100	0.232	0.06960	0.211	0.06330	0.178	0.05340	0.199	0.05970
PERFORMANCE ASSESSMENT	0.25	0.132	0.03300	0.132	0.03300	0.245	0.06125	0.311	0.07775	0.179	0.04475
UNDERGROUND TESTING	0.40	0.212	0.08480	0.231	0.09240	0.158	0.06320	0.158	0.06320	0.211	0.08440
SURFACE BASED TESTING	0.05	0.193	0.00965	0.217	0.01085	0.181	0.00905	0.181	0.00905	0.229	0.01145
TOTAL WEIGHTED VALUE			0.19345		0.20585		0.19680		0.20340		0.20030



# YUCCA MOUNTAIN PROJECT

## ESF ALTERNATIVES EVALUATION

**CURRENT  
ESF  
CONFIGURATION**

- TWO 12-FT SHAFTS
- DRILL AND BLAST
- SCP TESTS
- NORTHERN LOCATION

**C  
O  
N  
C  
E  
R  
N  
S**

- NRC
- NWTRB
- NEVADA
- DOE

**ESF  
CONFIGURATION  
FOR  
FINAL DESIGN**

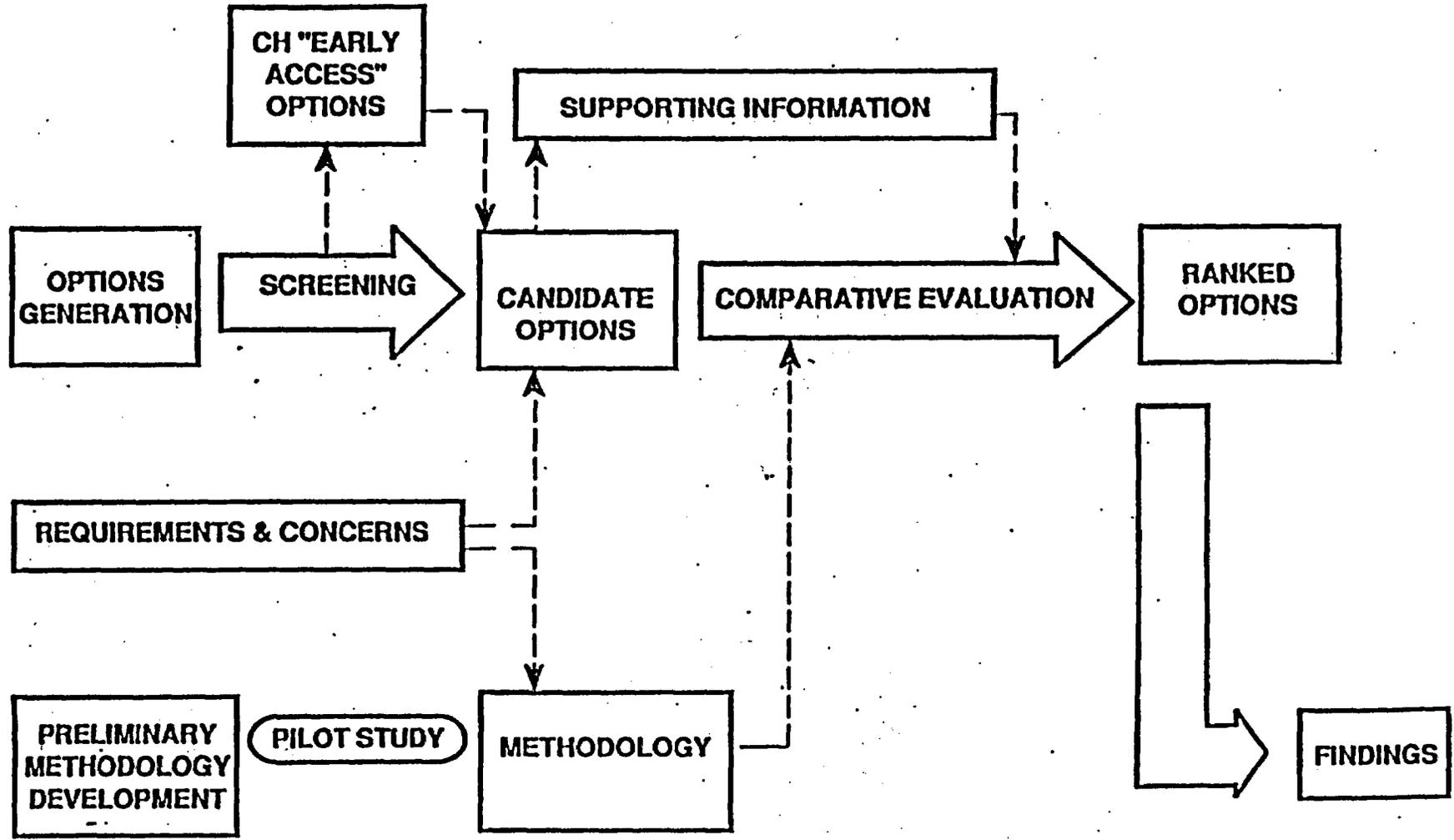
- SHAFTS OR RAMPS?
- MECH OR D/B?
- ADDITIONAL TESTS?
- ANOTHER LOCATION?

**TITLE II  
DESIGN BASIS**



Sandia  
National  
Laboratories

# ESF ALTERNATIVES STUDY



# GENERAL APPROACH

- **FIVE MAJOR DESIGN FEATURES WERE IDENTIFIED FOR SPECIFIC INCLUSION IN THE OPTIONS IN VARIOUS ALTERNATIVE WAYS AND COMBINATIONS**
  
- **ALL EXISTING ESF AND REPOSITORY CONFIGURATIONS WERE COMBINED WITH A NUMBER OF NEW CONFIGURATIONS TO FORM AN INITIAL POOL OF OPTIONS**
  
- **NEW CONFIGURATIONS WERE SPECIFICALLY CREATED TO**
  - **HAVE VARIOUS COMBINATIONS OF ALTERNATIVE DESIGN FEATURES**
  - **INCORPORATE A NUMBER OF FEATURES THAT WERE IDENTIFIED BY NRC AND NWTRB CONCERNS**

# GENERAL APPROACH

(CONTINUED)

- INITIAL SCREENING PROCESS WAS DESIGNED TO ENSURE THAT THE PROPER RANGE OF ALTERNATIVE MAJOR FEATURES WAS INCORPORATED IN THE SET OF OPTIONS TO BE EVALUATED
  
- DETAILED COMPARATIVE EVALUATION OF OPTIONS WAS PERFORMED CONSIDERING A NUMBER OF DIMENSIONS
  - POSTCLOSURE PERFORMANCE
  - CHARACTERIZATION TESTING
  - REGULATORY APPROVAL
  - PROGRAMMATIC VIABILITY
  - ETC

# FIVE MAJOR DESIGN FEATURES CONSIDERED

<u>MAJOR DESIGN FEATURE</u>	<u>ALTERNATIVES</u>
1. MEANS OF ACCESS	SHAFTS ONLY RAMPS ONLY SHAFT/RAMP COMBINATION
2. LOCATION OF ACCESSES	ALL IN NORTHEAST ALL IN SOUTH COMBINATION OF LOCATIONS
3. LOCATION OF MAIN TEST LEVEL (MTL) CORE AREA IN TOPOPAH SPRING (TS)	NORTHEAST SOUTH
4. EXCAVATION METHOD OF OPENINGS	SHAFTS <ul style="list-style-type: none"><li>- DRILL AND BLAST</li><li>- SHAFT BORING MACHINE</li><li>- BLIND HOLE DRILL</li><li>- V-MOLE</li><li>- RAISE BORE</li></ul>
	RAMPS <ul style="list-style-type: none"><li>- TUNNEL BORING MACHINE (TBM)</li><li>- ROAD HEADER</li><li>- DRILL AND BLAST</li></ul>

# FIVE MAJOR DESIGN FEATURES CONSIDERED

(CONTINUED)

## MAJOR DESIGN FEATURE

## ALTERNATIVES

### 4. EXCAVATION METHOD OF OPENINGS (CONT.)

MTL (TS) CORE  
AREA

- DRILL AND BLAST
- MOBILE MINER
- TBM\*

EXPLORATORY DRIFTING - DRILL AND BLAST  
IN TS & CH

- DRILL AND BLAST
- MOBILE MINER
- TBM
- ROAD HEADER

### 5. TOTAL NUMBER OF ACCESSES

ESF ACCESSES ARE AN INTEGRATED SUBSET  
OF THE TOTAL NUMBER OF ACCESSES FOR THE  
REPOSITORY

- \* TBM NOT SPECIFICALLY CONSIDERED FOR MTL EXCAVATION BUT IS EXPECTED TO  
BE AN ACCEPTABLE ALTERNATIVE FOR PART OF THE EXCAVATION

TABLE 5-1

DESCRIPTION OF FINAL SET OF OPTIONS

OPTION #			E.S.F.								REPOSITORY				TOTAL ACCESSES
			ACCESS-1		ACCESS-2		MAIN TEST LEVEL				ACCESSES		CONSTRUCTION METHOD		
			SIZE	CONST. METHOD	SIZE	CONST. METHOD	LAYOUT	CONST. METHOD	LOCATION	ELEVATION	SHAFTS	RAMPS (TBM)	RAMPS & DRIFTS	EMPL. AREA	
18	1	BASE CASE	12' SHAFT	DRILL & BLAST	12' SHAFT	DRILL & BLAST	TITLE N G.A.	DRILL & BLAST	NE	SAME AS REPOS.	2-20'	1-25' 1-23'	TBM	DRILL & BLAST	6
19	2	A1	16' SHAFT	---	25' RAMP	TBM	MODIFIED T.H.G.A.	---	---	---	2-25'	1-25' +ESF	---	---	5
20	3	A2	16' SHAFT	---	16' SHAFT	DRILL & BLAST	---	---	---	---	---	2-25'	---	---	6
21	4	A4 REV. 1	16' SHAFT	---	12' SHAFT 25' RAMP	DRILL & BLAST TBM	---	---	---	---	1-25' ENLARGE ES-2 25'	1-25' +ESF	---	---	5
22	5	A5	16' SHAFT	---	25' RAMP	TBM	---	---	S	---	2-25'	---	---	---	5
23	6	A7	25' RAMP	TBM	25' RAMP	---	---	---	NE	---	---	IN ESF	---	---	4
24	7	B3, REV. 2	16' SHAFT	SBM	---	---	---	MECH.	---	---	---	1-25' +ESF	---	TBM	5
25	8	B3, REV. 3		V-MOLE											
26	9	B3, REV. 4		BLIND BORE											
27	10	B3, REV. 5		RAISE BORE											
28	11	B3, REV. 6		DRILL/BLAST											
29	12	B4	16' SHAFT	DRILL & BLAST	---	---	---	---	S	---	---	---	---	---	5
30	13	B7	25' RAMP	TBM	---	---	---	---	---	---	---	IN ESF	---	---	4
31	14	B8	16' SHAFT	DRILL & BLAST	---	---	---	---	---	---	1-25'	2-25' +ESF	---	---	5
32	15	C1	16' SHAFT	---	---	---	TWO LEVEL	---	NE	TWO LEVELS SAME AS REPOS.	2-25' ENLARGE ES-1 25'	1-25' +ESF	---	---	4
33	16	C4	16' SHAFT	---	---	---	---	---	S	---	2-25'	---	---	---	5
34	17	R11	12' SHAFT	---	12' SHAFT	DRILL & BLAST	TITLE N G.A.	DRILL & BLAST	NE	SAME AS REPOS.	2-25'	2-25'	---	---	6

S-3

DRAFT

# METHODOLOGY

- **TECHNICAL PANELS - PROFESSIONAL JUDGEMENT**
  
- **FORMAL DECISION ANALYSIS LOGIC**
  - **DECISION TREE (SCENARIOS)**
  - **MULTIATTRIBUTE UTILITY ANALYSIS**

# **ALL TOP RANKED OPTIONS SHARE THE FOLLOWING COMMON FEATURES:**

- **ABILITY TO MEET DATA ACQUISITION MISSION**
  - **CAPABILITY TO SUPPORT EXTENSIVE DRIFTING IN THE CALICO HILLS**
  - **MULTIPLE INTERCEPTS OF STRUCTURAL FEATURE AT BOTH STRATIGRAPHIC LEVELS**
  - **E-W DRIFTS ACROSS REPOSITORY HORIZON IN TOPOPAH SPRING TUFF**
  
- **PRIMARY RELIANCE ON MECHANIZED MINING TECHNIQUES**
  
- **RAMP ACCESS FROM THE EAST**

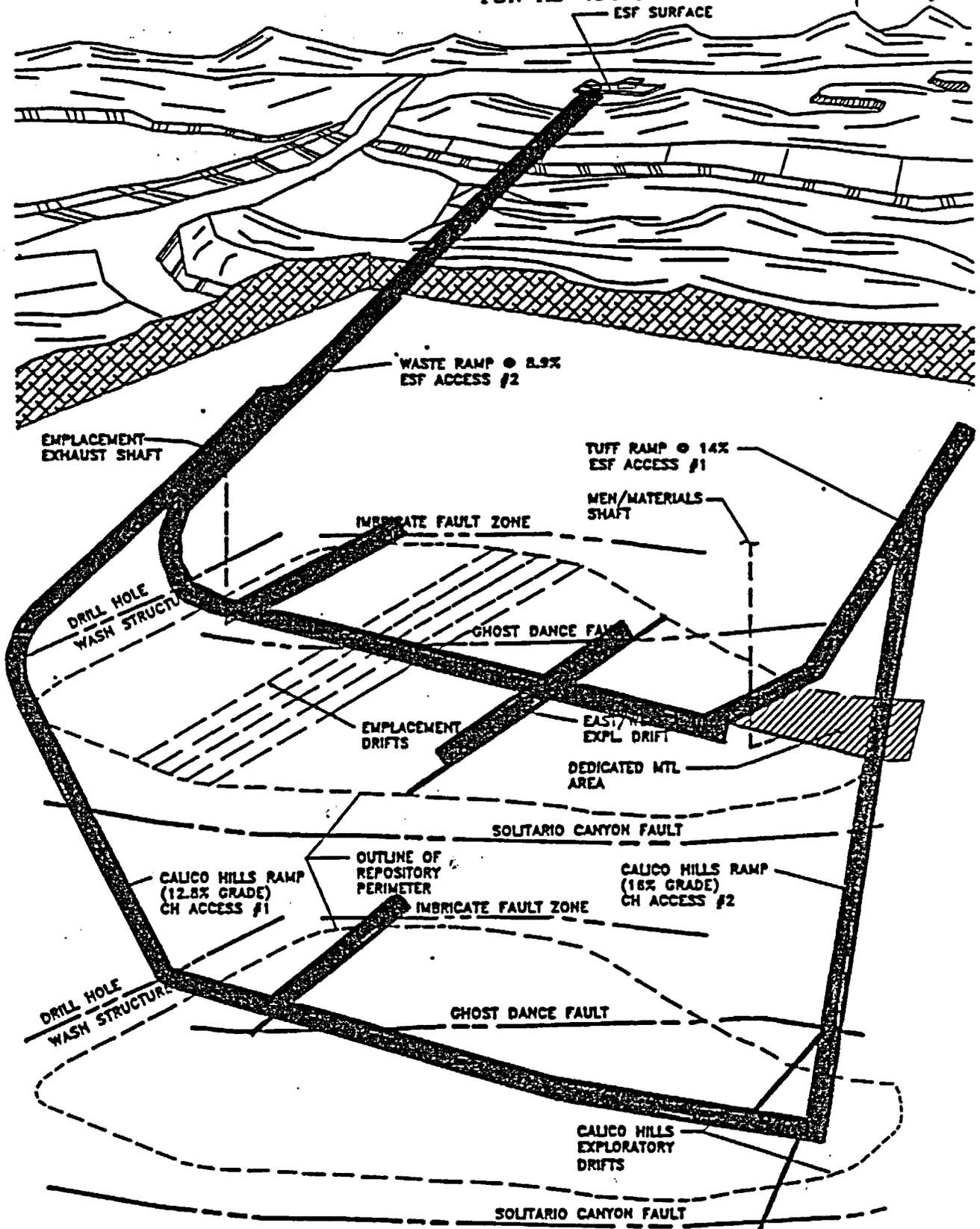
## IDENTIFICATION OF FAVORABLE FEATURES IN HIGHLY RATED OPTIONS

		1	2	3	4	5	6	7	8	9	10	11a	11b	11c
TOP-RANKED OPTIONS		NUMBER OF RAMP(S)	NUMBER OF SHAFT(S)	NUMBER OF ACCESSES	MTL LOCATION FLEXIBILITY	MECHANICAL MINED ACCESSES	NO GRAVITY FLOW PATHWAY FROM TS UNIT TO CHn	MAXIMIZE 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	2 INTERCEPTS OF GHOST DANCE FAULT IN TS	E-W DRIFT IN TS	LARGER MTL AREA TO AVOID INTERFERENCES
RANK	OPTION													
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				✓	✓			✓	✓	✓

# ESF ALTERNATIVES STUDY RESULTS

## ● 6 TOP RANKED OPTIONS

- |              |                     |
|--------------|---------------------|
| 1. OPTION 30 | ACCESS: RAMP, RAMP  |
| 2. OPTION 23 | ACCESS: RAMP, RAMP  |
| 3. OPTION 24 | ACCESS: RAMP, SHAFT |
| 4. OPTION 13 | ACCESS: RAMP, RAMP  |
| 5. OPTION 6  | ACCESS: RAMP, RAMP  |
| 6. OPTION 7  | ACCESS: RAMP, SHAFT |



**"FOR INFORMATION ONLY"**  
**TO BE USED IN THE**  
**ESF ALTERNATIVE STUDIES**

ESF ALTERNATIVES STUDY  
 TASK NO. 4  
 OPTION NO. 87  
 ISOMETRIC SCENARIO #2  
 DATE 21 1990

30

# ENHANCING THE ESF DESIGN

- **SUBJECT TO DESIGN CONTROL PROCESS**
- **SELECTED KEY FEATURES WILL BE SUBJECT TO ENGINEERING TRADE-OFF STUDIES DURING DESIGN PHASE**
- **ENGINEERING DESIGN METHODOLOGIES WILL BE USED TO REFINE OR IMPROVE ALL FEATURES OF THE BASELINED OPTION**

U.S. DEPARTMENT OF ENERGY

**YUCCA  
MOUNTAIN**



**YUCCA MOUNTAIN**

**SITE CHARACTERIZATION**

**PROJECT**

# **MSIS OVERVIEW**

*PRESENTED TO*

**MAY TPO MEETING**

*PRESENTED BY*

**EDGAR H. PETRIE**

**ACTING DIRECTOR,  
ENGINEERING & DEVELOPMENT DIVISION**



**MAY 21, 1991**

# DEFINITION

**MANAGEMENT SYSTEM IMPROVEMENT STRATEGY (MSIS).**

**A RIGOROUS TECHNICAL, SCIENTIFIC, MANAGERIAL  
AND PROGRAMMATIC EVALUATION OF ALL  
COMPONENTS THAT COMPRISE A COMPLEX,  
SYSTEMS ENGINEERING PROJECT SUCH AS THE  
DOE'S WASTE MANAGEMENT SYSTEM**

# GOALS

- **FULL SUPPORT/FULFILLMENT OF OCRWM MANAGEMENT SYSTEM IMPROVEMENT STRATEGY (MSIS) UTILIZING THE NECESSARY YMPO/PARTICIPANT RESOURCES**
- **INCORPORATE NEW MSIS TECHNICAL REQUIREMENTS DOCUMENTS INTO PROGRAM TECHNICAL BASELINE.**
- **COORDINATE THE TRANSITION FROM EXISTING YMPO TECHNICAL REQUIREMENTS DOCUMENTS TO JOINT USEAGE (HQ/DOE & YMPO) DOCUMENTS**

# YMPO APPROACH TO MSIS

- **TWO CORE TEAMS WITH REPRESENTATIVES FROM EACH PARTICIPANT**
  - **PHYSICAL SYSTEM**
  - **PROGRAMMATIC**
- **TEAM APPROACH PROVIDES CONSISTENCY AND FACILITATES COORDINATION OF YMPO SUPPORT TO OFFICE OF SYSTEMS COMPLIANCE (HQ/OSC)**
- **ESF DESIGN ACCOMPLISHED IN PARALLEL WITH MSIS EFFORT**
- **EXISTING TECHNICAL DOCUMENTS INCLUDED AS SOURCE MATERIAL TO MINIMIZE TRANSITION IMPACT**

# **RESULTS (PROGRAMMATIC)**

- **PROGRAMMATIC ANALYSIS DOCUMENTS IN PROCESS**
  - **SYSTEMS ENGINEERING**
  - **DESIGN**
  - **TESTING & EVALUATION**
  - **SUITABLE SITES**
  
- **MSIS PROGRAMMATIC PLANNING DOCUMENTS WILL BE INCORPORATED INTO YMPO PLANS**

# **RESULTS (PHYSICAL SYSTEM)**

- **PHYSICAL SYSTEM (OPERATING SYSTEM) FUNCTIONAL ANALYSIS IN DRAFT FORM FOR "OVERALL SYSTEM" AND "DISPOSE OF WASTE (REPOSITORY)"**
- **ESF MISSION ANALYSIS IN PREPARATION**
- **ESF FUNCTIONAL ANALYSIS COMMENCED MID-APRIL 1991 WITH COMPLETION (DRAFT) BY MID-JUNE 1991**

**MAY TPO MEETING**

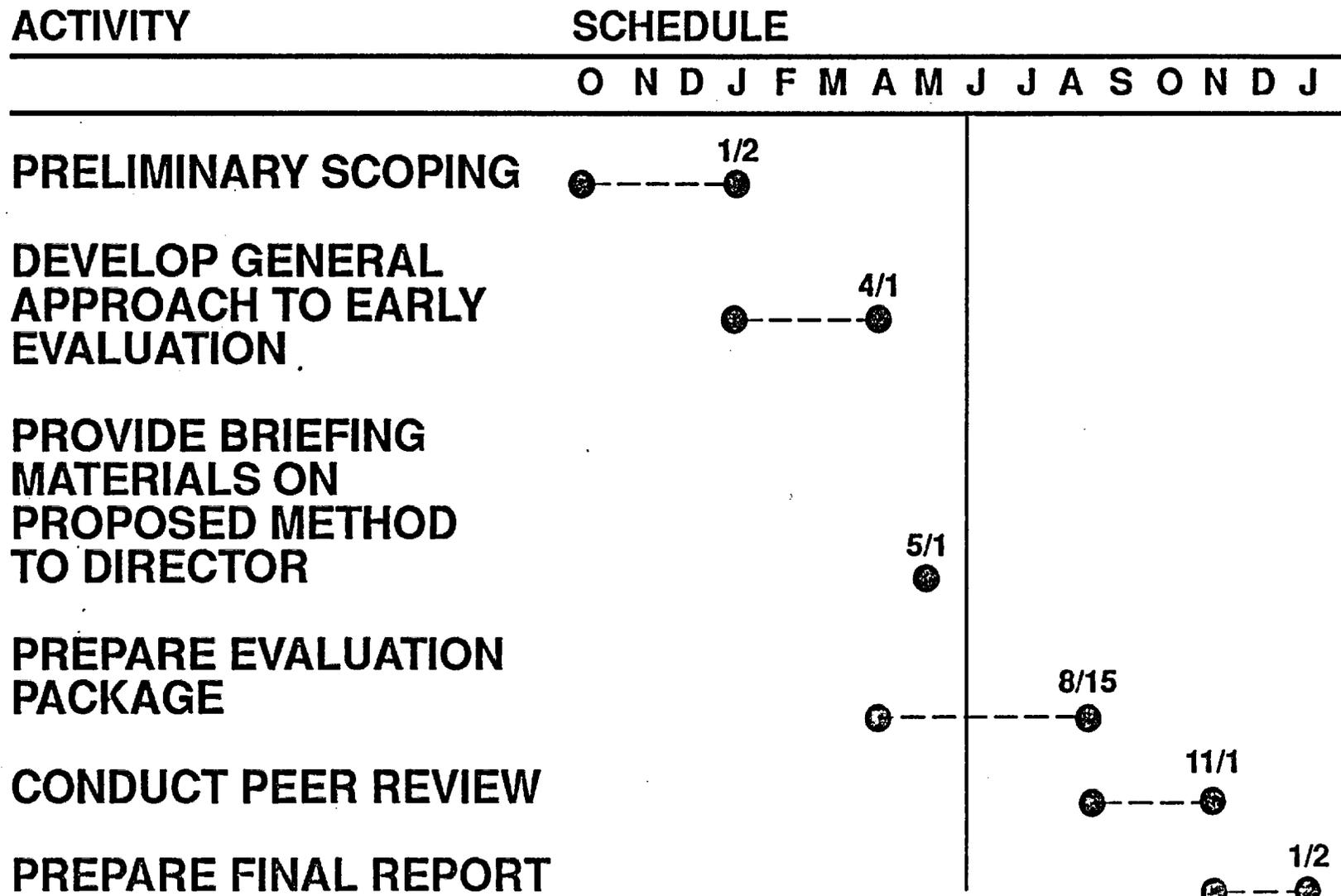
**EARLY SITE SUITABILITY  
EVALUATION TASK**

*PRESENTED BY*

**C. C. HERRINGTON**  
**LICENSING ENGINEER**

**MAY 21, 1991**

# EARLY SITE SUITABILITY EVALUATION TASK



# **EARLY SITE SUITABILITY EVALUATION TASK PROGRESS SINCE MARCH MEETING**

## **CORE TEAM ACTIVITIES**

- **MET ON APRIL 17, 18 AND MAY 1 TO:**
  - REVIEW PROGRESS
  - ADDRESS PROCESS QUESTIONS
  - HEAR AND CRITIQUE THE PRESENTATION OF THE SUB-GROUP TO DEVELOP THE GENERAL APPROACH TO EARLY SITE SUITABILITY EVALUATION
  
- **HELD TELECONFERENCES TO COMMUNICATE:**
  - ADMINISTRATIVE DIRECTIONS
  - PROCESS QUESTIONS
  - PROGRESS

# **EARLY SITE SUITABILITY EVALUATION TASK PROGRESS SINCE MARCH MEETING**

**(CONTINUED)**

## **GENERAL APPROACH SUB-GROUP ACTIVITIES**

- **DEVELOPED THE INFORMAL BRIEFING  
PACKAGE AND TRANSMITTED IT TO THE  
DIRECTOR**

# **EARLY SITE SUITABILITY EVALUATION TASK PROGRESS SINCE MARCH MEETING**

**(CONTINUED)**

## **TEAM LEADER ACTIVITIES**

- **PRESENTED THE STATUS AND GENERAL APPROACH TO THE OCRWM DIRECTOR AND ASSOCIATE-DIRECTORS**
- **PREPARED THE PEER REVIEW PLAN AND SUBMITTED FOR REVIEW**

# **EARLY SITE SUITABILITY EVALUATION TASK MAJOR ACTIVITIES NEXT MONTH**

- **INFORMAL INTERNAL REVIEWS AND INTEGRATION SESSIONS FOR COMPILING THE GUIDELINE EVALUATIONS ARE SCHEDULED THROUGHOUT MAY AND JUNE**
- **THE FORMAL INTERNAL REVIEW WILL BEGIN JULY 1**
- **PEER REVIEW PANEL PROCUREMENT WILL PROCEED**