Mr. Ralph Stein, Associate Director
Office of Systems Integration and Regulations
Office of Civilian Radioactive Waste Management
U. S. Department of Energy RW-24
Washington, D. C. 20545

Dear Mr. Stein:

The purpose of this letter is to transmit the meeting summary for the October 19-21, 1988 NRC-DOE meeting on the Exploratory Shaft Facility. Representatives from the State of Nevada, Nye County, Nevada, Utility Nuclear Waste Management Group, and General Accounting Office also attended and participated.

Should you have any questions on the enclosure, please contact King Stablein (492-0446) of my staff.

Sincerely,

ORIGINAL SIGNED BY

John J. Linehan, Director
Repository Licensing and Quality
Assurance Project Directorate
Division of High-Level Waste Management

Enclosure: As stated

cc: R. Loux, State of Nevada
C. Gertz, DOE-NV/YMPO
K. Turner, GAO
N. Montgomery, EEI/UNWMG
S. Bradhurst, Nye County
D. Bechtel, Clark County
M. Baughman, Lincoln County

DISTRIBUTION:

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LPDR	ACNW	PDR	D. Gupta

OFC :HLPD	:HLPD	:	:	:	:	:
NAME:KStablein	:JLinehan	:	:	:	:	:
DATE:12/ /88	:12/13/88	:	:	:	:	:

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SUMMARY OF DOE-NRC MEETING ON ESF OPEN ITEMS
October 19-21, 1988
DOE Forrestal Bldg., Washington, D.C.

Agenda: See Attachment 1

List of Attendees: See Attachment 2

Summary:

The objectives of the meeting were: (1) for NRC to restate all outstanding ESF open items previously documented in meeting notes or letters to DOE, noting the information needed to resolve the open item and whether the information is needed prior to the SCP, in the SCP, or prior to the start of ESF construction; (2) to get agreement from DOE that they clearly understand the NRC concerns; (3) for DOE to present an approach and schedule for addressing the ESF-related open items identified and documented by NRC from 1983 to the present that will lead to resolution of those open items; and (4) for NRC and DOE to agree on the approach and schedule for the resolving of each open item.

Opening statements were made by representatives of the NRC, the State of Nevada, Nye County, and the Department of Energy. The NRC presented an organization chart showing recent changes in the structure of the Division of High-Level Waste Management at NRC, and identified the roles in the organization of the NRC personnel present at the meeting. The State of Nevada said that the site characterization program is not integrated with the ESF design efforts, and stated disappointment that the State comments on the CDSCP would not be addressed in the SCP, but rather in subsequent SCP progress reports. Nye County indicated that the County was pleased to receive notification of the meeting and indicated that the County would participate fully in this meeting, and in future meetings between NRC and DOE. The DOE stated that the DOE has benefited from NRC's review of the repository program in the following three areas: review of the program's technical completeness, technical quality, and regulatory sufficiency. The DOE announced that the Title I design report will be released in the same time frame as the SCP, also noting that the Department would conduct the Title II design as a quality level 1 activity. The DOE then announced a modification to the schedule for the construction of the ESF. The following milestones were announced:

- Issue the SCP, December. 1988
- Start ESF Title II design, January, 1989
- Start ESF site preparation, May, 1989
- Start ESF construction, November, 1989

In describing the scope of the meeting, the NRC explained that it has concerns relative to the ESF because the staff considers the ESF to be important to waste isolation. The NRC further indicated that the staff considers the open

Received w/Ltr Dated 12/14/88

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items to be symptoms, rather than a cause, of what the staff considers to be a fundamental problem with the DOE's design control process.

The DOE presented its approach to addressing the open items (Attachment 3). The DOE distributed a summary table of the 125 ESF items plus an October 7, 1988 letter with three additional items, for a total of 128 items, which were the subject of the meeting (Attachments 4 and 5).

The NRC presented its concern with the design control process, stating that in addition to resolving the individual open items, the DOE must demonstrate to the NRC that the DOE has a design control process that complies with 10 CFR Part 50, Appendix B, Criterion III (Attachment 6) and QA requirements for qualification of personnel and data. The DOE presented the status of the DOE design control process including a description of QA implementation and the process of determining input to the design (Attachment 7). The DOE indicated its confidence in the design control process used during the development of shaft location, design and construction decisions that are included in the SCP and supporting references.

During consideration and discussion of the DOE's presentation on its design control process, the NRC indicated that the DOE presentation did not alleviate the NRC concerns about the DOE ESF design process. The NRC proposed a 7-point course of action that, if carried out, would give the NRC the confidence in the DOE design control process necessary for the NRC to provide comments on the ESF-related portions of the SCP prior to start of ESF construction. The DOE will be forthcoming with a response to the stated concerns by early November.

The NRC presented a review of the CDSCP point paper objections 2, 3, and 4 (Attachment 8). Concerning objection 2, penetration of Calico Hills (ESF Item 69), the DOE stated their position is to construct both shafts to a depth of approximately 1100 feet (Attachments 9 and 10). ES-1 will not penetrate the Calico Hills unit; however, the design of the facility will remain flexible enough to support drilling and testing in the Calico Hills Unit, if necessary. A decision about penetration of Calico Hills has been deferred until evaluation of benefits vs. potential risks has been completed and consultation with the NRC has occurred. Based on the approach presented by DOE, the NRC considers this item closed. Regarding objection 3, test interferences (ESF Item 70), the DOE outlined the information contained in SCP Section 8.4, which describes the interference evaluations performed (Attachment 11). These evaluations take into account the zones of influence of each particular test and included potential test-to-test interferences as well as evaluation of potential interferences between testing and ESF construction operations. Section 8.4 also contains more detailed information regarding the ESF design layout. With respect to objection 4, shaft location (ESF Item 71), the DOE summarized the analyses contained in Section 8.4 and supporting references (Attachment 12). These analyses evaluate the potential impacts of the ESF on the ability of the geologic repository to meet the postclosure performance objectives of 10 CFR Part 60. These analyses consider a full range of both nominal and disruptive scenario classes, including flooding and erosion potential. The DOE is confident that the proposed shaft location will not impact the health and safety of the public, nor the ability to characterize the site. In addition, DOE noted that it intends to provide a report documenting the process and decisions leading to selection of the ESF site location and presented further information concerning this report (Attachment 13). Based on the information provided at the meeting regarding Objections 3 and 4, the NRC considers the general approaches reasonable. Resolution of these two objections would be dependent on the implementation of the approaches in the SCP.

After the discussions of the design control process and the three ESF-related objections, the meeting participants discussed each of the ESF open items individually, including the DOE approach and schedule for their resolution. The categories under which these open items were discussed were: shaft location, performance assessment, seals, testing, design and construction, and miscellaneous (Attachments 14-21). In most cases, the information needed for resolution will be in the SCP and supporting references. For design and construction items, the DOE indicated that the requested information would be in Title II design documents. Further discussion showed that at the level of detail desired by the NRC, the information may be largely in Title I design technical specifications, five of which were provided at this meeting (Attachments 22-26).

Aside from the discussion of approach and schedule, numerous items were closed, removed from the ESF list, or merged with overlapping items such that the final number of ESF-related open items is 56. Attachment 27 shows the actions taken on all 128 ESF items as a result of this meeting. Attachment 28 is a compilation of the remaining ESF open items as of the finalization of these meeting notes.

The State of Nevada and the Nye Country, NV representative fully participated in the meeting discussions. The State of Nevada submitted the following comments for this meeting summary:

<u>State of Nevada Statement</u>:

1. The process DOE proposes to establish design control for ESF design is questionable. Because the ESF is proposed to become integrated into the repository, the same high standards of design required for the repository must also apply to the ESF. In the past the NRC and the State have criticized the DOE for not having an acceptable process in place to control the design of the ESF. The project has recently completed Title I design activities. According to DOE Order 4700.1, Title I work must develop sufficient designs to firmly fix the project scope and features, and develop costs and schedules. At this meeting the DOE proposed to incorporate acceptable design controls into the Yucca Mountain program prior to initiating Title II activities. The DOE also indicated that the NRC and the State will only have Title I design information to review and comment prior to ESF site preparation. Many questions on ESF design remain, some with health and safety implications. The State and NRC are

being asked to pass judgment on the ESF design prior to the implementation of quality controls on that design. The State requests that DOE revisit Title I design after the establishment of acceptable design controls and present that information for review prior to the initiation of title II design and any activities in the field.

2. The DOE presented a plan for developing documentation to support the ESF site location in Coyote Wash. On September 19, 1988, the State presented a letter to DOE with our concerns regarding the flooding potential in Coyote Wash, and on September 22, 1988, presented an additional letter to DOE analyzing the SAND84-1003 shaft location site-screening report. DOE intends to rely heavily on the SAND84-1003 report in their site location documentation. The State's letter of September 22 concludes that the screening effort in 1982 was flawed and continues to be flawed today. The screening study failed to consider health and safety concerns and placed the greatest weight on constructibility and land access. The State requests that the DOE instead of documenting a flawed process, rescreen Yucca Mountain using appropriate criteria which consider 10 CFR Part 60 requirements and identify an acceptable exploratory shaft site.

3. The purpose of this meeting was for the DOE to identify an acceptable approach and schedule for resolution of the NRC's ESF open items. For the majority of the open items, the DOE approach to resolution will be contained n the statutory SCP planned to be issued in late December 1988. According to the schedule presented at the meeting, the DOE intends to start ESF site preparation in May 1989. In the State's view the DOE is overly optimistic that complete resolution of the ESF open items is attainable prior to May, given the major concern with design controls for ESF Title I and the large volume of SCP material requiring review and judgment for adequacy. DOE may be at risk for proceeding with site preparation without resolution of the open items.

Acknowledgments:

The undersigned agree that this summary is a fair representation of the meeting. The signatures below do not necessarily indicate agreement with the comments or views expressed by other participants.

King Stablein 12/9/88

King Stablein, Project Manager
Repository Licensing Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission

Edward Regnier 12/9/88

Edward Regnier
Licensing Branch
Licensing and Compliance Division
Office of Civilian Radioactive Waste Management
U.S. Department of Energy

Stephan Brocoum

Stephan Brocoum, Chief
Siting and Geosciences Branch
Siting and Facilities Technology Division
Office of Civilian Radioactive Waste Management
U.S. Department of Energy

Attachment 1

AGENDA

NRC-DOE MEETING ON
EXPLORATORY SHAFT FACILITY (ESF)
OPEN ITEMS

DOE Forrestal Building, Washington, D.C.
October ~~18-20~~ 19-21, 1988

OBJECTIVE: The objectives of the meeting are: (1) for NRC to restate all outstanding ESF open items previously documented in meeting notes or letters to DOE, noting the information needed to resolve the open item and whether the information is needed prior to the SCP, in the SCP, or prior to the start of ESF construction; (2) to get agreement from DOE that they clearly understand the NRC concerns; (3) for DOE to present an approach and schedule for addressing the ESF-related open items identified and documented by NRC from 1983 to the present that will lead to resolution of those open items; and (4) for NRC and DOE to agree on the approach and schedule for the resolving each open item.

In the event that some agenda items for any session require less time than projected, items scheduled for later discussion may be discussed earlier than the time shown on this agenda.

October ~~18~~ 19, 1988

8:30 a.m.	OPENING STATEMENTS	NRC DOE STATE OF NEVADA OTHER AFFECTED PARTIES
	SCOPE OF MEETING	
	o History of ESF Open Items Identified and Documented by NRC	NRC
	o DOE Approach to Address ESF Open Items	DOE
9:30 a.m.	ESF DESIGN CONTROL PROCESS	
	o Review of Open Items	NRC
	o Requirements Flowdown	DOE
	o NUREG 1318 Philosophy	DOE
10:30 a.m.	SUMMARY OF PERFORMANCE ANALYSIS	
	o Review of CDSCP Objections 2,3, and 4	NRC
	o Penetration of Calico Hills Unit (CDSCP Objection 2)	DOE
	o Potential Interferences with Testing (CDSCP Objection 3)	DOE
	o Shaft Location (CDSCP Objection 4)	DOE
12:00	LUNCH	

1:00 p.m.	SUMMARY OF PERFORMANCE ANALYSIS (CONTINUED)	
2:30 p.m.	OPEN ITEMS ON SHAFT LOCATION	
	o Review of Open Items	NRC
	o Approach to and schedule for Resolution	DOE
3:30 p.m.	OPEN ITEMS ON PERFORMANCE ASSESSMENT	
	o Review of Open Items	NRC
	o Approach to and schedule for Resolution	DOE
5:00 p.m.	ADJOURN	

<u>October ~~19~~ 20, 1988</u>

8:30 a.m.	OPEN ITEMS ON SEALS	
	o Review of Open Items	NRC
	o Approach to and schedule for Resolution	DOE
12:00	LUNCH	
1:00 p.m.	OPEN ITEMS ON TESTING	
	o Review of Open Items	NRC
	o Approach to and schedule for Resolution	DOE
5:00 p.m.	ADJOURN	

<u>October ~~20~~ 21, 1988</u>

8:30 a.m.	OPEN ITEMS ON DESIGN AND CONSTRUCTION	
	o Review of Open Items	NRC
	o Approach to and schedule for Resolution	DOE
12:00	LUNCH	
1:00 p.m.	MISCELLANEOUS OPEN ITEMS	
	o Review of Open Items	NRC
	o Approach to and schedule for Resolution	DOE
2:00 p.m.	CAUCUS	ALL
3:30 p.m.	CLOSING STATEMENTS	NRC DOE STATE OF NEVADA OTHER AFFECTED PARTIES
4:30 p.m.	PREPARATION OF MEETING SUMMARY (To be continued ~~Friday~~ SATURDAY, October ~~21~~ 22, as necessary)	ALL

Attachment 2 (1)

ATTENDANCE LOG FOR DOE/NRC MEETING ON ESF CONCERNS

DATE: 10/19/88

NAME (PRINTED)	SIGNATURE	ORGANIZATION
Carl Johnson	Carl Johnson	State of Nevada
Mysore Nataraja	M S Nataraja	U S NRC
Bob Browning	R E Browning	US NRC
Wes Patrick	Wesley Patrick	SwRI
Joe Bunting	Joe Bunting	US NRC
Rick Weller	Rick Weller	USNRC
Joe Youngblood	R J Youngblood	USNRC
John Peshel	John Peshel	U.S. NRC
Dinesh Gupta	D C Gupta	U.S. NRC
Jim Kennedy	[illegible]	USNRC
Ken Beall	Ken Beall	SAIC.
Linda Desell	Linda Desell	U.S. DOE
Charlotte Abrams	Charlotte Abrams	US NRC

②

ATTENDANCE LOG FOR DOE/NRC MEETING ON ESF CONCERNS

DATE: 10/19/88

NAME (PRINTED)	SIGNATURE	ORGANIZATION
Maxwell Blanchard	Maxwell Blanchard	DOE-YMP FTS 544-7939
STEPHEN H. KALE	S. H. Kale	DOE - OCRWM - HQ
STEPHAN BROCOUM	Stephan Brocoum	DOE/OCRWM/HQ
Stein, Ralph	Ralph Stein	DOE - OCRWM - HQ
Edward Regnier	E P Regnier	DOE - OCRWM - HQ
KING STABLEIN		NRC/HLWM
JOHN LINEHAN	John Linehan	NRC/HLWM
Joe Holonich	Joe Holonich	NRC/HLWM
TOM HUNTER	Thomas O. Hunter	DOE/SNL
DAVID SIEFKEN	David Lee Siefken	WESTON

③

ATTENDANCE LOG FOR DOE/NRC MEETING ON ESF CONCERNS

DATE: 10/19/88

NAME (PRINTED)	SIGNATURE	ORGANIZATION
KEITH KLEIN	Keith Klein	DOE-OCRWM
JIM GRUBB	James Grubb	STATE OF NEVADA
James F. Thompson	[illegible]	Thompson Engineering / Nevada NWPO
John Robson	[illegible]	DOE/YMPO
R. F. PRITCHETT	R F Pritchett	REYNOLDS ELECT & ENGR CO.
PETE KARNOSKI	Peter J Karnoski	SAIC
Ram Lahoti	RB Lahoti	DOE-OCRWM
Michael Voegele	M D Voegele	SAIC-YMP
Bob Jackson	R E Jackson	Weston-DOE/HQ

ATTENDANCE LOG FOR DOE/NRC MEETING ON ESF CONCERNS

4

DATE: 10/19/88

NAME (PRINTED)	SIGNATURE	ORGANIZATION
JOE TILLERSON	Joe R Tillerson	Sandia National Laboratories
Thomas E. Blejwas	Thomas E Blejwas	Sandia National Laboratories
MARY LOU BROWN	M L Brown	SAIC LAS VEGAS
Mike Lugo	Miguel Lugo	WESTON/JACOBS
Sid Aiks	Sid Aiks	SAIC Las Vegas
Vick Renzi	[illegible] Renzi	GAO
Kathleen TURNER	R J Turner	GAO
JEROME R PEARRING	Jerome R Pearring	NRC/NMSS/HLW
Laurence S Costin	Laurence S Costin	Sandia National Labs
THOMAS E. HINKEBEIN	Thomas E. Hinkebein	SANDIA NATIONAL LABS
Andrew C. Peterson	Andrew C. Peterson	Sandia National Laboratories
PAUL L. AAMODT	Paul L Aamodt	Los Alamos National Laboratory
J B Easterling	JB Easterling	Dept of Energy, OCRWM
[illegible]	[illegible]	DOE - FC
JEROME SALTZMAN	Jerome Saltzman	DOE/OCRWM
DAVID B. GOINGS	David B. Goings	SAIC/L.V.
KEN CHACEY	K Chacey	DOE HQ's DP-123

ATTENDANCE LOG FOR DOE/NRC MEETING ON ESF CONCERNS

5

DATE: 10/19/88

NAME (PRINTED)	SIGNATURE	ORGANIZATION
M.A. GLORA	M A Glora	T&MSS/SAIC
Alan Handwerker	Alan Handwerker	DOE/CH
DICK BAKER	Richard C. Baker	DOE/CH
Muzaffer Kehnemuyi	M Kehnemuyi	Battelle/OWTD
RICHARD J LARK	R J Lark	DOE/CH
Tomas S. Gutmann	Thomas S. Gutmann	DOE/HQ/RW-3
Glen L. Faulkner	Glen L. Faulkner	USGS/DOE HQ/RW221
Ray Wallace	Raymond H Wallace	USGS-WRD/DOE-HQ RW22
CHED BRADLEY	[illegible]	DOE/EH-25
PHIL COLLYER	Philip L. Collyer	ICF TECHNOLOGY
Jeff Williams	Jeffrey R. Williams	DOE/EH-25
Bill Hewitt	W M Hewitt	Weston
JOHN JENKINS	J. J. Jenkins	WESTON
Philip Berger	Philip Berger	Energetics
JERRY SKOUSEN	[illegible]	DOE/NV

(6)

ATTENDANCE LOG FOR DOE/NRC MEETING ON ESF CONCERNS

DATE: 10/19/88

NAME (PRINTED)	SIGNATURE	ORGANIZATION
JERRY PARKER	[signature]	DOE - RW-333
Keith McConnell	Keith L. McConnell	US NRC
James Montgomery	[signature]	WESTON/Jacobs
Dean Stucker	Dean Stucker	DOE/RW 223
Scott Dam	Scott Dam	WESTON
MICHAEL BAUSER	M. A. Bauser	EEI/UNWMG
LESTER BERKOWITZ	Lester Berkowitz	WESTON
James R. Wolf	[signature]	NRC/OGC
William Hasleb[illegible]	W Hasleb[illegible]	WESTON
GINGER KING	Ginger King	DOE/HQ (RW-43)
Donald L. Chery Jr	Donald L. Chery	NRC/HLW/H-T
ROSETTA VIRGILIO	Rosetta Virgilio	NRC/GPA
PHILIP JUSTUS	Philip S. Justus	US NRC/Geology-Geophys.
Steve BRADHURST	Stephen T. Bradhurst	Nye County/NV
Elgie Holstein	Elgie Holstein	" "

(7)

ATTENDANCE LOG FOR DOE/NRC MEETING ON ESF CONCERNS

DATE: 10/19/88

NAME (PRINTED)	SIGNATURE	ORGANIZATION
Dwight Shelor		RW-3
Alan Brownstein		RW-3
GARY FAUST		WESTON
K. Michael Cline		WESTON
David C Dobson		DOE/YMPO
Amitendra N. Kalia		Los Alamos-YMPO
Jaak Daemen		Univ of Az
MANNY COMAR		RW-223
D. FEHRINGER		NRC
L. Barrett		DOE/QA
S. M. Coplan		NRC/HLWM
John Bradbury		NRC/HLWM
Fred Ross		NRC/HLWM
Jeff Kimball		DOE/HQ
Kathy Minn		DOE/HQ

Attachment 3

DOE/NRC

ESF ITEMS MEETING

OCTOBER 19–21, 1988

OPENING STATEMENTS

- PURPOSE OF MEETING
- APPROACH TO MEETING
- ORIGIN OF ESF ITEMS
- SUMMARY OF ESF ITEMS STATUS
- TABLE OF 125 ESF ITEMS
- INDIVIDUAL SUMMARY SHEETS FOR EACH ITEM
- FUTURE MEETINGS PLANNED WITH NRC

PURPOSE OF MEETING

- PRESENT STATUS OF EACH ITEM

- PRESENT A DISCUSSION OF THE APPROACH REQUIRED FOR RESOLUTION OF EACH ITEM

  - o DOE WILL PRESENT A DISCUSSION OF THE APPROACH TO RESOLUTION OF THE ESF-RELATED POINT PAPERS. A MORE DETAILED PRESENTATION OF THE APPROACH TO RESOLUTION OF THE OBJECTIONS AND OTHER MAJOR CONCERNS RAISED IN THE POINT PAPERS WILL BE GIVEN AT THE NOVEMBER DOE/NRC POINT PAPERS MEETING.

- PRESENT THE DATE OF ISSUANCE FOR THE DOCUMENTATION ADDRESSING EACH ITEM

DOE'S TREATMENT OF NRC'S ESF-RELATED POINT PAPER OBJECTIONS

- THE DOE WILL PROVIDE INFORMATION TO THE NRC TO EXPLAIN HOW THE SCP AND OTHER MATERIAL ADDRESS EACH OF THE NRC ESF-RELATED OBJECTIONS

- THE INFORMATION WILL ACCOMPANY THE LETTER THAT TRANSMITS THE STATUTORY SCP TO THE NRC

APPROACH TO MEETING

- ITEMS ARE GROUPED BY AGENDA CATEGORY

- ONE LEAD SPOKESMAN TO DISCUSS ITEMS IN EACH CATEGORY

- LEAD SPOKESMAN SUPPORTED BY LIMITED BACKUP PERSONNEL FAMILIAR WITH SUBJECT MATERIAL AT MAIN TABLE (ADDITIONAL SUPPORT SEATED AT AUXILIARY TABLE)

ORIGIN OF ESF OPEN ITEMS

A TOTAL OF 125 ESF ITEMS (AS TRANSMITTED TO DOE AT THE JULY 17-18, 1988 ESF MEETING) HAVE BEEN COMPILED, COMPRISED OF:

- 68 ACTION ITEMS AND INFORMATION REQUESTS FROM NRC/DOE INTERACTIONS DATING FROM APRIL 1983, IN CHRONOLOGICAL ORDER

- 57 ESF-RELATED NRC OBJECTIONS, COMMENTS AND QUESTIONS RAISED IN THE MAY 1988 NRC FINAL POINT PAPERS ON THE CD-SCP

- ALL OF THE 125 ITEMS HAVE PREVIOUSLY BEEN ADDRESSED BY DOE

SUMMARY OF ESF ITEMS STATUS

- 83 OF THE 125 ITEMS ARE ADDRESSED IN THE SCP AND/OR SUPPORTING DOCUMENTS

- 13 OF THE 125 ITEMS ARE ADDRESSED IN PROGRAMMATIC DOCUMENTS OTHER THAN THE SCP

- THE REMAINING 29 ITEMS ARE CLOSED (21), PENDING (4), OR COMMITMENTS BY NRC (4)

SUMMARY OF ESF OPEN ITEMS STATUS (CONT.)

CATEGORY	QUANTITY
CLOSED/DOCUMENTED	21
DESIGN CONTROL PROCESS	2
POINT PAPER OBJECTIONS	3
SHAFT LOCATION	6
PERFORMANCE ASSESSMENT	12
SEALS	28
TESTING	35
DESIGN AND CONSTRUCTION	8
MISCELLANEOUS	
-COMMITMENTS BY NRC	4
-ITEMS PENDING NRC RESPONSE TO DOE INPUT	4
-OTHER	2
TOTAL	125

STATUS OF ITEMS 19-22
(ESF-QA)

THESE ESF-QA ITEMS HAVE BEEN CLOSED BY THE MEETING MINUTES OF THE JULY 7-8, 1988 DOE/NRC QA MEETING

THESE ITEMS HAVE BEEN INCORPORATED INTO OPEN ITEM 9 OF THE JULY 7-8 QA MEETING SUMMARY

PLEASE REFER TO PAGE 32 OF THE CLOSED AND PENDING DOCUMENTATION FILE

DOE ITEM NUMBER

DOE ASSIGNED DISCUSSION CATEGORY

STATEMENT OF ITEM (VERBATIM FROM NRC CORRESPONDENCE)

ORIGIN CODE (FROM AUGUST 1985 ESF MEETING, ACTION ITEM 7)

SCP SECTIONS OR OTHER DOCUMENTS EXPECTED TO ADDRESS ITEM (A DESCRIPTION OF THE RELEVANT TOPIC IS INCLUDED)

29	SL	Need to establish the properties of characteristics that can be used in the evaluation of "representativeness." A method for analyzing the data also needs to be established.	885AI 7	SCP 8.4.2.1.5 (Rep.) SCP 8.4.2.1.6.2 (Drifting)	OPEN	12/30/88

STATUS AS STATED BY NRC

DATE OF ISSUANCE FOR CLOSURE DOCUMENTS

REFERENCE CODE

4 83 IR Ia

- Ia — ITEM NUMBER FROM NRC TRANSMITTAL
- IR — NATURE OF ITEM (INFORMATION REQUEST)
- 83 — YEAR ITEM FORMALLY TRANSMITTED (1983)
- 4 — MONTH ITEM FORMALLY TRANSMITTED (APRIL)

CODE FOR NATURE OF ITEM

IR = INFORMATION REQUEST

AI = ACTION ITEM

PP = POINT PAPER (O-OBJECTION, C-COMMENT, Q-QUESTION)

CATEGORY CODE

CODE	CATEGORY
CD	CLOSED (DOCUMENTED)
DES	DESIGN CONTROL PROCESS
OBJ	NRC CDSCP POINT PAPER OBJECTION
SL	SHAFT LOCATION
PERF	PERFORMANCE ASSESSMENT
SEAL	SEALS
TEST	TESTING
DC	DESIGN AND CONSTRUCTION
NRC	NRC COMMITMENT
P	PENDING
M	OTHER

EXAMPLE OF ESF ITEM SUMMARY SHEET

NRC/ESF CONCERN

p. SEAL10

ITEM NO.	REFERENCE CODE	EXPECTED DATE
4	483IR Id	12/30/88

DESCRIPTION

Describe the seal design and materials.

DOCUMENTATION

SCP 6.2.8 (Seal designs)

SCP 8.3.3.2.3 (Information Need 1.12.3: Placement method for seals for shafts, drifts, and boreholes)

SCP 8.3.3.2.2 (Information Need 1.12.2: Materials and characteristics of seals for shafts, drifts, and boreholes)

SCP 8.3.3.1.2 (Seal components)

SAND84-1895

SCP-Conceptual Design Report

APPROACH TO CLOSURE

The DOE approach is to describe the designs and materials in the SCP with supporting documentation in the SCP-CDR and SAND84-1895. The conceptual design of seals and seal materials for advanced conceptual design are given in Sections 6.2.8, 8.3.3.2.2, 8.3.3.1.2 and 8.3.3.2.3, respectively.

FUTURE MEETINGS PLANNED WITH NRC

- POINT PAPERS MEETING NOVEMBER 15–17, 1988

- MEETING ON ESF DESIGN CONTROL PROCESS WEEK OF DECEMBER 5, 1988

Attachment 4

SUMMARY TABLE OF 125

NRC-ESF CONCERNS

OCTOBER 19, 1988

ATTACHMENT 4

SUMMARY OF ESF ITEMS CATEGORIZATION

	AGENDA CATEGORY	QTY	QTY IN SCP	ITEM NUMBERS	REMARKS
1	APP. TO ESF OPEN ITEMS (CLOSED/DOCUMENTED)	21	N/A	6,18,19,20,21,22,23,24,25,27,30,31, 33,35,38,39,40,41,42,53,55	
2	DESIGN CONTROL PROCESS	2	1	67,68	ITEM 68 NOT IN SCP*
3	SUMM. OF PERF. ANALYSIS (POINT PAPER OBJECTIONS)	3	3	69,70,71	
4	SHAFT LOCATION	6	6	29,34,51,102,123,124	
5	PERFORMANCE ASSESSMENT	12	12	52,56,57,59,73,84,85, 88,91,96,98,100	
6	SEALS	28	27	1,2,3,4,5,8,9,10,11,12, 15,28,44,45,54,58,86,89, 92,93,94,95,97,101,103, 119,120,121	ITEM 15 NOT IN SCP*
	TESTING	35	35	17,32,36,46,49,50,72,74, 75,76,77,78,79,80,81,82, 83,87,99,104,105,106,107, 108,109,110,111,112,113, 114,115,116,117,118,125	
8	DESIGN AND CONSTRUCTION	8	1	7,13,14,16,47,61,63,90	ITEMS 7,13,14,16,47,61,63 NOT IN SCP*
9	MISCELLANEOUS				
	- NRC COMMITMENTS	4	N/A	26,37,48,65	
	- PENDING	4	N/A	60,62,64,66	
	- OTHER	2	1	43,122	ITEM 43 NOT IN SCP*
	TOTAL	125	86		86 ITEMS RESOLVED IN SCP 14 ITEMS RESOLVED IN OTHER PROGRAM DOCUMENTS 17 ITEMS CLOSED 4 ITEMS PENDING NRC CLOSURE 4 NRC COMMITMENTS 125 TOTAL

* RESOLVED IN PROGRAM DOCUMENTS OTHER THAN SCP

REFERENCE CODE

4 83 IR Ia

ITEM NUMBER FROM NRC TRANSMITTAL

NATURE OF ITEM (INFORMATION REQUEST)

YEAR ITEM FORMALLY TRANSMITTED (1983)

MONTH ITEM FORMALLY TRANSMITTED (APRIL)

CODE FOR NATURE OF ITEM

IR = INFORMATION REQUEST

AI = ACTION ITEM

PP = POINT PAPER (O–OBJECTION, C–COMMENT,
Q–QUESTION)

CATEGORY CODE

CODE	CATEGORY
CD	CLOSED (DOCUMENTED)
DES	DESIGN CONTROL PROCESS
OBJ	NRC CDSCP POINT PAPER OBJECTION
SL	SHAFT LOCATION
PERF	PERFORMANCE ASSESSMENT
SEAL	SEALS
TEST	TESTING
DC	DESIGN AND CONSTRUCTION
NRC	NRC COMMITMENT
P	PENDING
M	OTHER

Item No.	Group	Open Items	Reference	[illegible]ected Documents for Closure	NRC Status	Expe[illegible] Date
1.	SEAL	Provide an analysis of the potential effects of construction of the exploratory shaft on long-term sealing capabilities of the rock mass and identify factors that determine the nature and extent of such effects.	483IR Ia	SCP 8.4.2.3.6.3 (Integration of the ESF with repository design) SCP 8.4.3.2 (Summary of supporting technical analyses and data) SCP 8.4.3.2.4 (Design features that may contribute to performance) SCP 8.4.3.3 (Potential impacts of SC activities on on post-closure performance) Primary Supporting References SAND85-0598 ES Performance Analysis Report	Open	12/30/88
2.	SEAL	Describe how the selected excavation technique and shaft design accounts for limitations and uncertainties in long term sealing considerations.	483IR Ib	SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.4.2.3.3.3 (General arrangement of ES-1 and ES-2) SCP 8.4.3.3 (Potential impacts of SC activities on post-closure performance) SCP 8.4.3.2.4 (Design features that may contribute to performance)	Open	12/30/88
3.	SEAL	Provide design specifications for the shaft construction and show how they deal with the factors affecting sealing.	483IR Ic	Title I Drawings and Specifications Package (100 % Design Review) See also Item 52	Open	12/30/88
	SEAL	Describe the seal design and materials.	483IR Id	SCP 6.2.8 (Seal designs) SCP 8.3.3.2.3 (Information Need 1.12.3: Placement method for seals for shafts, drifts, and boreholes) SCP 8.3.3.1.2 (Seal components) SCP 8.3.3.2.2 (Information Need 1.12.2: Materials and characteristics of seals for shafts, drifts and boreholes) SCP 8.3.3.1.2 (Seal components) SAND84-1895 Technical Basis Report for Seals Site Characterization Plan--Conceptual Design Report	Open	12/30/88
5.	SEAL	Discuss the selected locations of any planned explorations or testing to be performed along the length of the shaft. Include discussion of data on sealing characteristics to be gathered and the limitations and uncertainties associated with the data.	483IR Ie	SCP 8.4.2.3.1 (ESF Testing, operations, layout constraints, and zones of influence) SCP 8.3.3.2.2.3 (In situ testing of seals and components)	Open	12/30/88
6.	CD	Provide drilling history and results of geotechnical testing from the principal borehole, G-4.	483IR If	USGS OFR-84-552, SAND83-1711, SAND85-0762, SAND84-1471 Closure documented by 2/8/88 Linehan to Gertz letter.	Closed	N/A
7.	DC	Identify the acceptance criteria for construction of the exploratory shaft.	483IR IIa	Title II Specifications	Open	Completion of Title II Design

Item No.	Group	Open Items	Reference	ted Documents for Closure	NRC Status	Expe ate
8.	SEAL	Identify procedures used to minimize damage to the rock mass penetrated.	483IR IIb	SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.4.2.3.3.2 (Integrated data system description) SCP 8.4.3.2.3 (Thermal/mechanical analyses and data)	Open	12/30/88
9.	SEAL	Identify liner construction and placement technique. Include such information as: liner type, liner material testing and placement of liner. This information needs to be fully considered in application of any permanent sealing program.	483IR IIc	SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the the characteristics and configurations of the shaft and borehole seals been adequately established to (a) show compliance with the post-closure design criteria of 10 CFR 60.134 and (b) provide information for the resolution of the performance issues? SCP 6.2.8 (Seals) SAND85-0598 Fernandez et al. (1988) ES Performance Analyses	Open	12/30/88
10.	SEAL	Describe how the seals are expected to perform in sealing the exploratory shaft. Describe tests done, both laboratory and field, to determine their long-term durability and their compatibility, both chemical and physical, to the host rock environment.	483IR IIIa	SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.3.3.1 (Impact on total system releases) SCP 8.3.3.2.2.3 (In situ testing of seal components) Primary Supporting References SAND85-0598 Fernandez et al. (1988) ES Performance Analyses SAND84-1895 Fernandez et al. (1987) Technical Basis Report	Open	12/30/88
11.	SEAL	Describe the placement methods.	483IR IIIb	SCP 6.2.8.2 (Shaft/ramp seal emplacement) SCP 6.2.8.4 (Borehole seal emplacement) SCP 8.3.3.2.2.3 (In situ testing of seal components) SAND84-2641 SCP-CDR SAND85-0598 Fernandez et al. (1988) ES Performance Analyses	Open	12/30/88
12.	SEAL	Describe remedial methods to be used if sealing methods are not adequate.	483IR IIIc	SCP 8.3.3.1 (Overview of the seal program)	Open	12/30/88
13.	DC	Describe test and inspection procedures to be used during excavation (e.g., plumbness of hole, rock mass disturbance etc.) to determine acceptability of the shaft as constructed.	483IR IVa	Title II Specifications	Open	Completion of Title II Design
14.	DC	Describe test and inspection procedures to be used during shaft liner construction. Include information such as grout injection rates, grout bond logs, thermal measurements of grout during curing, and liner instrumentation to be used.	483IR IVb	Title II Specifications DOE approved construction contractor procedures	Open	Completion of Title II Design and Acceptance by DOE of Contractor Submittals

Item No.	Group	Open Items	Reference	ted Documents for Closure	NRC Status	Expe te
15.	SEAL	Describe test and inspection procedures to be used after sealing of the shaft to assess the results of the sealing effort in controlling adverse effects. Include information such as grout strength tests, visual identification of seal conditions, records of water inflow, assessment of seal bond to hot rock, and logging of drill holes.	483IR IVc	SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone-- surface-based studies)	Open	
16.	DC	Describe plans to document the above construction activities.	483IR IVd	Title II Specifications Title III Reports	Open	Completion of Title II Design and Title III Submittals
17.	TEST	Describe test plans and procedures used to obtain adequate data on site characteristics that can be measured either directly or indirectly during construction of the exploratory shaft. For example: o Geologic mapping and rock mass characterization of the shaft walls o Measurements of rates and quantities of groundwater inflow and collection of groundwater samples for testing o Measurements of overbreakage during blasting o Rock mechanics testing of samples obtained during drill and blast operations	483IR Va	SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.4.2.3.6 (Evaluation of ESF layout and operations) SCP 8.3.1.2.2.3 (surface based study of percolation) SCP 8.3.1.2.2.3.1 Matrix hydrologic properties testing) SCP 8.3.1.2.2.4.4 (Radial borehole tests in the ESF) SCP 8.3.1.2.2.4.7 (Perched water test in ESF) SCP 8.3.1.2.2.4.5 (Excavation effects test in the ESF) SCP 8.3.1.2.2.4.8 (Hydrochemistry tests in the ESF) SCP 8.3.1.2.2.4.9 (Multi-purpose boreholes) SCP 8.3.1.15.1.8.1 (Evaluation of mining methods) SCP 8.3.1.15.1.1 (Evaluation of thermal properties) SCP 8.3.1.15.1.2 (Laboratory thermal expansion testing) SCP 8.3.1.15.1.3 (Laboratory determination of the mechanical properties of intact rock) SCP 8.3.1.15.1.4 (Laboratory determination of the mechanical properties of fractures) SCP 8.3.1.4.2.2 (Characterization of structural features within the area) SCP 8.3.1.5.1.5 (Excavation Investigations) SCP 8.3.1.15.2.1 (Characterization of the ambient stress conditions)	Open	12/30/88

Item No.	Group	Open Items	Reference	:ted Documents for Closure	NRC Status	Expe ate
18.	CD	Identify the line of responsibility for implementing QA procedures down to and including the Construction Contractor (10 CFR 50 Appendix B. Criteria I requires that "organizations performing quality assurance functions shall report to a management level such that this required authority and organizational freedom including sufficient independence from cost and schedule when opposed to safety consideration, are provided.") Identify the procedures to be used by the Quality Assurance organization for implementing and monitoring the QA program for exploratory shaft design, construction and testing.	483IR VIa	Provided at August 85 DOE/NRC meeting. Closure documented by 10/31/86 Linehan to Vieth letter	Closed	N/A
19.	CD	Provide a schedule for completion of ES Construction and testing QA procedures.	1185IR VIb1	Closure documented by 7/88 QA meeting summary.	Closed	N/A
20.	CD	Provide basis for assignment of quality level to the ES construction.	1185IR VIb2	Closure documented by 7/88 QA meeting summary.	Closed	N/A
21.	CD	Provide basis for assignment of quality level to data collection during construction.	1185IR VIb3	Closure documented by 7/88 QA meeting summary.	Closed	N/A
22	CD	Provide basis for assignment of quality level to the dewatering system.	1185IR VIb4	Closure documented by 7/88 QA meeting summary.	Closed	N/A
23.	CD	DOE would like copies of Ted Johnson's analysis that indicated the 1/2" runoff from the E. S. Drainage Area could result in a 4 order of magnitude increase of water into the ES over the SNL 500 year flood scenario.	885AI 1	4/21/86 Letter from NRC providing requested analysis. Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A
24.	CD	DOE would like a copy of the report on in situ stress measurement at NTC referenced by David Canover.	885AI 2	Reference Identified. Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A
25.	CD	DOE would like specific details on the areas of landslides at Yucca Mountain referenced by John Trapp.	885AI 3	Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A

Item No.	Group	Open Items	Reference	cted Documents for Closure	NRC Status	Expe ate
26.	NRC	NRC position on the 1 part per 100,000 release limit as an instantaneous differential or an integral over a year.	885AI 4	SCP 8.3.5 (Performance assessment program)	Open	
27.	CD	Need to establish an authoritative set of references on the subject of rock damage around openings in the earth.	885AI 5	SAND86-7001. Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A
28.	SEAL	Need to establish a common approach to evaluating the magnitude of the damage around openings.	885AI 6	8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.3.2.3 (Thermal/mechanical analyses and data) SCP 8.4.3.2.5 (Summary of potential impacts to site from SC activities for current site conditions) SCP 8.4.3.3 (Potential impacts of SC activities on post-closure performance) Case and Kelsall (1987)	Open	12/30/88
29.	SL	Need to establish the properties of characteristics that can be used in the evaluation of "representatitiveness." A method for analyzing the data also needs to be established.	885AI 7	SCP 8.4.2.1.5 (Representativeness of planned testing)	Open	
30.	CD	Need to structure the open items in a manner that will allow the April 1983 NRC Letter (Coplan to Vieth) to be closed out.	885AI 8	Letter sent to NRC 6/2/86. Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A
31.	CD	NRC final comments on the Draft Performance Assessment on the Exploratory Shaft.	885AI 9	Letter sent 11/25/85. Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A
32.	TEST	Need to review section 60.21(c) to determine NRC's expectations regarding the information of fracture characteristics to be obtained from the exploratory shaft.	885AI 10	SCP 8.3.1.3.2.1.3 (Fracture mineralogy) SCP 8.3.1.4.2.2.2 (Surface fracture network studies) SCP 8.3.1.4.2.2.4 (Geologic mapping of exploratory shaft and drifts) SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)	Open	12/30/88

Item No.	Group	Open Items	Reference	ted Documents for Closure	NRC Status	Expe ate
33.	CD	NRC staff concerned about the fact that the second exploratory shaft was located outside of the preferred area, needs to more thoroughly explain logic as to why this is a significant point. Is it an issue related to validity of testing data or radiological health and safety?	885AI 11	Letter sent 12/26/86. Closure documented by 8/19/87 Linehan to Vieth letter.	Closed	N/A
34.	SL	During the DOE presentation on the rationale for selection of the site for the exploratory shaft, the DOE stated that the site chosen is representative of the repository block but indicated that discussion of the question of representativeness would be deferred. The NRC staff agrees that this should be an agenda item for a future meeting.	885AI 12	SCP 8.4.2.1.5 (Representativeness of planned testing)	Open	12/30/88
35	CD	The DOE will provide to the NRC the Keystone Document 6310/85/1, Recommended Matrix and Rock Mass Bulk, Mechanical, and Thermal Properties for Thermomechanical Stratigraphy of Yucca Mountain, version 1, October, 1984, related to selection of the repository horizon.	885AI 13	Keystone document. Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A
36	TEST	The DOE delineated the underground layout of the exploratory shaft and drifts and stated that underground testing considerations heavily influenced the layout. The NRC cannot assess the adequacy of the planned tests and hence the testing layout until the test plans are provided prior to the NNWSI/NRC ESTP meeting.	885AI 14	SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.2.2.3.3 (ES general arrangement) SCP 8.4.2.3.3.4 (Main test level general arrangement) SCP 8.4.2.3.6 (Evaluation of ESF layout and operations) SCP 8.4.2.1 (Rationale for planned testing) SCP 8.3.4.2.4 (Information need 1.10.4: Post-emplacement near-field environment) SCP 8.3.1.2 (Overview of the geohydrology program) SCP 8.3.1.3 (Overview of the geochemistry program) SCP 8.3.1.5 (Overview of the climate program) SCP 8.3.1.15 (Overview of thermal and mechanical rock properties program)	Open	12/30/88

Item No.	Group	Open Items	Reference	ted Documents for Closure	NRC Status	Expe ate
37.	NRC	The NRC is to furnish the DOE with the information as to whether NRC's 10exp-5/yr release rate applies on a discrete year by year basis or a continuous rate basis.	885AI 15	See item 26.	Open	
38.	CD	The DOE will furnish the NRC with the document which contains recent information on thickness of the Calico Hills.	885AI 16	Closure (via 7/20/87 DOE submittal) documented by 9/10/87 Linehan to Gertz letter	Closed	N/A
39.	CD	The DOE will send the NRC copies of the viewgraphs used in the DOE's presentation of the damaged zone model for tuff.	885AI 17	Viewgraphs transmitted 3/11/86. Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A
40.	CD	The DOE will provide the NRC with the data (e.g., RQD's, stresses, hydraulic conductivities) used to get the results presented during the DOE presentation on damaged zone model for tuff.	885AI 18	SAND86-7001. Closure documented by 4/7/88 Youngblood to Gertz letter.	Closed	N/A
41.	CD	The NRC will provide the DOE with the U.S. Bureau of Mines reference related to horizontal stress of southern Nevada rocks.	885AI 19	Reference identified. Closure documented by 10/31/86 Linehan to Vieth letter.	Closed	N/A
42.	CD	DOE will provide NRC with information relating to testing performed in or on samples obtained from USW G-4 in addition to that presented in USGS-OFR-84-789.	885AI 20	DOE submitted information on 9/18/87. Closure documented by 2/8/88 Linehan to Gertz letter.	Closed	N/A
43.	M	NRC requests that DOE identify the schedule for providing the items identified in DOE's response of June 7, 1985 as being under development.	885AI 21	Letter on this subject.	Open	
44.	SEAL	A decision (and the implications of such a decision) on whether the DOE will remove the liner at permanent closure or use it as part of the long term sealing system has not been determined.	885AI 22	SCP 8.4.3.2.3 (Thermal/mechanical analyses and data) SCP 6.2.8.2 (Shaft and ramp seal emplacement) SCP 8.3.3.2.2 (Information Need 1.12.2: Materials and characteristics of seals for shafts, drifts, and boreholes.) SAND85-0598 Fernandez et al. (1988) ES Performance Analyses	Open	12/30/88

Item No.	Group	Open Items	Reference	ted Documents for Closure	NRC Status	Expec te
45.	SEAL	A discussion of sealing materials and placement method and timing for exploratory boreholes from the ES will be provided in a future meeting on repository design.	885AI 23	SCP 8.3.3.1.2 (Seal components) SCP 6.2.8.4 (Borehole seal emplacement) SCP 8.3.3.1 (Overview of the seal program) SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.4.2.3.3 (Description of ESF)	Open	
46.	TEST	The testing program to characterize perched water zones will be discussed at the ESTP meeting.	885AI 24	SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.3.1.2.2.4.7 (Perched water test in ESF) SCP 8.3.1.2.2.4.9 (Multi-purpose borehole) SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone - Surface Based Studies)	Open	
47.	DC	The design specifications and acceptance criteria for the shaft construction including construction controls, test blasting, and overbreak control will be provided to the NRC when available.	885AI 25	Title II Specifications DOE approved construction contractors procedures	Open	Title II Design and DOE Acceptance of Contractor Submittals
48.	NRC	The NRC will provide guidance on the key parameters that should be considered in determining the representativeness of the ESF.	885AI 26	SCP 8.4.2.1.5 (Representativeness of planned tests)	Open	

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
49.	TEST	DOE's plans on the characterization of lithophysal zones and on plans for demonstrating horizontal emplacement and exploration holes will be discussed in a future meeting on repository design.	885AI 27	SCP 8.3.1.4.2.2.4 (Geologic mapping of ES and drifts) SCP 8.3.1.15.1.1 (Laboratory thermal properties) SCP 8.3.1.15.1.2 (Laboratory thermal expansion testing) SCP 8.3.1.15.1.3 (Laboratory determination of mechanical properties of intact rock) SCP 8.3.1.15.1.4 (Laboratory determination of the mechanical properties of fractures) SCP 8.3.1.15.1.5.2 (Demonstration breakout room) SCP 8.3.1.15.1.6.1 (Heater experiment in unit TSw1) SCP 8.3.1.15.1.7.1 (Plate loading tests) SCP 8.3.2.5.6 (Development and demonstration of required equipment) SCP 8.4.2.3 (ESF testing operations, layout constraints, and zones of influence) SCP 8.3.1.15.1.8 (In situ design verification) LANL Report on Dry Drilling (Mike Ray)	Open	
50.	TEST	Has DOE/OGR made a decision that the use of radioactive materials in the site characterization program will not be considered in the future?	885AI 28	SCP 8.7.1 (Decontamination) SCP 8.4.1.2 (Incorporation of 10 CFR 60 in the development of the Site Characterization Program) SCP 8.4.2.2.2 (Descriptions of the locations, operations and construction controls for surface-based activities) SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)	Open	12/30/88
51.	SL	Demonstrate that flooding and erosion do not adversely affect long term repository performance (incorporate shaft location changes into performance analysis).	487IR Ia	SCP 8.4.2.3.3.1 (Rationale for ESF location) SCP 8.4.3.2.1 (Hydrologic analyses and data) SCP 8.4.3.3.2 (Impact on waste package containment) SCP 8.4.3.3 (Potential impacts of site char. activities on post-closure performance) SCP 8.4.3.2.4 (Design features that may contribute to performance)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
52.	PERF	Provide reasonable assurance that shafts are adequately separated so that testing in one does not adversely affect ability to obtain required data in the other shaft and adjacent test areas.	487IR Ib	SCP 8.4.2.3.1 (ESF testing operations, constraints and zones of influence) SCP 8.4.1.3.6.1 (Potential for interference between tests) SCP 8.4.2.3.6.2 (Potential for construction and operations interference with testing) SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.4.2.1.2.1 (Ground-water flow in matrix and fractures (Item 10, Boduarsson et al 1988) SCP 8.4.3.2.1.3 (Redistribution of water retained in the unsaturated zone (Item 1, West 1988) Item 3, Eaton and Peterson (1988)). SCP 8.4.3.2.3.2 (Analysis of in-situ experiments (Item 1, Costin and Bauer (1988))	Open	12/30/88
53.	CD	Adopt adequate drift construction controls to meet 10 CFR 60 pre/post-closure performance requirements.	487IR IIIa	Closure documented by 7/25/88 Linehan to Stein letter.	Closed	N/A
54	SEAL	Discuss recognition of possible need for remedial measures to maintain post-closure isolation capabilities due to penetration of targeted geological/hydrological structures.	487IR IIIb	SCP 8.5.2.3.4.4 (Description of ESF underground construction and operations) SCP 6.2.8.6 (Options for sealing a discrete fault or fracture zone in an access or emplacement drift - vertical emplacement.) Primary supporting references SAND84-2461 (Section 5.1.3 of the Conceptual Design Report) SAND 84-1895 Fernandez et al. (1987) Technical Basis for Sealing	Open	12/30/88
55.	CD	Provide assurance that planned drift length and directions are adequate for characterizing each of the targeted fault zones.	487IR IIIc	Letter summary sent 10/29/87. Closure documented by 7/25/88 Linehan to Stein letter.	Closed	N/A
56.	PERF	Describe the measures to be taken to avoid interference with testing by drifting operations.	487IR IV	SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence) SCP 8.4.2.3.6.2 (Potential for construction and operations interference with testing) SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
57.	PERF	Modify performance analysis to reflect increase in size of ES-2 to 12 feet.	487IR Va	SCP 8.4.3 (Potential impacts of characterization activities on post-closure performance objectives) SCP 8.4.2 (Description and location of characterization operations)	Open	12/30/88
58.	SEAL	Describe how construction methods minimize shaft wall damage.	487IR Vb	SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)	Open	12/30/88
59.	PERF	Demonstrate that there will be minimal interference with testing from underground construction activities. In particular, address the potential for: o movement of construction fluids through fractures from ES-2 to ES-1 test areas o damage to test instruments from blasting vibrations.	487IR Vc	SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.4.2.3.6.1 (Potential for interference between tests) SCP 8.4.2.3.6.2 (Potential for construction and operations interference with testing) SCP 8.4.3.2.1.2 (Ground-water flow in matrix and fractures) (Item 10, Boduarsson et al. (1988)) SCP 8.4.3.2.1.3 (Redistribution of water retained in the unsaturated zone) (Item 1, West (1988), Item 3, Eaton and Peterson (1988)) SCP 8.4.3.2.3.2 (Analyses of in-situ experiments (Item 1, Costin and Bauer (1988))	Open	12/30/88
60.	P	The DOE will assemble the draft ESF-Repository Interface Control Drawings in a manner that they can be released to NRC and the State by June 1, 1987.	487AI 1	Drawings sent to NRC on 6/4/87 Rev. 5 sent to NRC on 9/26/88	Pending	
61.	DC	The DOE will provide the technical analysis supporting the proposed size of the exploratory drifts by June 1, 1987.	487AI 2	Draft Letter Report titled "Proposed Alternative Configuration for the ESF Exploratory Drifts," Revision 2 Transmittal letter Skousen to Lahoti, dated 7/12/88, No. NN1.880712.0006.	Open	After DOE HQ approval of letter report
62.	P	The DOE committed to constructing exploratory drifts using controlled blasting techniques, but emphasized that this did not mean that DOE had agreed that Level I QA requirements will apply to controlled blasting in the drifts. The Department will evaluate the relevance of drift stability and damage control to retrievability and waste isolation considerations.	487AI 3	SCP 8.6.4.2.2 (Preliminary quality activities list) SCP 8.4.3.2.5 (Summary of potential impacts to the site from site characterization activities) SCP 8.3.2.2 (Issue resolution strategy for Issue 1.11: Have the characteristics and configurations of the repository and repository engineering barriers been adequately established?) SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4: Are the technologies of repository construction, operation, and decommissioning adequately established?) SCP-CDR	Pending	10/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
63.	P	The DOE committed to using the same construction control requirements in the second 12 ft. diameter shaft as in the first 12 ft. diameter shaft.	487AI 4	Upon completion of Title II	Pending	10/88
64.	P	The DOE committed to provide from files, if available, historic drawings depicting the initial repository elevation at the 1200 ft. horizon by June 1, 1987.	487AI 5	Drawing sent to NRC on 6/4/87 Closure not yet documented	Pending	10/88
65.	NRC	The NRC will review attachment 7 and will notify the DOE by June 1, 1987 if the proposed response plan to close out open items is satisfactory.	487AI 6	N/A	Open	
66.	P	The DOE provided the information requested in Attachment 6 to NRC and the State of Nevada on April 15, 1986. Copies are included with distribution of this summary.	487AI 7	Provided at meeting April 14 and 15	Pending	10/88
67.	DES	DOE should demonstrate that it has in place and is implementing an overall systematic design and approval process for the ESF that (i) considers 10 CFR 60 requirements including those for QA, (ii) recognizes uncertainties associated with site characterization activities, (iii) recognizes the need for feedback and interaction among participants responsible for design, scientific tests, performance assessment, construction and operation, and (iv) considers operational impacts on tests and space requirements to avoid test interferences.	588AI 1	SCP 8.4.2.1 (Rationale for planned testing) SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.2.3.3.1 (Design and interface control) SCP 8.4.2.3.6.1 (Potential for interference between tests) SCP 8.4.2.3.6.2 (Potential for construction and operations interference with testing) SCP 8.4.2.3.6.4 (Design flexibility) NV 88-9 Technical Assessment Review Reports Generic Requirements, Appendix E SDRD	Open	12/30/88
68.	DES	DOE should provide justification for assigning quality levels II and III to practically all activities for which specifications were handed out to F&S during the 50 % Title I design review of the ESF.	588AI 2	QMP-02-06, Assignment of Quality Assurance Levels Safety Basis Analysis Report SCP ESF Subsystems Design Requirements Document	Open	

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
69.	OBJ	The NRC staff considers that the need for extending the Exploratory shaft 1 (ES-1) approximately 400 ft below the repository horizon into the zeolitic zone of the Calico Hills unit has not been established in the CDSCP nor has the need been established for tests requiring drifting (horizontal excavation) through the Calico Hills unit. It has not been demonstrated that the proposed shaft (ES-1) penetration into the Calico Hills unit (an important barrier between the repository horizon and the underlying groundwater table) or the proposed drifting through it will not have potential adverse impacts on the waste isolation capability of the site.	588PP 02	SCP 8.4.2.1.6.1 (Characterization of Calico Hills)	Open	12/30/88
70	OBJ	The CDSCP does not include sufficient and consistent conceptual design information on the proposed ESF. This does not allow the evaluation of the potential interference of proposed investigations with each other and the interference of construction operations in the two shafts and long drifts with these investigations.	588PP 03	SCP 8.4.2.2.2.3 (Basis for surface-based testing construction controls) SCP 8.4.2.2.3 (Surface-based test interference) SCP 8.4.2.3.1 (Test constraints and zones of influence) SCP 8.4.2.3.3.2 (General arrangement of surface facilities) SCP 8.4.2.3.6.1 (Test to test interference) SCP 8.4.2.3.6.2 (Construction to test interference) SCP 8.4.2.3.4.4 (Underground operations) SCP 8.4.2.3.5 (General description of underground support systems) SCP 8.4.2.3.3.3 (General arrangement of ES-1 & ES-2) SCP 8.4.2.3.3.4 (General arrangement of main test level & drifts)	Open	12/30/88
71.	OBJ	The CDSCP does not sufficiently consider the potentially adverse impacts resulting from the proposed locations of ES-1, ES-2, other shafts and ramp portals in areas which may be susceptible to surface water infiltration, sheet flow, and lateral and vertical erosion (Refs. 1 and 2). For the proposed locations, there is a possibility of (a) potentially significant and unmitigable long-term adverse impacts on the waste isolation capability of the site and/or (b) affecting the ability to adequately characterize the site.	588PP 04	SCP 8.4.2.3.3.1 (Rationale for shaft location) SCP 8.4.3.1.1 (General approach to performance assessment) SCP 8.4.3.1.2 (Approach to assess the potential impacts of site char. activities) SCP 8.4.3.2 (Supporting technical analyses and data) SCP 8.4.3.3.1 (Impacts on total-system releases) SCP 8.4.3.3.2 (Impacts on waste package containment) SCP 8.4.3.3.3 (Impacts on EBS release) SCP 8.4.3.3.4 (Impacts on GWTT)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
72.	TEST	The rationale for the specification of information needs does not appear to ensure completeness of those information needs. Furthermore, the integration of testing with design and performance assessment appears to be lacking.	588PP C1	SCP 8.3 (Planned tests, analyses, and studies) SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4: Are the technologies of repository construction, operation, closure, and decommissioning adequately established for the resolution of performance issues?)	Open	12/30/88
73.	PERF	The CDSCP (Section 8.4.1.1 states that current plans call for drilling approximately 300 to 350 shallow holes (50 to 150 ft. deep), and 45 to 80 exploratory holes (presumably deep). Several trenches are also planned to be excavated for site characterization. In addition, Section 8.4.2.5.1 includes a summary of proposed numerous activities that would involve drilling from or very close to ES-1. The individual, the cumulative and the synergistic effects of these holes have not been considered in the evaluation of the potential impacts of exploratory shaft construction and testing on the waste isolation integrity of the site (Section 8.4.2.6, and supporting references, in particular Fernandez et al., 1987; Case and Kelsall, 1987).	588PP C27	SCP 8.4.2.2 (Surface-based activities) SCP 8.4.2.3 (Subsurface-based activities) SCP 8.4.2.2.2.3 (Basis for surface-based testing construction controls) SCP 8.4.3.2.5.2 (Evaluation of potential impacts to the site from drilling activities for current site conditions) SCP 8.4.3.2.5.1 (Evaluation of potential impacts to the site from surface activities for current site conditions) SCP 8.4.3.3.1.2 (Evaluation of impacts on total-system releases)	Open	12/30/88
74.	TEST	CDSCP's approach to characterizing the complex three-dimensional nature of fracture systems in the repository block appears to rely on fractal analysis of outcrop exposures and geologic mapping of ES-1, drifts and boreholes (excluding floors and working faces). Also the CDSCP limits the objectives of fracture network studies to providing fracture analyses to supporting hydrologic modeling. The approach and objective to characterization described in the CDSCP may not lead to sufficient descriptions of the fracture networks.	588PP C29	SCP 8.3.1.4.2.2 (Characterization of structural features in site area) SCP 8.3.1.4.2.2.2 (Surface-fracture network studies) SCP 8.3.1.4.2.2.4 (Geologic mapping of exploratory shaft and drifts) SCP 8.3.1.4.3.1.1 (Systematic drilling program) SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone--surface based study) SCP 8.3.1.4.2.2.3 (Borehole evaluation of faults and fractures) SCP 8.3.1.4.2.2.5 (Seismic tomography / vertical seismic profiling)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
75.	TEST	The required integration of site-specific subsurface information with repository design is not considered in this section (e.g., not even among the qualifying factors listed in the next to last paragraph on pg. 8.3.1.4-90.	588PP C30	SCP 8.3.1.4.3.1.1 (Systematic drilling program)	Open	12/30/88
76.	TEST	This table, which summarizes the requests for thermal and mechanical rock properties, appears to be far from complete.	588PP C42	SCP 8.3.1.15 (Overview of the thermal and mechanical rock properties program) SCP 8.4.2.1 (Rationale for planned testing) SCP 8.4.2.1.4 (Relationship of planned testing to data needs)	Open	12/30/88
77.	TEST	Section 8.3.1.15 does not present a clear testing rationale. Thermal and mechanical properties to be determined are not related to specific individual tests.	588PP C43	SCP 8.3.1.15 (Overview of the thermal and mechanical rock properties program)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
78.	TEST	The testing program laid out in Section 8.3.1.15 is deficient in several respects. In some cases, important information that could be gained in testing is not identified. Also, some proposed tests are ill-defined, and others may not be able to provide required information.	588PP C44	SCP 8.3.1.15 (Overview of the thermal and mechanical rock properties program) SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)	Open	12/30/88
79.	TEST	The discussion and use of statistics in this chapter is not clear. A statistical approach has been suggested to determine numbers of tests required to determine various rock properties, but the approach suggested is confusing and apparently overlooks several considerations that should be factors into such an approach. Also, needed confidences of "low," "medium," or "high" have been assigned without explaining the basis for such assignments. Bases for assigning the needed confidence of low, medium or high are not discussed.	588PP C45	SCP 8.3.1.15 (Overview of thermal and mechanical rock properties) SCP 8.3.1.15.1 (Investigation: Study on spatial distribution of thermal and mechanical properties) SCP 8.1.2.2 (Performance Allocation)	Open	12/30/88
80.	TEST	In order to examine the margin of safety engineered into the stability of emplacement holes from the standpoint of retrievability, the canister-scale heater experiment needs to be run beyond the average design heat load. The CDSCP does not include provisions for such testing. Also, no mention is made of testing of lined versus unlined holes, backfilled holes, etc.	588PP C46	SCP 8.3.1.15.1.6.2 (Canister-scale heater experiment)	Open	12/30/88
81.	TEST	This experiment is one of the more important rock mechanics experiments proposed; yet, virtually no detail is given regarding it. There seems to be a lack of integration between this experiment and the modeling activities and design.	588PP C47	SCP 8.3.1.15.1.6.5 (Heated room experiment) SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
82.	TEST	Plate-load tests do not necessarily provide a means of determining in-situ (i.e., undisturbed) rock mass deformational properties. Data obtained from such tests may be useful in assessing spatial variability, effects of different excavation procedures, etc. as part of the overall program to characterize deformational relations of the rock mass adjacent to underground openings but may not be useful in thermomechanical calculations.	588PP C48	SCP 8.3.1.15.1.7.1 (Plate loading tests) SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)	Open	12/30/88
83.	TEST	CDSCP has limited its consideration of how jointed tuff can be treated to equivalent continuum models. Although several possible models are described in Chapter 2 (pp. 2-19 and -20), representation of jointed tuff by equivalent continuum models only and disregarding of other models such as quasi-discrete or distinct element models has not been justified.	588PP C54	SCP 8.3.2.1.4.1.1 (Geomechanical analyses)	Open	12/30/88
84.	PERF	Geomechanical analyses do not consider the effects of emplaced support components or the effect of elevated temperature on the support system components.	588PP C55	SCP 8.3.2.1.4.1.1 (Geomechanical analyses)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
85.	PERF	The first section of the next to last paragraph on pg. 8.3.2.2-55 expresses the anticipation that contingency measures might strongly emphasize constructibility based on semi-empirical rock mass classifications. These classifications bear no direct relation to the primary long-term repository performance requirements of containment and isolation. It is not clear, therefore, whether the selected criteria are appropriate for guiding emplacement decisions, and, specifically to perform system performance studies for off-normal conditions, as proposed in the first sentence of the last paragraph on pg. 8.3.2.2-55.	588PP C56	SCP 8.3.2.2.3 (Information need 1.11.3: Design constraints for orientation, geometry, layout, and depth of the underground facility that contribute to waste containment and isolation including flexibility to accommodate site-specific conditions)	Open	12/30/88
86.	SEAL	The CDSCP states that the potential for the development of new paths to the accessible environment or for an extension of the disturbed zone will be mitigated by backfilling the emplacement drifts. Given the proposed loose backfill and only partial filling of the drifts, this effect may be quite limited.	588PP C57	SCP 8.3.2.2.6 (Information need 1.11.6: Repository thermal loading and predicted thermal and thermo-mechanical response of the host rock)	Open	12/30/88
87.	TEST	The proposed wedge analysis and key block analysis are not capable of including the effects of thermal loading or stress gradient on the host rock.	588PP C58	SCP 8.3.2.2.6 (Information need 1.11.6: Repository thermal loading and predicted thermal and thermo-mechanical response of the host rock)	Open	12/30/88
88.	PERF	The description of far field analysis in the CDSCP does not address potential for thermally induced movement along faults or fractures.	588PP C59	SCP 8.3.2.2.6 (Information need 1.11.6: Repository thermal loading and predicted thermal and thermo-mechanical response of the host rock)	Open	12/30/88
89.	SEAL	The comment that "... drifts will not be relied on to be open. They may have caved or settled on the backfill" raises concerns because it is formulated as a very broad option.	588PP C60	SCP 8.3.2.2.7 (Information need 1.11.7: Reference post-closure repository design)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
90.	PERF	Systematic studies or calculations may be needed to determine the heat moisture transfer from the rock to the ventilation air.	588PP C61	SCP 6.4.10.2.6 (Design analysis) SCP 8.3.2.4.1.2 (Air quality and ventilation) SCP 8.3.2.5.7 (Information need 4.4.7: Design analyses, including those addressing impacts of surface conditions, rock characteristics, hydrology, and tectonic activity)	Open	12/30/88
91.	PERF	The last tentative goal on pg. 8.3.2.5-21 indicates that high confidence is needed that ES-1 shafts will terminate no less than 150 m above ground-water table. It does not appear that this goal is reached under the present ES-1 design.	588PP C63	SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4: Are the technologies of repository construction, operation, closure, and decommissioning adequately established for the resolution of the performance issues?) SCP 8.4.2.2.3.3 (ESF shafts arrangement)	Open	12/30/88
92.	SEAL	The CDSCP does not include details of the in situ testing of the proposed seal design concepts. This information is necessary to evaluate the effects of seal testing activities on the ability of the site to meet the performance objectives (10 CFR 60.112 and 10 CFR 60.113). In addition, the CDSCP states that in situ testing to evaluate seal components and placement methods would not start until after the submission of License Application. In view of the uniqueness of the proposed seal design concepts and the associated uncertainties with the long-term performance of the seals, the NRC staff considers that the proposed start date of in situ testing for evaluation of seal components and placement methods will result in a lack of sufficient data for evaluating the license application.	588PP C64	SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.3.3.2.2.3 (In situ testing of seal components)	Open	12/30/88
93.	SEAL	The CDSCP states that "The lack of aquifer above the waste emplacement horizon at the Yucca Mountain site, makes it unnecessary to install either permanent or temporary shaft or ramp seal components at the time of access construction." No evidence or substantiation is presented for the statement that neither operational nor permanent seals will be required.	588PP C65	SCP 8.3.3.1 (Overview of seal program) SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone-surface based study.)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
94.	SEAL	The CDSCP states that "The shaft liner can be removed to emplace seal components later." This statement, without reference to an evaluation, analysis or justification, appears to imply that it is a straightforward matter to remove a shaft liner and that such a procedure has no implications for the isolation capability of the site.	588PP C66	SCP 8.4.3.2.3 (Thermal/mechanical analyses, and data)	Open	12/30/88
95.	SEAL	The statement near the end of the next to the last paragraph on pg. 8.3.3.1-4 that "boreholes that are upgradient or long distances from the repository may not require sealing" appears to be driven largely by the considerations of vertical downward flow in the pre-repository rock environment, and does not represent a conservative sealing approach.	588PP C67	SCP 8.3.3.1 (Overview of the seal program) SCP 8.4.1.3 (Concepts of unsaturated-zone flow and their application to Yucca Mountain)	Open	12/30/88
96.	PERF	It is stated in the second paragraph on pg. 8.3.3.2-24 that "more conservatism has been added by the selection of the design-basis performance goals to be substantially less than the maximum allowable values." Although this is true immediately after closure, the two curves (Fig. 8.3.3.2-3) do converge relatively rapidly. Although no time scale is included, it can be inferred from Fernandez et al, 1987, Fig. 3-2, that the breakpoint in the Design Basis Performance Goals is at about 1000 years. Beyond that point the two curves are so close together as to leave very little safety margin.	588PP C68	SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established?	Open	12/30/88
97.	SEAL	It is unclear whether a reasonably conservative design approach has been used to determine required backfill hydraulic conductivity.	588PP C70	SCP 8.3.3.2.1 (Information Need 1.12.1: site, waste package and underground facility information needed for design of seals and their placement methods) SAND84-1895 Technical Basis for Seals	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
98.	PERF	In evaluating potential effects of credible accidents on projected radiological exposures, the CDSCP has not sufficiently considered retrieval operations.	588PP C72	SCP 8.3.5.5 (Issue resolution strategy for Issue 2.3: Can the repository be designed, constructed, operated, closed, and decommissioned in such a way that credible accidents do not result in projected radiological exposures of the general public at the nearest boundary of the unrestricted area or workers in the restricted area in excess of applicable limiting values?)	Open	12/30/88
99.	TEST	Plans should be made to correlate persistence of geologic features from ES-1 to ES-2 which might provide preferential pathways and to develop a photographic record of ES-2 for possible future use.	588PP C97	SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.3.1.4.2.2 (Characterization of structural features within the site area)	Open	12/30/88
100.	PERF	A reasonable assurance that the shafts are far enough apart so that construction in ES-2 does not adversely affect the ability to obtain required data in ES-1 and adjacent test areas has not been provided.	588PP C98	See item 52.	Open	12/30/88
101.	SEAL	The CDSCP does not present appropriate information on blasting to reflect the most recent strategy for minimizing shaft wall damage as outlined in DOE's "Response to NRC Information Requests from the April 14-15 1987 Meeting Between DOE and NRC" (Ref. 1).	588PP C99	SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
102.	SL	The extent of site exploration described in the CDSCP indicates that the DOE plans to explore only a small portion of the underground repository block through underground testing and drifting. Substantially more drifting may be necessary to reduce uncertainties about the presence of faults and other geologic and hydrologic conditions. In the CDSCP no exploratory drift is planned to cross the main waste storage area to the southern portions of the block, which based upon existing information appears to contain more faults and fractures than other parts of the block. Borehole penetrations into the main waste storage area (boreholes from the surface, horizontal core drilling or other means) may not provide the representative information needed to construct a reliable three-dimensional geologic model of the repository block and evaluate ranges of parameters that could affect repository performance.	588PP C100	SCP 8.4.2.1.5 (Representativeness of planned testing) SCP 8.4.2.1.5.1 (Relation between surface-based testing in the ESF) SCP 8.4.2.1.5.2 (Respresentativeness of the ESF locations) SCP 8.4.2.1.5.5 (Need for drifting to the southern part of the repository block)	Open	12/30/88
103.	SEAL	Plans for remedial measures that may be required to minimize potentially adverse impacts of penetrating the target features are not given.	588PP C101	See Item 54.	Open	12/30/88
104.	TEST	In several activity descriptions, it is proposed that air coring will be used to drill holes to be used for permeability testing (e.g., Infiltration test, pg. 8.4-52; bulk permeability test, pg. 8.4-53; radial borehole tests, pg. 8.4-53; Calico Hills tests, pg. 8.4-54; diffusion tests, pg. 8.4-54. Aside from the potential technical difficulties associated with the feasibility of drilling such holes, this raises questions about the reliability of the permeability values thus obtained.	588PP C102	SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence) SCP 8.4.2.2.2.3 (Basis for surface-based testing construction controls)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
105.	TEST	The performance confirmation program has not been sufficiently well defined, and appropriate details are not included in the CDSCP. The discussion concerning confirmation, Issue 1.7, has not presented the strategy or a plan to meet the requirements set forth in Subpart F of 10 CFR 60 part 60.	588PP C103	SCP 8.3.5.16 (Issue resolution strategy for Issue 1.7: Will the performance-confirmation meet the requirements of 10 CFR 60.137?) SCP 8.4.2.3.6.4 (Design flexibility)	Open	12/30/88
106.	TEST	What are the definitions of the terms fracture "aperture" and "length"?	588PP Q12	SCP 8.3.1.4 (Overview of the rock characteristics program)	Open	12/30/88
107.	TEST	Does this program include all drilling or only surface based drilling?	588PP Q14	SCP 8.3.1.4.1 (Integrated Drilling Program and integrated geophysical activities) SCP 8.4.2.3.3 (Description of ESF)	Open	12/30/88
108.	TEST	How is the roughness coefficient parameter measured in a borehole? What is the difference between roughness coefficient listed here and "roughness" discussed elsewhere in Section 8.3.1.4.2.2.3?	588PP Q16	SCP 8.3.1.4.2.2.3 (Borehole evaluation of faults and fractures)	Open	12/30/88
109.	TEST	What role, if any, will the data presented in Chapter 2 play in the proposed model development and in scoping the amount of planned site specific in situ testing?	588PP Q17	SCP 8.3.1.4.3 (Development of 3-D models of rock characteristics at the repository site) SCP 8.3.1.15.1 (Studies to provide the required information for spatial distribution of thermal and mechanical properties)	Open	12/30/88
110.	TEST	What methods will be used to determine whether there is any impact of ground motion from underground nuclear explosions on repository design?	588PP Q25	SCP 6.4.10.2.6 (Design Analysis) SCP 8.3.1.17.3 (Studies to provide required information on vibratory ground motion that could affect repository design) SCP 8.3.2.5.7 (Information need 4.4.7: Design analyses, including those addressing impacts of surface conditions, rock characteristics, hydrology, and tectonic activity) SCP 8.3.1.17.4.1 (Historical and current seismicity) SAND84-7104 Blume Associates: Ground Motion Evaluations of Yucca Mountain, NV, with applications to repository conceptual design and siting.	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
111.	TEST	How will the heated block experiment be used for model validation if there are no imposed stress gradients or temperature gradients inside the block?	588PP Q26	SCP 8.3.1.15.1.6.3 (Yucca Mountain heated block experiment) SAND Zimmerman et al, 1986: Final Report: G-Tunnel Heated Heated Block Experiment SAND87-2699 Costin and Chen, in prep: An analysis of the G-Tunnel Thermomechanical response using a compliant joint rock mass model	Open	12/30/88
112.	TEST	What are the parameters and the strength model for which the strength experiment(s) are designed, and how will a substantial volume of rock be driven to failure?	588PP Q27	SCP 8.3.1.15.1.7.2 (Laboratory thermal expansion testing)	Open	12/30/88
113.	TEST	Why is there no link (other than that indicated in Figure 8.3.2.1-1) established between this plan and Issue 1.12 - Repository Sealing?	588PP Q34	SCP 8.3.2.2.3 (Information need 1.11.3: Design concepts for orientation, geometry, layout, and depth of underground facility that contribute to waste containment and isolation including flexibility to accommodate site-specific conditions.	Open	12/30/88
114.	TEST	According to the last sentence of this section, the approach to develop this plan is given in Section 8.3.2.3, and the data requirements for this plan are given in Section 8.3.2.2.1. Both of these referenced sections cover extremely broad topics. What are the relevant items for this section?	588PP Q35	SCP 8.3.2.2.3.4 (Design Activity 1.11.3.4:Drainage and moisture control plan) SCP 8.4.2.3.3 (Description of ESF)	Open	12/30/88
115.	TEST	Where in Section 8.3.2.2.1 are the data requirements for this activity discussed?	588PP Q36	SCP 8.3.2.2.5.1 (Excavation methods criteria) SCP 8.3.2.2.5.2 (Long-term subsidence control strategy) SCP 8.3.2.2.1 (Site characterization information needed for design)	Open	12/30/88
116.	TEST	Some concerns exist as to whether the list of parameters for performance goal C2 (rock radiation shielding) given on pg. 8.3.2.2-30 is comprehensive. For example, does the expected pre-emplacement saturation value of 65 % represent the expected post-emplacement saturation value?	588PP Q37	SCP 8.3.2.3 (Issue resolution strategy for Issue 2.7: Have the characteristics and configurations of the repository been adequately established?	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
117.	TEST	Use of mechanical excavation is considered not feasible in some parts of the document and plausible in other parts. The next to last paragraph on pg. 8.3.2.4-28 mentions the possibility that mechanical excavation may be used. Does this contradict other implications in the CDSCP (e.g., pg. 8.3.2.2-70) that mechanical excavation is not feasible?	588PP Q38	SCP 8.3.2.2 (Issue resolution strategy for Issue 1.11: Have the characteristics and configurations of the repository and repository barriers been adequately established? SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)	Open	12/30/88
118.	TEST	Why are the requirements for some items on pg. 8.3.2.5-23 different from the requirements for System Element 1.2.1.2 identified in Table 8.3.2.4-2, non-radiological health and safety?	588PP Q39	SCP 8.3.2.4.2 (Schedule for non-radiological health and safety (Issue 4.2))	Open	12/30/88
119.	SEAL	What is the justification for the statement on pg. 8.3.2.5-24 that "no site characterization data is required to develop the high level of confidence needed for installation of borehole liners."?	588PP Q40	SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4)	Open	12/30/88
120.	SEAL	There are many inconsistencies in this section when compared with the details given in other sections of the CDSCP and reference documents. What are the potential impacts of such inconsistencies?	588PP Q41	SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established?)	Open	12/30/88
121.	SEAL	Description of items included in Table 8.3.3.2-1 needs further clarification in several areas. Why have not all the seal components been included in this list?	588PP Q42	SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established?)	Open	12/30/88
122.	M	There are many apparent inconsistencies in the write-up of the proposed activities presented in this section when compared with the details given in other sections of the CDSCP and reference documents. What are the impacts of such inconsistencies?	588PP Q48	SCP 8.4 (Planned site characterization activities and potential performance impacts)	Open	12/30/88

Item No.	Group	Open Items	Reference	Expected Documents for Closure	NRC Status	Expected Date
123.	SL	Site characterization investigations should be planned based on the total area that may be needed for repository development. Is this the case for the drilling program laid out in the CDSCP?	588PP Q49	SCP 8.4.2.2 (Surface-based activities) SCP 8.4.2.2.1 (General description of location and extent of testing and construction (existing and planned)) SCP 8.4.2.2.2 (Description of locations, operations, and construction controls for surface-based activities) SCP 8.4.2.1.5 (Representativeness of planned testing) SCP 8.4.2.1.1 (Principal data needed for post-closure performance evaluation) SCP 8.3.1.4.3.1 (Systematic acquisition of subsurface information) SCP 6.4.2.2 (Configuration of Underground Facility)	Open	12/30/88
124.	SL	It is difficult to tell from various depictions in the CDSCP what are the actual boundaries of the area that may be involved in repository development and that therefore may need to be characterized intensively. What are these actual boundaries?	588PP Q50	SCP 8.3.1.4.3.1.1 (Systematic Drilling Program) SCP 8.4.2.2.1 (Location and extent of testing and construction)	Open	12/30/88
125.	TEST	Which activity in Table 8.3.1-15-1 is planned to investigate the effects of radiation on thermal and mechanical rock properties?	588PP Q51	SCP 8.3.1.15 (Overview of thermal and mechanical rock properties program: Description of thermal and mechanical rock properties required by the performance design issues.) SCP 8.3.4.2.4.1.5 (Effects of radiation on water chemistry)	Open	12/30/88

GROUP KEY

TEST = Testing
SEAL = Seals
PERF = Performance Assessment
DES = Design Control Process
SL = Shaft Location
DC = Design and Construction
NRC = NRC obligations
OBJ = NRC CDSCP Point Paper Objection
CD = Closed item (closure documented by
P = Pending item (material has been sent
awaiting response)

REFERENCE NUMBER EXAMPLES

483IR Ia = Information Request Ia from the April 1983 Coplan
885AI 4 = Action Item 4 from the August 1985 DOE/NRC ESF me
588PP C29 = Comment 29 from the NRC Point Papers on the CDS

Attachment 5

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

October 7, 1988

Mr. Ralph Stein, Acting Associate Director
Office of Systems Integration and Regulations
Office of Civilian Radioactive Waste
Management
U. S. Department of Energy RW-24
Washington, D. C. 20545

Dear Mr. Stein:

The following are the three open items from the NRC-DOE Exploratory Shaft Facility (ESF) Meeting of July 18-19, 1988 that should be included in the list of open items to be discussed in the NRC-DOE ESF Open Items Meeting scheduled for the week of October 17, 1988 in Washington, D.C.:

1. DOE should demonstrate that the ESF design process has provided for systematic review and consideration of 10 CFR Part 60 requirements in the development of the ESF design and for verification that those requirements have in fact been incorporated into the design.

2. DOE should identify the specific entity responsible for ensuring that 10 CFR Part 60 requirements are reviewed and considered in the development of the ESF design and then for verifying that those requirements have in fact been incorporated into the design.

3. DOE should describe its design control process to assure that items and activities potentially important to safety or waste isolation for the design and construction of the exploratory shaft facility are identified as Quality Level I. The description should include both criteria and methods to be used. It should also address plans for determining what previous data and analyses are needed to support Quality Level I items or activities and how DOE plans to validate these.

Sincerely,

John Linehan

John Linehan, Chief
Project Management and Quality
Assurance Branch
Division of High-Level Waste Management

cc: R. Loux, State of Nevada
C. Johnson, State of Nevada
C. Gertz, DOE/YMPO/NV
E. Regnier, DOE

~~8810110328~~

UNITED STATES NUCLEAR REGULATORY COMMISSION

OVERVIEW OF DESIGN PROCESS

Joe Holonich

Senior Project Manager

Division of High-Level Waste Management

Attachment 6

PRESENTATION

- Define problem
- Three examples of the problem
- Approach to resolution
- Conclusion

DEFINITION OF THE PROBLEM

- 10 CFR Part 60 Requirements
- DOE SDRD Requirements
- Problem: There is no documented design control process that clearly shows how DOE considered 10 CFR Part 60 requirements in its detailed design documents.

EXAMPLE 1

- 10 CFR Part 60.15(a)(1)

  "Investigations to obtain the required information shall be conducted in such a manner as to limit adverse effects on the long-term performance of the geologic repository to the extent practical."

- Exploratory shafts intially placed in the middle of a wash

- SNL report SAND84-1003 does not address 10 CFR Part 60.15(a)(1)

- DOE needs to document the design control process for going from 10 CFR Part 60.15(a)(1) to the location of the exploratory shafts

EXAMPLE 2

- 10 CFR Part 60.21(c)(1)(ii)(D)

  "... The analysis shall also include a comparative evaluation of alternatives to the major design features that are important to waste isolation, with particular attention to the alternatives that would provide longer radionuclide containment and isolation."

- No comparative evaluation of alternative ESF design concepts with respect to waste isolation was presented by DOE

- DOE needs to document the design control process that shows how the requirements of 10 CFR Part 60.21(c)(1)(ii)(D) were considered in the ESF design

EXAMPLE 3

- 10 CFR Part 60.140(d)(2)

  "The [performance confirmation] program shall be implemented so that: . . . (2) it provides baseline information and analysis of that information on those parameters and natural processes pertaining to the geologic setting that may be changed by site characterization, construction, and operational activities."

- Some in situ testing will be conducted in the close vicinity of ESF construction activities; therefore, both the baseline data and the response characteristics are likely to be affected

- DOE needs to document the design control process that demonstrates how 10 CFR Part 60.140(d)(2) was considered

CONSIDERATION OF REQUIREMENTS

At least three areas where DOE has not demonstrated how requirements were considered in ESF design:

- Important to waste isolation
- Analysis of alternatives
- Interference of ESF with site characterization

These examples are sufficient to indicate that DOE does not have a design control process in place.

APPROACH TO RESOLUTION

- Resolving individual technical issues is not sufficient
  - Does not correct overall design control problem
  - Isolated resolution of issues does not consider interrelationships

- DOE needs to establish a design control process

- DOE needs to properly implement the design control process

- In resolving open items, DOE needs to demonstrate how resolution has been achieved through a design control process

CONCLUSION

To resolve individual open items properly, DOE must first demonstrate to the NRC that it [DOE] has a design control process that complies with 10 CFR Part 50, Appendix B, Criterion III.

YUCCA MOUNTAIN PROJECT
EXPLORATORY SHAFT

STATUS OF DESIGN CONTROL

- QA IMPLEMENTATION
- DESIGN REQUIREMENTS

BACKGROUND FOR DETAILED DISCUSSIONS IN DECEMBER, 1988

PRESENTED BY

TOM HUNTER

OCTOBER 19,1988

Attachment 7

YUCCA MOUNTAIN PROJECT
EXPLORATORY SHAFT

STATUS OF DESIGN CONTROL

- QA IMPLEMENTATION
- DESIGN REQUIREMENTS

BACKGROUND FOR DETAILED DISCUSSIONS IN DECEMBER, 1988

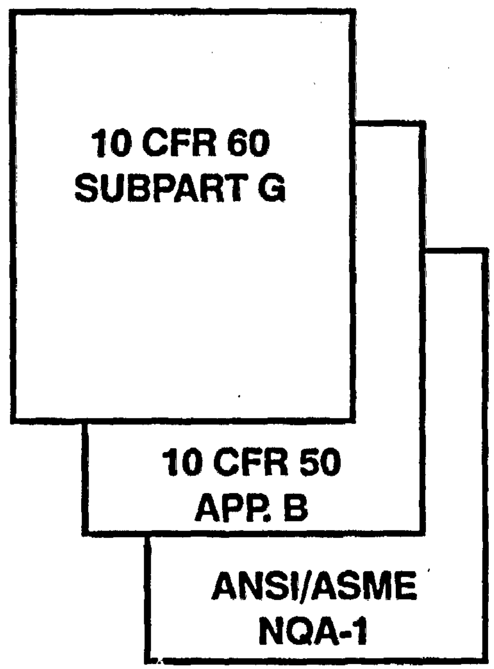
PRESENTED BY

TOM HUNTER

OCTOBER 19,1988

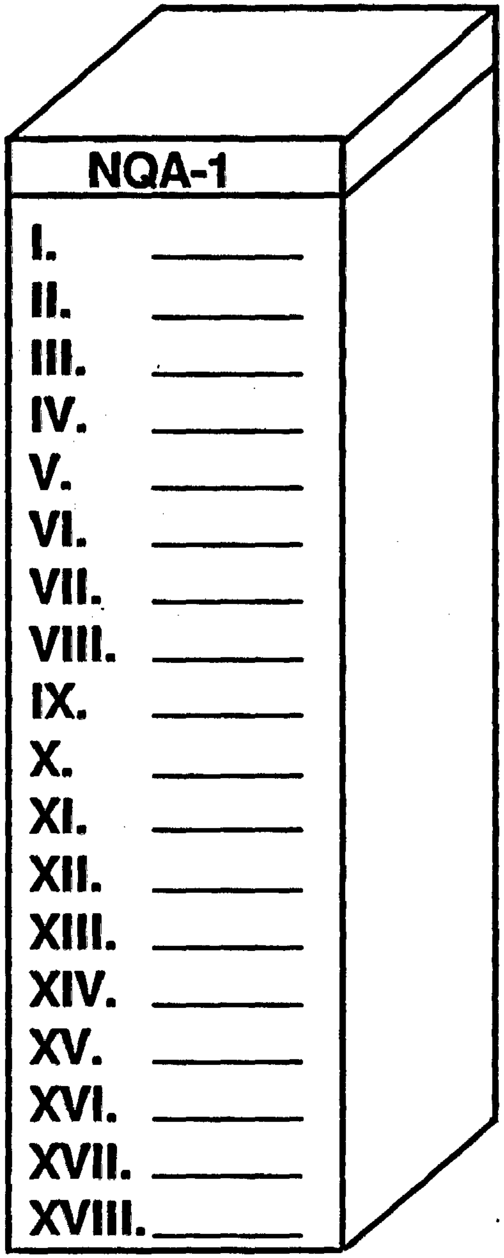
DESIGN CONTROL IS ADDRESSED BY THE DOE QA PROGRAM

- DOE QA PROGRAM IS BASED ON



ESFTH6P.A05/10-19-88

DESIGN CONTROL IS BASED ON NQA-1 CRITERIA

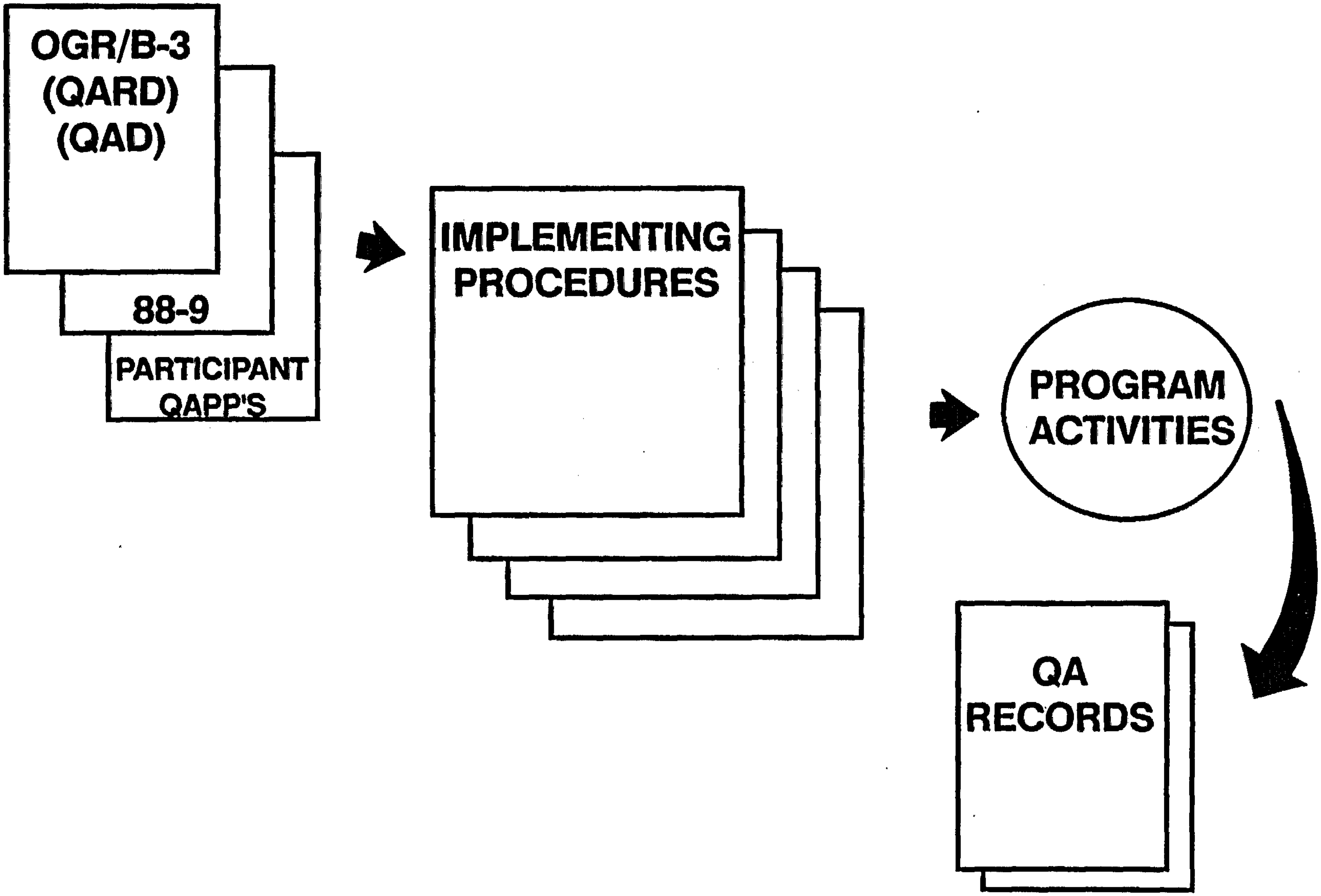


III. DESIGN CONTROL
- DESIGN INPUT
- DESIGN PROCESS
- DESIGN VERIFICATION
- DESIGN CHANGE CONTROL
- DESIGN INTERFACE CONTROL
- DESIGN DOCUMENTATION & RECORDS

QA PROGRAM

ESFTH6P.A05/10-19-88

DOE QA DOCUMENT STRUCTURE



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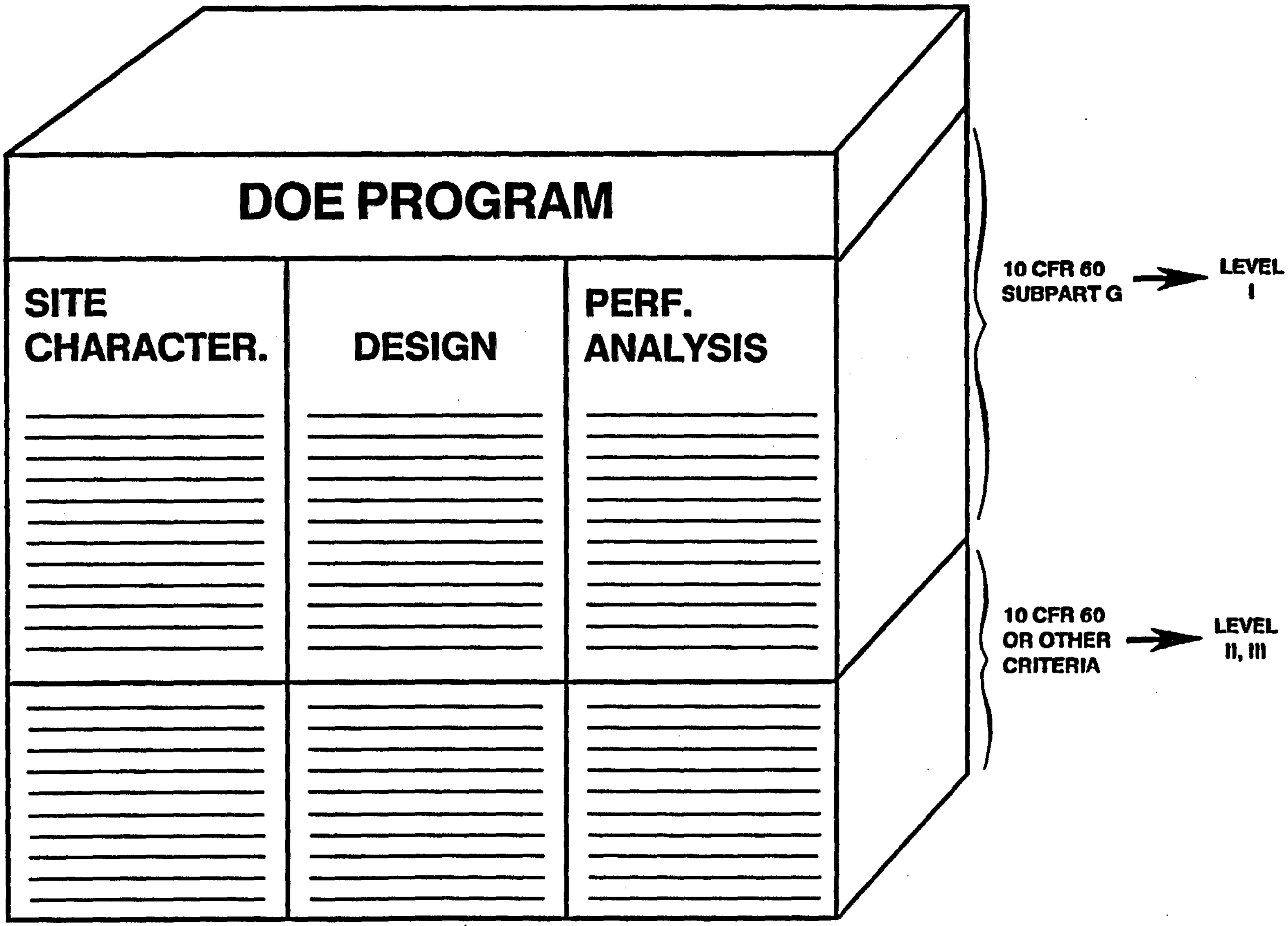
APPLICATION OF THE QA PROGRAM



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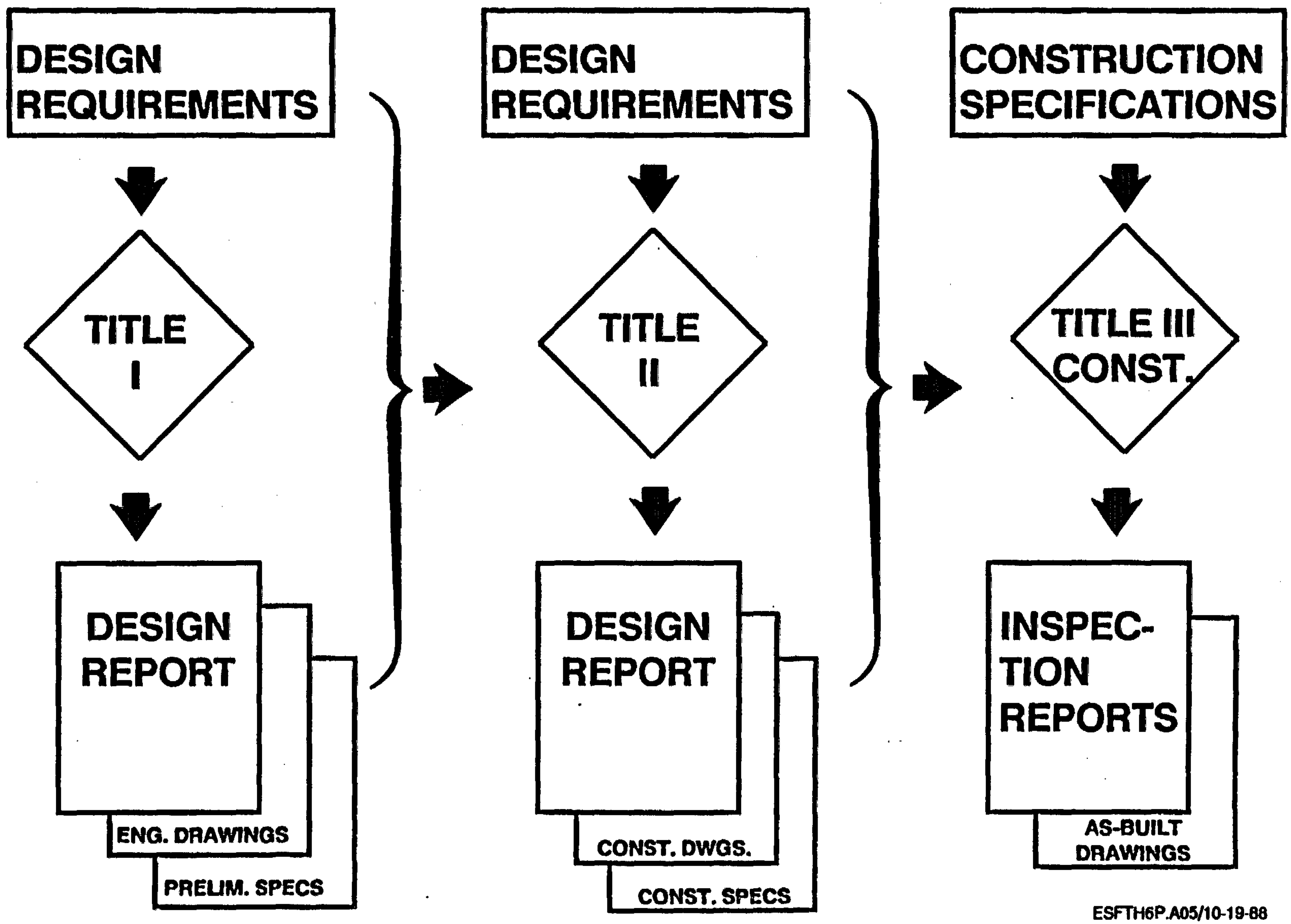
BASIS FOR APPLICATION OF QA PROGRAM IS NUREG 1318

- RECENTLY ISSUED BY NRC
- BEING IMPLEMENTED BY DOE
  - PART OF THE BASIS FOR ESF TITLE II

DESIGN PROCESS



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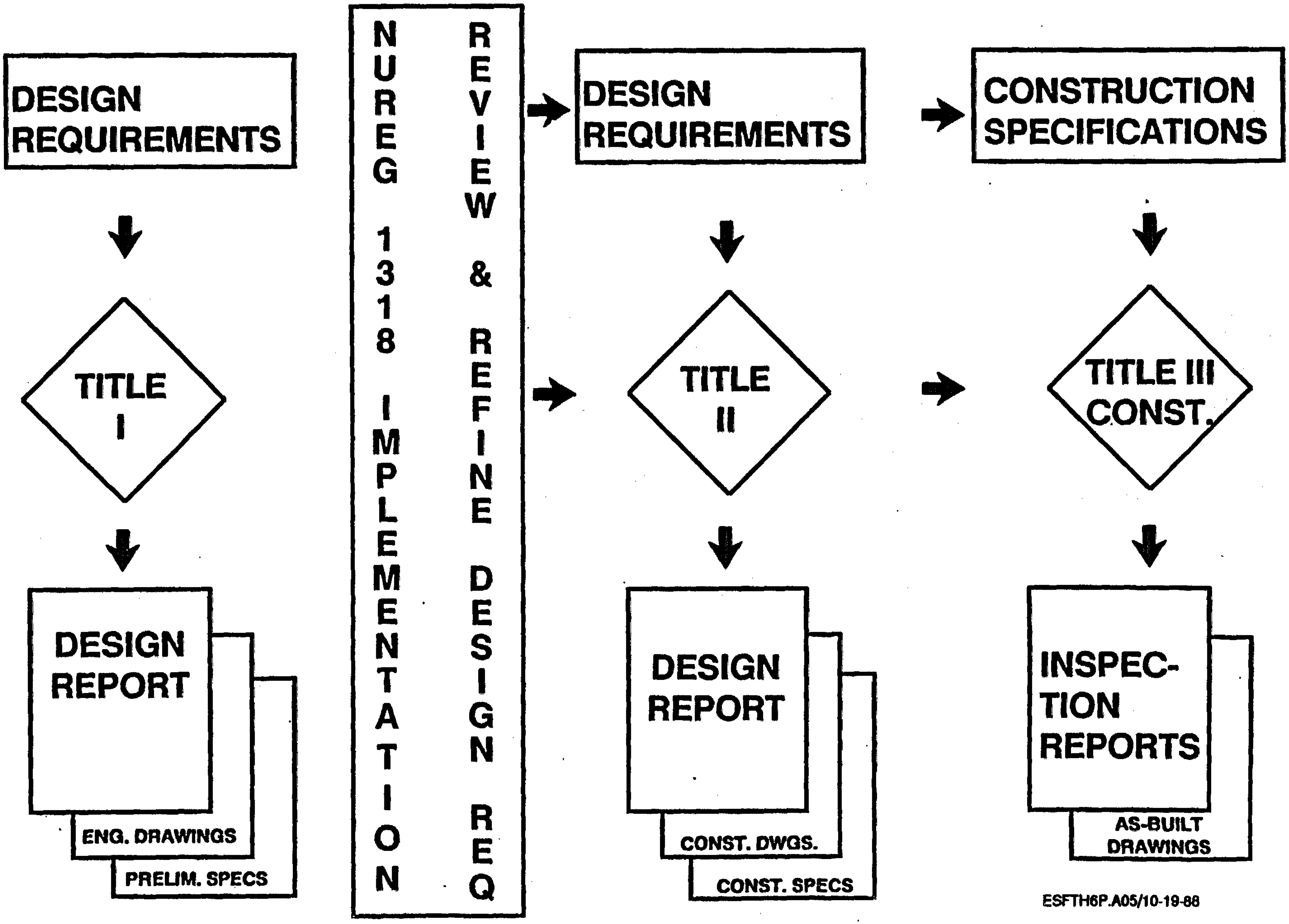
DESIGN PROCESS



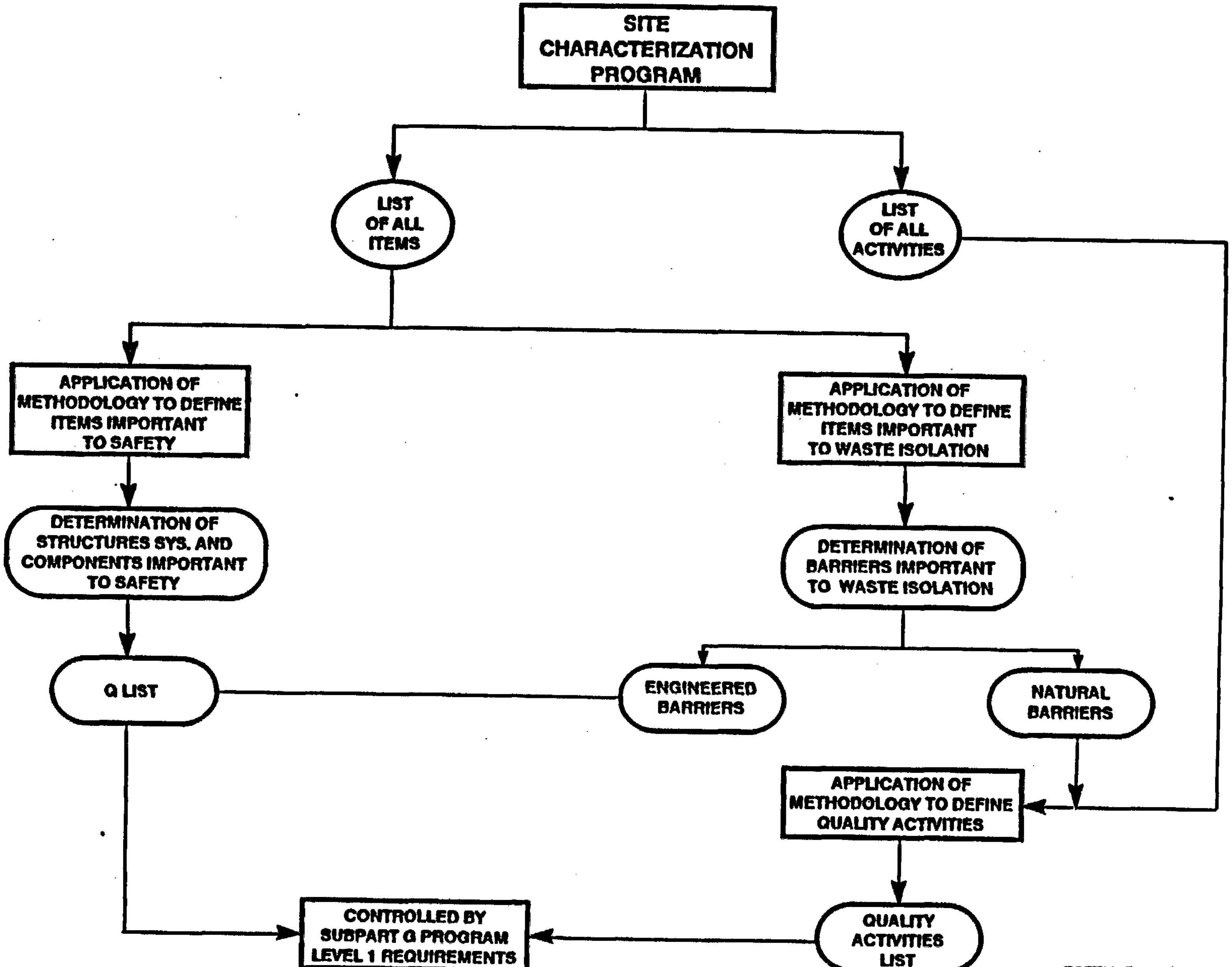
ESFTH6P.A05/10-19-88

APPROACH TO NUREG 1318 IMPLEMENTATION

REEVALUATION OF QUALITY LEVEL ASSIGNMENTS PRIOR TO SITE CHARACTERIZATION

- DOE ACTION PLAN DEVELOPED
- APPROACH/METHODOLOGY/PROCEDURES IN PROGRESS
- APPLICATION TO ESF ITEMS & ACTIVITIES

FLOW CHART FOR QA CLASSIFICATION



ESFTH6P.A05/10-19-88

APPROACH TO QA CLASSIFICATION

PROCEDURES

- IDENTIFICATION OF ITEMS/ACTIVITIES
- ITEMS IMPORTANT TO SAFETY
- ITEMS IMPORTANT TO WASTE ISOLATION
- QUALITY ACTIVITIES LIST
- ASSIGNMENT OF QA LEVELS & CRITERIA

ANALYSES

- ITEMS IMPORTANT TO SAFETY
- ITEMS IMPORTANT TO WASTE ISOLATION
- ACTIVITIES RELATED TO NATURAL BARRIERS IMPORTANT TO WASTE ISOLATION

RESULTS

- TITLE II QALA'S FOR ESF
- SUPPORTING RATIONALE

CONSERVATIVE APPROACH TO QA CLASSIFICATION

- 10 CFR 60 SUBPART G PROGRAM (LEVEL I) WILL BE APPLIED TO ITEMS/ACTIVITIES UNLESS DETERMINED OTHERWISE

- SUPPORTING ACTIVITIES (E.G., DESIGN -DESIGN CONTROL) WILL BE PERFORMED UNDER LEVEL I CONTROLS

STEPS TO IMPLEMENT THE ACTION PLAN

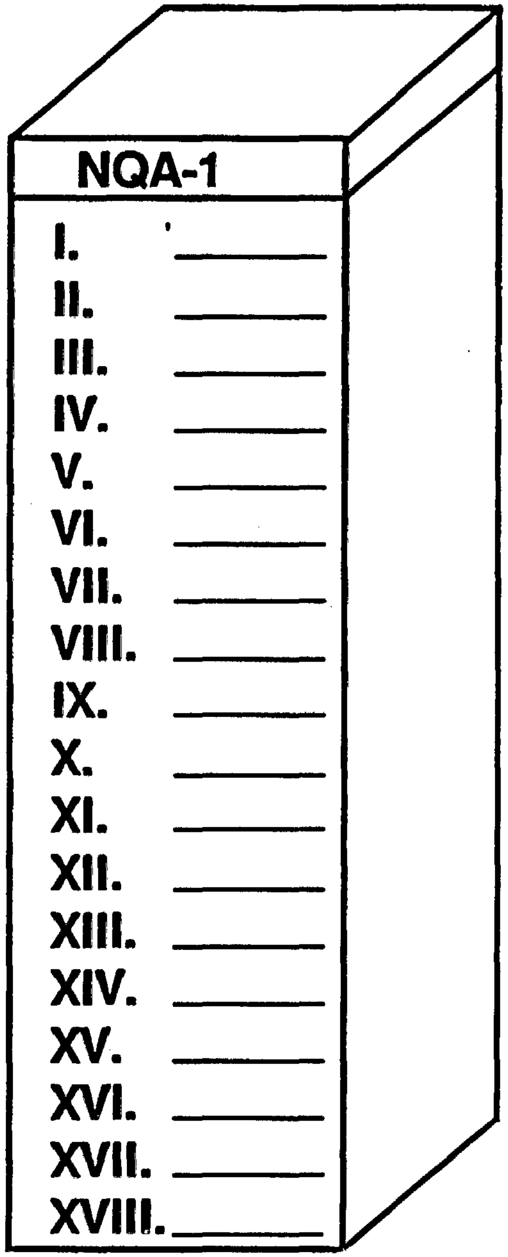
1. PREPARATION OF OVERALL METHODOLOGY
2. WORK PLANS FOR: ESTABLISHING ITEMS AND ACTIVITIES LISTS; DETERMINING ITEMS IMPORTANT TO SAFETY AND IMPORTANT TO WASTE ISOLATION; ASSIGNMENT OF QA LEVELS.
3. DETERMINATION OF ITEMS IMPORTANT TO SAFETY AND IMPORTANT TO WASTE ISOLATION.
4. COMPILATION OF Q-LIST AND QUALITY ACTIVITIES LIST
5. ASSIGNMENT OF QA LEVELS.

MORE DETAILED DISCUSSION OF ACTION PLAN IN DECEMBER 1988 MEETING

DESIGN REQUIREMENTS

(DESIGN INPUT)

DESIGN REQUIREMENTS ARE A PART OF DESIGN CONTROL



III. DESIGN CONTROL

- DESIGN INPUT
- DESIGN PROCESS
- DESIGN VERIFICATION
- DESIGN CHANGE CONTROL
- DESIGN INTERFACE CONTROL
- DESIGN DOCUMENTATION & RECORDS

QA PROGRAM

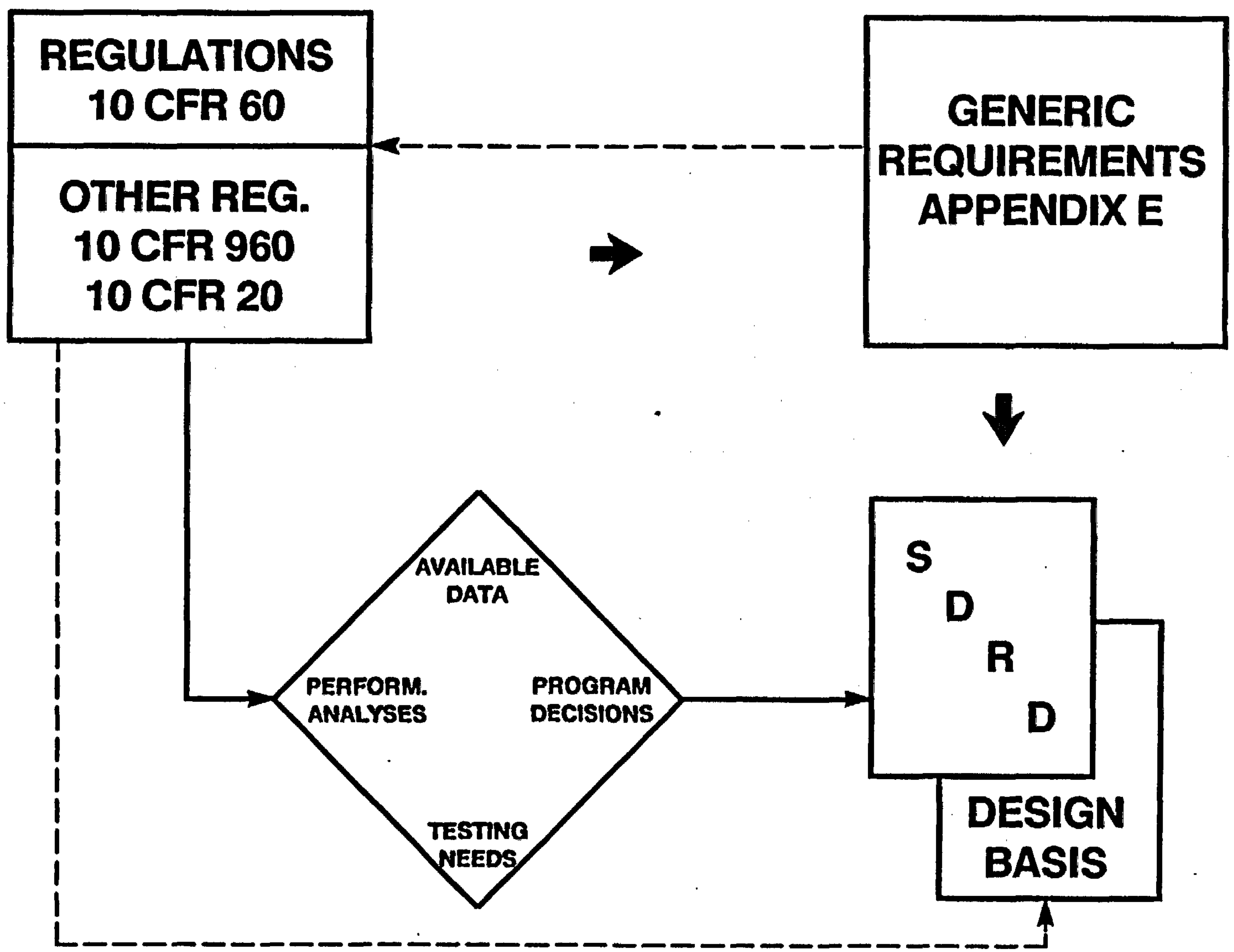
DESIGN INPUT

- **DESIGN REQUIREMENTS**

REGULA-TIONS 10 CFR 60 → GENERIC REQUIRE. APP. E → S D R D → A/E DESIGN BASIS

- CRITERIA
- DATA
- BASIC CONFIGURATION
  ES LOCATION
  REPOSITORY INTERFACE

DEVELOPMENT OF DESIGN INPUT



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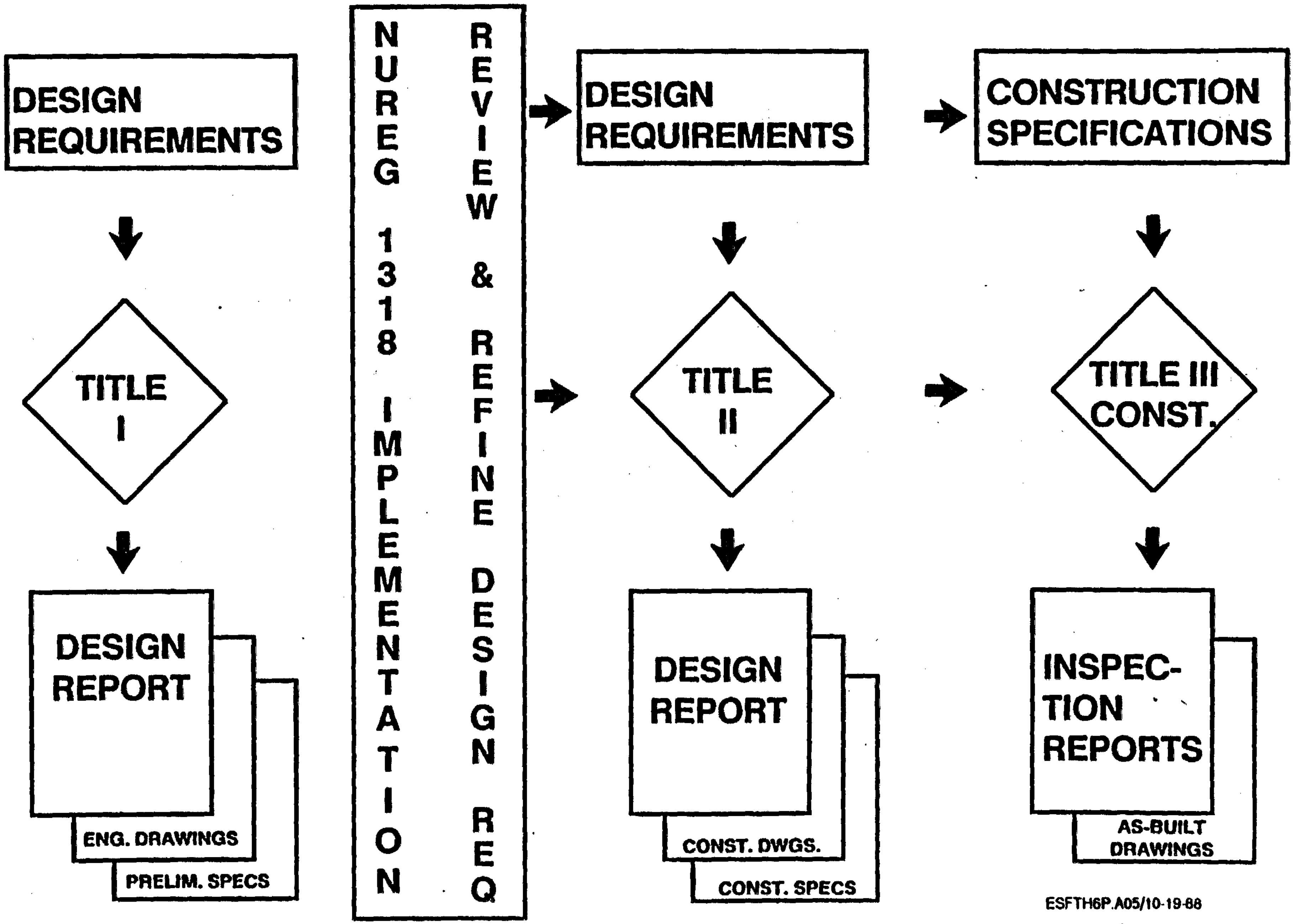
DESIGN PROCESS



MAJOR PROGRAM DECISIONS IN DESIGN INPUT

ESF LOCATION

- SCREENING METHODOLOGY (1982/83)
- DEVELOPMENT OF DOCUMENTATION FOR DECISION PROCESS LEADING TO CURRENT LOCATION
- ACCEPTABILITY ANALYSIS (SCP 8.4 + REFS)

STATUS OF DESIGN INPUT REVIEW FOR 10 CFR 60 FLOW DOWN

- TASK FORCE TO SYSTEMATICALLY EVALUATE GR/APP. E, SDRD, DESIGN BASIS
- RESULTS TO BE INCORPORATED INTO TITLE II DESIGN INPUT

STEPS TO UPDATE THE DESIGN INPUT

IN RESPONSE TO NRC COMMENTS ON 10 CFR 60 FLOWDOWN (CONSISTENT WITH DOE SEMP)

- PREPARE REVIEW PLAN
- SELECT AND TRAIN REVIEW BOARD
- REVIEW GR APPENDIX E

CHANGE APPENDIX E OF GR
- HQ CCB ACTION

- REVIEW SDRD
- INCORPORATE RESULTS OF ANALYSES FOR ITEMS IMPORTANT TO SAFETY/WASTE ISOLATION AND SCP 8.4

CHANGE SDRD
- PO CCB ACTION

- REVIEW A/E DESIGN BASIS

CHANGE DESIGN BASIS
- A/E CONTROL ACTION

REVISED DESIGN INPUT FOR ESF TITLE II

ESFTH6P.A05/10-19-88

STATUS OF REVIEW FOR 10 CFR PART 60 FLOWDOWN TO ESF DESIGN

- PREPARED REVIEW PLAN FOR DETERMINATION OF APPLICABILITY AND INCORPORATION OF 10 CFR PART 60 REQUIREMENTS INTO APPENDIX E TO MGDS-GR

- REVIEWED AND APPROVED THE REVIEW PLAN

- FORMAL QUALIFICATION AND QA TRAINING WAS PROVIDED TO THE REVIEW BOARD MEMBERS

- CONDUCTED AND COMPLETED THE PLANNED REVIEW IN ACCORDANCE WITH THE DOE QA PROCEDURES

STATUS OF REVIEW FOR 10 CFR PART 60 FLOWDOWN TO ESF DESIGN

(CONTINUED)

- DOCUMENTED REVIEW RESULTS AND RECOMMENDATIONS FOR DOE APPROVAL FOR INCORPORATING APPLICABLE 10 CFR PART 60 REQURIEMENTS INTO APPENDIX E

- AFTER DOE ACCEPTANCE OF THE REVIEW BOARD REPORT, THE CHANGES WILL BE MADE TO APPENDIX E THROUGH FORMAL CHANGE CONTROL PROCESS

- CONTINUATION OF EXISTING REVIEW TO COVER SDRD AND BASIS FOR DESIGN

SUMMARY

DESIGN FOR ESF IS:

- CONTROLLED BY A 10 CFR 60 SUBPART G QA PROGRAM
  - QA APPLICATION BEING MODIFIED BY EXPLICIT INCORPORATION OF NUREG 1318
  - CONSERVATIVE APPROACH WILL BE USED

- GUIDED BY DESIGN INPUT IN ACCORDANCE WITH NQA-1 (CRITERION III)
  - GR APPENDIX E, SDRD, & A/E DESIGN BASIS BEING INDEPENDENTLY REVIEWED FOR 10 CFR 60 FLOWDOWN AND WILL BE REVISED UNDER CHANGE CONTROL PROCESS

- PROCEEDING INTO TITLE II AFTER ABOVE PROVISIONS ARE COMPLETE

SPECIFIC MEETING ON DESIGN CONTROL QA, & OBJECTIONS IN DECEMBER, 1988

OPEN ITEMS
67,68

CDSCP OBJECTIONS

2, 3, & 4

PRESENTED BY: DINESH GUPTA

U. S. NUCLEAR REGULATORY COMMISSION

NRC/DOE MEETING **OCTOBER 19 - 21, 1988**

Attachment 8

CDSCP OBJECTION NO. 2

CALICO HILLS PENETRATION

* CALICO HILLS PRINCIPAL BARRIER

* DESIGN PROCESS SHOULD INCLUDE ADVERSE IMPACTS ANALYSIS (10 CFR 60.17 (a)(2)(iv))

* POTENTIAL CONNECTION OF FLOW-PATHS BETWEEN WASTE AREA AND ES-1 LOWER PORTION

* DOE's DESIGN GOAL - TERMINATE ES-1 150 m ABOVE WATER TABLE

CALICO HILLS PENETRATION (Contd.)

* DOE's DRAFT 1988 MISSION PLAN AMENDMENT SECTION 3.2.1.1 (EXPLORATORY-SHAFT FACILITY) STATES THAT BOTH EXPLORATORY SHAFTS WILL BE APPROXIMATELY 1100 FEET DEEP.

* ESF 50 % TITLE I DESIGN REVIEW (MAY-JUNE 1988) BASED ON TENTATIVE REQUIREMENT OF NO PENETRATION INTO CALICO HILLS.

CDSCP OBJECTION NO. 3

ESF DESIGN

THE CDSCP DOES NOT INCLUDE SUFFICIENT AND CONSISTENT CONCEPTUAL DESIGN INFORMATION ON THE PROPOSED ESF. THIS DOES NOT ALLOW THE NRC STAFF TO EVALUATE IF THE DOE HAS CONSIDERED THE POTENTIAL INTERFERENCE OF PROPOSED INVESTIGATIONS WITH EACH OTHER AND WITH CONSTRUCTION OPERATIONS.

CDSCP OBJECTION NO. 3 (CONTD.)

RELATIVE TEST LOCATIONS

* CDSCP DOES NOT INCLUDE DETAILS OF TEST LOCATIONS FOR SOME OF THE PROPOSED TESTS.

* CDSCP DOES NOT PROPOSE ANY IN-SITU SEAL AND DRAINAGE TESTS DURING SITE CHARACTERIZATION

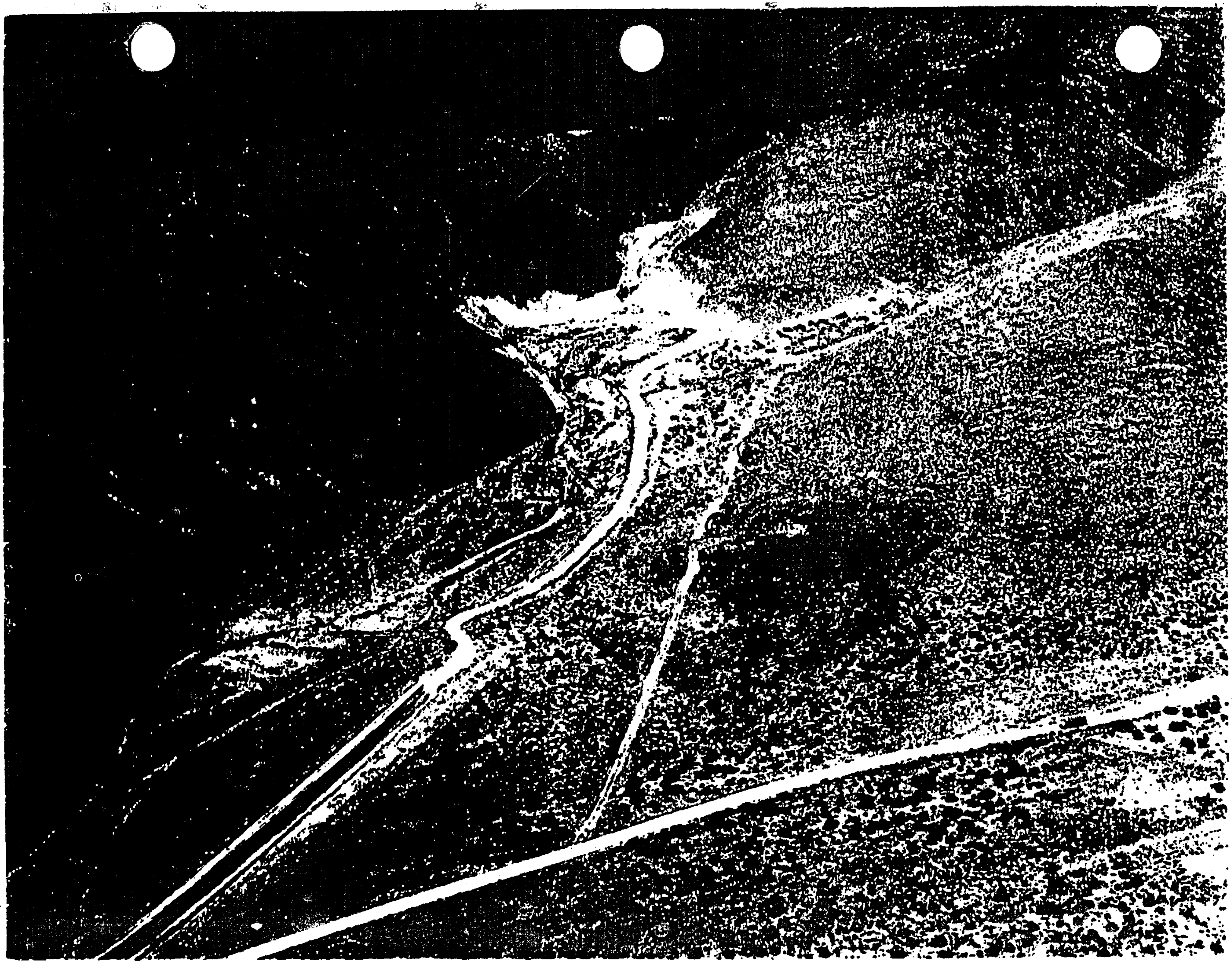
* CDSCP DOES NOT DISCUSS IMPACTS OF PERFORMANCE CONFIRMATION TESTING PROGRAM ON ESF LAYOUT

CONCERNS ON LOCATIONS OF ES-1 & ES-2

SHAFT LOCATIONS (Contd.)

ES-1 AND ES-2 WILL EVENTUALLY BECOME PART OF REPOSITORY.

THEREFORE, SAME DESIGN CRITERIA MUST APPLY TO ESF AND THE REPOSITORY.



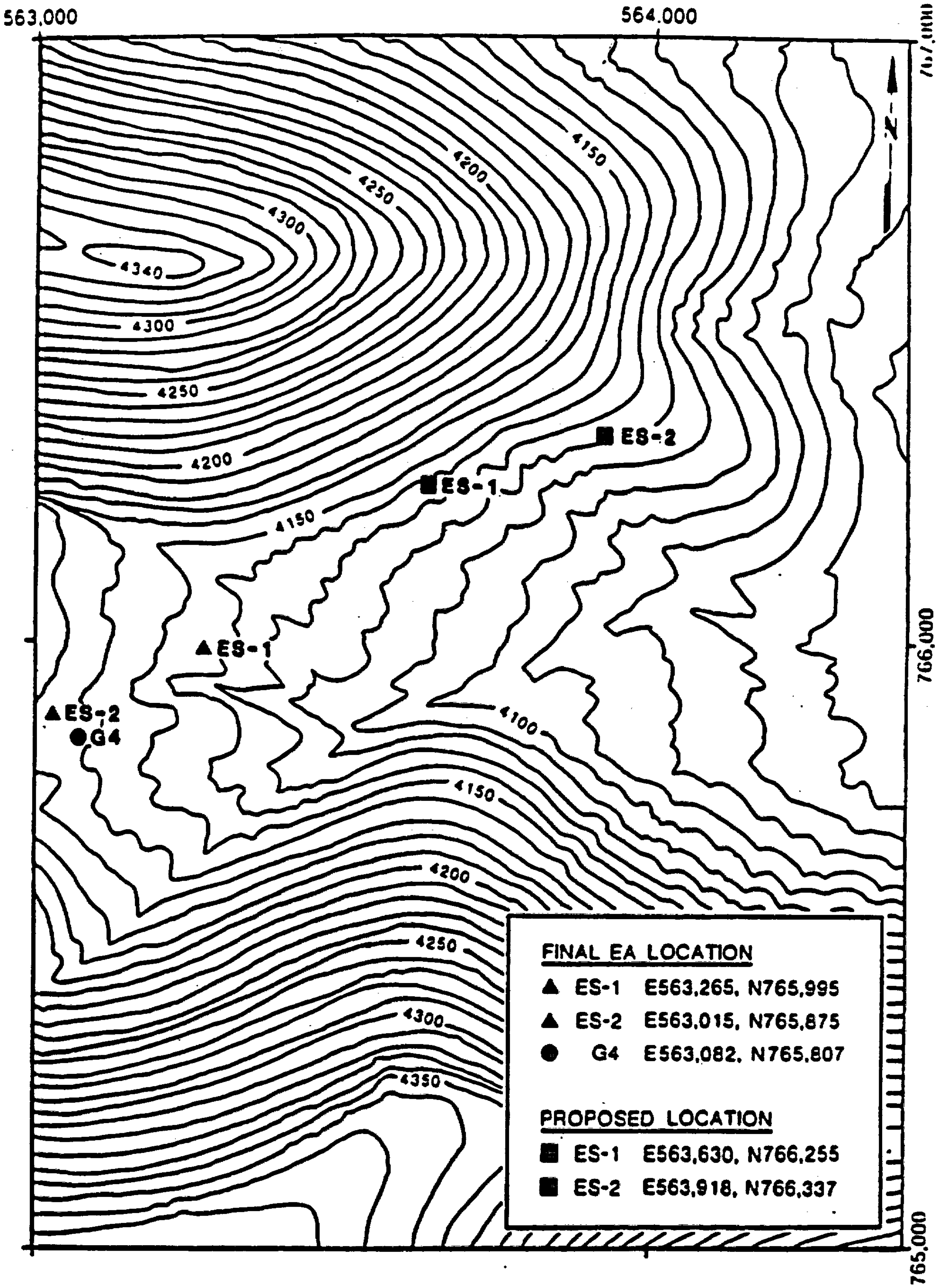


Figure 3. Comparative Illustration of the Final EA Versus the Proposed Exploratory Shaft Locations

SHAFT LOCATIONS (contd.)

DOE SHOULD DEMONSTRATE THAT THE DECISION PROCESS THAT LED TO THE SELECTION OF EXPLORATORY SHAFT LOCATIONS CLOSE TO A WASH ADEQUATELY CONSIDERED 10 CFR 60 REQUIREMENTS.

SHAFT LOCATIONS (Contd.)

DOE SHOULD DEMONSTRATE THAT ESF DESIGN LIMITS ADVERSE IMPACTS ON LONG-TERM REPOSITORY PERFORMANCE.

SHAFT LOCATIONS (CONTD.)

THE SHAFT LOCATIONS DECISION PROCESS SHOULD DEMONSTRATE THAT "PARTICULAR ATTENTION (WAS GIVEN) TO THE ALTERNATIVES THAT WOULD PROVIDE LONGER RADIONUCLIDE CONTAINMENT AND ISOLATION."
(10 CFR 60.21 (c)(1)(ii)(D))

SHAFT LOCATIONS (CONTD.)

AS IMPLEMENTATION OF THE DESIGN CONTROL PROCESS THE DOE SHOULD IDENTIFY SPECIFIC ENTITY THAT WAS RESPONSIBLE FOR ENSURING THAT 10 CFR 60 REQUIREMENTS ARE INCORPORATED IN THE SHAFT LOCATION SELECTION CRITERIA.

SHAFT LOCATIONS (CONTD.)

THE DECISION PROCESS FOR SHAFT LOCATION SELECTION SHOULD DEMONSTRATE THAT QUALIFIED DATA WERE USED IN ARRIVING AT THE DECISION.

SHAFT LOCATIONS (CONTD.)

DOE SHOULD PROVIDE DOCUMENTATION OF THE DESIGN CONTROL PROCESS FOR ESTABLISHING TIE BETWEEN SDRD REQUIREMENTS AND 10 CFR 60 REQUIREMENTS GOVERNING SHAFT LOCATIONS.

EXAMPLES

* SHAFT LOCATIONS
* SHAFT SIZES
* SEPARATION OF SHAFTS
* DISTANCE BETWEEN TESTING AND CONSTRUCTION
* DISTANCE BETWEEN SHAFTS AND WASTE PACKAGES
* FUTURE SEAL PLACEMENT NEEDS

SHAFT LOCATIONS (CONTD.)

DESIGN CONTROL DOCUMENTATION EXAMPLES:

* IMPLEMENTATION OF 10 CFR 60 REQUIREMENTS IN THE SHAFT LOCATION SELECTION PROCESS, INCLUDING USE OF QUALIFIED DATA
* CONSIDERATION OF INTERFACES BETWEEN SHAFT LOCATIONS, UNDERGROUND TEST AREA, AND REPOSITORY DESIGN, INCLUDING INTERFACES AMONG PARTICIPATING DESIGN ORGANIZATIONS
* VERIFICATION OF ADEQUACY OF SHAFT LOCATIONS AND ESF/REPOSITORY DESIGN INTERFACES
* EVIDENCE OF ADEQUATE DESIGN CONTROL PROCESS FOR THE DECISION TO CHANGE SHAFT LOCATIONS IN APRIL '87

SUMMARY OF PERFORMANCE ANALYSIS

RELATED TO OBJECTION 2 CALICO HILLS PENETRATION
OBJECTION 3 INTERFERENCE
OBJECTION 4 IMPACTS ON PERFORMANCE (LOCATION CONCERNS)

PRESENTED BY

MAXWELL BLANCHARD

Attachment 9

INTRODUCTION

PRESENTATIONS ABOUT PERFORMANCE ANALYSES

A. OVERVIEW
B. OBJECTION NO. 2 - CALICO HILLS PENETRATION
C. OBJECTION NO. 3 - INTERFERENCE
D. OBJECTION NO. 4 - IMPACTS ON PERFORMANCE (INCLUDES LOCATION CONCERNS)
E. EXPLORATORY SHAFT LOCATION DOCUMENTATION
F. DISCUSSION ON RELATED OPEN ITEMS

OVERVIEW

- SUMMARY OF CHANGES TO SCP RESPONDING TO OBJECTIONS 2, 3 &4
- APPROXIMATELY 70% OF THE ESF OPEN ITEMS ARE ADDRESSED IN SCP SECTION 8.4
- IN RESPONSE TO THE ESF OPEN ITEMS AND THE NRC POINT PAPERS, REVISIONS WERE MADE TO THE SCP. OBJECTIONS 2, 3 & 4 HAVE LED TO SIGNIFICANT REVISIONS IN SECTION 8.4

OVERVIEW
CONTENTS OF SCP SECTION 8.4

8.4.1 INTRODUCTION

8.4.2 DESCRIPTION AND LOCATION OF CHARACTERIZATION OPERATIONS

- **8.4.2.1 RATIONALE FOR PLANNED TESTING**
- **8.4.2.2 SURFACE BASED ACTIVITIES**
- **8.4.2.3 SUBSURFACE BASED ACTIVITIES**

8.4.3 POTENTIAL IMPACTS OF CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE OBJECTIVES

- **8.4.3.1 APPROACH TO PERFORMANCE ASSESSMENT**
- **8.4.3.2 SUMMARY OF SUPPORTING TECHNICAL ANALYSES AND DATA**
- **8.4.3.3 POTENTIAL IMPACTS OF SITE CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE**
  - **.1 IMPACTS ON TOTAL SYSTEM RELEASE - NOMINAL AND DISRUPTIVE SCENARIOS**
  - **.2 IMPACTS ON WASTE-PACKAGE CONTAINMENT**
  - **.3 IMPACTS ON EBS RELEASE**
  - **.4 IMPACTS ON GWTT**

OBJECTION NO. 2

(ESF OPEN ITEM #69)

PENETRATION OF CALICO HILLS UNIT

- DOE ACKNOWLEDGEMENT OF NRC OBJECTION
- DOCUMENTATION OF RESPONSE TO THE OBJECTION
- DOE APPROACH TO ADDRESS THE OBJECTION

PRESENTED BY

MAXWELL BLANCHARD

Attachment 10

ACKNOWLEDGMENT OF NRC'S OBJECTION #2

NRC'S SUMMARY

- THE NEED HAS NOT BEEN ESTABLISHED TO EXTEND, OR TO DRIFT HORIZONTALLY FROM ES-1, INTO THE CALICO HILLS

- POTENTIAL ADVERSE IMPACTS ON WASTE ISOLATION AS A RESULT OF PENETRATING THE CALICO HILLS HAVE NOT BEEN DEMONSTRATED

ACKNOWLEDGMENT OF NRC'S OBJECTION #2

(CONTINUED)

NRC RECOMMENDATION

- CONSIDER CHARACTERIZING THE CALICO HILLS WITHOUT PENETRATING THE BARRIER BETWEEN THE REPOSITORY HORIZON AND THE WATER TABLE
- A DETAILED DISCUSSION IS NEEDED BY DOE TO SHOW WHY THE BENEFITS OUTWEIGH THE POTENTIAL ADVERSE IMPACTS OF PENETRATING THE CALICO HILLS, RATHER THAN OBTAINING THE NECESSARY INFORMATION BY ALTERNATE MEANS (FROM BASIS)
- IF ALTERNATE MEANS CANNOT BE DEVELOPED, THEN JUSTIFY DESTRUCTIVE TESTING OF CALICO HILLS; INCLUDE THE CONSEQUENCES OF CONNECTING PATHWAYS FOR RADIONUCLIDES FROM WASTE EMPLACEMENT AREAS TO THE WATER TABLE

DOCUMENTATION OF RESPONSE TO OBJECTION #2

SCP SECTIONS

8.4.2.1.6: DECISION DEFERRED
SUMMARY DISCUSSION ABOUT NEEDED DATA AND MEANS TO OBTAIN THE DATA, REFERENCING:

- SITE ATLAS - SCP SECTION 8.4.2.2
- SURFACE-BASED INVESTIGATION PLAN, SCP SECTION 8.4.2.2
- SYSTEMATIC DRILLING PROGRAM SCP SECTIONS 8.3.1.4 AND 8.4.2.1.5, AND 8.4.2.2
- ES-UNDERGROUND TESTING DESCRIPTIONS, SCP SECTION 8.4.2.3, 8.4.2.3.1

8.4.2.3.3: SDRD AND ES DESIGN MODIFIED (RETAINS CAPABILITY TO EXTEND ES-1)

APPROACH TO ADDRESS NRC'S OBJECTION #2

- **CALICO HILLS IS DESIGNATED AS THE PRIMARY BARRIER TO GROUNDWATER FLOW AND RADIONUCLIDE TRANSPORT**
  - SCP ESTABLISHES THAT DATA ABOUT CALICO HILLS UNIT PROPERTIES ARE NEEDED FOR PERFORMANCE EVALUATIONS (SUMMARIZED IN SECTION 8.4.2.1)
  - SCP ACKNOWLEDGES THAT VARIOUS MEANS EXIST TO OBTAIN DATA

APPROACH

(CONTINUED)

- THE DECISION TO PROCEED WITH DEEPENING ES-1 TO THE CALICO HILLS IS DEFERRED PENDING COMPLETION OF ANALYSES COMPARING:
  - (1) NEEDED DATA,
  - (2) ALTERNATE MEANS OF OBTAINING DATA,
  - (3) BENEFITS OF OBTAINING THE DATA, AND
  - (4) RISKS TO SITE PERFORMANCE BY OBTAINING DATA

APPROACH
(CONTINUED)

SCP SECTION 8.4.2.1.6.1

- UNCERTAINTIES IN CHARACTERISTICS OF ROCKS BENEATH THE REPOSITORY HORIZON NEED TO BE QUANTIFIED. THE CHARACTERISTICS INCLUDE:

  (a) HYDROLOGIC PARAMETERS AND PROCESSES
  - MATRIX VS. FRACTURE FLOW
  - RANGE OF VALUES USED IN TRAVEL-TIME CALCULATIONS
  - IDENTIFICATION OF FLOW PATHS AND TRAVEL TIMES

  (b) RADIONUCLIDE RETARDATION PARAMETERS AND PROCESSES
  - SORPTION, DIFFUSION, PRECIPITATION, ETC., ALONG UZ FLOW PATHS

APPROACH
(CONTINUED)

SCP SECTION 8.4.2.1.6.1: (CONTINUED)

- AN EVALUATION OF THE BENEFITS AND RISKS ASSOCIATED WITH PENETRATING THE ROCK BETWEEN THE REPOSITORY AND THE WATER TABLE IS UNDERWAY

  (A) BENEFITS WILL FOCUS ON THE NEED TO REDUCE UNCERTAINTY AND IMPROVE UNDERSTANDING OF HYDROLOGIC AND GEOCHEMICAL PARAMETERS USED TO ASSESS BARRIER'S POTENTIAL TO ISOLATE WASTE

APPROACH

(CONTINUED)

- AN EVALUATION OF THE BENEFITS AND RISKS...(CONTINUED)

  (B) REPRESENTATIVENESS OF INFORMATION THAT COULD BE OBTAINED FROM BOREHOLES AND IN SITU TESTING AT DEPTH WILL BE EVALUATED

  EXAMPLES OF ALTERNATE MEANS UNDER CONSIDERATION:

  - OUTCROPS
  - BOREHOLES FROM SURFACE
  - BOREHOLES FROM SUBSURFACE
  - IN SITU FROM TOPOPAH SPRING - FROM MTL
  - IN SITU FROM BELOW TOPOPAH SPRING

  (C) RISKS WILL ADDRESS THE POTENTIAL LACK OF SUFFICIENT DATA AND POTENTIAL IMPACT ON FLOW PATHS, TRAVEL TIME, AND RADIONUCLIDE RETARDATION

SUMMARY OF DOE'S APPROACH TO ADDRESS NRC'S OBJECTION #2

- THE DECISION ON HOW BEST TO CHARACTERIZE THE CALICO HILLS WILL BE BASED ON:

  (1) REVIEW OF THE DATA NEEDED TO CHARACTERIZE THE ROCK UNIT,
  (2) AN ANALYSES OF THE RISKS AND BENEFITS OF ACQUIRING THESE DATA WITH A VARIETY OF TECHNIQUES, AND
  (3) AN EVALUATION OF THE POTENTIAL IMPACTS ON SITE PERFORMANCE FROM THE CHARACTERIZATION ACTIVITIES

- PRIOR TO TAKING ACTION, THE NRC WILL BE CONSULTED

OBJECTION NO. 3
(ESF OPEN ITEM #70)
INTERFERENCE

- DOE ACKNOWLEDGEMENT OF NRC CONCERN
- DOCUMENTATION OF RESPONSE TO THE OBJECTION
- DOE APPROACH TO ADDRESS THE OBJECTION

PRESENTED BY

MAXWELL BLANCHARD

Attachment 11

ACKNOWLEDGEMENT OF NRC'S OBJECTION #3

<u>NRC'S SUMMARY -</u>

- CDSCP DOES NOT INCLUDE SUFFICIENT AND CONSISTENT CONCEPTUAL DESIGN INFORMATION ON PROPOSED ESF. THIS DOES NOT ALLOW EVALUATION OF POTENTIAL INTERFERENCE:

  - BETWEEN INVESTIGATIONS, AND

  - BETWEEN CONSTRUCTION OPERATIONS AND INVESTIGATIONS

ACKNOWLEDGEMENT OF NRC'S OBJECTION #3

(CONTINUED)

NRC RECOMMENDATION -

- INCLUDE CONCEPTUAL DESIGN INFORMATION IN SCP IN MORE DETAIL AND CONSISTENT FASHION
- DISCUSS STRATEGY TO MINIMIZE POTENTIAL INTERFERENCE BETWEEN INVESTIGATIONS

APPROACH TO ADDRESS NRC'S OBJECTION #3

- REVISE SCP SECTION 8.4 TO ENSURE DESIGN, CONSTRUCTION AND OPERATION OF ESF WILL NOT COMPROMISE TESTING. INFORMATION ADDED TO SCP INCLUDES:

  - EXPANDED DESIGN DESCRIPTION BASED UPON ESF TITLE I DESIGN

  - EXPANDED TEST DESCRIPTIONS THAT INCLUDE CONSTRAINTS ON ESF LAYOUT AND TEST ZONES OF INFLUENCE

  - EXPANDED ESF CONSTRUCTION AND OPERATIONS DESCRIPTIONS THAT PROVIDE BASIS FOR INTERFERENCE EVALUATIONS

  - DESCRIPTION OF ASSESSMENTS OF INTERFERENCE CONSIDERATIONS

DOCUMENTATION OF RESPONSE TO OBJECTION #3

PRIMARY RESPONSE

- SCP SECTIONS 8.4.2.2 (SURFACE BASED ACTIVITIES) AND 8.4.2.3 (SUBSURFACE BASED ACTIVITIES)

SUPPORTING INFORMATION

- NUMEROUS DESCRIPTIONS IN SCP SECTION 8.3
- PORTIONS OF SCP SECTION 8.4.3.2 - SUMMARY OF SUPPORTING TECHNICAL ANALYSES AND DATA
- SUPPORTING TECHNICAL REFERENCES CITED

APPROACH
(CONTINUED)

THE APPROACH FOR RESPONDING TO OBJECTION #3 WAS TO CONDUCT THE EVALUATION DESCRIBED IN 8.4.2.3.6, USING THE SUPPORTING INFORMATION FROM 8.4.2.3.1-8.4.2.3.5

CONTENTS OF SCP SECTION 8.4.2.3
SUBSURFACE BASED ACTIVITIES

8.4.2.3.1	ESF TESTING OPERATIONS, LAYOUT CONSTRAINTS, AND ZONES OF INFLUENCE
8.4.2.3.2	ESF INTEGRATED DATA SYSTEM
8.4.2.3.3	DESCRIPTION OF EXPLORATORY SHAFT FACILITY
8.4.2.3.4	DESCRIPTION OF ESF CONSTRUCTION OPERATIONS
8.4.2.3.5	GENERAL DESCRIPTION OF UNDERGROUND SUPPORT SYSTEMS
8.4.2.3.6	EVALUATION OF ESF LAYOUT AND OPERATIONS

APPROACH
(CONTINUED)

APPROACH USED IN SCP SECTION 8.4.2.3.1 ADDRESSED ESF TESTING OPERATIONS, LAYOUT CONSTRAINTS, AND ZONES OF INFLUENCE

FOR EACH OF 34 EXPLORATORY SHAFT FACILITY TESTS:

- BRIEF DESCRIPTION OF TEST
- REFERENCE TO 8.3 SECTION CONTAINING ADDITIONAL INFORMATION
- IDENTIFY TEST-RELATED CONSTRAINTS ON ESF DESIGN/OPERATIONS
- IDENTIFY ZONES OF INFLUENCE FOR EACH TEST

SUMMARY TABLES PROVIDED FOR:

- PRINCIPAL CONSTRAINTS IMPOSED ON ESF LAYOUT BY TEST REQUIREMENTS
- PRINCIPAL FACTORS CONSIDERED IN IDENTIFYING ZONE OF INFLUENCE FOR EACH TEST

APPROACH
(CONTINUED)

ESF TEST LAYOUT CONSTRAINTS (SCP 8.4.2.3.1)

- FOR EACH ES TEST, ASSESS PRINCIPAL CONSTRAINTS RELATED TO ESF LAYOUT
  - SEQUENCING
  - PHYSICAL LAYOUT
  - CONSTRUCTION AND OPERATION
  - NATURAL CONDITIONS
- INFORMATION IS ALSO TABULATED IN SUMMARY FORM

APPROACH
(CONTINUED)

ZONES OF INFLUENCE FOR ES TESTS (SCP SEC. 8.4.2.3.1)

- FOR EACH ES TEST, EVALUATE PRINCIPAL FACTORS THAT COULD AFFECT OTHER TEST ENVIRONMENTS
  - MECHANICAL
  - THERMAL
  - HYDROLOGICAL
  - CHEMICAL
- INFORMATION ALSO TABULATED IN SUMMARY FORM

APPROACH
(CONTINUED)

- SECTIONS 8.4.2.3.2 THROUGH 8.4.2.3.5 SUMMARIZE INFORMATION ABOUT ESF DESIGN AND OPERATIONS
- THE SECTIONS ARE BASED UPON THE REPOSITORY INTERFACE DRAWINGS (CONTROLLED) AND TITLE I DESIGN INFORMATION

APPROACH
(CONTINUED)

EVALUATION OF ESF LAYOUT AND OPERATIONS (SCP SECTION 8.4.2.3.6)

8.4.2.3.6.1 POTENTIAL FOR INTERFERENCE BETWEEN TESTS

- THE APPROACH USED TO ASSESS INTERFERENCE AND THE RESULTS OF INTERFERENCE EVALUATION ARE DESCRIBED USING TEST-RELATED CONSTRAINTS AND ZONES OF INFLUENCE, ESF TITLE I LAYOUT, AND CONSTRUCTION AND OPERATIONS DESCRIPTIONS

- EVALUATIONS CONSIDERED THE FOLLOWING:
  - TIME-SEQUENCING
  - PHYSICAL SEPARATION
  - POTENTIAL MODIFICATION TO NATURAL CONDITIONS CAUSED BY INTRODUCTION OF FLUIDS, MATERIALS AND CHANGES TO STRESS AND THERMAL REGIMES
  - CONTROLS PLACED UPON CONSTRUCTION AND OPERATION METHODS

- ESF LAYOUT WITHIN DEDICATED TESTING AREA IS SHOWN WITH ZONES OF INFLUENCE FOR EACH TEST

APPROACH
(CONTINUED)

EVALUATION OF ESF LAYOUT AND OPERATIONS (SCP SECTION 8.4.2.3.6)

8.4.2.3.6.2 POTENTIAL FOR CONSTRUCTION AND OPERATIONS INTERFERENCE WITH TESTING

- THE APPROACH USED TO ASSESS INTERFERENCE AND THE CURRENT ASSESSMENT OF POTENTIAL FOR INTERFERENCE ARE DISCUSSED USING TEST-RELATED CONSTRAINTS, ESF TITLE I LAYOUT, AND OPERATIONS DESCRIPTIONS

- EVALUATIONS CONSIDERED THE FOLLOWING:
  - ANALYSES TO ENSURE CONSTRUCTION & OPERATIONS WERE COMPATIBLE WITH TEST REQUIREMENTS
  - ESF DESIGN WAS COMPATIBLE WITH REPOSITORY LAYOUT
  - ESF DESIGN WAS SUFFICIENTLY FLEXIBLE TO ADAPT TO CHANGES IN UNDERGROUND SITE CONDITIONS, WHEN ENCOUNTERED
  - ESF DESIGN AND OPERATIONS MET APPLICABLE REGULATIONS (EG. MSHA)

APPROACH
(CONTINUED)

SURFACE-BASED INTERFERENCE
(SCP SECTION 8.4.2.2.3)

- **ANALYZES DISTURBANCES (8.4.2.2.3) CAUSED TO NATURAL HYDROLOGIC CONDITIONS BY:**
  - ARTIFICIAL INTRODUCTION OF WATER DURING DRILLING, TESTING AND DUST SUPRESSION
  - MODIFICATION OF STRUCTURAL CHARACTER OF THE ROCK (TO DETERMINE IF TESTS MIGHT YIELD SPURIOUS MEASUREMENTS ABOUT HYDROLOGIC AND GAS PHASE PROPERTIES)

- **ANALYSES TO ESTABLISH CONTROL (8.4.2.2.2.3) OF WATER-USE DURING SURFACE-BASED TESTING CONSIDERS:**
  - WATER USE (PAST & FUTURE)
  - DRY DRILLING (PROTOTYPE BOREHOLE)
  - FLUID INVASION OF ROCK FORMATION

    (CONSIDERS DRILLING WITH CONVENTIONAL FLUIDS USING TRACERS, AIR-FOAM & DRY)

SUMMARY OF DOE'S APPROACH TO ADDRESS NRC'S OBJECTION #3

- **INFORMATION ABOUT THE FOLLOWING IS DESCRIBED IN THE SCP AND WILL BE ADDED TO THE ESF-SDRD**
  - TEST-TO-TEST INTERFERENCE
  - CONSTRUCTION/OPERATIONS INTERFERENCE WITH TESTING

- **ANY LAYOUT CHANGES MADE IN TITLE II DESIGN WILL BE EVALUATED FOR POSSIBLE INTERFERENCES**

RESPONSE TO NRC CDSCP POINT PAPERS
OBJECTION NO. 4

(ESF OPEN ITEM #71)
IMPACTS ON PERFORMANCE
(INCLUDES LOCATION CONCERNS)

- DOE ACKNOWLEDGEMENT OF NRC OBJECTION
- DOCUMENTATION OF RESPONSE TO THE OBJECTION
- DOE APPROACH TO ADDRESS THE OBJECTION

PRESENTED BY

MAXWELL BLANCHARD

Attachment 12

ACKNOWLEDGEMENT OF NRC'S OBJECTION NO. 4

NRC'S SUMMARY -

- CDSCP DOES NOT ADEQUATELY CONSIDER THE POTENTIALLY ADVERSE IMPACTS RESULTING FROM LOCATING SHAFT AND RAMP PORTALS IN AREAS WHICH MAY BE SUSCEPTIBLE TO SURFACE WATER INFILTRATION, AND LATERAL AND VERTICAL EROSION

- ES-1 IS SUBJECT TO SHEET FLOW

- FOR THE PROPOSED LOCATIONS, THERE IS POSSIBILITY OF:

  - POTENTIALLY SIGNIFICANT AND UNMITIGABLE LONG-TERM ADVERSE IMPACTS ON WASTE ISOLATION CAPABILITY OF SITE

  - AFFECTING ABILITY TO ADEQUATELY CHARACTERIZE THE SITE

ACKNOWLEDGMENT OF NRC'S OBJECTION NO. 4

(CONTINUED)

NRC RECOMMENDATION -

- **PRIOR TO FINALIZING SHAFT AND RAMP LOCATIONS, CONSIDER:**
  - SURFACE WATER INFILTRATION AND FLOODING
  - VERTICAL AND LATERAL EROSION
  - POTENTIAL FOR SEALS (DRAINAGE) TO BECOME INEFFECTIVE
  - FUTURE CHANGES IN GEOMORPHIC PROCESSES DUE TO TECTONIC EVENTS OR REPOSITORY-INDUCED UPLIFT/ SUBSIDENCE
  - POTENTIAL ADVERSE IMPACTS ON ISOLATION CAPABILITY OF SITE
  - POTENTIAL IMPACT ON ABILITY TO CHARACTERIZE SITE

DOCUMENTATION OF RESPONSE TO OBJECTION #4

PRIMARY RESPONSE -

- SCP SECTION 8.4.3, POTENTIAL IMPACTS OF CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE OBJECTIVES

SUPPORTING INFORMATION -

- PORTIONS OF SCP SECTION 8.4.2.3 DESCRIBING ESF TESTS, LAYOUT, AND OPERATIONS, PARTICULARLY THOSE RELATED TO WATER USAGE AND EXCAVATION METHOD

DOCUMENTATION OF RESPONSE TO OBJECTION #4
(CONTINUED)

SUPPORTING TECHNICAL REFERENCES CITED -

- ES LOCATION DOCUMENTATION REPORT
- NNWSI PROJECT SITE ATLAS
- ESF - REPOSITORY INTERFACE CONTROL DRAWINGS AND PRELIMINARY CONSTRUCTION SPECIFICATIONS
- APPROXIMATELY 25 TECHNICAL REFERENCES DIRECTLY ADDRESSING ESF; E.G.:
  - EXPLORATORY SHAFT FACILITY FLUIDS AND MATERIALS EVALUATION
  - ANALYSES TO EVALUATE THE EFFECT OF THE EXPLORATORY SHAFT ON REPOSITORY PERFORMANCE AT YUCCA MOUNTAIN
  - DISTRIBUTION OF RESIDUAL DRILLING AND DRIFT CONSTRUCTION WATER IN THE EXPLORATORY SHAFT FACILITY AT YUCCA MOUNTAIN

APPROACH TO ADDRESS OBJECTION # 4

- CONDUCT DETAILED EVALUATIONS TO ENSURE THAT SITE CHARACTERIZATION ACTIVITIES ARE CONDUCTED SO AS TO LIMIT ADVERSE EFFECTS ON LONG-TERM PERFORMANCE OF THE REPOSITORY TO THE EXTENT PRACTICAL (10 CFR 60.15(d)(1))

- CONDUCT DETAILED EVALUATIONS TO ENSURE THAT SITE CHARACTERIZATION-RELATED ACTIVITIES DO NOT LIMIT THE ABILITY TO ADEQUATELY CHARACTERIZE THE SITE

APPROACH
(CONTINUED)

- **EXPAND SCOPE OF SCP SECTION 8.4 TO INCLUDE:**
  - EVALUATION OF POTENTIAL IMPACTS TO THE SITE FROM SURFACE AND UNDERGROUND TEST PROGRAMS
  - EVALUATION OF POTENTIAL IMPACTS OF SURFACE-BASED AND ESF SITE CHARACTERIZATION ACTIVITIES ON MEETING POSTCLOSURE PERFORMANCE OBJECTIVES
  - CONSIDERATION OF SPECIFIC TECHNICAL CONCERNS RELATIVE TO ES LOCATIONS (FLOODING, EROSION, ETC.)

CONTENTS OF SCP SECTION 8.4.3

POTENTIAL IMPACTS OF CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE OBJECTIVES

8.4.3.1 INTRODUCTION TO POSTCLOSURE PERFORMANCE OBJECTIVES AND APPROACH TO PERFORMANCE ASSESSMENT

- GENERAL P.A. APPROACH
- SUMMARY OF APPROACH TO POTENTIAL IMPACTS OF SITE CHARACTERIZATION ACTIVITIES

8.4.3.2 SUMMARY OF SUPPORTING TECHNICAL ANALYSES AND DATA

- HYDROLOGICAL
- GEOCHEMICAL
- THERMAL/MECHANICAL

8.4.3.3 POTENTIAL IMPACTS OF SITE CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE

- IMPACTS ON TOTAL-SYSTEM RELEASES
- IMPACTS ON WASTE-PACKAGE CONTAINMENT
- IMPACTS ON EBS RELEASE
- IMPACTS ON GWTT

APPROACH USED IN SCP SECTION 8.4.3.2

SUMMARY OF SUPPORTING TECHNICAL ANALYSES AND DATA

- SUMMARIES OF QUANTITATIVE, SITE-SPECIFIC INFORMATION USED IN PERFORMANCE IMPACT EVALUATIONS PROVIDED.
  - INFORMATION ORGANIZED IN SECTIONS ON:
    (1) HYDROLOGICAL INFORMATION
    (2) GEOCHEMICAL INFORMATION
    (3) THERMAL/MECHANICAL INFORMATION
  - ANALYSES INCLUDE:
    (1) WATER INFILTRATION FROM SURFACE
    (2) GROUND WATER FLOW-MATRIX VS. FRACTURE
    (3) REDISTRIBUTION OF WATER RETAINED IN UNSATURATED ZONE
    (4) WATER VAPOR MOVEMENT

- SUMMARY OF DESIGN FEATURES THAT CONTRIBUTE TO MEETING PERFORMANCE REQUIREMENTS

APPROACH USED IN SCP SECTION 8.4.3.2

(CONTINUED)

SUMMARY OF SUPPORTING TECHNICAL ANALYSES AND DATA

- SUMMARY OF POTENTIAL IMPACTS CAUSED TO CURRENT SITE CONDITIONS FROM SITE CHARACTERIZATION ACTIVITIES FOR:
  - SURFACE-RELATED ACTIVITIES
  - DRILLING ACTIVITIES
  - SHAFT CONSTRUCTION
  - UNDERGROUND DRIFT CONSTRUCTION
  - UNDERGROUND TESTING ACTIVITIES

  (EACH ABOVE EVALUATION CONSIDERS PERTURBATIONS CAUSED BY SITE CHARACTERIZATION ACTIVITIES TO HYDROLOGIC, GEOCHEMICAL AND THERMAL/MECHANICAL CONDITIONS)

APPROACH USED IN SCP SECTION 8.4.3.3

POTENTIAL IMPACTS OF SITE CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE

8.4.3.3.1 IMPACTS ON TOTAL-SYSTEM RELEASES

SUMMARY OF ISSUE RESOLUTION STRATEGY

EVALUATION OF IMPACTS ON TOTAL-SYSTEM RELEASES

REVIEW OF RESULTS OF ANALYSES DESCRIBING POTENTIAL IMPACTS IMPORTANT TO TOTAL SYSTEM RELEASES; NOMINAL AND DISRUPTIVE SCENARIO CLASSES OF EVENTS AND PROCESSES (CONSISTENT WITH 8.3.5.13) USED AS BASIS FOR EVALUATION

- 16 INITIATING EVENTS AND PROCESSES INCLUDED IN NOMINAL SCENARIO CLASS

- 13 INITIATING EVENTS AND PROCESSES INCLUDED FOR DISRUPTIVE SCENARIO CLASS

APPROACH
(CONTINUED)

POTENTIAL IMPACTS OF SITE CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE

NOMINAL SCENARIO CLASSES INCLUDES THE FOLLOWING:

- CLIMATE CHANGE
- FLOODING
- GEOCHEMICAL CHANGE
- UNDETECTED FAULTS & SHEAR ZONES
- UNDETECTED DIKES
- FAULTY WASTE EMPLACEMENT
- UNDISCOVERED BOREHOLES
- UNDISCOVERED MINESHAFTS
- DIFFERENTIAL ELASTIC RESPONSE TO HEATING
- INELASTIC RESPONSE TO HEATING
- TEMPERATURE DRIVEN FLUID MIGRATION
- LOCAL MECHANICAL FRACTURING
- CORROSION
- CHEMICAL REACTION OF WASTE PACKAGE WITH ROCK
- CHEMICAL ALTERATION OF ROCK
- MICROBIAL ACTIVITY

APPROACH

(CONTINUED)

POTENTIAL IMPACTS OF SITE CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE

DISRUPTIVE SCENARIO CLASSES INCLUDES THE FOLLOWING:

- EXTREME CLIMATE CHANGE
- STREAM EROSION
- FAULTING AND SEISMICITY
- MAGMATIC INTRUSION
- EXTRUSIVE MAGMATIC ACTIVITY
- IRRIGATION
- INTENTIONAL GROUND WATER WITHDRAWAL
- EXPLORATORY DRILLING
- RESOURCE MINING
- CLIMATE CONTROL
- SURFACE FLOODING OR IMPOUNDMENTS
- REGIONAL CHANGES IN TECTONIC REGIMES
- FOLDING, UPLIFT, AND SUBSIDENCE

APPROACH

(CONTINUED)

POTENTIAL IMPACTS OF SITE CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE

8.4.3.3.2 IMPACTS ON WASTE-PACKAGE CONTAINMENT

- SUMMARY OF ISSUE RESOLUTION STRATEGY
- EVALUATION OF IMPACTS ON WASTE-PACKAGE CONTAINMENT

  FOCUSES ON POTENTIAL FOR SITE CHARACTERIZATION ACTIVITIES TO IMPACT THE QUANTITY AND QUALITY OF WATER, OR ROCK-INDUCED LOADS IN THE IMMEDIATE VICINITY OF WASTE PACKAGES. EFFECTS ON WASTE CONTAINER AND WASTE FORM ARE CONSIDERED

APPROACH

(CONTINUED)

POTENTIAL IMPACTS OF SITE CHARACTERIZATION ACTIVITIES ON POSTCLOSURE PERFORMANCE

8.4.3.3.3 IMPACT ON EBS RELEASE

- SUMMARY OF ISSUE RESOLUTION STRATEGY
- EVALUATION OF IMPACTS ON EBS RELEASE

  SIMILAR TO APPROACH USED IN CONTAINMENT EVALUATION, DISCUSSION FOCUSES ON IMPACTS ON ENGINEERED ENVIRONMENT, WASTE CONTAINER, AND WASTE FORM

EXPLORATORY SHAFT LOCATION DOCUMENTATION

- SUMMARY OF ESF MANAGEMENT DECISIONS
- DESIGN CRITERIA
- MANAGEMENT CONTROLS

PRESENTED BY

MICHAEL VOEGELE

Attachment 13

EXPLORATORY SHAFT LOCATION DOCUMENTATION TO SUPPORT SCP

- DOE IS PREPARING A SUMMARY REPORT RELEVANT TO EXPLORATORY SHAFT MANAGEMENT DECISIONS
  - SHAFT OBJECTIVES
  - SHAFT LOCATION
  - SHAFT CONSTRUCTION METHOD
  - SHAFT CONFIGURATION

- DOCUMENT RELATIONSHIP BETWEEN DESIGN CRITERIA AND 10 CFR 60 REQUIREMENTS

- DESCRIBE MANAGEMENT CONTROLS AND QUALITY ASSURANCE PROGRAMS IN PLACE

EXPLORATORY SHAFT LOCATION DOCUMENTATION TO SUPPORT SCP

SHAFT LOCATION

THE REPORT INCLUDES:

1. A COMPILATION OF CRITERIA USED IN EVALUATING POTENTIAL ES SITES AND SELECTING THE SITE DESCRIBED IN THE SCP.

2. A DESCRIPTION OF THE PROCESS USED TO IDENTIFY ALTERNATE SITES AND SELECT THE ES SITE

3. A SUMMARY OF THE RATIONALE AND BASIS FOR THE SITE LOCATION

COMBINED SCIENTIFIC AND ENGINEERING PREFERENCES

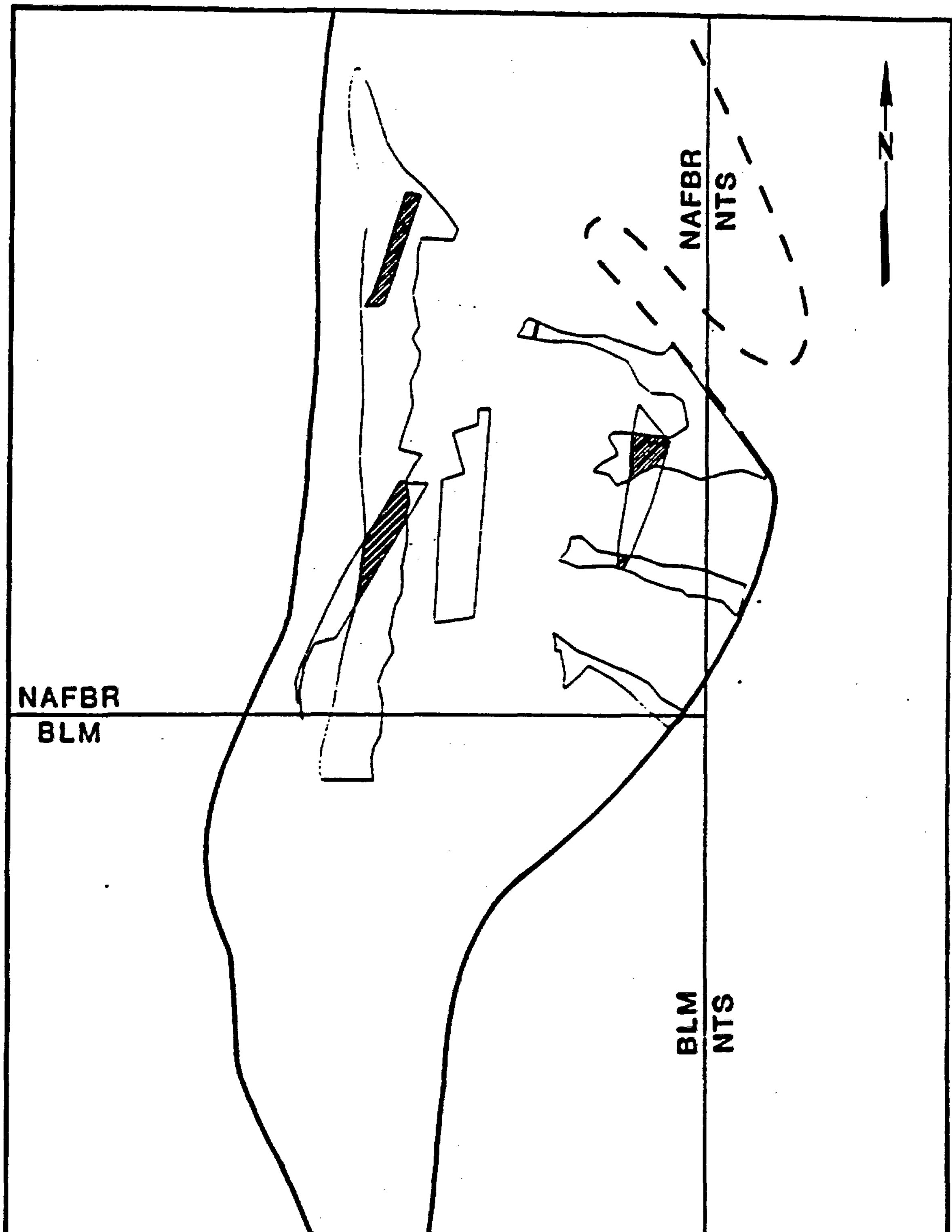


Figure 7. Overlay of Scientific and Topographic Preference Areas

ESFJ14.BRF/7-18,19 88 13

EXPLORATORY SHAFT LOCATION DOCUMENTATION TO SUPPORT SCP

DESIGN REQUIREMENTS

THE REPORT WILL CONTAIN:

1. A DESCRIPTION OF THE ESF DESIGN REQUIREMENTS
2. A DESCRIPTION OF HOW THE CRITERIA OF 10 CFR 60 WERE USED TO ESTABLISH THE REQUIREMENTS
3. A COMPARISON OF THE DESIGN REQUIREMENTS WITH THE CRITERIA OF 10 CFR 60

EXPLORATORY SHAFT LOCATION DOCUMENTATION TO SUPPORT SCP

ES FACILITY CONFIGURATION

THE REPORT WILL CONTAIN:

1. A DISCUSSION OF THE OBJECTIVES FOR THE EXPLORATORY SHAFT FACILITY (INCLUDING TESTING AND INCORPORATION INTO REPOSITORY).

2. A DISCUSSION OF THE PROCESS AND CRITERIA USED TO SELECT THE CONSTRUCTION METHODOLOGY

3. A DISCUSSION ABOUT THE RATIONALE FOR SIZE OF THE SHAFT

4. A DISCUSSION OF THE SECOND SHAFT WHICH WAS ADDED FOR SAFETY PURPOSES.

EXPLORATORY SHAFT LOCATION DOCUMENTATION TO SUPPORT SCP

ES FACILITY CONFIGURATION (CONTINUED)

THE REPORT WILL ALSO SUMMARIZE MATERIAL COVERED IN GREATER DETAIL IN SCP AND SCP REFERENCES:

1. A SUMMARY DESCRIPTION OF THE LOGIC AND RATIONALE FOR SEPARATION OF THE SHAFTS

2. A SUMMARY DESCRIPTION OF THE CRITERIA AND PROCESS TO EVALUATE POTENTIAL INTERFERENCES
   - SHAFT-TO-SHAFT
   - SHAFT-TO-TEST
   - TEST-TO-TEST
   - OPERATIONS-TO-TEST

MANAGEMENT CONTROL AND QUALITY ASSURANCE ASPECTS

- DOE/NV QA PLAN - IN PLACE
- SNL (TECHNICAL OVERVIEW) - HAD QA PLAN IN PLACE
- EVALUATION CRITERIA WERE DEVELOPED BY DESIGNATED COMMITTEE
- EVALUATION CRITERIA AND PROCESS REVIEWED BY NNWSI PROJECT MANAGEMENT

MANAGEMENT CONTROL AND QUALITY ASSURANCE ASPECTS
(CONTINUED)

- **EVALUATION CRITERIA, PROCESS, AND RESULTS WERE REVIEWED AT DOE/HQ**
  - -APPROVAL OF APPROACH, CRITERIA, AND RESULTS

- **EVALUATION CRITERIA, PROCESS, AND RESULTS WERE DOCUMENTED IN BERTRAM (1984)**
  - -SAND REPORT: UNDERWENT INTERNAL PEER REVIEW AND MANAGEMENT REVIEW PRIOR TO PUBLICATION

Attachment 14

ESF ITEMS CONCERNING ESF DESIGN CONTROL PROCESS

BY

T. HUNTER

K. BEALL

M. COMAR

R. LAHOTI

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
67	588AI 1	12/30/88

Description

DOE should demonstrate that it has in place and is implementing an overall systematic design and approval process for the ESF that (i) considers 10 CFR 60 requirements including those for QA, (ii) recognizes uncertainties associated with site characterization activities, (iii) recognizes the need for feedback and interaction among participants responsible for design, scientific tests, performance assessment, construction and operation, and (iv) considers operational impacts on tests and space requirements to avoid test interferences.

Documentation

SCP 8.4.2.1 (Rationale for Planned Testing)
SCP 8.4.2.3.1 (ESF Testing Operations, Layouts Constraints, and Zones of Influence)
SCP 8.4.2.3.3.1 (Design and Interface Control)
SCP 8.4.2.3.6.1 (Potential for Interference Between Tests)
SCP 8.4.2.3.6.2 (Potential for Construction and Operations Interference with Testing)
SCP 8.4.2.3.6.4 (Design Flexibility)
NV88-9
Technical Assessment Review Reports
Generic Requirements, Appendix E
Subsystem Design requirements for the ESF

Approach for Closure

DOE has an overall systematic design and approval process for the ESF. It is summarized in SCP Section 8.4.2.3.3.1. 10 CFR 60 requirements that have been determined as being applicable to ESF design (as described in Sec. 8.4.1.2), are reflected in design requirements documents (e.g., App. E, SDRD, Design Basis Doc.). In response to NRC comment on 10 CFR 60 flowdown, the DOE instituted a special review board to analyze the requirements documents. This review is partially complete and will result in change-controlled modification to the requirement documents where appropriate. To ensure the above activities are being carried out properly, the Project conducts audits, surveillances, and formal design technical assessment reviews. The audits and

Item 67
Approach for Closure (cont'd)

surveillances are primarily a check for compliance with QA procedures and are conducted as defined in the Project QA Plan. Technical assessment reviews include a specific check to assure 10 CFR 60 requirements have been incorporated in the design. DOE's approach to cover uncertainties associated with site characterization activities is to provide design flexibility (SCP Section 8.4.2.3.6.4). The ICWG is the mechanism for feedback and interaction among participants responsible for design, scientific tests, performance assessment, construction, and operations and the ICWG also considers operational impacts on tests and space requirements to avoid test interferences (SCP Section 8.4.2.3.3.1). When interferences or design impacts are identified, formal change requests (ECR's) are made to the change control board for the ESF.

The design control process will be discussed in more detail with the NRC in the December meeting.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
68	588AI 2	

Description

DOE should provide justification for assigning quality Levels II and III to practically all activities for which specifications were handed out to F&S during the 50% Title I design review of the ESF.

Documentation

Procedures to implement NUREG-1318
Safety Basis Analysis Report
SCP, Section 8.6
ESF Subsystems Design Requirements Document

Approach for Closure

DOE's approach is to reassess the quality level assignments for the ESF design. A major effort has been initiated to modify all QA level assignments prior to Title II for the ESF. As part of this effort the DOE is implementing the methodology identified in NUREG-1318. Procedures are being developed for preparing the Q-List and Quality Activities List. In addition, procedures will be developed for performing analysis to identify items important to safety or waste isolation.

DOE and NRC have agreed to meet in December to discuss the methodology for implementing NUREG-1318. Until the analyses are completed, DOE is assuming the following are on the Quality Activities List: 1) activities related to site characterization; 2) activities related to post-closure performance assessment and 3) activities that may affect a natural barriers ability to isolate waste including Mining, Drilling, Fluid and Material Control, Liner Construction, Ground Support, Surface Excavation (Site and Shaft), and Rock Blasting. All Title II design activities will be conducted under level I controls and, in general, activities will be assumed to be level I until demonstrated otherwise.

Attachment 15

ESF ITEMS CONCERNING POINT PAPER OBJECTIONS 2, 3, AND 4

BY
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J. KIMBALL

J. TILLERSON

M. VOEGELE

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
69	588PP 02	12/30/88

Description

The NRC staff considers that the need for extending the Exploratory Shaft 1 (ES-1) approximately 400 ft. below the repository horizon into the zeolitic zone of the Calico Hills Unit has not been established in the CDSCP nor has the need been established for tests requiring drifting (horizontal excavation) through the Calico Hills Unit. It has not been demonstrated that the proposed shaft (ES-1) penetration into the Calico Hills Unit (an important barrier between the repository horizon and the underlying groundwater table) or the proposed drifting through it will not have potential adverse impacts on the waste isolation capability of the site.

Documentation

SCP 8.4.2.1.6.1 (Characterization of Calico Hills)

Approach for Closure

The DOE approach to resolution of this objection is to defer the decision on penetrating and drifting in the Calico Hills from the ES-1 pending completion of analysis comparing: (1) the needed data (2) alternate means of obtaining the data, (3) benefits of obtaining the data and (4) risks to site performance by obtaining the data. DOE will retain flexibility in the design of the ESF to support such penetrations and drifting if deemed necessary. NRC will be consulted before a decision is made.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
70	588PP 03	12/30/88

Description

The CDSCP does not include sufficient and consistent conceptual design information on the proposed ESF. This does not allow the evaluation of the potential interference of proposed investigations with each other and the interference of construction operations in the two shafts and long drifts with these investigations.

Documentation

SCP 8.4.2.2.2.3 (Basis for Surface-Based testing Construction Controls)
SCP 8.4.2.2.3 (Surface-Based Test Interference)
SCP 8.4.2.3.1 (Test constraints and zones of influence)
SCP 8.4.2.3.3.2 (General arrangement of surface facilities)
SCP 8.4.2.3.6.1 (Test to test interference)
SCP 8.4.2.3.6.2 (Construction to test interference)
SCP 8.4.2.3.4.4 (Underground operations)
SCP 8.4.2.3.5 (General description of underground support systems)
SCP 8.4.2.3.3.3 (General arrangement of ES-1 and ES-2)
SCP 8.4.2.3.3.4 (General arrangement of main test level and drifts)

Approach for Closure

The DOE approach has been to revise the SCP (Section 8.4.2.3) to incorporate the NRC recommendation that the ESF conceptual design information should be included in the SCP in a consistent fashion and that a strategy to minimize potential interference between investigations should be discussed.

Sections 8.4.2.3.3 through 8.4.2.3.5 provide a description of the conceptual design of the ESF. To ensure consistency, this description is based upon the detailed drawings presented in the 100% design review drawing package for the ESF Title I Design. Since this package is a reference used in the SCP, copies of this drawings package will accompany the SCP.

Item 70
Approach for Closure (cont'd)

Section 8.4.2.3.1 provides a description of each of the 34 test activities planned for the ESF. This section also discusses the constraints imposed on the design, construction, and operation of the ESF by each test activity. The constraints that could impact the underground layout were categorized into one of four main types: sequencing, physical location, construction operations, or natural conditions. A table was developed that identifies the principal constraints placed on the layout by each test activity. The potential zone of influence (region around each test activity in which the natural conditions may be altered by the test) of each test is also identified. Zones of influence were estimated based on the associated principal mechanisms for the alteration of the in situ conditions. The principal mechanisms considered included: stress altered regions, thermally altered regions, hydrologically altered regions, and chemically altered regions. Coupling between various mechanisms was also considered. The combination of test descriptions, design constraints, zones of influence (Section 8.4.2.3.1), and the ESF conceptual design description (Sections 8.4.2.3.3 through 8.4.2.3.5) provides sufficient information to evaluate the current ESF layout with regard to meeting test-to-test and test-to-construction interference concerns.

Section 8.4.2.3.6.1 discusses the approach for assessing the potential for test-to-test interference. This approach consists of (1) evaluate each test for potential interferences and zones of influence, (2) translate each interferences consideration and zone of influence for each test into a physical area (standoff) requirement, (3) overlay the standoff requirement for each test onto the design layout of the ESF dedicated test area, and (4) evaluating the overlay for potential interferences. If potential interferences are found, timing of tests or the layout of tests was adjusted.

Section 8.4.2.3.6.2 discusses the approach for assessing the potential for construction-to-test interference. This consists of two evaluations. The first evaluation looked in detail at the description of planned operations and specifically at the controls placed on those operations to reduce the effect of construction and operations on the testing environment and determines whether those controls are sufficient to satisfy the constraints to the design imposed by the experiment plans (given in Section 8.4.2.3.1). The second evaluation consisted of looking at each constraint placed on the design by the experiment plans (given in Section 8.4.2.3.1) and determines whether ESF operations would satisfy that constraint. Included in this part of the assessment are evaluations of each experiment to changes in the environment that may occur due to ESF operations.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
71	588PP 04	12/30/88

Description

The CDSCP does not sufficiently consider the potentially adverse impacts resulting from the proposed locations of ES-1, ES-2, other shafts and ramp portals in areas which may be susceptible to surface water infiltration, sheet flow, and lateral and vertical erosion (Refs. 1 and 2). For the proposed locations, there is a possibility of (a) potentially significant and unmitigable long-term adverse impacts on the waste isolation capability of the site and/or (b) affecting the ability to adequately characterize the site.

Documentation

SCP 8.4.2.3.3.1 (Rationale for shaft location)
SCP 8.4.3.1.1 (General approach to performance assessment)
SCP 8.4.3.1.2 (Approach to assess the potential impacts of site-characterization activities)
SCP 8.4.3.2 (Supporting technical analyses and data)
SCP 8.4.3.3.1 (Impacts on total system releases)
SCP 8.4.3.3.2 (Impacts on waste package containment)
SCP 8.4.3.3.3 (Impacts on EBS release)
SCP 8.4.3.3.4 (Impacts on GWTT)

Approach for Closure

DOE's approach to resolving this objection was to revise the SCP to assess the impacts of site characterization activities on long term performance and the ability to characterize the site. These assessments included consideration of the processes recommended by the NRC (infiltration and flooding, erosion, potential for seals to become ineffective, changes in geomorphic processes due to tectonic events, adverse impacts on isolation capability of the site and potential impacts on the ability to characterize the site). Section 8.4.2.3.3.1 describes the activities leading to the proposed location of the exploratory shafts. Section 8.4.2.3.3.3 describes the locations and general arrangement of ES-1 and ES-2 as well as industrial safety and operational considerations. These considerations include the types of fluid controls and construction controls that will be implemented to limit potential impacts to

Item 71
Approach for Closure (cont'd)

the capability to characterize the site or to isolate waste. SCP Section 8.4.3.2 summarizes technical analyses and data which support evaluations of the potential long term or short term impacts of the exploratory shafts on the hydrological, geochemical, and thermal/mechanical conditions of the site. Section 8.4.3.2.5.3 evaluates the potential impacts to the site from ESF construction. The potential impacts of shaft construction on the ability to characterize the site are considered by evaluating test-to-test and shaft-to-test interference in Sections 8.4.2.3.3 and 8.4.2.3.6. Section 8.4.3.3 evaluates the potential impacts caused by site-characterization activities on each of the four regulatory post-closure performance objectives. Sections 8.4.3.3.1, 8.4.3.3.2, 8.4.3.3.3, and 8.4.3.3.4 evaluate whether the long-term changes to the site caused by construction of the exploratory shafts will have significant and unmitigable long-term adverse impacts on the release of radionuclides from the system, on waste-package containment, on engineered-barrier-system release, and on pre-waste-emplacement groundwater travel time, respectively. Section 8.4.3.3.1 considers nominal and disruptive scenarios. Section 8.4.3.3.1 considers the potential impacts of surface water infiltration and flooding, potential impacts of erosion, the potential impacts from decreased drainage capability, and the potential impacts from future changes in the geomorphic processes due to tectonic events and repository-induced uplift/subsidence.

Attachment 16

ESF ITEMS CONCERNING SHAFT LOCATION

BY
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D. DOBSON
J. TILLERSON

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
51	487IR Ia	12/30/88

Description

Demonstrate the flooding and erosion do not adversely affect long term repository performance (incorporate shaft location changes into performance analysis).

Documentation

SCP 8.4.2.3.3.1 (Rationale for ESF location)
SCP 8.4.3.2.1 (Hydrologic analyses and data)
SCP 8.4.3.3.2 (Impact on waste package containment)
SCP 8.4.3.3 (Potential impacts of site-characterization activities on postclosure performance)
SCP 8.4.3.2.4 (Design features that may contribute to performance)

Approach for Closure

The DOE approach to closure for this concern is to provide the requested information in the SCP.

Section 8.4.2.3.3.1 provides the rationale for the location of the shafts. The location of the shafts considers the levels of the probable maximum flood and the characteristics of the drainage area. Section 8.4.3.2.1.1 describes data and analyses that indicate potential effects of flooding on site conditions. Section 8.4.3.3.1.2 evaluates the effects of flooding and erosion on long term repository performance, given the occurrence of the presently planned exploratory shafts and other site-characterization activities. Section 8.4.3.3.1.2 references Fernandez et al., (1988), which provides detailed analyses of flooding potentials including the margin of protection for floods greater than the PMF, and impacts to long term performance related to the exploratory shafts.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
29	885AI 7	

Description

Need to establish the properties of characteristics that can be used in the evaluation of "representativeness." A method for analyzing the data also needs to be established.

Documentation

SCP 8.4.2.1.5 (Representativeness of planned testing)

Approach for Closure

The DOE approach is to have a systematic drilling program for statistical characterization of the variation of site conditions encountered; to locate the shaft where it can sample or allow access to a variety of conditions, both favorable and possibly unfavorable; and to integrate test results from the ES with those from the surface based programs.

Section 8.4.2.1.5.1 describes a basic, generally applicable set of measurements that will be made on samples from the planned systematic drilling program. In addition, the section describes how other properties, such as intact rock compressive strength, can sometimes be inferred from the basic properties. An extensive inventory of samples from the systematic drilling program will be available for other types of tests, and the boreholes themselves will remain uncased and available for any testing that is not presently planned. The description of the systematic drilling program and associated statistical modeling (Section 8.3.1.4.3) and the discussion of statistical representativeness (Section 8.4.2.1.5.3) present methods and rationale for collecting and analyzing information on spatial variability of various parameters through the use of borehole sampling and testing, sampling and testing in the ESF, and surface outcrop studies.

The underground facility as currently configured contains approximately 11,000 feet of drifting including access to three inferred discrete structural features.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
34	885AI 12	12/30/88

Description

During the DOE presentation on the rationale for selection of the site for the exploratory shaft, the DOE stated that the site chosen is representative of the repository block but indicated that discussion of the question of representativeness would be deferred. The NRC staff agrees that this should be an agenda item for a future meeting.

Documentation

SCP 8.4.2.1.5 (Representativeness of planned testing)

Approach for Closure

See item 29.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
102	588PP C100	12/30/88

Description

The extent of site exploration described in the CDSCP indicates that the DOE plans to explore only a small portion of the underground repository block through underground testing and drifting. Substantially more drifting may be necessary to reduce uncertainties about the presence of faults and other geologic and hydrologic conditions. In the CDSCP no exploratory drift is planned to cross the main waste storage area to the southern portions of the block, which based on existing information appears to contain more faults and fractures than other parts of the block. Boreholes penetrations into the main waste storage area (boreholes from the surface, horizontal core drilling or other means) may not provide the representative information needed to construct a reliable three-dimensional geologic model of the repository block and evaluate ranges of parameters that could affect repository performance.

Documentation

SCP 8.4.2.1.5 (Representativeness of planned testing)
SCP 8.4.2.1.5.1 (Relation between surface-based testing in the ESF)
SCP 8.4.2.1.5.2 (Representativeness of the ESF locations)
SCP 8.4.2.1.5.5 (Need for drifting to the southern part of the repository block)

Approach for Closure

The DOE approach to this concern is to have a comprehensive, statistically based program that utilizes data from both systematic surface drilling and underground drifting. The currently planned drifting encompasses nearly 11,000 ft and will sample variability in the expected rock conditions including crossing 3 inferred discrete structural features.

As stated in Section 8.4.2.1.5.5 (drifting to the southern part of the repository block) the southeastern margin of the proposed repository block possibly has higher density of faulting than other areas within the repository perimeter, as mapped or inferred from geologic indications. The SCP contains plans to drill several surface-based vertical boreholes in this area (Activity 8.3.1.4.3.1.1), and to deepen existing unsaturated zone boreholes USW UZ-7 and UZ-8 (Activity 8.3.1.2.2.3.2). Drifting to the southern part of the

Item 102
Approach for Closure (cont'd)

repository block is currently not planned, but could provide useful information for assessing the representativeness of information acquired by other means, and is described as a possible additional activity in the SCP. Substantial drifting through the waste emplacement areas including the southern portion of Yucca Mountain will occur during early construction activities and will provide additional information to increase confidence about rock property values, and provide information about representativeness.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
123	588PP Q49	12/30/88

Description

Site characterization investigations should be planned based on the total area that may be needed for repository development. Is this the case for the drilling program laid out in the CDSCP?

Documentation

SCP 8.4.2.2 (Surface-based activities)
SCP 8.4.2.2.1 (General description of location and extent of testing and construction (existing and planned))
SCP 8.4.2.2.2 (Description of location, operations, and constructions controls for surface-based activities)
SCP 8.4.2.1.5 (Representativeness of planned testing)
SCP 8.4.2.1.1 (Principal Data needed for Post-closure site-specific performance evaluation)
SCP 8.3.1.4.3.1 (Systematic acquisition of subsurface information)
SCP 6.4.2 (Configuration of underground facility)

Approach for Closure

The DOE approach to site characterization as described in the SCP is to investigate an area larger than the repository block. The focus of the program is to concentrate systematically on the area within the conceptual perimeter drift boundary (CPDB) initially. The systematic drilling program described in the SCP 8.3.1.4.3.1 is complemented by investigations of specific features or anomalies that are not limited to the area within the CPDB. The systematic drilling program focuses on the area within the repository CPDB; however, its coverage extends outside the CPDB and could be redirected to intensify coverage, including areas outside the CPDB, should information indicate the need to do so. The investigation programs described in the SCP recognize the need to obtain information that covers the controlled area, as indicated for example in Section 8.4.2.2.1

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
124	588PP Q50	12/30/88

Description

It is difficult to tell from various depictions in the CDSCP what are the actual boundaries of the area that may be involved in repository development and that therefore may need to be characterized intensively. What are these actual boundaries?

Documentation

SCP 6.2.6 (Subsurface Design)
SCP 8.3.1.4.3.1.1 (Systematic Drilling Program)
SCP 8.4.2.2.1 (General descriptions of Location and extent of testing and construction (existing and planned))

Approach for Closure

The DOE approach to closure of this concern is to provide the requested information in the SCP. Section 6.2.6 summarizes the conceptual subsurface design. The SCP-Conceptual Design Report (SCP-CDR) (SNL, 1987) provided complete details of the underground repository design. The underground facility area for repository conceptual design, based on the SCP-CDR, is shown in Figure 6-59. The outline of the conceptual boundary of the underground repository area is represented by the conceptual perimeter drift boundary (CPDB).

Figure 6-88 is an illustration of the revised usable portion of the primary area. The current layout of the underground facility (illustrated in the above figures) is based on a preliminary determination of the area needed for a 70,000 metric tons uranium underground facility, including area needed for underground support facilities. This conceptual layout occupies approximately 1420 acres, and is within the revised usable portion of the primary area. The original primary area, illustrated in Figure 6-87, was selected based on geologic data from surface mapping of outcrops and faults and from unit contacts determined using core and cuttings taken from boreholes drilled at the site. The original primary area was approximately 2,200 acres. The revised primary area (Fig. 6-88) deleted from consideration those areas of Figure 6-87 that did not meet the disqualifying condition for erosion and where efficient development of the underground facility was not considered feasible. The revised primary area (Fig. 6-88) is approximately 1850 acres.

Item 124
Approach for Closure (cont'd)

The relationship of the CPDB and the conceptual controlled area boundary is described in SCP Section 8.4.2.2

Attachment 17

ESF ITEMS CONCERNING PERFORMANCE ASSESSMENT

BY

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NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
52	487IR Ib	12/30/88

Description

Provide reasonable assurance that shafts are adequately separated so that testing in one does not adversely affect ability to obtain required data in the other shaft and adjacent test areas.

Documentation

SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)
SCP 8.4.2.3.6.1 (Potential for Interference between Tests)
SCP 8.4.2.3.6.2 (Potential for construction and operations interference with testing)
SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)
SCP 8.4.3.2.1.2 (Ground-water flow in matrix and fractures (Item 10, Boduarsson et al., 1988))
SCP 8.4.3.2.1.3 (Redistribution of water retained in the unsaturated, (Item 1, West 1988) Item 3, Eaton and Peterson (1988)).
SCP 8.4.3.2.3.2 (Analysis of in situ Experiments (Item 1, Costin and Bauer (1988))

Approach for Closure

The DOE approach to provide assurance that shafts are adequately separated so that testing in one does not adversely affect the ability to obtain required data in the other shaft and adjacent test areas, is to provide substantial additional evaluations in Section 8.4 of the SCP.

The general approach to evaluating the adequacy of separation of the shafts and adjacent test areas was to evaluate zones of influence and constraints resulting from the construction and testing on the hydrologic, geochemical, mechanical, and thermal conditions and then provide operational controls, or time sequencing or physical separation sufficient to avoid any overlap of the zones of influence.

Analysis of the sufficiency of the shaft separation distance is given in 8.4.2.3.6.2 and consists of: (1) identification of fluid quantities likely to be used and the impacts of using those fluids (8.4.3.2.1.3), (2) estimating the extent of matrix flow of water away from the ES, taking into account the

Item 52
Approach for Closure (cont'd)

possibility of water flow in fractures under pressure (8.4.3.2.1.2 and 8.4.3.2.1.3), (3) consideration of previous occurrences of fluid transport such as between G-1 and UZ-1, (4) consideration of the potential for mechanical interference between the shafts and between the shafts and the tests planned for the main test level (8.4.2.3.1, 8.4.2.3.4.4, 8.4.2.3.6.2, and 8.4.3.2.3.2), and (5) examination of the potential for interference of construction activities in ES-1 and ES-2 (including drilling, blasting, vibration, fluid usage, etc.) with the testing and instrumentation installed in ES-1 (8.4.2.3.1, 8.4.2.3.4.4, 8.4.2.3.6.1, and 8.4.2.3.6.2), and (6) examination of the potential for interference with testing on the main test level caused by construction or testing in ES-1 and ES-2 (8.4.2.3.1, 8.4.2.3.4.4, 8.4.2.3.6.1, and 8.4.2.3.6.2).

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
100	588PP C98	12/30/88

Description

A reasonable assurance that the shafts are far enough apart so that construction in ES-2 does not adversely affect the ability to obtain required data in ES-1 and adjacent test areas has not been provided.

Documentation

See item 52.

Approach for Closure

See item 52.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
56	487IR IV	12/30/88

Description

Describe the measures to be taken to avoid interference with testing by drifting operations.

Documentation

SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)
SCP 8.4.2.3.6.2 (Potential for construction and operations interference with testing)
SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)

Approach for Closure

The DOE approach to resolve this concern is to add a description of the measures to avoid interference with testing by construction operations (including drifting) to the SCP in Section 8.4. An approach was defined in Section 8.4.2.3.6.2 to evaluate the potential impact of construction and operations on the testing program. This approach consisted of two evaluations.

One evaluation considered whether the planned construction and operations of the ESF were compatible with the constraints placed on the layout by the experimental program (8.4.2.3.1, 8.4.2.3.4.4). The principal construction and operational requirement in the dedicated test area was to provide adequate isolation of tests from construction activities to allow construction to continue while tests were being conducted. This requirement is reflected in the design by (1) physically separating the experiment and shop/training areas (2) avoiding additional traffic in test areas by placing the shop/training drift close to ES-2 where most of the construction activities are centered, (3) locating the ES-2 muck pocket to the north side, limiting mine traffic to one service drift while developing the dedicated test area and mining the long exploratory drifts, (4) placing sensitive experiments in drifts isolated from construction and mine traffic, (5) allowing flexibility in experiment locations to avoid interference with construction activities, and (6) sequencing tests and construction operations to limit interferences.

Item 56
Approach for Closure (cont'd)

The other evaluation considered whether the experiment locations were consistent with the specific requirements of each test. The principal interference considerations addressed in this evaluation were (1) timesequencing e.g., ensuring that early tests can be initiated without construction impacts, (2) physical separation e.g., ensuring that experiments requiring isolation from the mining environment are located away from the shafts or in isolated drifts or alcoves, and (3) operational controls e.g., controlling of fluids in the underground area.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
59	487IR Vc	12/30/88

Description

Demonstrate that there will be minimal interference with testing from underground construction activities. In particular, address the potential for:

- movement for construction fluids through fractures from ES-2 to ES-1 tests areas

- damage to test instruments from blasting vibrations

Documentation

SCP 8.4.2.3.1 (ESF Testing Operations, Layout Constraints, and Zones of Influence)
SCP 8.4.2.3.4.4 (Description of ESF Underground Construction and Operations
SCP 8.4.2.3.6.1 (Potential for Interference Between Tests)
SCP 8.4.2.3.6.2 (Potential for Construction and Operations Interference with Testing)
SCP 8.4.3.2.1.2 (Ground-water Flow in Matrix and Fractures) (Item 10 Boduarsson et al. (1988))
SCP 8.4.3.2.1.3 (Redistribution of Water Retained in the Unsaturated Zone) (Item 1, West (1988), Item 3, Eaton and Peterson (1988))
SCP 8.4.3.2.3.2 (Analyses of in situ Experiments) (Item 1, Costin and Bauer (1988))

Approach for Closure

The DOE approach to resolve this concern is to provide a description of the measures to avoid construction related interference with testing in Section 8.4 of the SCP. The general approach used to limit interference with testing from underground construction activities is discussed in the response to Item 56. This approach principally relies on physical separations, time sequencing

Item 59
Approach for Closure (cont'd)

of construction and testing, and operational constraints such as controlling fluids. Regarding the particular concerns:

- The approach to evaluating sufficiency of the separation of ES-1 and ES-2 and the potential for movement of fluids through fractures between the two shafts is based upon control of fluids as discussed in the responses to Items 52 and 100.

- A discussion was included in Section 8.4 to evaluate construction and operations effects on testing. This evaluates the potential for damage to test instruments. In general, experiment instrumentation is not emplaced in locations such that it would be damaged by blasting operations including vibrations. There are a few specific tests that would investigate mechanical effects where instrumentation is placed near blasts. References to the SCP have demonstrated that such instrumentation can be designed to be robust and survive full face blasts.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
73	588PP C27	12/30/88

Description

The CDSCP (Section 8.4.1.1 states that current plans call for drilling approximately 300 to 350 shallow holes (50 to 150 ft. deep), and 45 to 80 exploratory holes (presumably deep). Several trenches are also planned to be excavated for site characterization. In addition, Section 8.4.2.5.1 includes a summary of proposed numerous activities that would involve drilling from or very close to ES-1. The individual, the cumulative and the synergistic effects of these holes have not been considered in the evaluation of the potential impacts of exploratory shaft construction and testing on the waste isolation integrity of the site (Section 8.4.2.6, and supporting references, in particular Fernandez et al., 1987; Case and Kelsall, 1987).

Documentation

SCP 8.4.2.2 (Surface-based activities)
SCP 8.4.2.3 (Subsurface-based activities)
SCP 8.4.2.2.2.3 (Basis for Surface-based testing construction controls)
SCP 8.4.3.2.5.2 (Evaluation of Potential impacts to the site from drilling activities for current site conditions)
SCP 8.4.3.2.5.1 (Evaluation of Potential impacts to the site for surface activities)
SCP 8.4.3.3.1.2 (Evaluation of Impacts on total-system releases)

Approach for Closure

The DOE approach to resolution of this concern is consistent with the NRC recommendation; SCP Section 8.4 has been rewritten to broaden the analysis of the potential impact of exploratory shaft construction and testing on the waste isolation capability of the site. The effects of proposed boreholes, trenches and characterization activities have been included. The evaluation of the impacts of characterization activities on waste isolation proceeds from the following basic descriptive approach. Section 8.4.2.2 summarizes the current plans for surface-based site-characterization activities, including both shallow and deep drillholes and trenches. Section 8.4.2.3 summarizes the current plans for subsurface testing, including holes drilled from the shafts. Section 8.4.2.2.2.3 describes the basis for surface-based testing

Item 73
Approach for Closure (cont'd)

construction controls. The summaries of the drilling and trenching activities described in Section 8.4.2 are used in Section 8.4.3.2 to analyze the magnitude and extent of the potential impacts to the hydrologic, geochemical, and thermal/mechanical conditions of the site from these activities. The effects of proposed boreholes, trenches, and other characterization activities within the zone mechanically influenced by the exploratory shafts were considered. Section 8.4.3.2.5.1 evaluates the potential impacts to the site from surface-related activities, Section 8.4.3.2.5.2 evaluates the potential impacts to the site from surface-based drilling activities, and Section 8.4.3.2.5.5 evaluates the potential impacts to the site from ESF testing activities. The perturbations to site conditions are evaluated to determine if the perturbations are short-term or long-term with respect to the postclosure performance objectives. Section 8.4.3.3.1 evaluates the potential impacts of these site-characterization activities on the waste isolation integrity of the site.

These evaluations are focused on whether or not the site characterization penetrations create preferential pathways, introduce increased flux to the repository horizon, or result in increased flux from the repository horizon through the primary isolation barrier.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
57	487IR Va	12/30/88

Description

Modify performance analysis to reflect increase in size of ES 2 to 12 feet.

Documentation

SCP 8.4.3 (Potential impacts of characterization activities on postclosure performance objectives)
SCP 8.4.2 (Description and location of characterization operations)

Approach for Closure

The DOE approach to resolution of this concern is to modify performance analyses for the exploratory shafts to reflect the increase in the diameter of ES-2 to 12 feet. This is true for both the SCP and the primary supporting reference (Fernandez et al., 1988).

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
84	588PP C55	12/30/88

Description

Geomechanical analyses do not consider the effects of emplaced support components or the effect of elevated temperature on the support system components.

Documentation

SCP 8.3.2.1.4.1.1 (Geomechanical analyses)

Approach for Closure

The DOE approach to resolution of the concern is to modify Section 8.3.2.1.4 to reflect that rock-support system interactions (including thermal effects) can be modelled using finite element methods.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
88	588PP C59	12/30/88

Description

The description of far field analysis in the CDSCP does not address potential for thermally induced movement along faults or fractures.

Documentation

SCP 8.3.2.2.6 (Information Need 1.11.6: Repository thermal loading and predicted thermal and thermomechanical response of the host rock)

Approach for Closure

The DOE approach to resolution of this concern is to clarify that thermally induced movement along faults or fractures will be considered in the far field analysis. Text has been modified in SCP Section 8.3.2.2.6 to reflect this.

Performance Allocation Table 8.3.2.2-5 of the CDSCP indicates that the location of the faults is a performance parameter for thermal modelling.

Table 8.3.2.2-14 includes fault locations and fault properties as parameters needed for far field thermal and thermal/mechanical analysis.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
98	588PP C72	12/30/88

Description

In evaluating potential effects of credible accidents on projected radiological exposures, the CDSCP has not sufficiently considered retrieval operations.

Documentation

SCP 8.3.5.5 (Issue resolution strategy for Issue 2.3: Can the repository be designed, constructed, operated, closed, and decommissioned in such a way that credible accidents do not result in projected radiological exposures of the general public at the nearest boundary of the unrestructed area, or workers in the restricted area, in excess of applicable limiting values?)

Approach for Closure

The DOE approach to resolution of this concern is to modify Section 8.3.5.5 to indicate that retrieval will be considered in evaluating the effects of credible accidents.

This comment will be addressed in more detail in the November meeting about NRC Point Papers.

NRC/ESF CONCERN

Item No.		Reference Code	Expected Date
96	588PP C68	12/30/88	

Description

It is stated in the second paragraph on pg. 8.3.3.2-24 that "more conservatism has been added by the selection of the design-basis performance goals to be substantially less than the maximum allowable values." Although this is true immediately after closure, the two curves (Fig. 8.3.3.2-3) do converge relatively rapidly. Although no time scale is included, it can be inferred from Fernandez et al, 1987, Fig. 3-2, that the breakpoint in the Design Basis Performance Goals is at about 1000 years. Beyond that point the two curves are so close together as to leave very little safety margin.

Documentation

SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12 have the characteristics and configurations of the shaft and borehole seals been adequately established?)

Approach for Closure

The DOE approach to resolution of this concern is to add text to Section 8.3.3.2 to clarify the conservative features of the evaluations shown on these two curves related to the Maximum Allowable and Design Basis Performance goals. Text also indicates that reevaluation of performance goals and design requirements will occur as more design information, site data, and performance evaluations are completed during ACD and LAD. These evaluations will allow better comparison between needed and expected performance of seals.

NRC/ESF CONCERN

Item No.		Reference Code	Expected Date
85	588PP C56	12/30/88	

Description

The first section of the next to last paragraph on pg. 8.3.2.2-55 expresses the anticipation that contingency measures might strongly emphasize constructibility based on semi-empirical rock mass classifications. These classifications bear no direct relation to the primary long-term repository performance requirements of containment and isolation. It is not clear, therefore, whether the selected criteria are appropriate for guiding emplacement decisions, and specifically to perform system performance studies for off-normal conditions, as proposed in the first sentence of the last paragraph on pg. 8.3.2.2-55.

Documentation

SCP 8.3.2.2.3 (Information need 1.11.3: Design concepts for orientation, geometry, layout, and depth of the underground facility that contribute to waste containment and isolation including flexibility to accommodate site-specific conditions)

Approach for Closure

The DOE approach to resolution of this concern follows the three recommendations identified by the NRC. The text in section 8.3.2.2-3 indicates that post closure implications of contingency procedures should consider total system performance concerns. The criteria for guiding emplacement decisions have not yet been completely established, but are reflected in the performance allocation tables established; section 8.3.2.2.3 indicates a proposed study to ascertain the criteria and thus the parameters necessary to make contingency decisions.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
91	588PP C63	12/30/88

Description

The last tentative goal on pg. 8.3.2.5-21 indicates that high confidence is needed that ES-1 shafts will terminate no less than 150 m above groundwater table. It does not appear that this goal is reached under the present ES-1 design.

Documentation

SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4 Are the technologies of repository construction, operation, closure, and decommissioning adequately established for the resolution of the performance issue?)
SCP 8.4.2.2.3.3 (ESF shafts arrangement)

Approach for Closure

The DOE approach to resolution of this concern is to modify the entry in Section 8.3.2.5 Table 8.3.3.2-2, which is incorrect. Consistent with the goals in the sealing program (Table 8.3.3.2-2) the tentative goal should have read "The thickness between the bottom of ES-1 or any drifting and the groundwater table should be greater than the minimum thickness of the Calico Hills unit above the water table anywhere else within the repository boundary." DOE currently plans to terminate ES-1 above the Calico Hills unit. Confidence that this tentative goal will be met is obtained from the fact that the ES doesn't penetrate the rock unit. Section 8.4 and the overview have been modified to be consistent with the current ESF design. Table 8.3.2.5-3 has also been revised to reflect this goal.

Attachment 18

ESF ITEMS CONCERNING SEALS

BY

J. TILLERSON

D. DOBSON

p. SEAL1

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
8	483IR IIb	12/30/88

Description

Identify procedures used to minimize damage to the rock mass penetrated.

Documentation

SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)
SCP 8.4.3.2.3 (Thermal/mechanical analyses and data)

Approach for Closure

The DOE approach is to use controlled blasting techniques in construction of the exploratory shaft facility as the primary means of limiting damage to the rock mass penetrated. The DOE modified the SCP to include a discussion of controlled blasting techniques in Section 8.4.2.3.4.4. An estimation of the changes in permeability (damage) resulting from the use of the techniques is presented in 8.4.3.2.3 and in a table of case histories provided in Section 8.4.2.3.4.4. These techniques are being evaluated by DOE in G-tunnel to develop a controlled blast program for use in ESF construction.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
58	487IR Vb	12/30/88

Description

Describe how construction methods minimize shaft wall damage.

Documentation

SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)

Approach for Closure

The principal method used by the DOE to limit shaft wall damage during construction is through the use of controlled blasting. The discussion of item 8 identifies where the method and its effects are discussed. Discussions in 8.4.2.3.4.4 indicate that the blast method limits the energy transferred to the rock mass by influencing the direction and magnitude of the propagating fractures.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
101	588PP C99	12/30/88

Description

The CDSCP does not present appropriate information on blasting to reflect the most recent strategy for minimizing shaft wall damage as outlined in DOE'S "Response to NRC Information Requests from the April 14-15, 1987 Meeting between DOE and NRC" (Ref. 1).

Documentation

SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)

Approach for Closure

This item is covered by Item No. 8. The response to Item No. 8 discusses the text added by DOE to SCP Section 8.4 relative to the blasting techniques. This discussion is consistent with the statements made in ref. 1.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
28	885AI 6	12/30/88

Description

Need to establish a common approach to evaluating the magnitude of the damage around openings.

Documentation

SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)
SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)
SCP 8.4.3.2.3 (Thermal/mechanical analyses and data)
SCP 8.4.3.2.5 (Summary of potential impacts to site from SC activities for current site conditions)
SCP 8.4.3.3 (Potential impacts of SC activities on postclosure performance)
Case and Kelsall (1987)

Approach for Closure

The need to establish a common approach to evaluating the magnitude of damage around openings was originally related to assuring consistency in the approach that DOE was taking in evaluating repositories proposed in tuff, basalt, and salt. With the focus now on the tuff repository, the "common" aspect of the action item is no longer appropriate.

The DOE has developed an approach for estimating the extent and magnitude of the modified permeability zone near openings in tuff that results from stress redistribution and blasting. This approach (see Case and Kelsall, 1987 and the summary in 8.4.3.2.3) documented case histories and developed an effective permeability method of estimating the MPZ for a variety of site conditions.

<u>Item 28</u>
<u>Approach for Closure</u> (cont'd)

The MPZ model is consistent with the construction techniques proposed for ESF construction (8.4.2.3.4.4). It is also considered in the development of the testing program in that several tests (e.g., shaft convergence, radial borehole, excavation effects and mining effects tests) will provide data useful for evaluating the model. (Section 8.4.2.3.1). Finally, the model has been used in the evaluation of the potential effects of ESF construction on postclosure performance (SCP Section 8.4.3.3).

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
54	487IR IIIb	12/30/88

Description

Discuss recognition of possible need for remedial measures to maintain postclosure isolation capabilities due to penetration of targeted geological/hydrological structures.

Documentation

SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)
SCP 6.2.8.6 (Options for sealing a discrete fault or fracture zone (in an access or emplacement drift-vertical emplacement))

SAND84-2641 Conceptual Design Report Section 5.1.3 of the Conceptual Design Report
SAND84-1895 Fernandez et al. (1987) Technical Basis for Sealing

Approach for Closure

The approach taken by DOE to satisfy this information request consists of summarizing the numerous places in various documents in which the possible need for remedial sealing measures have been discussed and by indicating that operational constraints are identified that will allow the DOE to identify (prior to penetration with planned drifts) conditions that might require the use of remedial measures.

The possible need for remedial sealing measures to maintain postclosure isolation capabilities has been recognized for several years in the NNWSI Project in both the program to gather site data and in the development of designs for seals. Because of the highly fractured nature of the Topopah Spring member, it is possible that flow could occur in faults and fracture zones. Within the ESF, it is considered desirable to drift to intercept the Ghost Dance Fault, the potential structure beneath the Drill Hole Wash and the potential imbricate fault zone to obtain hydrologic data necessary for sealing and other evaluations. Hence, consideration must be given to sealing fault and fracture zones. Several fault sealing concepts have been discussed in SCP

<u>Item 54</u>
<u>Approach for Closure</u> (cont'd)

Sections 6.2.8.5 and 6.2.8.6 including drains, water collection areas, dams, grout curtains, fault seals, drift backfill, and massive bulkheads. These concepts are also presented in Section 5.1.3 of the SCP-CDR, SAND84-2641. The potential for water flow within fault zones is also discussed in SAND84-1895, (Section 4.2.2) and the design options for controlling water flow are considered in Chapter 6 of SAND84-1895.

p. SEAL8

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
103	588PP C101	12/30/88

Description

Plans for remedial measures that may be required to minimize potentially adverse impacts of penetrating the target features are not given.

Documentation

See Item 54

Approach for Closure

The DOE approach is to recognize the potential need for remedial measures (see Item No. 54) and to identify (prior to penetration) conditions that might require their use (Section 8.4.2.3.4.4). As per the NRC recommendation, DOE has modified the SCP to discuss potential remedial measures to isolate and stabilize target structures (Section 8.4.2.3.4.4). Drilling in advance of the mining is planned in areas near the targeted structures to determine if conditions are present that would require remedial measures. However, specific plans would be dependent on actual conditions encountered and will require that decisions be made when conditions are identified.

p. SEAL9

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
1	483IR Ia	12/30/88

Description

Provide an analysis of the potential effects of construction of the exploratory shaft on long-term sealing capabilities of the rock mass and identify factors that determine the nature and extent of such effects.

Documentation

SCP 8.4.2.3.6.3 (Integration of the ESF with the repository design)
SCP 8.4.3.2 (Summary of Supporting Technical Analyses and Data)
SCP 8.4.3.3 (Potential Impacts of SC activities on postclosure performance)

Primary Supporting References
SAND85-0598 ES Performance Analysis Report

Approach for Closure

The DOE approach for closure of this item is to provide in SCP Section 8.4.3 an analysis of the effects of site characterization activities on potential postclosure performance. Included in this analysis are the potential effects of exploratory shaft construction on performance. Supporting evaluations have been completed to provide an initial performance allocation for seals and to provide a preliminary indication of the degree of reliance to be placed on sealing components. The principal factors that determine the nature and extent of the construction effects as related to sealing capabilities are the shaft location (particularly as regards proximity to flood levels and potential for erosion), and the extent of the zone of modified permeability near the shaft created during construction as a result of blasting and stress relief. The potential impacts of shaft construction on postclosure performance are documented in Section 8.4.3.3. Sections that contain additional information pertinent to this item are Section 8.4.3.2, Summary of Supporting Technical Analyses (particularly those related to hydrology); Section 8.4.3.2.4, Design features that may contribute to performance; Section 8.4.3.2.5.3, Evaluation of potential impacts to the site from construction of the exploratory shafts for current site conditions; and Section 8.4.2.3.6.3, Integration of the ESF with the repository design. Factors considered for analyses of seal performance for the exploratory shafts are discussed in SAND85-0598.

p. SEAL10

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
2	483IR Ib	12/30/88

Description

Describe how the selected excavation technique and shaft design accounts for limitations and uncertainties in long term sealing considerations.

Documentation

SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)
SCP 8.4.2.3.3.3 (General arrangement of ES-1 and ES-2)
SCP 8.4.3.3 (Potential Impacts of SC activities on postclosure performance)
SCP 8.4.3.2.4 (Design features that may contribute to performance)

Approach for Closure

The DOE approach is to identify the principal uncertainties and limitations in the long term sealing considerations and to describe how the excavation techniques (Section 8.4.2.3.4.4) and shaft design (Section 8.4.2.3.3.3) relate to them. The principal uncertainties related to sealing are related to the performance of the seals, the emplacement methods, and the location of the seals. Concerns and data needs related to these uncertainties are described in Section 8.3.3.2 in the performance allocation tables and in Section 8.3.3.2.2.3. The ESF excavation techniques and shaft design accounts for the uncertainties in the following principal ways:

1. Shafts located to limit potential water inflow and thereby reduce uncertainty in seal performance.
2. Controlled blasting used throughout shaft construction thereby allowing installation of seals in multiple and optimal locations at closure when maximum information is known about the site behavior, sealing materials, sealing designs and performance requirements. This reduces uncertainty in the ability to emplace the seals and to predict their performance.
3. Concrete shaft liner and temporary ground support are installed to limit rock movement and thereby reduce uncertainty in both the ability to emplace seal components and the extent of the zone of modified permeability near the shaft.

Consideration of these design features is part of the performance evaluations presented in SCP Section 8.4.3.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
3	483IR Ic	12/30/88

Description

Provide design specifications for the shaft construction and show how they deal with the factors affecting sealing.

Documentation

Title I Drawings and Specifications Package (100% Design Review)
See also Item 52

Approach for Closure

The DOE approach has been to develop design specifications (see Title I package) for shaft construction and to discuss how shaft construction may effect sealing. Preliminary specifications from Title I design have been provided by the DOE through the 100% design review. These specifications will evolve through the Title II design. For a discussion of how shaft construction may effect factors related to sealing, see item #2.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
4	483IR Id	12/30/88

Description

Describe the seal design and materials.

Documentation

SCP 6.2.8 (Seal designs)
SCP 8.3.3.2.3 (Information Need 1.12.3: Placement method for seals for shafts, drifts, and boreholes)
SCP 8.3.3.2.2 (Information Need 1.12.2: Materials and characteristics of seals for shafts, drifts, and boreholes)
SCP 8.3.3.1.2 (Seal components)
SAND84-1895 Technical Basis Report
Site Characterization Plan - Conceptual Design Report

Approach for Closure

The DOE approach is to describe the designs and materials in the SCP with supporting documentation in SCP-CDR and SAND84-1895. The conceptual design of seals and seal materials are discussed in Sections 6.2.8, 8.3.3.2.2, 8.3.3.1.2 and 8.3.3.2.3.

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NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
121	588PP Q42	12/30/88

Description

Description of items included in Table 8.3.3.2-1 needs further clarification in several areas. Why have not all the seal components been included in this list?

Documentation

SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established?)

Approach for Closure

Consistent with the recommendation that the SCP should clarify the items included in Table 8.3.3.2-1 in more detail and explain why certain items are not included in the table, the DOE has modified both the table and associated text. For example, the role of borehole sealing elements in limiting gaseous releases has been clarified.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
5	483IR Ie	12/30/88

Description

Discuss the selected locations of any planned explorations or testing to be performed along the length of the shaft. Include discussion of data on sealing characteristics to be gathered and the limitations and uncertainties associated with the data.

Documentation

SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)
SCP 8.3.3.2.2.3 (In situ testing of seal components)

Approach for Closure

The requested discussion of testing to be performed along the exploratory shafts is given in 8.4.2.3.1. References to the associated activities described in Section 8.3.1 are provided for each of the tests. Specific discussion of the planning activity to determine an in situ seals testing program are given in Section 8.3.3.2.2.3. In addition, a table has been added to Section 8.3.3.2.2.3 to relate the data needed to support sealing to the specific activities in the site characterization program that will provide that data. As requested, emphasis is given in Section 8.3.3.2.2.3 to the limitations and uncertainties associated with the data.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
92	588PP C64	12/30/88

Description

The CDSCP does not include details of the in situ testing of the proposed seal design concepts. This information is necessary to evaluate the effects of seal testing activities on the ability of the site to meet the performance objectives (10 CFR 60.112 and 10 CFR 60.113).

In addition, the CDSCP states that in situ testing to evaluate seal components and placement methods would not start until after the submission of License Application. In view of the uniqueness of the proposed seal design concepts and the associated uncertainties with the long-term performance of the seals, the NRC staff considers that the proposed start date of in situ testing for evaluation of seal components and placement methods will result in a lack of sufficient data for evaluating the license applications.

Documentation

SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)
SCP 8.3.3.2.2.3 (In situ testing of seal components)

Approach for Closure

The approach taken by the DOE to respond to this comment is consistent with the recommendation that tests for seal components should commence as early as practicable during the site characterization program such that adequate preliminary information would become available at License application submittal. Substantial additional text has been added to the SCP (Section 8.3.3.2.2.3). Specifically, the methodology for selecting needed in situ seals tests is given in Section 8.3.3.2.2.3 and summarized in 8.4.2.3.1. Section 8.3.3.2.2.3 has been expanded to present a four-step process which is required to define in situ seals tests. The four steps are the following:

1. An evaluation of current information needed to resolve performance and design emplacement issues of the seal system.

Item 92
Approach to Closure (cont'd)

2. An evaluation of the adequacy of the data by comparing current confidence with needed confidence in the data.

3. Definition, evaluation, and selection of in situ tests of seal components.

4. Detailed definition and design of specific field tests to evaluate the performance of seal components.

Regarding Step 1, extensive new tables were developed and inserted in SCP Section 8.3.3.2.2.3 to clearly identify the site and seals property data needed and which SCP activities are to provide the data. Another new table has been added in Section 8.3.3.2.2.3 that identifies emplacement concerns and related material properties for each of the sealing components. For Step 2, an evaluation of the current and needed confidence in the data and a summary of the state-of-the-art in emplacing sealing components to achieve specific performance goals has been added to Section 8.3.3.2.2.3. In Step 3, examples of potentially appropriate in situ tests of seal components have been added in Section 8.3.3.2.2.3 and it is recognized that some data from ESF observations and testing are needed regarding the likely environment for seals and evaluations are needed of both potential performance impacts and potential interferences before design of the specific tests (Step 4) can be completed.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
10	483IR IIIa	12/30/88

Description

Describe how the seals are expected to perform in sealing the exploratory shaft. Describe tests done, both laboratory and field, to determine their long-term durability and their compatibility, both chemical and physical, to the host rock environment.

Documentation

SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)
SCP 8.4.3.3.1 (Impact on total-system releases)
SCP 8.3.3.2.2.3 (in situ testing of seal components)

Primary Supporting References
SAND85-0598 Fernandez et al. (1988) ES Performance Analyses
SAND84-1895 Fernandez et al. (1987) Technical Basis Report

Approach for Closure

The DOE has described how the seals should perform in sealing shafts in performance allocation tables in SCP Section 8.4.3.2, in SAND85-0598, in SAND 84-1895, and in SCP Section 8.4.3.3. Testing needed for durability and compatibility have to date focused on potential use of crushed tuff where practical to limit chemical compatibility concerns. Specific recognition of the need for long-term durability and materials compatibility is provided in Table 8.3.3.2-4, Table 8.3.3.2-6, and in SCP Section 8.3.3.2.2.3. As discussed in item #92, the data needed for sealing (including that from potential in situ tests) are summarized in Section 8.3.3.2.2.3.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
11	483IR IIIb	12/30/88

Description

Describe the placement methods.

Documentation

SCP 6.2.8.2 (Shaft/ramp seal emplacement)
SCP 6.2.8.4 (Borehole seal emplacement)
SCP 8.3.3.2.2.3 (In situ testing of seal components)
SAND84-2641 SCP-CDR
SAND85-0598 - Fernandez, et al., 1988 - ES Performance Analysis

Approach for Closure

The DOE approach for closure of this item is to provide a discussion of emplacement methods in the SCP and supporting references. Emplacement methods for borehole seals are given in SCP 6.2.8.4, for shaft and ramp seals in SCP 6.2.8.2, and backfill placement is presented in SCP-CDR 5.2.2. In addition, techniques for liner removal and shaft seal emplacement are described in SAND85-0598. Finally, a summary of the state-of-the-art related to emplacement concerns has been added to SCP Section 8.3.3.2.2.3.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
12	483IR IIIc	12/30/88

Description

Describe remedial methods to be used if sealing methods are not adequate.

Documentation

SCP 8.3.3.1 (Overview of the seal program)

Approach for Closure

In the DOE's previous response to this information request, it was stated that remedial measure for seals intended to function during the postclosure period are not planned. At that time the NRC responded that "NNWSI should provide a schedule for completion of the remedial/contingency plans that can be implemented if sealing methods prove to be inadequate during performance confirmation testing." (Letter from J.J. Linehan to D.L. Vieth, dated October 31, 1986).

The DOE approach to providing the requested schedule is described below. The approach in the DOE sealing program is to use results from early phases of seal design and from performance confirmation testing as inputs into the final procurement and construction design for seals. The general schedule for this design and the timing of the availability of the data from performance confirmation testing are shown in Figure 8.3.3.1-1 of the SCP. Hence, the performance confirmation testing result will be used to modify, if necessary, the sealing designs provided in earlier phases thereby increasing confidence that seals will perform as designed after installation. The remaining schedule-related information requested on how performance confirmation testing information will be used to modify seal designs is supplied in Figure 8.3.3.1-1. of the SCP.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
15	483IR IVc	

Description

Describe test and inspection procedures to be used after sealing of the shaft to assess the results of the sealing effort in controlling adverse effects. Include information such as grout strength tests, visual identification of seal conditions, records of water inflow, assessment of seal bond to hot rock, and logging of drill holes.

Documentation

8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone - surface-based studies)

Approach for Closure

The DOE approach has been to evaluate existing data from surface-based testing and, more recently, to plan additional multipurpose boreholes to determine if water is present in sufficient quantities at the ES locations to warrant further consideration of operational seals. The new boreholes will be drilled before shaft construction. Based on the information available at this time (SCP Section 8.3.1.2.2.3) it is not anticipated that perched water would be encountered in sufficient quantities to require seals. For seals planned to be installed during repository closure, item #4 provides the information on seal designs and placement methods.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
45	885AI 23	

Description

A discussion of sealing materials and placement method and timing for exploratory boreholes from the ES will be provided in a future meeting on repository design.

Documentation

SCP 8.3.3.1.2 (Seal components)
SCP 6.2.8.4 (Borehole seal emplacement)
SCP 8.3.3.1 (Overview of the seal program)
SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)
SCP 8.4.2.3.3 (Description of ESF)

Approach for Closure

In the design of the ESF (Section 8.4.2.3) the proposed long horizontal exploratory boreholes that formed the original basis for this action item have been eliminated from the ES plans and replaced by long lateral drifts. No other long exploratory boreholes are planned in the ESF. If planned in the future, sealing requirements will be evaluated.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
44	885AI 22	12/30/88

Description

A decision (and the implications of such a decision) on whether the DOE will remove the liner at permanent closure or use it as part of the long term sealing system has not been determined.

Documentation

SCP 8.4.3.2.3 (Thermal/mechanical analyses and data)
SCP 6.2.8.2 (Shaft and ramp seal emplacement)
SCP 8.3.3.2.2 (Information Need 1.12.2: Materials and characteristics of seals for shafts, drifts, and boreholes)
SAND85-0598 Fernandez et al. (1988) ES Performance Analysis

Approach for Closure

The DOE approach is to gather hydrologic (and other) data to better define the seal environment and to develop more detailed designs of shaft seals prior to making the final decision on whether the shaft liner will be removed. The exploratory shaft liners are therefore being designed to be capable of being removed.

Text is provided in the SCP to indicate how the possibility of liner removal is being considered in the current ESF design, to document the feasibility of liner removal, and to indicate how the possibility of liner removal is considered in planned sealing evaluations.

The shaft liner is designed to be capable of being removed (SCP 8.4.3.2.4) and the removal of that portion of the shaft liner below the repository horizon is currently a preferred design option. Additionally, it may be necessary to remove sections of the liner to place certain sealing components (SCP 8.3.3.1). Techniques considered feasible to remove the liner are discussed in Fernandez et al., (1988). Liner removal concerns relative to sealing are identified in SCP Section 8.3.3.2.2.3 and some chemical effects related to the presence of a liner are described in SAND85-0598. The effect of liner removal on the performance of the shaft sealing system is considered in SCP 8.4.3.2.3. Finally, SCP Section 8.3.3.2.2.2 identifies that a degradation model for cementitious materials such as may be used in the liner is being developed.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
94	588PP C66	12/30/88

Description

The CDSCP states that "The shaft liner can be removed to emplace seal components later."

This statement, without reference to an evaluation, analysis or justification, appears to imply that it is a straightforward matter to remove a shaft liner and that such a procedure has no implications for the isolation capability of the site.

Documentation

SCP 8.4.3.2.3 (Thermal/mechanical analyses and data)

Approach for Closure

Consistent with the recommendation that the SCP evaluate the consequence of removing a shaft liner, the DOE has provided text in SCP Section 8.4.3.2.3 that describes the potential effects of liner removal on the zone of modified permeability in the rockmass. See Item #44 for additional information related to liner removal.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
9	483IR IIc	12/30/88

Description

Identify liner construction and placement technique. Include such information as: liner type, liner material testing and placement of liner. This information needs to be fully considered in application of any permanent sealing program.

Documentation

SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)
SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established to (a) show compliance with the post-closure design criteria of 10 CFR 60.134 and (b) provide information for the resolution of the performance issues?)
SCP 6.2.8 (Seals)
SAND85-0598 Fernandez et al. (1988) ES Performance Analysis

Approach for Closure

The DOE approach to closure has been to modify the SCP to include more description of the liner construction and placement technique. Liner construction and placement technique is described in Section 8.4.2.3.4.4. Liner-related information is being considered in the sealing program as shown in SCP Section 8.3.3.2 (e.g., planned materials testing and seal emplacement discussion), in SCP Section 6.2.8 (e.g., seal designs) and in sealing evaluations reported in SAND85-0598.

NRC/ESF CONCERN

Item No.		Reference Code	Expected Date
93	588PP C65	12/30/88	

Description

The CDSCP states that "The lack of aquifer above the emplacement horizon at the Yucca Mountain site, makes it unnecessary to install either permanent or temporary shaft or ramp seal components at the time of access construction."

No evidence of substantiation is presented for the statement that neither operations nor permanent seals will be required.

Documentation

SCP 8.3.3.1 (Overview of seal program)
SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone-surface based study)

Approach for Closure

The DOE approach to addressing this concern has been to modify the SCP text in Section 8.3.3.1 to more clearly indicate the basis for anticipating that seals will not need to be installed during shaft construction. Exploratory drilling indicates that natural perched water has not been observed at Yucca Mountain (SCP Section 8.3.1.2.2.3). In addition, the DOE has now planned the drilling of multipurpose boreholes near the exploratory shaft locations. These boreholes will be drilled prior to shaft construction and will provide additional data on the likelihood of encountering perched water in sufficient quantities to warrant consideration of operational seals.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
95	588PP C67	12/30/88

Description

The statement near the end of the next to the last paragraph on pg. 8.3.3.1-4 that "boreholes that are upgradient or long distances from the repository may not require sealing" appears to be driven largely by the considerations of vertical downward flow in the pre-repository rock environment, and does not represent a conservative sealing approach.

Documentation

SCP 8.3.3.1 (Overview of the seal program)
SCP 8.4.1.3 (Concepts of unsaturated-zone flow and their application to Yucca Mountain)

Approach for Closure

Consistent with the NRC recommendation, the DOE has modified the text in Sections 8.3.3.1 and 8.3.3.2 to more clearly indicate that both liquid and gaseous flow concerns (including thermal effects) are part of the decision-making strategy for sealing. It is recognized that more site data, design detail, and performance evaluations are required prior to making final decisions on backfill or sealing requirements for individual boreholes. The request for detailed information (e.g., location, depth, and distance from the site boundary) on boreholes is met by text additions in SCP Section 8.4.2.2 and by modifications made to performance allocation tables in Section 8.3.3.2.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
89	588PP C60	12/30/88

Description

The comment that "...drifts will not be relied on to be open. They may have caved or settled on the backfill" raises concerns because it is formulated as a very broad option.

Documentation

SCP 8.3.2.2.7 (Information need 1.11.7: Reference post-closure repository design)

Approach for Closure

The DOE approach to closure of this comment has been to remove the apparently misleading statement from the SCP. The role of backfill and the consequences of caving are recognized by DOE to require further evaluation as indicated by the performance allocation in Table 8.3.3.2-3.

p. SEAL28

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
86	588PP C57	12/30/88

Description

The CDSCP states that the potential for the development of new paths to the accessible environment or for an extension of the disturbed zone will be mitigated by backfilling the emplacement drifts. Given the proposed loose backfill and only partial filling of the drifts, this effect may be quite limited.

Documentation

SCP 8.3.2.2.6 (Information need 1.11.6: Repository thermal loading and predicted thermal and thermo-mechanical response of the most rock)

Approach for Closure

The current approach in the performance allocation table is that the mechanical effects provided by the backfill are not relied on for postclosure performance. If future evaluations indicate that more reliance on the backfill performance is warranted, analyses similar to that proposed in the recommendation would be completed.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
97	588PP C70	12/30/88

Description

It is unclear whether a reasonably conservative design approach has been used to determine required backfill hydraulic conductivity.

Documentation

SCP 8.3.3.2.1 (Information Need 1.12.1: Site, waste package, and underground facility information needed for design of seals and their placement methods)
SAND84-1895 Seals Tech Basis Report
SAND85-0598

Approach for Closure

The DOE approach has been to provide the sensitivity analyses completed in support of the backfill conductivity evaluations and to modify the SCP text in Section 8.3.3.2 to indicate their use.

The sensitivity analysis requested in the NRC recommendation is contained in the supporting reference (SAND84-1895 and SAND85-0598). A broad range of rock mass hydraulic conductivities was considered in these preliminary estimations of the required hydraulic conductivity of the backfill. As more information on the backfill and its role in performance are developed, performance measures and goals will be reexamined. In situ testing discussions are provided in item #2. Alternative scenarios have been considered in the performance evaluation in Section 8.4.3.3 and a full suite of processes and mechanisms are identified in Section 8.3.3.2 as being needed for more detailed evaluation of sealing components.

p. SEAL30

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
119	588PP Q40	12/30/88

Description

What is the justification for the statement on pg. 8.3.2.5-24 that "no site characterization data is required to develop the high level of confidence needed for installation of borehole liners"?

Documentation

SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4)

Approach for Closure

The DOE approach is to modify Table 8.3.2.5-5 to reflect that no "additional" data are required. This indicates that the data requested in the rest of Table 8.3.2.5-5 are judged sufficient to allow installation of the liner.

p. SEAL31

NRC/ESF CONCERN

Item No.		Reference Code	Expected Date
120	588PP Q41	12/30/88	

Description

There are apparent inconsistencies in the write-up of the proposed activities presented in this section when compared with the details given in other sections of the CDSCP and reference documents. What are the potential impacts of such inconsistencies?

Documentation

SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established?)

Approach for Closure

The recommendation that the CDSCP should be reviewed to remove inconsistencies between referenced sections and documents has been implemented. Text modifications have been made in Section 8.3.3.2 to remove inconsistencies.

Attachment 19

ESF ITEMS CONCERNING TESTING

BY

D. DOBSON

H. KALIA

T. BLEJWAS

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
17	483IR Va	12/30/88

Description

Describe test plans and procedures used to obtain adequate data on site characteristics that can be measured either directly or indirectly during construction of the exploratory shaft. For example:

- Geologic mapping and rock mass characterization of the shaft walls
- Measurements of rates and quantities of groundwater inflow and collection of groundwater samples for testing
- Measurements of overbreakage during blasting
- Rock mechanics testing of samples obtained during drill and blast operations

Documentation

SCP 8.4.2.3.1 (ESF Testing Operations, Layout Constraints, and Zones of Influence)
SCP 8.4.2.3.4.4 (Description ESF underground construction and operations)
SCP 8.4.2.3.6 (Evaluation of ESF layout and operations)
SCP 8.3.1.2.2.3.1 (Matrix hydrologic properties testing)
SCP 8.3.1.2.2.4.4 (Radial borehole tests in the ESF)
SCP 8.3.1.2.2.4.7 (Perched water test in ESF)
SCP 8.3.1.2.2.4.5 (Excavation Effects test in the ESF)
SCP 8.3.1.2.2.4.8 (Hydrochemistry Tests in the ESF)
SCP 8.3.1.2.2.4.9 (Multi-purpose Boreholes)
SCP 8.3.1.15.1.8.1 (Evaluation of Mining methods)
SCP 8.3.1.15.1.1 (Laboratory Thermal properties)
SCP 8.3.1.15.1.2 (Laboratory Thermal expansion testing)
SCP 8.3.1.15.1.3 (Laboratory determination of Mechanical properties of intact rock)
SCP 8.3.1.15.1.4 (Laboratory determination of the Mechanical properties of Fractures)
SCP 8.3.1.4.2.2 (Characterization of Structural Features within the site area)
SCP 8.3.1.5.1.5 (Excavation Investigations)
SCP 8.3.1.15.2.1 (Characterization of the Ambient Stress conditions)

Item 17 (cont'd)

Approach for Closure

The DOE approach to resolving this item has been to provide the information needed to assess the adequacy of the test program in the SCP. The SCP describes what information is needed for the resolution of performance and design issues, and what tests are planned to collect the data requirement defined. The sections of the SCP listed above provide descriptions of tests planned for the gathering of site characterization data during construction of the exploratory shaft.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
36	885AI 14	12/30/88

Description

The DOE delineated the underground layout of the exploratory shaft and drifts and stated that underground testing considerations heavily influenced the layout. The NRC cannot assess the adequacy of the planned tests and hence the testing layout until the test plans are provided prior to the NNWSI/NRC ESTP meeting.

Documentation

SCP 8.4.2.3.1 (ESF Testing Operations, Layout Constraints and zones of Influence)
SCP 8.4.2.2.3.3 (ES general arrangement)
SCP 8.4.2.3.3.4 (Main test level general arrangement)
SCP 8.4.2.3.6 (Evaluation of ESF layout and operations)
SCP 8.1.4.2.1 (Rationale for planned testing)
SCP 8.3.4.2.4 (Information Need 1.10.4: Postemplacement near-field environment)
SCP 8.3.1.2 (Overview of the geohydrology program)
SCP 8.3.1.3 (Overview of the geochemistry program)
SCP 8.3.1.5 (Overview of the climate program)
SCP 8.3.1.15 (Overview of thermal and mechanical rock properties program)

Approach for Closure

The DOE has described the ESF Test Program in the appropriate parts of Section 8.3.1 of the SCP, and the description is summarized in Section 8.4. The rationale and technical bases for the tests, as derived from the information needs and data requirements, appears in Section 8.3.1. This Section should be the basis for the assessment of the adequacy of the planned tests. The constraints imposed on the ESF underground layout by the testing program and how those constraints are reflected in the design of the ESF are discussed in Section 8.4.2.3. Section 8.4.2.3.1 describes the constraints on the ESF imposed by each of the 34 planned tests. This section also discusses the zone of influence expected as a result of each test activity. This zone of influence generally translates into a distance from other activities to

Item 36
Approach to Closure (cont'd)

preclude interference with the test. Sections 8.4.2.3.3 through 8.4.2.3.5 describe the design, layout, and construction operations for the ESF. Section 8.4.2.3.6 then provides a discussion of how design considerations (such as constraints and zones of influence from the testing program, construction to test interference, compatibility with the repository design, design flexibility, and safety) are satisfied by the ESF design and reflected in the underground layout.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
104	588PP C102	12/30/88

Description

In several activity descriptions, it is proposed that air coring will be used to drill holes to be used for permeability testing (e.g., Infiltration test, pg. 8.4-52; bulk permeability test, pg. 8.4-53; radial borehole tests, pg. 8.4-53; Calico Hills tests, pg. 8.4-54; diffusion tests, pg. 8.4-54).

Aside from the potential technical difficulties associated with the feasibility of drilling such holes, this raises questions about the reliability of the permeability values thus obtained.

Documentation

SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)
SCP 8.4.2.2.2.3 (Basis for Surface-based Testing Construction Controls)

Approach for Closure

The feasibility of surface-based dry drilling and coring has been demonstrated at Yucca Mountain to depths of 519 feet. A feasibility drilling program is planned to demonstrate the capability to dry core and/or drill to depths of up to 2600 feet, as discussed in Section 8.4.2.2.2.3.

As recommended by the NRC, prototype testing conducted underground at G-tunnel on the Nevada Test Site has demonstrated that air coring is feasible in both welded and non-welded material, under health, safety, and other conditions attendant to the underground environment. The method tested uses reverse vacuum circulation which minimizes the mobilization of the fine particles which could clog pores or fractures. The positive outcome of this test is reflected in the descriptions of ESF activities (summarized in Section 8.4.2.3), many of which call explicitly for the use of air coring.

Item 104
Approach for Closure (cont'd)

The effects of air coring on rock mass hydrologic response, relative to conventional coring methods using water circulation, are being investigated in an ongoing prototype test in G-tunnel, as recommended by the NRC. The prototype program is entitled: "Evaluation of the effects of wet and dry drilling fluids on the in situ hydrologic properties of tuffaceous rocks," and is discussed briefly in Section 8.4.2.2.2.3 in the context of construction controls to preserve in situ conditions.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
107	588PP Q14	12/30/88

Description

Does this program include all drilling or only surface based drilling?

Documentation

SCP 8.3.1.4.1 (Integrated drilling program and integrated geophysical activities)
SCP 8.4.2.3.3.1 (Introduction to description of ESF)

Approach for Closure

Section 8.3.1.4.1 pertains to surface-based activities only. A similar integration function for ESF activities is described in Section 8.4.2.3.3.1. Text in Section 8.3.1.4.1 has been changed to clearly indicate applicability to surface-based activities.

As recommended by the NRC, the DOE approach to resolving concerns related to potential site impacts caused by site characterization activities, including drilling, has been to address all such concerns in Section 8.4.3. That section has been extensively rewritten to include consideration of the impact of drilling on waste isolation.

p. T8

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
46	885AI 24	

Description

The testing program to characterize perched water zones will be discussed at the ESTP meeting.

Documentation

SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and Zones of Influence)
SCP 8.3.1.2.2.4.7 (Perched water test in ESF)
SCP 8.3.1.2.2.4.9 (Multi-purpose Borehole)
SCP 8.3.1.2.2.3 (Characterization of Percolation in the unsaturated Zone - Surface Based Studies)

Approach for Closure

The DOE approach to resolve this item is to provide a description of the characterization of perched water zones in the SCP. Plans for characterizing perched water at the ESF site (using multipurpose boreholes on the surface and the perched water test in the shafts or drifts) are described in the above cited SCP sections and are also summarized in Section 8.4.2.3.

Any perched water zones encountered during surface based drilling will also be tested for hydrologic characteristics and sampled for geochemical analysis.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
49	885AI 27	

Description

DOE's plans on the characterization of lithophysal zones and on plans for demonstrating horizontal emplacement and exploration holes will be discussed in a future meeting on repository design.

Documentation

SCP 8.3.1.4.2.2.4 (Geologic mapping of ES and drifts)
SCP 8.3.1.15.1.1 (Laboratory thermal properties)
SCP 8.3.1.15.1.2 (Laboratory thermal expansion testing)
SCP 8.3.1.15.1.3 (Laboratory determination of mechanical properties of intact rock)
SCP 8.3.1.15.1.4 (Laboratory determination of the mechanical properties of fractures)
SCP 8.3.1.15.1.5.2 (Demonstration breakout rooms)
SCP 8.3.1.15.1.6.1 (Heater experiment in unit TSw1)
SCP 8.3.1.15.1.7.1 (Plate loading tests)
SCP 8.3.2.5.6 (Development and demonstration of required equipment)
SCP 8.4.2.3 (ESF testing operations, layout constraints and zones of influence)
SCP 8.3.1.15.1.8 (In situ design verification)

LANL Report on Dry Drilling (Mike Ray)

Approach for Closure

The DOE approach to resolving this item is to provide the information relevant to characterization of the site (including lithophysal zones) in the SCP. The first nine SCP sections listed above contain descriptions of experiments that will contribute to the characterization of lithophysal zones (especially the main lithophysal zone, which lies directly above the proposed repository horizon).

Although current plans do not call for long horizontal emplacement holes, demonstration of the capability to construct long horizontal emplacement holes is a contingency, as discussed in Section 8.4.2.3.1 and 8.3.2.5.6. The capability to drill dry-cored horizontal exploration holes has been demonstrated in prototype testing in G-tunnel.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
32	885AI 10	12/30/88

Description

Need to review Section 60.21(c) to determine NRC's expectations regarding the information of fracture characteristics to be obtained from the exploratory shaft.

Documentation

SCP 8.3.1.3.2.1.3 (Fracture Mineralogy)
SCP 8.3.1.4.2.2 (Surface-fracture network studies)
SCP 8.3.1.4.2.2.4 (Geologic mapping of Exploratory Shaft and drifts)
SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of Influence)

Approach for Closure

Section 60.21(c) calls for the Safety Analysis Report to describe the site at which the proposed repository is to be located with, "appropriate attention to those features of the site that might affect geologic repository operations area design and performance." The level of detail required varies according to proximity and relationship to the repository block.

The DOE approach is to use a wide variety of techniques to gather information on fracture characteristics. See item 74.

NRC/ESF CONCERN

Item No.		Reference Code	Expected Date
74	588PP C29	12/30/88	

Description

The CDSCP's approach to characterizing the complex three-dimensional nature of fracture systems in the repository block appears to rely on fractal analysis of outcrop exposures and geologic mapping of ES-1, drifts, and boreholes (excluding floors and working faces). Also the CDSCP limits the objectives of fracture network studies to providing fracture analyses to supporting hydrologic modeling. The approach and objective to characterization described in the CDSCP may not lead to sufficient descriptions of the fracture networks.

Documentation

SCP 8.3.1.4.2.2 (Characterization of structural features in the site area)
SCP 8.3.1.4.2.2.2 (Surface-fracture network studies)
SCP 8.3.1.4.2.2.4 (Geologic mapping of exploratory shaft and drifts)
SCP 8.3.1.4.3.1.1 (Systematic Drilling Program)
SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone--surface based study)
SCP 8.3.1.4.2.2.3 (Borehole evaluation of faults and fractures)
SCP 8.3.1.4.2.2.5 (Seismic tomography/vertical seismic profiling)
SCP 8.3.1.4.2.1.6 (Integration of geophysical activities)
SCP 8.3.1.2.2.3.2 (Site vertical borehole studies)

Approach for Closure

As recommended by the NRC, the DOE approach to resolving this item has been to modify the SCP to clarify the goals and requirements of the fracture mapping program. The data requirements derived from the performance and design programs and the site hydrology, rock characteristics, and geochemistry programs have resulted in definition of the needed parameters as described in the SCP. The plans for collecting the fracture data are primarily described in Study 8.3.1.4.2.2.

Some revisions have been made to the activity descriptions in that study. The planned approach to characterizing fracture systems and fault zones in the subsurface at Yucca Mountain will utilize available exposures of these features for direct observation, and non-invasive geophysical methods as

Item 74
Approach for Closure (cont'd)

well. The surface of Yucca Mountain and selected areas where fracture systems are exposed in outcrop, or can be exposed by removal of a reasonable amount of surface cover will be mapped for structural offsets (Activity 8.3.1.4.2.2.2). Subsurface access afforded by boreholes of the systematic drilling program (Activity 8.3.1.4.3.1.1) and other activities (e.g., 8.3.1.2.2.3) will be used to the extent possible for characterizing faults and fractures (Activity 8.3.1.4.2.2.3). The effectiveness of borehole methods will be assessed, which will involve field testing methods such as borehole radar and crosshole methods. If practicable, borehole methods or surface-to-borehole methods will be used to characterize lateral and spatial variability of fracture systems, and to identify and characterize fault zones. Geologic mapping in the ESF will be performed using both conventional mapping and photogrammetric methods (Activities 8.3.1.4.2.2.4). Finally, the feasibility of vertical seismic profiling will be investigated, and if appropriate the method will be used to obtain information on the characteristics of fracture systems and fault zones between surface-based boreholes (Activity 8.3.1.4.2.2.5 and 8.3.1.2.2.3.2). Geophysical activities that are planned in conjunction with other studies including vertical seismic profiling are discussed in Activity 8.3.1.4.2.1.6.

Fractal analysis is one of several statistical techniques which will be used to characterize fracture distributions (Activity 8.3.1.4.2.2.2). The description of this activity has also been revised to recognize other uses of subsurface fracture data, in addition to hydrologic modeling. The planned approach to characterization of subsurface fracture systems will make use of surface exposures, boreholes, and underground openings. Most of the boreholes in the immediate site area, including those of the systematic drilling program, will remain uncased and available for geophysics and other studies during site characterization.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
106	588PP Q12	12/30/88

Description

What are the definitions of the terms fracture "aperture" and "length"?

Documentation

SCP 8.3.1.4 (Overview of the Rock characteristics Program)

Approach for Closure

The DOE approach to resolve this item has been to define the terms in a consistent way for all technical disciplines, as recommended by the NRC. The terms "fracture", "length," and "aperture" have been redefined in SCP Section 8.3.1.4 and in the SCP glossary. The term "length" has been replaced by "persistence."

In brief the definitions are:

Fracture is a general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fractures include cracks, joints, and faults.

Aperture is the perpendicular distance separating the adjacent rock walls of an open discontinuity.

Persistence is the areal extent or size of a discontinuity within a plane. It is essentially the trace length of surface exposure of a discontinuity.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
108	588PP Q16	12/30/88

Description

How is the roughness coefficient parameter measured in a borehole? What is the difference between roughness coefficient listed here and "roughness" discussed elsewhere in Section 8.3.1.4.2.2.3?

Documentation

SCP 8.3.1.4.2.2.3 (Borehole evaluation of faults and fractures)

Approach for Closure

The DOE approach to resolve this question has been to modify the SCP to provide a consistent definition and usage of terms in all sections, as recommended by the NRC. For example, the term "roughness coefficient" has been changed to "roughness" in Section 8.3.1.4.2.2.3. Roughness coefficient is an empirical parameter in the NGI system for rock mass classification (Barton and Choubey, 1977). "Roughness" is a more general term intended to describe the condition of joints. A short paragraph has also been added to Section 8.3.1.4.2.2.3 to explain the use of different terms in the SCP.

Roughness can be observed and information can be inferred from a borehole but the measurement of roughness coefficient is commonly done on rock samples.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
110	588PP Q25	12/30/88

Description

What methods will be used to determine whether there is any impact of ground motion from underground nuclear explosions on repository design?

Documentation

SCP 6.4.10.2.6 (Design analysis)
SCP 8.3.1.17.3 (Studies to provide required information on vibratory ground motion that could affect repository design)
SCP 8.3.2.5.7 (Information need 4.4.7: Design analyses, including those addressing impacts of surface conditions, rock characterization, hydrology and tectonic activity)
SCP 8.3.1.17.4.1 (Historical and current seismicity)
- Blume Associates, Ground Motion Evaluations of Yucca Mountain, NV, with applications to repository conceptual design and siting.

SAND85-7104

Approach for Closure

Potential vibratory ground motion from underground nuclear explosions (UNEs) at the NTS will be determined in Study 8.3.1.17.3.2, 8.3.1.17.3.3, and 8.3.1.17.4.1.3. Based on current information, (SAND85-7104) it appears that potential earthquake ground motions are much larger than potential UNE ground motions (see Section 6.4.10.2.6) and, hence, will control repository seismic design. Seismic design analyses to be conducted are described in Section 8.3.2.5.7.

NRC/ESF CONCERN

Item No.		Reference Code	Expected Date
113	588PP Q34	12/30/88	

Description

Why is there no link (other than that indicated in Figure 8.3.2.1-1) established between this plan and Issue 1.12-Repository Sealing?

Documentation

SCP 8.3.2.2.3 (Information need 1.11.3: Design concepts for orientation, geometry, layout, and depth of the underground facility that contribute to waste containment and isolation including flexibility to accommodate site-specific conditions)

Approach for Closure

The DOE accepts the recommendation and has modified the SCP to more fully describe the relationship between Issues 1.11 and 1.12. Specifically, the Issues 1.11 and Issue 1.12 interface is discussed in Section 8.3.2.2; and is reflected in the performance allocation (Table 8.3.2.2-1). To further emphasize the interface with Issue 1.12, the text which describes the drainage and moisture control plan has been modified to include an interface to seals and a reference to Issue 1.12 (Section 8.3.3.2.3).

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
114	588PP Q35	12/30/88

Description

According to the last sentence of this section, the approach to develop this plan is given in Section 8.3.2.3, and the data requirements for this plan are given in Section 8.3.2.2.1. Both of these referenced sections covered extremely broad topics. What are the relevant items for this section?

Documentation

SCP 8.3.2.2.3.4 (Design Activity 1.11.3.4: Drainage and moisture control plan)
SCP 8.4.2.3.3 (Description of the ESF)

Approach for Closure

The DOE approach to resolving this item is to modify the SCP to clarify the data needs for Section 8.3.2.2.3.4. The reference to Section 8.3.2.3 is incorrect and the text has been modified to reference 8.3.2.2.1.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
115	588PP Q36	12/30/88

Description

Where in Section 8.3.2.2.1 are the data requirements for this activity discussed?

Documentation

SCP 8.3.2.2.5.1 (Excavation methods criteria)
SCP 8.3.2.2.5.2 (Long term subsidence control strategy)
SCP 8.3.2.2.1 (Site characterization information needed for design)

Approach for Closure

The SCP text in Section 8.3.2.2.5.1 was modified to reference Table 8.3.2.2-11 which contains the requested information.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
116	588PP Q37	12/30/88

Description

Some concerns exist as to whether the list of parameters for performance goal C2 (rock radiation shielding) given on pg. 8.3.2.3-30 is comprehensive. For example, does the expected pre-emplacement saturation value of 65% represent the expected post-emplacement saturation value?

Documentation

SCP 8.3.2.3 (Issue resolution strategy for Issue 2.7: Have the characteristics and configurations of the repository been adequately established?)

Approach for Closure

The DOE approach is to set performance goals to guide development of testing strategies, and to ensure that the pre/post-emplacement conditions (saturation and temperature) are considered, Table 8.3.2.3-3 and text in Section 8.3.2.3 were modified to identify this data need.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
117	588PP Q38	12/30/88

Description

Use of mechanical excavation is considered not feasible in some parts of the document and plausible in other parts. The next to last paragraph on pg. 8.3.2.4-28 mentioned the possibility that mechanical excavation may be used. Does this contradict other implications in the CDSCP (e.g., pg. 8.3.2.2-70) that mechanical excavation is not feasible?

Documentation

SCP 8.3.2.2 (Issue resolution strategy for Issue 1.11 Have the characteristics and configurations of the repository and repository barriers been adequately established?)
SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)

Approach for Closure

In order to address the NRC question, the text on page 8.3.2.2-70 was modified to clarify that the use of mechanical mining is still under study. The intent of the discussion of excavation methods was to indicate that continuous mining of the drifts (for the shapes under consideration) has not yet been proven to be practical in welded tuff.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
118	588PP Q39	12/30/88

Description

Why are the requirements for some items on pg. 8.3.2.5-23 different from the requirements for System Element 1.2.1.2 identified in Table 8.3.2.4-2, non-radiological health and safety?

Documentation

SCP 8.3.2.4.2 (Schedule for non-radiological health and safety (Issue 4.2))

Approach for Closure

The DOE approach to resolve the question is to establish consistency between tables and text in various sections of the SCP. For example, the text in Table 8.3.2.4-2 was modified to indicate that the ventilation velocity goal is <2000 fpm for supply and exhaust. This resolves the discrepancy with Table 8.3.2.5-4. To resolve the discrepancy related to site data requirements, Table 8.3.2.5-4 was modified to state that no additional site data is needed beyond the site data requirements for the ventilation system in Table 8.3.2.5-8.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
76	588PP C42	12/30/88

Description

This table, which summarizes the requests for thermal and mechanical rock properties, appears to be far from complete.

Documentation

SCP 8.3.1.15 (Overview of the thermal and mechanical rock properties program)
SCP 8.4.2.1 (Rationale for planned testing)
SCP 8.4.2.1.4 (Relationship of planned testing to data needs)

Approach for Closure

As recommended by the NRC, the DOE has reassessed Table 8.3.1.15-1 to ensure a complete interface between the rock properties program and other sections of the SCP. The DOE approach to deriving the table was to identify all site data information needs from the performance, design and other site programs in the SCP. The issues listed on the Table are those issues which request the information. For other issues not specifically listed on the Table, the issue resolution strategies in Chapter 8.3 describe the information needs and explain that the needed information will be obtained from site programs derived from the performance allocations for other issues.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
77	588PP C43	12/30/88

Description

Section 8.3.1.15 does not present a clear testing rationale. Thermal and mechanical properties to be determined are not related to specific individual test.

Documentation

SCP 8.3.1.15 (Overview of thermal and mechanical rock properties)

Approach for Closure

The DOE approach to deriving testing programs was to use performance allocation for the performance and design issues to develop comprehensive lists of parameters to be measured in field and laboratory tests. Table 8.3.1.15-1 collates all thermal and mechanical property tests and information requests identified through performance allocation. Table 8.3.1.15-1 indicates, for each parameter to be measured, the specific SCP activity in the test program.

Many of the ESF experiments are intended to provide a database for model validation. The current test program was developed as a result of performance allocation meetings between modelers and experimentalists, and is designed to obtain sufficient data for the validation of models.

The ESF Title I Report will contain a summary of repository thermal/mechanical analyses. Parametric performance calculations (sensitivity studies) are ongoing that will help to refine parameter goals and associated required confidence levels.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
78	588PP C44	12/30/88

Description

The testing program laid out in Section 8.3.1.15 is deficient in several respects. In some cases, important information that could be gained in testing is not identified. Also, some proposed tests are ill-defined, and others may not be able to provide required information.

Documentation

SCP 8.3.1.15 (Overview of thermal and mechanical rock properties)
SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)

Approach for Closure

The DOE approach to defining testing programs was to use performance allocation for the performance and design issues to develop comprehensive lists of parameters to be measured in field and laboratory tests. Table 8.3.1.15-1 collates all thermal and mechanical property tests and information requests identified through performance allocation. Table 8.3.1.15-1 indicates the specific SCP activity that will investigate the parameters to be measured.

Potential difficulties with specific tests will be described in study plans. For tests where difficulties may be expected, the study plans describe alternate methods of acquiring the needed data. Furthermore, as the program progresses, the performance allocation will be refined, possibly leading to revised issue resolution or testing strategies.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
79	588PP C45	12/30/88

Description

The discussion and use of statistics in this chapter is not clear. A statistical approach has been suggested to determine numbers of tests required to determine various rock properties, but the approach suggested is confusing and apparently overlooks several considerations that should be factors into such an approach. Also, needed confidences of "low", "medium," or "high" have been assigned without explaining the basis for such assignments. Bases for assigning the needs confidence of low, medium or high are not discussed.

Documentation

SCP 8.3.1.15 (Overview of thermal and mechanical rock properties)
SCP 8.3.1.15.1 (Investigation Study on spatial distribution of thermal and mechanical properties)
SCP 8.1.2.2 (Performance Allocation)

Approach for Closure

The DOE approach to the resolution of this comment has been to revise the discussion of statistics in Section 8.3.1.15.1 to eliminate some of the confusion pointed out by the reviewer. Specifically, discussions of the qualitative confidence levels and of the use of existing data have been expanded. As the results of parametric or sensitivity studies become available, any ramifications for sampling or testing needs will be factored into the plans for testing. Also, as the results of initial site characterization tests are obtained; the possibilities of spatial dependence, non-normality of data, and other complicating conditions will be examined. Should one or more of the assumptions in the sampling strategy be shown to be unwarranted by the site characterization data, sampling and testing plans will be adjusted accordingly. The SCP describes the basis for assigning needed confidence levels in Section 8.1.2.2.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
80	588PP C46	12/30/88

Description

In order to examine the margin of safety engineered into the stability of emplacement holes from the standpoint of retrievability, the canister-scale heater experiment needs to be run beyond the average design heat load. The CDSCP does not include provisions for such testing. Also, no mention is made of testing of lined versus unlined holes, backfilled holes, etc.

Documentation

SCP 8.3.1.15.1.6.2 (Canister scale heater experiment)

Approach for Closure

Section 8.3.1.15.1.6.2 has been modified to include overload conditions that may cause spalling around the heater borehole. The DOE approach is to test unlined boreholes before the testing of any lined-holes, because unlined holes are better suited for determining if spalling is a concern. At the present time, the DOE is not considering backfilling of emplacement holes. If such backfilling becomes likely, the need for additional testing will be assessed. Other heater tests, specifically the engineered barrier system field tests, Section 8.3.4.2.4.4, are planned to continue for years as suggested by the NRC. As discussed in Section 8.3.5.16, these tests will continue after the license application as a performance confirmation test.

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NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
81	588PP C47	12/30/88

Description

This experiment is one of the more important rock mechanics experiments proposed; yet, virtually no detail is given regarding it. There seems to be a lack of integration between this experiment and the modeling activities and design.

Documentation

SCP 8.3.1.15.1.6.5 (Heated room experiment)
SCP 8.4.2.3.1 (ESF Testing operations, layout constraints and zones of influence)
SAND87-3092 Klavetter et al, in prep: Suggested structure for model validation for the NNWSI

Approach for Closure

The DOE approach is to provide a general description of the tests in the SCP; additional technical details will be provided in the Study plans for 8.3.1.15.1.6. The confirmation and validation of models is a major driving force in designing many of the in situ experiments. Section 8.3.1.15.1.6.5 has been modified to provide the approach to the conduct of this test and to more clearly express the importance of model validation for the heated room experiment. The strategy for the validation of models is maturing. Klavetter, et al., describe the overall approach in more detail than SCP Section 8.3.5.20. Ongoing work will deal specifically with thermal-mechanical models. A variety of models and validation strategies have been implicitly considered in developing the data needs and testing strategies described in the SCP. Therefore, detailed plans for the validation of specific models are not considered critical to the level of test planning presented in the SCP.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
99	588PP C97	12/30/88

Description

Plans should be made to correlate persistence of geologic features from ES-1 to ES-2 which might provide preferential pathways and to develop a photographic record of ES-2 for possible future use.

Documentation

SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and Zones of Influence)
SCP 8.3.1.4.2.2 (Characterization of Structural Features within the site area)

Approach for Closure

The NRC recommendation that a photographic record of both ES-1 and ES-2 be maintained is accepted as discussed in 8.3.1.4.2.2 and 8.4.2.3. The geologic mapping planned for ES-2 are similar to those in ES-1. A geologic map will be compiled in each shaft as the shaft advances. ES-2 mapping will also include a complete photographic record identical to ES-1 but detailed mapping of fracture characteristics along datum lines will be at greater intervals than in ES-1. On-site geologists will determine whether additional, detailed geologic mapping of specific features in either shaft may be required.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
82	588PP C48	12/30/88

Description

Plate-load tests do not necessarily provide a means of determining in situ (i.e., undisturbed) rock mass deformational properties. Data obtained from such tests may be useful in assessing spatial variability, effects of different excavation procedures, etc. as part of the overall program to characterize deformational relations of the rock mass adjacent to underground openings, but may not be useful in thermomechanical calculations.

Documentation

SCP 8.3.1.15.1.7.1 (Plate loading tests)
SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)

Approach for Closure

The DOE approach to defining needed tests is to rely on performance allocation to derive a testing strategy. Plate-loading tests are a standard ASTM and ISRM approach to estimating rock-mass modulus of deformation. The NRC's comment acknowledges good reasons for conducting such tests, although there are limitations to the use of the data. The test description included some recognition of anisotropic behavior (the inclusion of both horizontal and vertical tests), and the text has been changed to include the possible use of acoustic emissions and rock-bolt load cells to monitor non-uniform response. Further modifications of the details of the tests and the application of results will be discussed in the Study Plan.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
83	588PP C54	12/30/88

Description

The CDSCP has limited its consideration of how jointed tuff can be treated to equivalent continuum models. Although several possible models are described in Chapter 2 (pp. 2-19 and -20), representation of jointed tuff by equivalent continuum models only and disregarding of other models such as quasi-discrete or distinct element models has not been justified.

Documentation

SCP 8.3.2.1.4.1.1 (Geomechanical analyses)

Approach for Closure

The DOE approach to resolve the comment is to investigate the use of various modeling techniques to represent the behavior of jointed tuff. Quasi-discrete and distinct element modeling techniques may be used in the analysis of the fractured rock mass response. Clarifying text has been added to Section 8.3.2.1.4.1.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
87	588PP C58	12/30/88

Description

The proposed wedge analysis and key block analysis are not capable of including the effects of thermal loading or stress gradient on the host rock.

Documentation

SCP 8.3.2.2.6 (Information need 1.11.6: Repository thermal loading and predicted thermal and thermomechanical response of the most rock)

Approach for Closure

The DOE approach to resolve this item is to revise the text (consistent with the "basis" discussion by the NRC) to clarify that the thermally induced stress history used in the wedge analysis may be approximated from a separate series of thermal/mechanical analyses.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
111	588PP Q26	12/30/88

Description

How will the heated block experiment be used for model validation if there are no imposed stress gradients or temperature gradients inside the block?

Documentation

SCP 8.3.1.15.1.6.3 (Yucca Mountain heated block experiment)
SAND 84-2621 Zimmerman et al, 1986: Final Report: G-Tunnel Heated Block Experiment
SAND87-2699 Costin and Chen, in prep: An Analysis of the G-Tunnel Thermomechanical response using a compliant joint rock mass model

Approach for Closure

The DOE approach to resolution of this item has been to use a uniform stress, and temperature field for the heated block experiment as was done for prototype testing in G-Tunnel (Zimmerman et al., 1986) and to evaluate the effect of gradients in other planned experiments such as the heated room experiment and heater tests (SCP 8.5.1.15.1.6). The heated block experiment will be used for both constitutive model development and validation of deformation. The description of the experiment (8.3.1.15.1.6.3) includes both the application of normal and shear stress across a representative sampling of joints. Preliminary validation type analyses of the experiment have clearly demonstrated the utility of the experiment for model validation consistent with the DOE approach to verification and validation of thermomechanical models and codes. (Costin and Chen).

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
112	588PP Q27	12/30/88

Description

What are the parameters and the strength model for which the strength experiment(s) are designed, and how will a substantial volume of rock be driven to failure?

Documentation

SCP 8.3.1.15.1.2 (Laboratory thermal expansion testing)

Approach for Closure

The DOE approach to this question has been to revise the experiment (now renamed the rock-mass response experiment) to focus on the deformational response of the rock mass rather than on failure. These needed parameters are tied to the data needs of repository design through Table 8.3.1.15-1. The revised experiment description explains how the needed data will be obtained, and specifies that experiments will be conducted using techniques that have been demonstrated in other rock types. These techniques will be prototyped in G-Tunnel before measurements are made at Yucca Mountain during site characterization.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
125	588PP Q51	TBD

Description

Which activity in Table 8.3.1.15-1 is planned to investigate the effects of radiation on thermal and mechanical rock properties.

Documentation

SCP 8.3.1.15 (Overview of thermal and mechanical rock properties program: Description of thermal and mechanical rock properties required by the performance and design issues)
SCP 8.3.4.2.4.1.5 (Effects of radiation on water chemistry)

Approach for Closure

The current SCP does not contain plans to investigate radiation effects on thermal and mechanical rock properties. A scoping study is ongoing to evaluate the magnitude of the radiation effects on thermal and mechanical properties, and the need for testing. When the scoping study is completed, results will be reported in SCP Progress Reports and plans will be presented, if necessary.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
50	885AI 28	12/30/88

Description

Has DOE/OGR made a decision that the use of radioactive materials in the site characterization program will not be considered in the future?

Documentation

SCP 8.7.1 (Decontamination)
SCP 8.4.1.2 (Incorporation of 10 CFR 60 in the Development of the Site Characterization Program)
SCP 8.4.2.2.2 (Description of locations, operations and construction controls for surface based activities)
SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)

Approach for Closure

Current plans for surface based testing, and testing in the ESF do not include the use of radioactive materials, or introduction of radioactive tracers. Radioactive sensors and sources will be used in planned testing, such as borehole geophysical logging, but are designed to be fully contained and retrievable. Any plans to use radioactive materials or to introduce radioactive tracers at the site will be included in the SCP progress reports and will be subject to NRC review as specified by 10 CFR Part 60.18(e).

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NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
72	588PP C1	12/30/88

Description

The rationale for the specification of information needs does not appear to ensure completeness of those information needs. Furthermore, the integration of testing with design and performance assessment appears to be lacking.

Documentation

SCP 8.3 (Planned tests, analyses, and studies)
SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4: Are the technologies of repository construction, operation, closure, and decommissioning adequately established for the resolution of performance issues?)

Approach for Closure

The DOE approach to resolve this comment is to revise the SCP to respond to each point made by NRC in the basis section of the point paper. As suggested by the NRC, the DOE has revised some sections of the SCP to clarify the relationship between tests, design and performance. In general, it has been the intent of the DOE to conservatively design the test program so that the tests collect not only sufficient information as required by the performance allocation but also, as discussed in individual sections, data for providing confidence in constitutive and numerical models. These objectives are not evident from the tables of needed data but are described in the text. The performance allocations completed to date are preliminary and were done to guide the initial definition of the testing program. As noted in 8.2 and 8.3.1, the completeness of the information needs derived from the performance

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Approach for Closure (cont'd)

allocation will be continuously reevaluated throughout site characterization. Any changes to the identification of information needs, or to the test plans derived from them, will be documented in SCP Progress Reports.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
75	588PP C30	12/30/88

Description

The required integration of site specific subsurface information with repository design is not considered in this section (e.g., not even among the qualifying factors listed in the next to last paragraph on pg. 8.3.1.4-90.

Documentation

Section 8.3.1.4.3.1.1 (Systematic Drilling Program)

Approach for Closure

The DOE approach to resolve this comment is to modify the text of the SCP to better integrate acquisition of site specific subsurface information. Section 8.3.1.4.3.1.1 which describes the systematic drilling program has been extensively revised to incorporate the NRC recommendation. Geostatistical evaluations of data are discussed with added emphasis on representativeness of the data.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
105	588PP C103 12/30/88	

Description

The performance confirmation program has not been sufficiently well defined, and appropriate details are not included in the CDSCP. The discussion concerning confirmation, Issue 1.7 has not presented the strategy or a plan to meet the requirements set forth in Subpart F of 10 CFR 60.

Documentation

SCP Section 8.3.5.16 (Issue resolution strategy for Issue 1.7: Will the performance-confirmation program meet the requirement of 10 CFR 60.137?)
8.4.2.3.6.3 (Integration of the ESF with the Repository Design)
8.4.2.3.6.4 (Design Flexibility)

Luke, B.A., "Performance Confirmation Program Strategy and Guidelines," SAND88-2244, in review.

Approach for Closure

Section 8.3.5.16 has been modified to clearly indicate those experiments and monitoring activities that will begin during the site characterization phase and identifies this phase as the baseline phase for the performance confirmation program. The section also recognizes that one of the purposes of performance confirmation is to provide additional confidence in the validation of conceptual and numerical models of the site. The overall approach to performance confirmation is presented in more detail in Luke. However, the DOE's position is that a complete definition of the performance confirmation program is premature for the SCP. The regulations do not require a complete definition at this time and our technical understanding of the site is inadequate for a complete definition. The DOE anticipates that the performance confirmation program will evolve as site characterization proceeds. Changes in the plan will be presented in progress reports to the SCP. As discussed in Section 8.4.2.3.6.3, the underground testing area is intended to accommodate both site characterization and performance confirmation testing. The flexibility of the design to accommodate changes and additions is discussed in Section 8.4.2.3.6.4. As needs for performance confirmation testing are identified, the details that the NRC is requesting will be provided in progress reports and technical documents.

NRC/ESF CONCERN

Item No.		Reference Code	Expected Date
109	588PP Q17	12/30/88	

Description

What role, if any, will the data presented in Chapter 2 play in the proposed model development and in scoping the amount of planned site specific in situ testing?

Documentation

SCP 8.3.1.4.3 (Development of 3-D models of rock characteristics at the repository site)
SCP 8.3.1.1.5.1 (Studies to provide the required information for spatial distribution to thermal and mechanical properties)

Approach for Closure

Section 8.3.1.4.3 has been revised to reference Chapter 2, as suggested by the NRC. In addition, introductory material in Section 8.3.1.15.1 briefly outlines the use of data that have already been obtained by the NNWSI Project. In general, these data will be used primarily for planning future sampling requirements and for preliminary analyses and evaluation. The development of the 3D rock characteristics model will rely on data collected during site characterization.

Attachment 20

ESF ITEMS CONCERNING DESIGN AND CONSTRUCTION

BY

K. BEALL

J. ROBSON

D. STUCKER

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
7	483IR IIa	Completion of Title II Design

Description

Identify the acceptance criteria for construction of the exploratory shaft.

Documentation

Title II Specifications

Approach for Closure

Detailed acceptance criteria for shaft construction will be developed as the ESF Title II Design evolves. The acceptance criteria will be included in the Title II specifications.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
47	885AI 25	Title II Design and DOE acceptance of contractor submittals

Description

The design specifications and acceptance criteria for the shaft construction including construction controls, test blasting, and overbreak control will be provided to the NRC when available.

Documentation

Title II Specifications
DOE approved construction contractor procedures

Approach for Closure

The design specifications and acceptance criteria for shaft construction will be developed in Title II Design on the ESF. The construction controls will be included in the contractor procedures which must be approved by DOE.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
13	483IR IVa	Completion of Title II Design

Description

Describe test and inspection procedures to be used during excavation (e.g., plumbness of hole, rock mass disturbance etc.) to determine acceptability of the shaft as constructed.

Documentation

Title II Specifications

Approach for Closure

Testing and inspection procedures to determine the acceptability of the ESF shafts as constructed will be developed in Title II Design. The test and inspection procedures will include requirements for plumbness blasting to minimize rock mass disturbance, acceptance criteria, etc.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
14	483IR IVb	Completion of Title II Design and DOE acceptance of contractor submittals

Description

Describe test and inspection procedures to be used during shaft liner construction. Include information such as a grout injection rates, grout bond logs, thermal measurements of grout during curing, and liner instrumentation to be used.

Documentation

Title II Specifications
DOE approved construction contractor procedures

Approach for Closure

Test and inspection procedures for shaft liner construction will be developed during and after Title II design. The Title I design does not include grouting. If Title II design doesn't identify a need for grouting, then grout injection rates, grout bond logs, and thermal measurements of grout during coring will not be included in the specifications. Test and inspection instrumentation will be identified in the test and inspection procedures.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
16	483IR IVd	Completion of Title II Design and Title III Submittals

Description

Describe plans to document the above construction activities.

Documentation

Title II Specifications
Title III Reports

Approach for Closure

The DOE approach to document construction activities is to identify reporting and submittal requirements in the Title II specifications and in the general and special contract provisions. This documentation will be supplemented by other Title III reports prepared by the DOE or their designated representatives.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
61	487AI 2	After DOE HQ approval of letter report

Description

The DOE will provide the technical analysis supporting the proposed size of the exploratory drifts by June 1, 1987.

Documentation

Draft Letter Report titled "Proposed Alternative Configuration for the ESF Exploratory Drifts," Revision 2 Transmittal letter Skousen to Lahoti, dated 7/12/88, No. NN1.880712.0006.

Approach for Closure

The technical analysis supporting the proposed size of the exploratory drifts is documented in a Yucca Mountain Project Office letter report as cited above. The report discusses regulatory requirements related to drift size selection, proposed drift configurations, cross sections of minimum size drifts, rationale for defining minimum drift size, and flexibility for future requirements. When the DOE/HQ review of this letter report is complete, the document will be provided to the NRC.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
63	487AI 4	Completion of Title II

Description

The DOE committed to using the same construction control requirements in the second 12 ft. diameter shaft as in the first 12 ft. diameter shaft.

Documentation

Title II Design drawings and specification
DOE approved construction contractor procedures

Approach for Closure

DOE will develop the final construction controls for the two shafts during Title II design. It is anticipated that these controls will be the same. If the construction controls for the two shafts are different, the reasons for the differences will be documented.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
90	588PP C61	During Repository ACD

Description

Systematic studies or calculations may be needed to determine the heat moisture transfer from the rock to the ventilation air.

Documentation

SCP 6.4.10.2.6 (Design analysis)
SCP 8.3.2.4.1.2 (Air quality and ventilation)
SCP 8.3.2.5.7 (Information need 4.4.7: Design analyses, including those addressing impacts of surface conditions, rock characteristics, hydrology, and tectonic activity)

Approach for Closure

The DOE approach to resolution of this concern is to modify Section 8.3.2.4.1.2 to explicitly identify that heat and moisture transfer into the ventilation system should be evaluated as part of the ventilation system design.

The design already considers heat and moisture transfer in the ventilation system (6.4.10.2.6). In Section 8.3.2.5.7 ventilation analyses are discussed. Input to those analyses include heat and moisture transfer coefficients.

Section 8.3.1.15.1.8.4 describes an activity which will evaluate parameters and variables needed to confirm the input to the models for design of the repository underground facility ventilation systems. The activity has been revised to include the determination of the heat transfer coefficients for moisture and heat as part of the activity.

Attachment 21

ESF ITEMS CONCERNING MISCELLANEOUS ITEMS

BY

S. BROCOUM

M. BLANCHARD

M. FREI

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
26	885AI 4	TBD

Description

NRC position on the 1 part per 100,000 release limit as an instantaneous differential or an integral over a year.

Documentation

Approach for Closure

This information is not currently required by DOE. The DOE may elect to propose an interpretation of the release rate criterion.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
37	885AI 15	TBD

Description

The NRC is to furnish the DOE with the information as to whether NRC's 10exp-5/yr release rate applies on a discrete year by year basis or a continuous rate basis.

Documentation

Approach for Closure

See item 26.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
48	885AI 26	12/30/88

Description

The NRC will provide guidance on the key parameters that should be considered in determining the representativeness of the ESF.

Documentation

SCP 8.4.2.1.5 (Representativeness of planned tests)

Approach for Closure

The DOE approach to resolution of this item is to provide a proposed list of parameters in the SCP.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
65	487AI 6	10/88

Description

The NRC will review Attachment 7 and will notify the DOE by June 1, 1987 if the proposed response plan to close out open items is satisfactory.

Documentation

N/A

Approach for Closure

The DOE approach to close this item is to conduct this meeting proposing the approaches and schedules to close up items.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
60	487AI 1	

Description

The DOE will assemble the draft ESF Repository Interface Control Drawings in a manner that they can be released to NRC and the State by June 1, 1987.

Documentation

Drawings sent to NRC on 6/4/87
SDRD Rev. 5 sent to NRC on 9/26/88

Approach for Closure

This item was addressed through transmittal (6-4-87) of enclosure 1 (The ESF/repository interface control drawing [SNL drawing R07048A]).

R07048A has been superseded by R07048A/1 which is entitled "ESF-Repository Interface Control Drawing" and is contained in the SDRD.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
62	487AI 3	10/88

Description

The DOE committed to constructing exploratory drifts using controlled blasting techniques, but emphasized that this did not mean that DOE had agreed that Level I QA requirements will apply to controlled blasting in the drifts. The Department will evaluate the relevance of drift stability and damage control to retrievability and waste isolation considerations.

Documentation

SCP 8.6.4.2.2 (Preliminary Quality Activities List)
SCP 8.4.3.2.5 (Summary of potential impacts to the site from site characterization activities for current site conditions)
SCP 8.3.2.2 (Issue resolution strategy for Issue 1.11: Have the characteristics and configurations of the repository and repository engineering barriers have been adequately established?)
SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4: Are the technologies of repository construction, operation, closure and decommissioning adequately established?)
SCP-CDR

Approach for Closure

The DOE approach to closure of this item is to address the concern in the SCP and supporting references. A preliminary quality activities list, which includes controlled blasting has been developed and is included in Section 8.6.4.2.2. Section 8.4.3.2.5 describes analyses of the impacts of excavation induced damage on the site performance. Drift stability and excavation induced damage effects on retrievability are addressed in the SCP-CDR.

Activities described in Sections 8.3.2.2 and 8.3.2.5 describe design activities to refine the calculations on drift stability and excavation induced damage effects.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
64	487AI 5	

Description

The DOE committed to provide from files, if available, historic drawings depicting the initial repository elevation at the 1200 ft. horizon by June 1, 1987.

Documentation

Drawing sent NRC on 6/4/87

Approach for Closure

This item was addressed through transmittal (6-4-87) of historic drawings that depict the initial repository level at the 1200 ft. horizon (SNL drawings R06948, R06948/1 and R06949).

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
66	487AI 7	10/88

Description

The DOE provided the information requested in Attachment 6 to NRC and the State of Nevada on April 15, 1986. Copies are included with distribution of this summary.

Documentation

Provided at meeting April 14 and 15

Approach for Closure

The DOE approach to resolving this item was to provide a copy of Attachment 6 to the NRC with the meeting summary.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
43	885AI 21	10/88

Description

NRC requests that DOE identify the schedule for providing the items identified in DOE's response of June 7, 1985 as being under development.

Documentation

Letter on this subject

Approach for Closure

The DOE approach is to close this item on the basis of information provided at this meeting.

NRC/ESF CONCERN

Item No.	Reference Code	Expected Date
122	588PP Q48	12/30/88

Description

There are many apparent inconsistencies in the write-up of the proposed activities presented in this section when compared with the details given in other sections of the CDSCP and reference documents. What are the impacts of such inconsistencies?

Documentation

SCP 8.4 (Planned site characterization activities and potential performance impacts)

Approach for Closure

The DOE's approach to resolve this item is to substantially revise Section 8.4 to remove these inconsistencies

Attachment 22

TECHNICAL SPECIFICATION

(OUTLINE SPECIFICATION)

NO. FS-SP-0202

QA Level: II

TITLE: SHAFT SINKING, ES-1
DIVISION 2 - SITEWORK
SUBDIVISION - SITE PREPARATION

APPROVED BY *James B. McKenzie/ms* DATE AUG 1 1988

APPROVED BY *[signature]* DATE AUG 1 1988

APPROVED BY *Paul B Hale (OAR)* DATE AUG 1 1988

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Form LV-313 (3-88)

PART 1 - GENERAL

1.1 WORK INCLUDED

This work covered by this specification includes shaft excavation by drill and blast methods, temporary ground support, and testing support services.

1.2 REFERENCED PUBLICATIONS

The publications listed below form a part of this specification.

1.2.1 Federal Regulations

- 30 CFR 57 — Safety and Health Standards - Underground Metal and Nonmetal Mines
- 27 CFR — Chap. 1 Part 55, Commerce in Explosives
- 29 CFR 1926 — Part U, Blasting and Use of Explosives (OSHA)

1.2.2 U. S. Department of Interior - Bureau of Reclamation

- Construction Safety Standards

1.2.3 U. S. Department of Energy - Nevada Nuclear Waste Site Investigation

- ESF Project Q.A.P.P. 002 - Quality Assurance Program Plan
- DOE/NV/00410, Exploratory Shaft at Yucca Mountain - Safety and Health Program Plan

1.2.4 State of Nevada

- Title 46, Chapter 512, Health and Safety Standards for Open Pit and Underground Metal and Non-metal Mines, and Sand, Gravel and Crushed Stone Operations

1.2.5 State of California Administrative Code

- Title 8, Chapter 4, Subchapter 17 - Mine Safety Orders

1.2.6 American Conference of Governmental Industrial Hygienists (ACGIH)

- Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment

1.3 SYSTEM DESCRIPTION

The system specifies activities required for conventional shaft excavation, including:

- Blast Hole Drilling*
- Blasting*
- Muck Loading and Hoisting
- Temporary Ground Support
- Temporary Utilities
- Temporary Ventilation
- Temporary Communications
- Schedule
- Location
- Dimensions
- Permanent Ground Support
- Outfitting

*Requirements for blasthole drilling and blasting are further specified in FS-SP-0205, "Controlled Drilling and Blasting."

1.4 QUALITY ASSURANCE

The Quality Assurance Level Assignment for Shaft Sinking is II.

PART 2 - PRODUCTS

2.1 ALIGNMENT

- Survey Tolerances
- Excavation Centerline Tolerances

2.2 OVERBREAK AND UNDERBREAK

- Allowed Tolerances on Overexcavation and Underexcavation

PART 3 - EXECUTION

3.1 BLAST HOLE DRILLING

(Refer to FS-SP-0205, "Controlled Drilling and Blasting")

3.1.1 Equipment

- Subcontractors Option
- Minimize Drill Water Use

3.1.2 Hole Patterns

3.2 BLASTING

(Refer to FS-SP-0205, "Controlled Drilling and Blasting")

3.2.1 Patterns

3.2.2 Dust and Fume Control

3.2.3 Minimize Water Usage

3.2.4 Vibration Monitoring

3.3 SCALING AND TEMPORARY SUPPORT

3.3.1 Wet Down and Scale

3.3.2 Temporary Support

- o Rock Bolts (FS-SP-0208, "Rock Bolting")
- o Wire Mesh
- o Straps
- o Shotcrete (FS-SP-0307, "Shotcrete")

3.3.3 Minimizing Water Usage

3.4 EXCAVATION OF ES-1 SHAFT

3.4.1 Constraints on Excavation Sequence

A number of testing activities under the direction of the CONTRACTING OFFICER will be carried out concurrent with underground construction and which will require construction to stop for specified periods of time at particular locations. These constraints allow for the installation of test facilities to be time-phased with excavation in order to avoid loss of test data. The constraints imposed on an excavation sequence and schedule by the concurrent testing activities are to be determined.

Constraints related to DAS Alcoves: To be determined

Constraints Related to Monitoring Arrays: To be determined

Constraints Related to Tests: To be determined

Constraints Related to Groundwater Inflow Monitoring: The CONTRACTOR shall notify the CONTRACTING OFFICER immediately of any groundwater inflow during underground excavation.

3.5 TEST SUPPORT AFTER BLAST

3.5.1 Visual Inspection for Perched Water

3.5.2 Rock Matrix Hydrologic Test

3.5.3 Hydrochemistry Test

3.5.4 Chlorine 36 Test

3.6 MUCKING

3.6.1 Rubble Collection for Hydrochemistry Test

3.6.2 Loading

3.6.3 Hoisting

3.6.4 Dumping

3.7 TEMPORARY SERVICES

- o Compressed Air
- o Construction Water
- o Waterwaste Discharge
- o Ventilation
- o Electrical Power
- o Communications

3.8 TEST SUPPORT PRIOR TO LINING PLACEMENT

3.8.1 Before each pour:

- o Geologic Mapping
- o Location Markers

Attachment 23

TECHNICAL SPECIFICATION

(OUTLINE SPECIFICATION)

NO. FS-SP-0203

QA Level: II

TITLE: SHAFT SINKING, - ES-2
DIVISION 2 - SITEWORK
SUBDIVISION - SITE PREPARATION

APPROVED BY James B. McKenzie /ndz DATE AUG 1 1988

APPROVED BY T. W. Weyand DATE AUG 1 1988

APPROVED BY Paul B Hale (QAR) DATE AUG 1 1988

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Form LV-313 (3-88)

PART 1 - GENERAL

1.1 WORK INCLUDED

The work covered by this specification includes shaft excavation by drilling and blast methods, and temporary ground support.

1.2 REFERENCED PUBLICATIONS

The publications listed below form a part of this specification.

1.2.1 Federal Regulations

- 30 CFR 57 — Safety and Health Standards - Underground Metal and Nonmetal Mines
- 27 CFR — Chap. 1 Part 55, Commerce in Explosives
- 29 CFR 1926 — Part U, Blasting and Use of Explosives (OSHA)

1.2.2 U. S. Department of Interior - Bureau of Reclamation

- Construction Safety Standards

1.2.3 U. S. Department of Energy - Nevada Nuclear Waste Site Investigation

- ESF Project Q.A.P.P. 002 - Quality Assurance Program Plan
- DOE/NV/00410, Exploratory Shaft at Yucca Mountain - Safety and Health Program Plan

1.2.4 State of Nevada

- Title 46, Chapter 512, Health and Safety Standards for Open Pit and Underground Metal and Non-metal Mines, and Sand, Gravel and Crushed Stone Operations

1.2.5 State of California Administrative Code

- Title 8, Chapter 4, Subchapter 17 - Mine Safety Orders

1.2.6 American Conference of Governmental Industrial Hygienists (ACGIH)

- Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment

1.3 SYSTEM DESCRIPTION

The system specifies activities required for conventional shaft excavation, including:

- Blast Hole Drilling*
- Blasting*
- Muck Loading and Hoisting
- Temporary Ground Support
- Temporary Utilities
- Temporary Ventilation
- Temporary Communications
- Schedule
- Location
- Dimensions
- Permanent Ground Support
- Outfitting

*Requirements for blasthole drilling and blasting are further specified in FS-SP-0205, "Controlled Drilling and Blasting."

1.4 QUALITY ASSURANCE

The Quality Assurance Level Assignment for Shaft Sinking is II.

PART 2 - PRODUCTS

None

PART 3 - EXECUTION

3.1 ALIGNMENT

- o Survey Tolerances
- o Excavation Centerline Tolerances

3.2 OVERBREAK AND UNDERBREAK

- o Allowed Tolerances on Overexcavation and Underexcavation

3.3 BLAST HOLE DRILLING

(Refer to FS-SP-0205, "Controlled Drilling and Blasting")

3.3.1 Equipment

- o Subcontractors Option
- o Minimize Drill Water Use

3.3.2 Hole Patterns

3.4 BLASTING

(Refer to FS-SP-0205, "Controlled Drilling and Blasting")

3.4.1 Patterns

3.4.2 Dust and Fume Control

3.4.3 Minimize Water Usage

3.4.4 Vibration Monitoring

3.5 SCALING AND TEMPORARY SUPPORT

3.5.1 Wet Down and Scale

3.5.2 Temporary Support

- o Rock Bolts (FS-SP-0208, "Rock Bolting")
- o Wire Mesh
- o Straps
- o Shotcrete (FS-SP-0307, "Shotcrete")

3.5.3 Minimizing Water Usage

3.6 EXCAVATION OF ES-2 SHAFT

3.6.1 Constraints on Excavation Sequence

A number of testing activities under the direction of the CONTRACTING OFFICER may be carried out concurrent with underground construction and which may require construction to stop for specified periods of time at particular locations. These constraints allow for the installation of test facilities to be time-phased with excavation in order to avoid loss of test data. The constraints imposed on an excavation sequence and schedule by the concurrent testing activities are to be determined.

Constraints Related to Tests: To be determined

Constraints Related to Groundwater Inflow Monitoring: The CONTRACTOR shall notify the CONTRACTING OFFICER immediately of any groundwater inflow during underground excavation.

3.7 TEST SUPPORT AFTER BLAST

- o Visual Inspection for Perched Water
- o Geologic Mapping (if required)

3.8 MUCKING

3.8.1 Loading

3.8.2 Hoisting

3.8.3 Dumping

3.9 TEMPORARY SERVICES

- o Compressed Air
- o Construction Water
- o Waterwaste Discharge
- o Ventilation
- o Electrical Power
- o Communications

3.10 SHAFT CONCRETE LINING

(Refer to FS-SP-0308, "Shaft Liner Concrete")

Attachment 24

TECHNICAL SPECIFICATION
(OUTLINE SPECIFICATION)

NO. FS-SP-0205

QA Level: II

TITLE: CONTROLLED DRILLING AND BLASTING
DIVISION 2 - SITEWORK
SUBDIVISION - TUNNELING

APPROVED BY James B. McKenzie /mw DATE AUG 1 1988

APPROVED BY [signature] DATE AUG 1 1988

APPROVED BY Paul B Hale (OAR) DATE AUG 1 1988

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Form LV-313 (3-88)

PART 1 - GENERAL

1.1 WORK INCLUDED

This specification covers drilling and blasting operations for rock excavation in vertical shafts, shaft stations, and drifts.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Specification Number	Description
FS-SP-0202	Shaft Sinking, ES-1
FS-SP-0203	Shaft Sinking, ES-2
FS-SP-0204	Excavation for Stations, Drifts and Alcoves

1.3 REFERENCED PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

In the event of a conflict between this specification and a referenced publication, this specification shall take precedence.

1.3.1 Federal Regulations

27 CFR Chap 1 Part 55, Commerce in Explosives

29 CFR 1926 Part U, Blasting and Use of Explosives (OSHA)

30 CFR 57 Safety and Health Standards - Underground Metal and Nonmetal Mines

1.3.2 U.S. Dept. of the Interior - Bureau of Reclamation

Construction Safety Standards, Sec. 24

1.3.3 US DOE NNWSI

ESF Project Q.A.P.P. 002 (Latest Revision) - Quality Assurance Program Plan

DOE/NV/00410-77 Exploratory Shaft at Yucca Mountain - Safety and Health Program Plan

1.3.4 State of Nevada

Title 46, Chapter 512, Health and Safety Standards for Open Pit and Underground Metal and Nonmetal Mines, and Sand, Gravel and Crushed Stone Operations

1.3.5 State of California Administrative Code (CAC)

Title 8, Chapter 4, Subchapter 17 Mine Safety Orders

1.3.6 American Conference of Governmental Industrial Hygienists (ACGIH)

Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment

1.4 SYSTEM DESCRIPTION

All subsurface rock excavations which require explosives to expedite removal, shall employ controlled blasting methods to create designed shaft, station and drift spaces, to minimize disturbance to the rock remaining outside of the spaces and fragment the rock to be moved.

The smooth blasting technique of controlled blasting shall be employed as the drilling and blasting method as shown on the Construction Drawings for vertical shaft sinking and horizontal drifting. The "Line Drilling" controlled blasting technique shall be used in initiating shaft openings or other areas where precise opening dimensions are required.

Shots required to trim rock projections inside of the neat excavation line shall use the minimum amount of explosive required to remove the projection. Blasts of this type will be controlled in the same manner as all other blasting governed by this specification.

1.5 QUALITY ASSURANCE REQUIREMENTS

The Quality Assurance Program for this work shall be in accordance with the NNWSI Quality Assurance Program Plan QAPP-002, latest revision. Quality Assurance Level II has been assigned to this work by the DOE/WMPO. To assure that controlled blasting for the ESF will be performed in accordance with specified drilling and blasting procedures, restrictions and tolerances, a set of comprehensive quality control procedures for the drilling, blasting and excavation processes are required. In summary, these procedures shall describe:

1. The blasting/excavation Quality Control organization:
   - Titles
   - Responsibilities
   - Authorities
     - o Stop Work

- o Work Acceptance
- o Approval of Changes in Blasting Program

2. Quality Control inspection methods and procedures together with acceptance standards:
   - Blasthole location and drilling alignment
   - Methods of controlling charge density in holes and/or blasthole pattern
   - Water usage
   - Blast results
   - Dust control

3. Records that will be used to verify the application of Quality Control methods employed, the acceptability of the drilling and blasting methods used and the blasting results obtained.

1.6 SUBMITTALS

The following items shall be submitted, by the Subcontractor, in accordance with the Data Requirements List (DRL) following Section 3 of this specification. The DRL will indicate intent of each submittal, i.e., for approval or for record and required submittal periods or dates.

a. Chemical analysis of all blasting materials proposed for the job. The manufacturer's certified chemical analysis will be acceptable.

b. Chemical analysis of all drilling lubricants or fluids, other than water, used to assist blast hole drilling. The manufacturer's certified chemical analysis will be acceptable.

c. Credentials and resumes of Contractor's Drilling and Blasting Supervisor.

d. Contractor's Drilling and Blasting Plan.

e. Contractor's Individual Shot Plan.

f. Contractor's Daily Blasting Log.

g. Contractor's Blasting Vibration Monitoring Plan.

h. Contractor's Seismograph Tape Records of Each Blast's Peak Particle Velocities with the Blast Round Location, Number and Time of Blast Identified.

i. Blast Area Security Plan

1.7 DELIVERY, STORAGE AND HANDLING

The Contractor shall transport, handle, store, and use explosives in accordance with the provisions of 29 CFR 1926 Part U, "Blasting and the Use of Explosives," 27 CFR Chap 1, Part 55," " Commerce in Explosives", the Bureau of Reclamation, "Construction Safety Standards", Sec. 24 and 30 CFR 57, Subpart E, "Explosives"

The Contractor shall maintain an inventory record of storage and withdrawal of all explosives. This record shall be available to.the Contracting Officer, who shall be promptly notified of any loss or theft of explosives. The Contractor shall provide such reasonable and adequate protective facilities, as necessary, to prevent loss or theft of explosives. Storage of explosives and detonators outside of approved magazines is not permitted.

1.8 MEASUREMENTS AND PAYMENT

Payment for controlled blasting in drifts and shafts shall be included in the unit prices bid for the items for which the drilling and blasting operations are required. Additional allowances in the unit prices bid for the sinking and mining in rock sections may be made at the discretion of the Contracting Officer on account of changes indicated by test blast results where the class, nature, or condition of the material encountered mandates said changes.

1.9 Drilling and blasting shall be closely supervised by an experienced, well-qualified drilling and blasting supervisor. The Drilling and Blasting Supervisor shall have demonstrated experience and competency in conducting such operations, by having a minimum of 10 years experience, directly involved in performing blasting of structure foundations and/or underground excavations, including tunnels and shafts. In addition, at least 3 years of the total experience shall have been in a supervisory capacity where the individual has had full responsibility for directing and drilling and blasting operations of a project or projects utilizing controlled blasting techniques. A portion of the qualifying experience shall have been within the last 10 years.

PART 2 - PRODUCTS

2.1 EXPLOSIVE MATERIALS

Free running explosives are prohibited for use in the shaft.

A chemical analysis of all explosive materials proposed for use on the job is required to be submitted 30 days prior to proposed use date. The Contracting Officer shall approve or disapprove the material within 10 days of receipt. No blasting materials shall be used prior to the issuance of the Contracting Officer's written approval of their use. Approval for each lot or each individual shipment is required.

2.1.1 Explosives for Production Holes (Stoping Holes and Cut Holes) - Production Holes shall be charged with water gel explosive or other emulsion, with blast strength characteristics similar to "TOVEX 100" manufactured by DuPont.

2.1.2 Explosive for Perimeter Holes - Perimeter Holes shall be charged by string loading small-diameter cartridges of a low density water gel explosive, or other emulsion with strength characteristics similar to "TOVEX 90" manufactured by DuPont.

2.2 DETONATORS

2.2.1 Blasting Caps - Detonators shall be NONEL blasting caps, manufactured by Ensign-Bickford, or an approved equal. Caps shall be furnished in delay groups to fire in the sequences and timing internal shown on Contract Drawings. Other approved non-electric detonating systems may be used. An electric blasting cap may be used to initiate the non-electric detonating circuit.

2.2.2 Detonating Cord and Connectors - The detonating cord system shall be "PRIMACORD", manufactured by Ensign-Bickford, or an approved equal.

2.3 STEMMING MATERIAL

The stemming shall be granular or non-granular material as shown on the drawing (approximately 100 pounds/cubic foot when tamped). The stemming material shall not contain any particles larger than 1/4 inch in any direction.

PART 3 - EXECUTION

3.1 DRILLING AND BLASTING METHODS

The Contractor shall employ the controlled blasting methods identified on the construction drawings for all subsurface excavation. In smooth blasting, closely spaced holes are drilled along the excavation line, lightly loaded with string loaded charges, and fired after the main interior excavation charges have detonated. Line drilling uses a single row of closely spaced holes, not charged, along the excavation neatline. Main interior charges develop fractures between the line-drilled perimeter holes to form the excavated surface.

The Contractor shall take all steps necessary to ensure that no damage or unacceptable excavation of shaft, drift, or foundation occurs. The Contracting Officer, or his representative and the Mining Inspector, will inspect the excavation following each blast and cleanup cycle to determine acceptability. If a portion of a shaft, drift, or foundation is deemed unacceptable by the Contracting Officer or Mining Inspector due to blasting procedures, the Contractor shall plan an adjustment to his procedures to prevent any further damage. The revised shot plan shall be approved by the Contracting Officer, prior to the next detonation.

3.2 DRILLING AND BLASTING SAFETY

Drilling and blasting will be permitted only after adequate provision has been made for the protection of persons, the work, and public or private property.

The Contractor shall make every effort to prevent surface blasting fly rock damage to structures or injury to personnel. The Contractor shall be responsible for any damage or injury resulting from blasting. When necessary, as determined by the Contractor, blasting mats shall be used to protect adjacent property and installations.

The Contractor shall erect proper warning signs of adequate number and size that state that blasting operations are taking place in the area. The warning signs shall be clearly visible to all traffic entering the area. The Contractor shall establish and use a reliable audible blast-warning system, and use watchmen to ensure that all personnel in the area are properly warned and kept at a safe distance from each impending blast.

The Contractor shall submit a Blast Area Security Plan which includes pre-blast evacuation and shot guarding procedures.

3.3 MAPPING, MEASURING AND TESTING BY OTHERS

During the excavation of ES-1, the UDBR and MTL levels, scientific testing personnel will map and measure the rock fractures, in situ stresses and other parameters. The measurements will be available to the Contracting Officer for use in controlling blasting activity and performance. If these measurements indicate the creation of unacceptable conditions such as, but not limited to, excessive fracture dilation, creation of excessive new fracturing or creation of damaged zones beyond the pre-established limits, the Contracting Officer may direct modifications to the Contractor's blasting procedures.

The Contractor shall be responsible for determining that blasted areas are adequately prepared for the safe entrance of measurement and testing personnel, and that preparatory treatment of surfaces to be measured and mapped has been performed as specified in test support specifications.

3.4 VIBRATION MONITORING

In addition to visual damage inspections to be performed by the Mining Inspectors, the Contractor shall supply, install, and maintain a calibrated seismograph system. The seismograph system shall be suitable for use in measuring and recording velocity and include transducer channels. Operation, calibration and interpretation of seismograph records will be performed by the Mining Inspector. The system shall be installed in accordance with manufacturers' instructions and the transducers shall be placed by the Contractor at designated locations on the rock or structures, or both, as directed by the Contracting Officer. The monitoring of not less than two locations will be required of the Contractor during each blast. If concrete shaft lining is placed closer than 30 feet from the blast, the Contractor shall demonstrate through coring evidence, that vibration did not damage the concrete. The seismograph recording or seismogram shall be a real-time, direct-readout, permanent record of the vibration measurements. These records shall be made available to the Contracting Officer for analysis before the next shot is made.

A Blasting Vibration Monitoring Plan shall be submitted by the Contractor, for approval, at least 10 days prior to conducting the initial test blast program. Additional blasting vibration monitoring shall be conducted at the Contractor's expense if the pounds per delay is increased by more than 25 percent.

3.5 DRILLING AND BLASTING PROCEDURES

The specific drill and blast procedures and patterns, as specified herein, are to be used to prepare the Contractor's initial Blasting Plan and the Base Bid unit prices for pay items involving rock excavation.

3.5.1 Test Blast Program - Strict adherence to proven drilling and blasting practices shall be applied at the start of the work and progressive improvements in the excavation of the work will be expected as the result of test blast programs. The Contractor shall demonstrate the ability to maintain the specified tolerance as each new blasting plan is established. Test blasting programs shall be performed at the onset of blasting for Shaft ES-1 collar, the Topopah Springs Member at approximately the 100-foot level (L), and at the shaft breakouts occurring at the UDBR and MTL, in order to verify Contractor's blasting plans. The results of each test blast shall be approved by the Contracting Officer before continuing use of the test blast pattern and loading. The Contractor shall conduct additional test blast programs as necessary to accommodate any changing rock conditions and to assure that the shaft construction meets the requirements of this Specification.

In conjunction with the test blast program specified herein, the Contractor shall monitor the blasting vibrations during shaft excavations and lining to measure the actual peak particle velocity results of the test blast. If monitored blasting vibrations exceed the limits specified herein, the Contractor shall modify the blasting plan to ensure that the stated requirements are met.

The test blasting programs shall produce the following results:

a. Demonstrate that:

   1. The blasted round will break consistently 85% of the drilled depth in both shafts and drifts.

   2. The Peak Particle Velocities are held within the specified limits.

   3. The overbreak is held to a maximum of 6 inches.

   4. "Half-casts" of the perimeter holes are visible after the walls have been scaled where rock conditions permit.

b. Improved blasting and excavation practices.

c. Demonstrate that the blasting program proposed can be safely accomplished.

d. Demonstrate that the pounds of explosive or blasting agent detonated with each delay, does not produce peak particle velocities at the closest in place concrete, that exceed the allowable ppv mentioned in section 3.10.2.2.

3.5.2 Drilling Patterns - Initial drill patterns to be employed for smooth blasting of ES-1 shaft and horizontal drifts are shown in the Contract Drawings. The diameter of drill holes shall be a maximum of 1-7/8 inches. The maximum depth of drill holes for each blasting round shall not be greater than 10 feet in the shaft and 12 feet in drifts.

3.5.3 Hole Charging - Typical loading for blast round drillholes shall be as shown on the Contract Drawings and as specified in the following paragraphs.

3.5.3.1 Production Holes (Stoping and Cut Holes): Production holes shall be loaded and tamped to the charge density shown on Contract Drawings.

3.5.3.2 Perimeter Holes: Perimeter holes shall be loaded with light, string loaded charges, as shown on the Contract Drawings. Perimeter holes shall not be tamped, and they shall be loaded with a decoupled charge (the use of small diameter explosive cartridges with respect to the hole diameter, leaving an air cushion in the annulus space.)

3.5.3.3 Timing - Timed delays shall be used to stagger blasting in each round. Initial time delays to be employed are indicated on Contract Drawings. The initial Blasting Test Program results may determine a better delay sequence.

3.5.4 Stemming - Production holes shall be stemmed, if necessary, to prevent hole charges from being "sucked out" by the firing of holes detonated earlier in the delay sequence. Two feet of non-granular stemming is required in the perimeter. The stemming in perimeter holes shall be above the decoupled explosive charge. A means of preventing the stemming material from filling the annulus between the decoupled explosives and the hole wall shall be provided.

3.5.5 Fragmentation - It is the intent of this specification that the rock be adequately fragmented to allow effective muck loading to be accomplished. The acceptance criteria for drift fragmentation shall be that 90% (by volume) of all rock fragments resulting from a blast shall pass through a 12" x 12" grizzly.

3.6 DRILLING BLAST HOLES

Drill water use is to be limited to the minimum amount required for efficient blast hole drilling. A selected chemical tracer will be added to all of the water used in drilling so that it can be distinguished from water being used for other construction and testing activities or naturally occurring water. Unnecessary and uncontrolled use of water is prohibited. In areas that require dry drilling of blast holes, a dust collection system shall be used to keep airborne dust below threshold limits. In areas that require dry drilling of blast holes, a dust collection system shall be used to keep airborne dust below threshold limits.

The Contractor shall provide, to the Contracting Officer for approval, a chemical analysis of all drilling lubricants or other fluids to be used to assist the drilling operations.

3.7 DRILL HOLE ALIGNMENT

Drill Hole alignment shall conform to the Contract Drawings. Maximum allowable deviation from planned direction shall not exceed 1/2 inch per foot. Drill holes will be inspected for alignment by the Mining Inspectors prior to charging.

3.8 DUST AND FUME CONTROL

When drilling in rock or other dust-producing material, the dust shall be controlled within the limits specified in the ACGIH "Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment". The Contractor shall provide to the Contracting Officer for approval, a description of the dust collection equipment to be used.

3.9 DRILLING EQUIPMENT

A description of the drilling equipment also be provided for approval by the Contracting Officer.

3.10 DRILLING AND BLASTING QUALITY CONTROL

All drilling and blasting activities will be subject to inspection methods described in the "ESF Controlled Drilling and Blasting Quality Control Procedures". These procedures describe the Quality Control processes that the Mining Inspector will employ to assure that the drilling and blasting practices used meet the requirements of this specification. The following describes elements of the Quality Control procedures.

3.10.1 Field Inspection of Drilling and Blasting - Field inspection or the quality control evaluation of drilling and blasting practices and results will be performed by assigned Mining Inspectors, acting in behalf of DOE/WMPO. The Mining Inspectors will review and approve the Contractor's drilling and blasting documentation and observe all drilling and blasting results. Inspectors will advise the Contracting Officer of all areas of non-compliance and, when requested, consult and advise on corrective actions. In addition, Inspectors will observe the work place for unsafe working conditions and/or potential hazards and immediately advise the Contracting Officer. The above actions will be documented in Mine Inspector's daily Quality Control reports.

3.10.2 Acceptance Criteria

3.10.2.1 Visual Observations: The following visual observations shall be used by the Mining Inspectors to evaluate the effectiveness of the controlled blasting programs.

a. Success or failure to achieve advance of 85% of the drilled depth.

b. Muck fragmentation

c. Overbreak or underbreak Blast Hole Traces - Half casts of at least a portion of the drill hole traces, in horizontal and shaft excavations, in any round or lift, shall be visible in the final rock surface. These traces should be distributed uniformly after the scaling down of all loose and shattered rock. If, after a reasonable trial this half cast standard is unattainable, the Contracting Officer may direct an adjustment in the blasting pattern and charge density.

3.10.2.2 Seismograph Readings: Seismograph readings shall indicate that peak particle velocities are within specified limits of 5 ips in the lined shafts, and 10 ips in drifts. These limits, empirically developed, will be confirmed or adjusted as actual data is obtained from shaft and drift blasting in tuff, in order to achieve optimum results.

3.10.2.3 Drift Wall Smoothness: At the start of drifting at each test level, a smooth wall standard panel or area shall be established at a location designated by the Contracting Officer. This standard for wall smoothness in rock shal be established during the Contractor's drilling and blasting test program at that level. Routine drilling and blasting shall not proceed until a smooth wall standard is established and agreed upon with the Contracting Officer. The approved standard shall be marked off and protected during the drifting phases and shall be used to determine subsequent drilling and blasting of horizontal drifts. If the Contractor fails to comply with the established standard wall smoothness, as determined by the Contracting Officer, all drilling and blasting operations shall cease and a new drilling and blasting testing program shall be submitted and performed by the Contractor to meet the established smoothness standard.

3.10.2.4 Coring Tests: At the discretion of the Contracting Officer, cores shall be drilled at designated locations in rock and/or in-place concrete in accordance with approved specifications.

3.11 DRILLING AND BLASTING PLANS

3.11.1 Project Drilling and Blasting Plan - The Contractor shall submit to the Contracting Officer, for approval, an ESF Drilling and Blasting Plan. No drilling and blasting activity shall begin until the Drilling and Blasting Plan and the assignment of the drilling and blasting supervisor have been approved by the Contracting Officer.

The Contractor's Drilling and Blasting Plan shall include a complete summary of the proposed use, source, chemical composition, transportation, handling, and storage of explosives. The plan shall include the proposed activities for drilling and blasting to achieve the desired excavations, using controlled blasting techniques and the methods for the control of noise, dust, fly rock, airblast, and vibrations. The Plan shall provide data that demonstrates the adequacy of the Contractor's proposed efforts regarding the safety of structures and excavated surfaces, and the assurance that adequate rock conditions will be maintained.

The Drilling and Blasting Plan shall contain, but not be limited to, the following information:

- Drill hole pattern, hole depth and diameter
- Types of explosives to be used
- Size of cartridges
- Powder factor
- Hole loading configurations
- Delays (arrangement, type, brand and periods between delays)
- Stemming or decking details (if required)
- Blasting circuit details (machine brand, voltages, wire sizes, detonating cord, etc.)

- Rock type and conditions

- Safety procedures - step by step description of procedures for preventing the uncontrolled detonation of explosives, and prevention of injury or damage.

The blasting plan shall also indicate the safe distance of blasting from segments of already placed concrete lining.

Under normal circumstances, the liner will be no closer than 20 feet from the next blasting round.

Before the blasting plan is submitted and before blasting agents or explosives are used underground, a technical representative(s) of the manufacturer or supplier of the blasting agents, explosives, and initiating device shall be consulted and his recommendations reviewed for incorporation into the blasting plan. The technical representative(s) shall visit the site and inspect the blasting equipment to be used.

During the refinement procedures of blasting plans, the manufacturers or suppliers technical representative(s) shall observe the drill-blast patterns, and the results of trial blasts, and make recommendations. The technical representative's recommendations shall be considered in any adjustments to the blasting plan. All recommendations by the manufacturer's technical representatives shall be in writing.

Approval of the blasting plans, all blasting operations, blasting materials and the assigned blasting supervisor, by the Contracting Officer, shall not relieve the Contractor of his responsibility or liability for the safety of persons and property.

After an initial review by the Contracting Officer, the adequacy of the blasting plan shall be confirmed by a test blast program. Blasting plans shall be revised and resubmitted, for approval and record, prior to continuation of construction, based on satisfactory results of the test blast program. Review of blasting plans does not relieve the Contractor of the responsibility for minimizing the overbreak or for performing required corrective action, by modifying the blasting plan, if excessive overbreak or other undesirable conditions occur. A new blasting plan shall be submitted, for record, when conditions require alteration of the previous plan, to assure that shaft and drift construction meets the requirements of this Specification.

3.11.2 Individual Shot Drilling and Blasting Plan - In addition to the Drilling and Blasting Plan, a plan for each individual shot, signed by the Drilling and Blasting Supervisor, shall be submitted to the Contracting Officer so that the plan is received no less than 4 hours before each blast. The plans for individual shots shall include:

- Drilling patterns - number, location, inclination, diameter, and depth of drilled holes; amount, type, and distribution of blasting agent/explosive per hole
- the blasting material data
- powder factor
- time delays
- sequence of firing
- planned time of blast
- weight of explosives in place at any one time within the area to be excavated under this contract

In the event that rock conditions, discovered while drilling, dictate a change in an individual shot blasting plan, such changes shall be approved by the Contracting Officer before drill/blast/muck operations are allowed to proceed.

DATA REQUIREMENTS LIST

	DESCRIPTION	WHEN REQUIRED*	NUMBER OF COPIES REQUIRED	REFERENCE	REQUIRED FOR**
1.	Chemical Analysis of Blasting Materials	PS	TBD	1.6(a)	ACM
2.	Chemical Analysis of Drilling Lubricants	PS	TBD	1.6(b)	ACM
3.	Credentials and Resumes of Drilling and Blasting Supervisor	BU	TBD	1.6(c)	ACM
4.	Contractor's Drilling and Blasting Plan	BU	TBD	1.6(d)	ACM
5.	Contractor's Individual Shot Plan	BU	TBD	1.6(e)	ACM
6.	Contractor's Daily Blasting Log	AC	TBD	1.6(f)	ACM
7.	Contractor's Blasting-Vibration Monitoring Plan	BU	TBD	1.6(g)	ACM
8.	Contractor's Seismograph Tape Records	AC	TBD	1.6(h)	ACM
9.	Contractor's Blast Area Security Plan	BU	TBD	1.6(i)	ACM

* "AC" - AS COMPLETED
"BC" - BEFORE CONTRACT CAN BE AWARDED
"BU" - BEFORE USE (OF PROCEDURE OR BY PERSONNEL)
"BFR" - BEFORE FABRICATION RELEASE
"PS" - PRIOR TO SHIPMENT
"WS" - WITH SHIPMENT

** "ACM" - APPROVAL BY MANAGER
"INFO" - INFORMATION

FENIX & SCISSON, INC.	SHEET 15 OF 15	WBS NUMBER 1.2.6.6.0	DOCUMENT NO. FS-SP-0205	REV. 0

Form LV-315 (3-88)

Attachment 25

TECHNICAL SPECIFICATION

(OUTLINE SPECIFICATION)

NO. FS-SP-0301

QA Level: II

TITLE: FORMS, SHAFT LINER
DIVISION 5 - METALS
SUBDIVISION - STRUCTURAL STEEL

APPROVED BY *James B. McKenzie/[illegible]* DATE AUG 1 1988

APPROVED BY *[illegible signature]* DATE AUG 1 1988

APPROVED BY *Paul B Hale (DAR)* DATE AUG 1 1988

REVISION DESCRIPTION	SECT. OR PAGES	REV. BY	APPR. BY	REV. NO.	DATE

FENIX & SCISSON, INC.	SHEET OF	WBS NUMBER 1.2.6.4.1	DOCUMENT NO.	REV.

Form LV-313 (3-88)

PART 1 - GENERAL

1.1 WORK INCLUDED

The work under this specification includes furnishing all materials, equipment, tools and labor required to fabricate, paint and deliver a steel form for a concrete lined shaft.

1.2 REFERENCED PUBLICATIONS

The publications listed below form a part of this specification.

1.2.1 American Institute of Steel Construction (AISC)

- M011 Manual of Steel Construction, Eighth Edition
- S314 Structural Joints Using ASTM A325 or A490 Bolts
- M013 Detailing for Steel Construction

1.2.2 American Society for Testing and Materials (ASTM)

- A6 General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
- A36 Specification for Structural Steel
- A53 Standard Specification for Pipe, Steel, Black Hot-Dipped, Zinc Coated Welded and Seamless
- A325 High-Strength Bolts for Structural Steel Joints
- A490 Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
- A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- A563 Specification for Carbon and Alloy Steel Nuts
- F436 Specification for Hardened Steel Washer

1.2.3 American Welding Society (AWS)

- o D1.1 Structural Welding Code
- o A2.4 Symbols for Welding and Non-Destructive Testing

1.2.4 Steel Structures Printing Council (SSPC)

- o SSPC SP6 Commercial Blast Cleaning

1.3 SYSTEM DESCRIPTION

The shaft liner forms consist of a base ring, barrel structure and pour lip totaling up to 20 feet high for a 12 foot diameter shaft.

1.4 QUALITY ASSURANCE

1.4.1 The Quality Assurance Level Assignment for this fabrication is II.

1.4.2 The vendor shall have an approved quality assurance program describing specified work, including a description which identifies management controls related to the fabrication process, quality control and inspection requirements, material procurement procedures test procedures, and documentation.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Structural steel plates, shapes and bars shall conform to ASTM A36 Specification.

2.1.2 Structural tubing shall conform to ASTM A500 Grade B Specification.

2.1.3 High strength bolts shall conform to ASTM A325 Specification.

2.1.4 Carbon and alloy steel nuts shall conform to ASTM A563 Specification.

2.1.5 Hardened steel washers shall conform to ASTM F436 Specification, Vendor shall supply two washers per bolt.

2.1.6 Pipe shall conform to ASTM A53 Grade B Specification, pipe shall be black.

2.1.7 All material shall be new and clean.

2.1.8 Plate material shall be ordered to thickness and shall not be more than 0.01" less than nominal thickness.

2.2 EQUIPMENT

2.2.1 All welding equipment shall be in good condition and subject to inspection and approval by the QCR.

2.3 FABRICATION

2.3.1 Fabrication shall be in accordance with approved shop drawings, AISC Manual of Steel Construction, AWS Structural Welding Code - Steel, and this specification.

- Plates to be formed by rolling shall be cold rolled.
- No localized heating for forming will be permitted.
- The edges of all parts to be joined by welding shall be prepared by machining, grinding, flame cutting or combinations of these methods.
- All weld joints and the immediate area shall be mechanically or chemically cleaned of all foreign matter.
- Close fitup is required at points where fillet welds are applied.
- Welding shall be performed with 70 Ksi low hydrogen electrodes.
- All welding shall conform to AWS D1.1.

- All weld defects as specified herein and in the AWS D1.1 Structural Welding Code - Steel, Section 8.15 shall be repaired as specified in Section 3.7 of the AWS Code.

2.3.2 Inspection and testing of welds shall be in accordance with Chapter 6 of the AWS D1.1 Code.

- Inspection and testing shall be performed by the vendor.
- All welds shall be 100% visual and dimensionally inspected. Up to 50% of the welds shall also be magnetic particle or dye penetrant inspected as requested by the QCR.
- If stiffener rings are spliced by butt weld, this weld shall be full penetration, and 100% radiographically inspected.
- The weld inspector shall certify that the welds were inspected, repaired where required and reinspected and are free of specified defects.

2.3.3 Dimensional Inspection

- The vendor shall give proper notice and furnish all facilities necessary for inspection. This shall include personnel and equipment required. Any inspection may be witnessed by the QCR.
- Prior to fabrication, the vendor shall identify and measure the thickness of each plate. The thickness shall be measured at each corner and at the centerline on each edge. A record of each plate thickness shall be supplied to the QCR prior to fabrication. Plates 0.01" less than nominal thickness will not be accepted.
- For checking dimensional tolerances, the vendor shall completely erect the form. Acceptable tolerances shall be measured at 70° Fahrenheit (±10°), and are as follows:
  - At any point along the form axis, the radius shall not exceed 6 feet 1/4 inch, ± 1/4 inch.
  - Overall height ± 1/4"; bottom of base ring to top of top circumferential stiffener.
  - Spacing circumferential and vertical stiffeners ± 1/4".

- Plumbness: 1/2" measured centerline top of form to centerline bottom of base ring.

- Wall straightness ± 1/2" measured at any location on the circumference.

2.3.4 Mark each section of the form to assure erection at the site will be identical to shop erection.

2.3.5 Blast clean in accordance with SSPC SP6.

PART 3 - EXECUTION

Not Used

Attachment 26

TECHNICAL SPECIFICATION
(OUTLINE SPECIFICATION)

NO. FS-SP-0308

QA Level: II

TITLE: SHAFT LINER CONCRETE
DIVISION 3 - CONCRETE
SUBDIVISION - CAST IN PLACE CONCRETE

APPROVED BY H. Gleuser / rws DATE AUG 1 1988

APPROVED BY [illegible] DATE AUG 1 1988

APPROVED BY Paul B Hale (QAR) DATE AUG 1 1988

REVISION DESCRIPTION	SECT. OR PAGES	REV. BY	APPR. BY	REV. NO.	DATE

FENIX & SCISSON, INC.	SHEET OF	WBS NUMBER 1.2.6.4.1	DOCUMENT NO.	REV.

Form LV-313 (3-88)

SECTION 03XXX
SHAFT LINER CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

The work of this section includes the supply of all labor, plant and materials and the performance of all work necessary for supplying and placing concrete in the shafts and subsurface, as shown on the Contract Drawings, and as specified.

1.2 REFERENCED PUBLICATIONS

The publications listed below form a part of this specification.

1.2.1 American Concrete Institute (ACI)

- 214 Evaluation of Strength Test Results of Concrete
- 301 Specification for Structural Concrete for Buildings
- 315 Details and Detailing of Concrete Reinforcement
- 318 Building Code Requirements for Reinforced Concrete
- 347 Concrete Formwork
- 305 Hot Weathering Concreting
- 306 Cold Weathering Concreting

1.2.2 American Society for Testing and Materials (ASTM)

- A97 Steel Welded Wire Fabric, Deformed for Concrete Reinforcement
- A185 Steel Welded Wire Fabric, Plain, for Concrete Placement
- A615 Deformed and Plain Billet-Steel Bars for Concrete
- A775 Epoxy-coated Reinforcing Steel Bars
- C31 Making and Curing Concrete Test Specimens in the Field
- C33 Concrete Aggregates

- o C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- o C40 Organic Impurities in Fine Aggregates for Concrete
- o C87 Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
- o C88 Soundness of Aggregates by User of Sodium Sulfate or Magnesium Sulfate
- o C94 Ready-Mixed Concrete
- o C125 Standard Definitions of Terms Relating to Concrete and Concrete Aggregates
- o C127 Specific Gravity and Absorption of Coarse Aggregate
- o C128 Specific Gravity and Absorption of Fine Aggregate
- o C131 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- o C136 Sieve Analysis of Fine and Coarse Aggregates
- o C138 Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
- o C143 Slump of Portland Cement Concrete
- o C150 Standard Specification for Portland Cement
- o C156 Water Retention by Concrete Curing-Materials
- o C171 Sheet Materials for Curing Concrete
- o C172 Sampling Freshly Mixed Concrete
- o C260 Air-Entraining Admixtures for Concrete
- o C231 Air Content of Freshly Mixed Concrete by the Pressure Method
- o C311 Standard Methods of Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete

- o C496 Chemical Admixtures for Concrete
- o D75 Sampling Aggregates
- o D512 Chloride Ion in Water and Waste Water
- o D1293 Standard Test Methods for pH of Water
- o D1888 Particulate and Dissolved Matter, Solids or Residue in Water

1.2.3 American Welding Society (AWS)

- o D1.4 Structural Welding Code-Reinforcing Steel

1.3 SYSTEM DESCRIPTION

Set formwork, place and cure concrete for the shaft liner to provide support for the shaft excavation and anchorage for shaft furnishings. Where required, blockouts will be placed to allow access to shaft instrumentation holes.

1.4 QUALITY ASSURANCE

1.4.1 The Quality Assurance Level Assignment for Shaft Liner concrete is II.

1.4.2 The supplier shall have an approved Quality Assurance program.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Portland Cement

Shall conform to the requirements of ASTM C150

2.1.2. Aggregates

Shall conform to requirements of ASTM C33

2.1.3 Air-Entraining Admixtures

Shall conform to requirements of ASTM C260

2.1.4 Chemical Admixtures

Shall conform to requirements of ASTM C496

2.1.5 Reinforcement

Provide reinforcing bars and welded steel fabric reinforcement conforming to ASTM A615 and A97 and in accordance with the applicable drawings.

2.2 MIXES

Furnish mix proportions to obtain concrete of 5,000 psi 28-day compressive strength when tested according to ASTM C39.

PART 3 - EXECUTION

3.1 MIXING

Begin mixing within 30 minutes after cement has been added to the aggregates.

3.2 PLACING

Transport concrete from the mixer to the forms as rapidly as practical without causing segregation or loss of ingredients.

3.3 FORMWORK

Forms will be placed to tolerance as shown on the Contract Drawings.

3.4 PLACING

Method of placement into the forms shall not cause segregation of the ingredients.

3.5 SAMPLING

Obtain samples at point of discharge into the forms to perform slump tests and to form test cylinders for testing in an approved materials-testing laboratory.

3.6 VIBRATING

Vibrate the newly-placed concrete in the forms for no longer than necessary to achieve consolidation.

3.7 CURING

Allow concrete to cure for a minimum period of 48 hours after placement before removing forms. (This may be modified by the Contracting Officer based on a Pre-Construction Test Program).

3.8 TESTING

Frequency of obtaining concrete samples for testing shall be at the direction of the CONTRACTING OFFICER.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING ATTACHMENT 27

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
1.	Provide an analysis of the potential effects of construction of the exploratory shaft on long-term sealing capabilities of the rock mass and identify factors that determine the nature and extent of such effects.	483IR Ia	Merged	Merged with Item 71.
2.	Describe how the selected excavation technique and shaft design accounts for limitations and uncertainties in long term sealing considerations.	483IR Ib	Open	Pending NRC review of SCP.
3.	Provide design specifications for the shaft construction and show how they deal with the factors affecting sealing.	483IR Ic	Open	Pending NRC review of SCP.
4.	Describe the seal design and materials.	483IR Id	Open	Pending NRC review of SCP.
5.	Discuss the selected locations of any planned explorations or testing to be performed along the length of the shaft. Include discussion of data on sealing characteristics to be gathered and the limitations and uncertainties associated with the data.	483IR Ie	Open	Pending NRC review of SCP.
6.	Provide drilling history and results of geotechnical testing from the principal borehole, G-4.	483IR If	Closed	Item closed prior to this meeting.
7.	Identify the acceptance criteria for construction of the exploratory shaft.	483IR IIa	Open	Pending NRC review of SCP and Title I specifications.
8.	Identify procedures used to minimize damage to the rock mass penetrated.	483IR IIb	Open	Pending NRC review of SCP.
9.	Identify liner construction and placement technique. Include such information as: liner type, liner material testing and placement of liner. This information needs to be fully considered in application of any permanent sealing program.	483IR IIc	Open	Pending NRC review of the SCP. A copy of the liner construction specifications was provided to the NRC on-site representative during the 100% ESF Title I technical assessment review.
10.	Describe how the seals are expected to perform in sealing the exploratory shaft. Describe tests done, both laboratory and field, to determine their long-term durability and their compatibility, both chemical and physical, to the host rock environment.	483IR IIIa	Merged	Merged with Item 4.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
11.	Describe the placement methods.	4831R IIIb	Merged	Merged with Item 4.
12.	Describe remedial methods to be used if sealing methods are not adequate.	4831R IIIc	Open	Pending NRC review of SCP.
13.	Describe test and inspection procedures to be used during excavation (e.g., plumbness of hole, rock mass disturbance etc.) to determine acceptability of the shaft as constructed.	4831R IVa	Open	Pending NRC review of SCP and Title I specifications.
14.	Describe test and inspection procedures to be used during shaft liner construction. Include information such as grout injection rates, grout bond logs, thermal measurements of grout during curing, and liner instrumentation to be used.	4831R IVb	Open	Pending NRC review of SCP and Title I specifications. Second sentence is closed. (Primarily intended for BWIP)
15.	Describe test and inspection procedures to be used after sealing of the shaft to assess the results of the sealing effort in controlling adverse effects. Include information such as grout strength tests, visual identification of seal conditions, records of water inflow, assessment of seal bond to hot rock, and logging of drill holes.	4831R IVc	Open	Pending NRC review of SCP. Second sentence is closed. (Primarily intended for BWIP)
16.	Describe plans to document the above construction activities.	4831R IVd	Open	Pending NRC review of SCP and Title I specifications.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
17.	Describe test plans and procedures used to obtain adequate data on site characteristics that can be measured either directly or indirectly during construction of the exploratory shaft. For example: o Geologic mapping and rock mass characterization of the shaft walls o Measurements of rates and quantities of groundwater inflow and collection of groundwater samples for testing o Measurements of overbreakage during blasting o Rock mechanics testing of samples obtained during drill and blast operations	483IR Va	Open	Pending NRC review of SCP and related study plans.
18.	Identify the line of responsibility for implementing QA procedures down to and including the Construction Contractor (10 CFR 50 Appendix B. Criteria I requires that "organizations performing quality assurance functions shall report to a management level such that this required authority and organizational freedom including sufficient independence from cost and schedule when opposed to safety consideration, are provided.") Identify the procedures to be used by the Quality Assurance organization for implementing and monitoring the QA program for exploratory shaft design, construction and testing.	483IR VIa	Closed	Item closed prior to this meeting.
19.	Provide a schedule for completion of ES Construction and testing QA procedures.	1185IR VIb1	Merged	Merged with Item 68.
20.	Provide basis for assignment of quality level to the ES construction.	1185IR VIb2	Merged	Merged with Item 68.
21.	Provide basis for assignment of quality level to data collection during construction.	1185IR VIb3	Merged	Merged with Item 68.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
22.	Provide basis for assignment of quality level to the dewatering system.	1185IR VIb4	Merged	Merged with Item 68.
23.	DOE would like copies of Ted Johnson's analysis that indicated the 1/2" runoff from the E. S. Drainage Area could result in a 4 order of magnitude increase of water into the ES over the SNL 500 year flood scenario.	885AI 1	Closed	Item closed prior to this meeting.
24.	DOE would like a copy of the report on in situ stress measurement at NTC referenced by David Canover.	885AI 2	Closed	Item closed prior to this meeting.
25.	DOE would like specific details on the areas of landslides at Yucca Mountain referenced by John Trapp.	885AI 3	Closed	Item closed prior to this meeting.
26.	NRC position on the 1 part per 100,000 release limit as an instantaneous differential or an integral over a year.	885AI 4	Closed	Information no longer needed by DOE.
27.	Need to establish an authoritative set of references on the subject of rock damage around openings in the earth.	885AI 5	Closed	Item closed prior to this meeting.
28.	Need to establish a common approach to evaluating the magnitude of the damage around openings.	885AI 6	Closed	With only one site, instead of three, a common approach is no longer relevant.
29.	Need to establish the properties of characteristics that can be used in the evaluation of "representatitiveness." A method for analyzing the data also needs to be established.	885AI 7	Open	Pending NRC review of SCP.
30.	Need to structure the open items in a manner that will allow the April 1983 NRC Letter (Coplan to Vieth) to be closed out.	885AI 8	Closed	Item closed prior to this meeting.
31.	NRC final comments on the Draft Performance Assessment on the Exploratory Shaft.	885AI 9	Closed	Item closed prior to this meeting.
32.	Need to review section 60.21(c) to determine NRC's expectations regarding the information of fracture characteristics to be obtained from the exploratory shaft.	885AI 10	Closed	Closed based on information provided in letter from D. Vieth to J. Linehan, dated 12/26/86, with the agreement stated in this meeting that faults and fractures may be important to waste isolation.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
33.	NRC staff concerned about the fact that the second exploratory shaft was located outside of the preferred area, needs to more thoroughly explain logic as to why this is a significant point. Is it an issue related to validity of testing data or radiological health and safety?	885AI 11	Closed	Item closed prior to this meeting.
34.	During the DOE presentation on the rationale for selection of the site for the exploratory shaft, the DOE stated that the site chosen is representative of the repository block but indicated that discussion of the question of representativeness would be deferred. The NRC staff agrees that this should be an agenda item for a future meeting.	885AI 12	Open	Pending NRC review of SCP.
35.	The DOE will provide to the NRC the Keystone Document 6310/85/1, Recommended Matrix and Rock Mass Bulk, Mechanical, and Thermal Properties for Thermomechanical Stratigraphy of Yucca Mountain, version 1, October, 1984, related to selection of the repository horizon.	885AI 13	Closed	Item closed prior to this meeting.
36.	The DOE delineated the underground layout of the exploratory shaft and drifts and stated that underground testing considerations heavily influenced the layout. The NRC cannot assess the adequacy of the planned tests and hence the testing layout until the test plans are provided prior to the NNWSI/NRC ESTP meeting.	885AI 14	Open	Pending NRC review of SCP.
37.	The NRC is to furnish the DOE with the information as to whether NRC's 10^{-5}/ yr release rate applies on discrete year by year basis or a continuous rate basis.	885AI 15	Closed	Information no longer needed by DOE.
38.	The DOE will furnish the NRC with the document which contains recent information on thickness of the Calico Hills.	885AI 16	Closed	Item closed prior to this meeting.
39.	The DOE will send the NRC copies of the viewgraphs used in the DOE's presentation of the damaged zone model for tuff.	885AI 17	Closed	Item closed prior to this meeting.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
40.	The DOE will provide the NRC with the data (e.g., RQD's, stresses, hydraulic conductivities) used to get the results presented during the DOE presentation on damaged zone model for tuff.	885AI 18	Closed	Item closed prior to this meeting.
41.	The NRC will provide the DOE with the U.S. Bureau of Mines reference related to horizontal stress of southern Nevada rocks.	885AI 19	Closed	Item closed prior to this meeting.
42.	DOE will provide NRC with information relating to testing performed in or on samples obtained from USW G-4 in addition to that presented in USGS-OFR-84-789.	885AI 20	Closed	Item closed prior to this meeting.
43.	NRC requests that DOE identify the schedule for providing the items identified in DOE's response of June 7, 1985 as being under development.	885AI 21	Closed	Item no longer relevant.
44.	A decision (and the implications of such a decision) on whether the DOE will remove the liner at permanent closure or use it as part of the long term sealing system has not been determined.	885AI 22	Open	Pending NRC review of SCP.
45.	A discussion of sealing materials and placement method and timing for exploratory boreholes from the ES will be provided in a future meeting on repository design.	885AI 23	Open	Pending NRC review of SCP.
46.	The testing program to characterize perched water zones will be discussed at the ESTP meeting.	885AI 24	Open	Pending NRC review of SCP.
47.	The design specifications and acceptance criteria for the shaft construction including construction controls, test blasting, and overbreak control will be provided to the NRC when available.	885AI 25	Open	Pending NRC review of SCP and Title I Specifications.
48.	The NRC will provide guidance on the key parameters that should be considered in determining the representativeness of the ESF.	885AI 26	Closed	Information no longer needed by DOE.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
49.	DOE's plans on the characterization of lithophysal zones and on plans for demonstrating horizontal emplacement and exploration holes will be discussed in a future meeting on repository design.	885AI 27	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
50.	Has DOE/OGR made a decision that the use of radioactive materials in the site characterization program will not be considered in the future?	885AI 28	Closed	DOE does not plan to use radioactive material during site characterization.
51.	Demonstrate that flooding and erosion do not adversely affect long term repository performance (incorporate shaft location changes into performance analysis).	487IR Ia	Merged	Merged with item 71.
52.	Provide reasonable assurance that shafts are adequately separated so that testing in one does not adversely affect ability to obtain required data in the other shaft and adjacent test areas.	487IR Ib	Merged	Merged with item 70.
53.	Adopt adequate drift construction controls to meet 10 CFR 60 pre/post-closure performance requirements.	487IR IIIa	Closed	Item closed prior to this meeting.
54.	Discuss recognition of possible need for remedial measures to maintain postclosure isolation capabilities due to penetration of targeted geological/hydrological structures.	487IR IIIb	Open	Pending NRC review of SCP. Closure to be contingent on closure if Item 71.
55.	Provide assurance that planned drift length and directions are adequate for characterizing each of the targeted fault zones.	487IR IIIc	Closed	Item closed prior to this meeting.
56.	Describe the measures to be taken to avoid interference with testing by drifting operations.	487IR IV	Merged	Merged with item 70.
57.	Modify performance analysis to reflect increase in size of ES-2 to 12 feet.	487IR Va	Merged	Merged with Item 71.
58.	Describe how construction methods minimize shaft wall damage.	487IR Vb	Merged	Merged with Item 8.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
59.	Demonstrate that there will be minimal interference with testing from underground construction activities. In particular, address the potential for: o movement of construction fluids through fractures from ES-2 to ES-1 test areas o damage to test instruments from blasting vibrations.	487IR Vc	Merged	Merged with Item 70.
60.	The DOE will assemble the draft ESF-Repository Interface Control Drawings in a manner that they can be released to NRC and the State by June 1, 1987.	487AI 1	Closed	Information transmitted to NRC on 6/4/87 and 9/26/88.
61.	The DOE will provide the technical analysis supporting the proposed size of the exploratory drifts by June 1, 1987.	487AI 2	Open	Pending NRC review of the DOE letter report.
62.	The DOE committed to constructing exploratory drifts using controlled blasting techniques, but emphasized that this did not mean that DOE had agreed that Level I QA requirements will apply to controlled blasting in the drifts. The Department will evaluate the relevance of drift stability and damage control to retrievability and waste isolation considerations.	487AI 3	Closed	NRC agrees with first part of approach (controlled blasting for drifts). Information request on QA levels is merged with Item 68.
63.	The DOE committed to using the same construction control requirements in the second 12 ft. diameter shaft as in the first 12 ft. diameter shaft.	487AI 4	Closed	NRC agrees with the DOE approach, which conforms with recommendation in the open item.
64.	The DOE committed to provide from files, if available, historic drawings depicting the initial repository elevation at the 1200 ft. horizon by June 1, 1987.	487AI 5	Closed	DOE provided information on 6/4/87.
65.	The NRC will review attachment 7 and will notify the DOE by June 1, 1987 if the proposed response plan to close out open items is satisfactory.	487AI 6	Closed	Item no longer relevant.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
66.	The DOE provided the information requested in Attachment 6 to NRC and the State of Nevada on April 15, 1986. Copies are included with distribution of this summary.	487AI 7	Closed	DOE provided information at 4/14-15 meeting.
67.	DOE should demonstrate that it has in place and is implementing an overall systematic design and approval process for the ESF that (i) considers 10 CFR 60 requirements including those for QA, (ii) recognizes uncertainties associated with site characterization activities, (iii) recognizes the need for feedback and interaction among participants responsible for design, scientific tests, performance assessment, construction and operation, and (iv) considers operational impacts on tests and space requirements to avoid test interferences.	588AI 1	Open	Pending DOE providing NRC with further evidence (documentation) that it has an adequate design control process in place.
68.	DOE should provide justification for assigning quality levels II and III to practically all activities for which specifications were handed out to F&S during the 50 % Title I design review of the ESF.	588AI 2	Open	Pending DOE providing NRC with further evidence (documentation) that it has an adequate design control process in place.
69.	The NRC staff considers that the need for extending the Exploratory shaft 1 (ES-1) approximately 400 ft below the repository horizon into the zeolitic zone of the Calico Hills unit has not been established in the CDSCP nor has the need been established for tests requiring drifting (horizontal excavation) through the Calico Hills unit. It has not been demonstrated that the proposed shaft (ES-1) penetration into the Calico Hills unit (an important barrier between the repository horizon and the underlying groundwater table) or the proposed drifting through it will not have potential adverse impacts on the waste isolation capability of the site.	588PP 02	Closed	NRC agrees with the DOE approach presented at the meeting. (See Attachment 15)

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
70.	The CDSCP does not include sufficient and consistent conceptual design information on the proposed ESF. This does not allow the evaluation of the potential interference of proposed investigations with each other and the interference of construction operations in the two shafts and long drifts with these investigations.	588PP 03	Open	NRC sees no general flaws with the approach for closure presented at the meeting. (See Attachment 15), but would require further evaluation and review of the SCP.
71.	The CDSCP does not sufficiently consider the potentially adverse impacts resulting from the proposed locations of ES-1, ES-2, other shafts and ramp portals in areas which may be susceptible to surface water infiltration, sheet flow, and lateral and vertical erosion (Refs. 1 and 2). For the proposed locations, there is a possibility of (a) potentially significant and unmitigable long-term adverse impacts on the waste isolation capability of the site and/or (b) affecting the ability to adequately characterize the site.	588PP 04	Open	NRC sees no general flaws with the approach for closure presented at the meeting. (See Attachment 15), but would require further evaluation and review of the SCP.
72.	The rationale for the specification of information needs does not appear to ensure completeness of those information needs. Furthermore, the integration of testing with design and performance assessment appears to be lacking.	588PP C1	Open	Pending NRC review of SCP.
73.	The CDSCP (Section 8.4.1.1 states that current plans call for drilling approximately 300 to 350 shallow holes (50 to 150 ft. deep), and 45 to 80 exploratory holes (presumably deep). Several trenches are also planned to be excavated for site characterization. In addition, Section 8.4.2.5.1 includes a summary of proposed numerous activities that would involve drilling from or very close to ES-1. The individual, the cumulative and the synergistic effects of these holes have not been considered in the evaluation of the potential impacts of exploratory shaft construction and testing on the waste isolation integrity of the site (Section 8.4.2.6, and supporting references, in particular Fernandez et al., 1987; Case and Kelsall, 1987).	588PP C27	Open	Pending NRC review of SCP.

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
74.	CDSCP's approach to characterizing the complex three-dimensional nature of fracture systems in the repository block appears to rely on fractal analysis of outcrop exposures and geologic mapping of ES-1, drifts and boreholes (excluding floors and working faces). Also the CDSCP limits the objectives of fracture network studies to providing fracture analyses to supporting hydrologic modeling. The approach and objective to characterization described in the CDSCP may not lead to sufficient descriptions of the fracture networks.	588PP C29	Open	Pending NRC review of SCP.
75.	The required integration of site-specific subsurface information with repository design is not considered in this section (e.g., not even among the qualifying factors listed in the next to last paragraph on pg. 8.3.1.4-90.	588PP C30	Open	Pending NRC review of SCP.
76.	This table, which summarizes the requests for thermal and mechanical rock properties, appears to be far from complete.	588PP C42	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
77.	Section 8.3.1.15 does not present a clear testing rationale. Thermal and mechanical properties to be determined are not related to specific individual tests.	588PP C43	Open	Pending NRC review of SCP.
78.	The testing program laid out in Section 8.3.1.15 is deficient in several respects. In some cases, important information that could be gained in testing is not identified. Also, some proposed tests are ill-defined, and others may not be able to provide required information.	588PP C44	Open	Pending NRC review of SCP.

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
79.	The discussion and use of statistics in this chapter is not clear. A statistical approach has been suggested to determine numbers of tests required to determine various rock properties, but the approach suggested is confusing and apparently overlooks several considerations that should be factors into such an approach. Also, needed confidences of "low," "medium," or "high" have been assigned without explaining the basis for such assignments. Bases for assigning the needed confidence of low, medium or high are not discussed.	588PP C45	Open	Pending NRC review of SCP.
80.	In order to examine the margin of safety engineered into the stability of emplacement holes from the standpoint of retrievability, the canister-scale heater experiment needs to be run beyond the average design heat load. The CDSCP does not include provisions for such testing. Also, no mention is made of testing of lined versus unlined holes, backfilled holes, etc.	588PP C46	Open	Pending NRC review of SCP.
81.	This experiment is one of the more important rock mechanics experiments proposed; yet, virtually no detail is given regarding it. There seems to be a lack of integration between this experiment and the modeling activities and design.	588PP C47	Open	Pending NRC review of SCP.
82.	Plate-load tests do not necessarily provide a means of determining in-situ (i.e., undisturbed) rock mass deformational properties. Data obtained from such tests may be useful in assessing spatial variability, effects of different excavation procedures, etc. as part of the overall program to characterize deformational relations of the rock mass adjacent to underground openings but may not be useful in thermomechanical calculations.	588PP C48	Open	Pending NRC review of SCP.

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
83.	CDSCP has limited its consideration of how jointed tuff can be treated to equivalent continuum models. Although several possible models are described in Chapter 2 (pp. 2-19 and -20), representation of jointed tuff by equivalent continuum models only and disregarding of other models such as quasi-discrete or distinct element models has not been justified.	588PP C54	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
84.	Geomechanical analyses do not consider the effects of emplaced support components or the effect of elevated temperature on the support system components.	588PP C55	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
85.	The first section of the next to last paragraph on pg. 8.3.2.2-55 expresses the anticipation that contingency measures might strongly emphasize constructibility based on semi-empirical rock mass classifications. These classifications bear no direct relation to the primary long-term repository performance requirements of containment and isolation. It is not clear, therefore, whether the selected criteria are appropriate for guiding emplacement decisions, and, specifically to perform system performance studies for off-normal conditions, as proposed in the first sentence of the last paragraph on pg. 8.3.2.2-55.	588PP C56	Open	Pending NRC review of SCP.
86.	The CDSCP states that the potential for the development of new paths to the accessible environment or for an extension of the disturbed zone will be mitigated by backfilling the emplacement drifts. Given the proposed loose backfill and only partial filling of the drifts, this effect may be quite limited.	588PP C57	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
87.	The proposed wedge analysis and key block analysis are not capable of including the effects of thermal loading or stress gradient on the host rock.	588PP C58	Removed	Removed from ESF open items list since it is not explicitly an ESF item.

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
88.	The description of far field analysis in the CDSCP does not address potential for thermally induced movement along faults or fractures.	588PP C59	Open	Pending NRC review of SCP.
89.	The comment that "... drifts will not be relied on to be open. They may have caved or settled on the backfill" raises concerns because it is formulated as a very broad option.	588PP C60	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
90.	Systematic studies or calculations may be needed to determine the heat moisture transfer from the rock to the ventilation air.	588PP C61	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
91.	The last tentative goal on pg. 8.3.2.5-21 indicates that high confidence is needed that ES-1 shafts will terminate no less than 150 m above ground-water table. It does not appear that this goal is reached under the present ES-1 design.	588PP C63	Open	Pending NRC review of SCP.
92.	The CDSCP does not include details of the in situ testing of the proposed seal design concepts. This information is necessary to evaluate the effects of seal testing activities on the ability of the site to meet the performance objectives (10 CFR 60.112 and 10 CFR 60.113). In addition, the CDSCP states that in situ testing to evaluate seal components and placement methods would not start until after the submission of License Application. In view of the uniqueness of the proposed seal design concepts and the associated uncertainties with the long-term performance of the seals, the NRC staff considers that the proposed start date of in situ testing for evaluation of seal components and placement methods will result in a lack of sufficient data for evaluating the license application.	588PP C64	Merged	Merged with Item 4.

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
93.	The CDSCP states that "The lack of aquifer above the waste emplacement horizon at the Yucca Mountain site, makes it unnecessary to install either permanent or temporary shaft or ramp seal components at the time of access construction." No evidence or substantiation is presented for the statement that neither operational nor permanent seals will be required.	588PP C65	Open	Pending NRC review of SCP.
94.	The CDSCP states that "The shaft liner can be removed to emplace seal components later." This statement, without reference to an evaluation, analysis or justification, appears to imply that it is a straightforward matter to remove a shaft liner and that such a procedure has no implications for the isolation capability of the site.	588PP C66	Merged	Merged with Item 44.
95.	The statement near the end of the next to the last paragraph on pg. 8.3.3.1-4 that "boreholes that are upgradient or long distances from the repository may not require sealing" appears to be driven largely by the considerations of vertical downward flow in the pre-repository rock environment, and does not represent a conservative sealing approach.	588PP C67	Open	Pending NRC review of SCP.
96.	It is stated in the second paragraph on pg. 8.3.3.2-24 that "more conservatism has been added by the selection of the design-basis performance goals to be substantially less than the maximum allowable values." Although this is true immediately after closure, the two curves (Fig. 8.3.3.2-3) do converge relatively rapidly. Although no time scale is included, it can be inferred from Fernandez et al, 1987, Fig. 3-2, that the breakpoint in the Design Basis Performance Goals is at about 1000 years. Beyond that point the two curves are so close together as to leave very little safety margin.	588PP C68	Open	Pending NRC review of SCP.
97.	It is unclear whether a reasonably conservative design approach has been used to determine required backfill hydraulic conductivity.	588PP C70	Open	Pending NRC review of SCP.

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
98.	In evaluating potential effects of credible accidents on projected radiological exposures, the CDSCP has not sufficiently considered retrieval operations.	588PP C72	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
99.	Plans should be made to correlate persistence of geologic features from ES-1 to ES-2 which might provide preferential pathways and to develop a photographic record of ES-2 for possible future use.	588PP C97	Open	Pending NRC review of SCP.
100.	A reasonable assurance that the shafts are far enough apart so that construction in ES-2 does not adversely affect the ability to obtain required data in ES-1 and adjacent test areas has not been provided.	588PP C98	Merged	Merged with Item 70.
101.	The CDSCP does not present appropriate information on blasting to reflect the most recent strategy for minimizing shaft wall damage as outlined in DOE's "Response to NRC Information Requests from the April 14-15 1987 Meeting Between DOE and NRC" (Ref. 1).	588PP C99	Merged	Merged with Item 8.
102.	The extent of site exploration described in the CDSCP indicates that the DOE plans to explore only a small portion of the underground repository block through underground testing and drifting. Substantially more drifting may be necessary to reduce uncertainties about the presence of faults and other geologic and hydrologic conditions. In the CDSCP no exploratory drift is planned to cross the main waste storage area to the southern portions of the block, which based upon existing information appears to contain more faults and fractures than other parts of the block. Borehole penetrations into the main waste storage area (boreholes from the surface, horizontal core drilling or other means) may not provide the representative information needed to construct a reliable three-dimensional geologic model of the repository block and evaluate ranges of parameters that could affect repository performance.	588PP C100	Open	Pending NRC review of SCP.

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
103.	Plans for remedial measures that may be required to minimize potentially adverse impacts of penetrating the target features are not given.	588PP C101	Merged	Merged with Item 54.
104.	In several activity descriptions, it is proposed that air coring will be used to drill holes to be used for permeability testing (e.g., Infiltration test, pg. 8.4-52; bulk permeability test, pg. 8.4-53; radial borehole tests, pg. 8.4-53; Calico Hills tests, pg. 8.4-54; diffusion tests, pg. 8.4-54. Aside from the potential technical difficulties associated with the feasibility of drilling such holes, this raises questions about the reliability of the permeability values thus obtained.	588PP C102	Open	Pending NRC review of SCP.
105.	The performance confirmation program has not been sufficiently well defined, and appropriate details are not included in the CDSCP. The discussion concerning confirmation, Issue 1.7. has not presented the strategy or a plan to meet the requirements set forth in Subpart F of 10 CFR 60 part 60.	588PP C103	Open	Pending NRC review of SCP.
106.	What are the definitions of the terms fracture "aperture" and "length"?	588PP Q12	Removed	Removed from ESF open items list since it is not explicitly an ESF item. Also the requested item was actually provided at this meeting.
107.	Does this program include all drilling or only surface based drilling?	588PP Q14	Open	Pending NRC review of SCP.
108.	How is the roughness coefficient parameter measured in a borehole? What is the difference between roughness coefficient listed here and "roughness" discussed elsewhere in Section 8.3.1.4.2.2.3?	588PP Q16	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
109.	What role, if any, will the data presented in Chapter 2 play in the proposed model development and in scoping the amount of planned site specific in situ testing?	588PP Q17	Open	Pending NRC review of SCP.
110.	What methods will be used to determine whether there is any impact of ground motion from underground nuclear explosions on repository design?	588PP Q25	Removed	Removed from ESF open items list since it is not explicitly an ESF item.

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
111.	How will the heated block experiment be used for model validation if there are no imposed stress gradients or temperature gradients inside the block?	588PP Q26	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
112.	What are the parameters and the strength model for which the strength experiment(s) are designed, and how will a substantial volume of rock be driven to failure?	588PP Q27	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
113.	Why is there no link (other than that indicated in Figure 8.3.2.1-1) established between this plan and Issue 1.12 - Repository Sealing?	588PP Q34	Open	Pending NRC review of SCP.
114.	According to the last sentence of this section, the approach to develop this plan is given in Section 8.3.2.3, and the data requirements for this plan are given in Section 8.3.2.2.1. Both of these referenced sections cover extremely broad topics. What are the relevant items for this section?	588PP Q35	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
115.	Where in Section 8.3.2.2.1 are the data requirements for this activity discussed?	588PP Q36	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
116.	Some concerns exist as to whether the list of parameters for performance goal C2 (rock radiation shielding) given on pg. 8.3.2.2-30 is comprehensive. For example, does the expected pre-emplacement saturation value of 65 % represent the expected post-emplacement saturation value?	588PP Q37	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
117.	Use of mechanical excavation is considered not feasible in some parts of the document and plausible in other parts. The next to last paragraph on pg. 8.3.2.4-28 mentions the possibility that mechanical excavation may be used. Does this contradict other implications in the CDSCP (e.g., pg. 8.3.2.2-70) that mechanical excavation is not feasible?	588PP Q38	Open	Pending NRC review of SCP.
118.	Why are the requirements for some items on pg. 8.3.2.5-23 different from the requirements for System Element 1.2.1.2 identified in Table 8.3.2.4-2, non-radiological health and safety?	588PP Q39	Removed	Removed from ESF open items list since it is not explicitly an ESF item.

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Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
119.	What is the justification for the statement on pg. 8.3.2.5-24 that "no site characterization data is required to develop the high level of confidence needed for installation of borehole liners."?	588PP Q40	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
120.	There are many inconsistencies in this section when compared with the details given in other sections of the CDSCP and reference documents. What are the potential impacts of such inconsistencies?	588PP Q41	Open	Pending NRC review of SCP.
121.	Description of items included in Table 8.3.3.2-1 needs further clarification in several areas. Why have not all the seal components been included in this list?	588PP Q42	Merged	Merged with Item 4.
122.	There are many apparent inconsistencies in the write-up of the proposed activities presented in this section when compared with the details given in other sections of the CDSCP and reference documents. What are the impacts of such inconsistencies?	588PP Q48	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
123.	Site characterization investigations should be planned based on the total area that may be needed for repository development. Is this the case for the drilling program laid out in the CDSCP?	588PP Q49	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
124.	It is difficult to tell from various depictions in the CDSCP what are the actual boundaries of the area that may be involved in repository development and that therefore may need to be characterized intensively. What are these actual boundaries?	588PP Q50	Removed	Removed from ESF open items list since it is not explicitly an ESF item.
125.	Which activity in Table 8.3.1-15-1 is planned to investigate the effects of radiation on thermal and mechanical rock properties?	588PP Q51	Removed	Removed from ESF open items list since it is not explicitly an ESF item.

STATUS OF ESF OPEN ITEMS AS DISCUSSED AT THE OCTOBER 19-21, 1988 DOE-NRC MEETING

Item No.	Open Items	Reference	Status Resulting From Meeting	Remarks
126.	DOE should demonstrate that the ESF design process has provided for systematic review and consideration of 10 CFR 60 requirements in the development of the ESF design and for verification that these requirements have in fact been incorporated into the design.	788 AI 1	Open	Pending DOE providing NRC with further evidence (documentation) that it has an adequated design control process in place (New open item from October 7, 1988 Linehan to Stein letter --first item in letter-- not included in pre-meeting material.)
127.	DOE should identify the specific entity responsible for ensuring that 10 CFR 60 requirements are reviewed and considered in the development of the ESF design and then for verifying that those requirements have in fact been incorporated into the design.	788 AI 2	Open	Pending DOE providing NRC with further evidence (documentation) that it has an adequated design control process in place (New open item from October 7, 1988 Linehan to Stein letter --second item in letter-- not included in pre-meeting material.)
128.	DOE should describe its design control process to assure that items and activities potentially important to safety or waste isolation for the design and construction of the exploratory shaft facilitiy are identified as Quality Level I. The description should include both criteria and methods to be used. It should also address plans for determinining what previous data and analyses are needed to support Quality Level I items or activities and how DOE plans to validate these.	788 AI 3	Open	Pending DOE providing NRC with further evidence (documentation) that it has an adequated design control process in place (New open item from October 7, 1988 Linehan to Stein letter --third item in letter-- not included in pre-meeting material.)

Reference Number Examples

483IR Ia = Information request Ia from the April 1983 Coplan to Vieth letter.

885 AI 4 = Action Item 4 from the August 1985 DOE-NRC ESF Meeting.

588 PP C29 = Comment 29 from the NRC Point Papers on the CDSCP (Issued May 1988)

REVISED ESF OPEN ITEMS LIST

ATTACHMENT 28

New Item No.	Relationship to Old Item No.	Statement of Open Item
ESF Design Control Process		
1.	67	DOE should demonstrate that it has in place and is implementing an overall systematic design and approval process for the ESF that (i) considers 10 CFR 60 requirements including those for QA, (ii) recognizes uncertainties associated with site characterization activities, (iii) recognizes the need for feedback and interaction among participants responsible for design, scientific tests, performance assessment, construction and operation, and (iv) considers operational impacts on tests and space requirements to avoid test interferences.
2.	19,20,21,22,62,68	DOE should provide the basis for assignment of quality levels to ESF design, construction, data collection during construction, the liner, rock structure, and the dewatering system. Also, provide a schedule for completion of ESF construction and testing QA procedures.(Note: Q-list for the ESF is QA open item 9 as identified in the meeting summary for the 7/7/88 DOE-NRC meeting on QA open items. This open item and QA open item 9 each need to be addressed individually.)
3.	126	DOE should demonstrate that the ESF design process has provided for systematic review and consideration of 10 CFR 60 requirements in the development of the ESF design and for verification that those requirements have in fact been incorporated into the design.
4.	127	DOE should identify the specific entity responsible for ensuring that 10 CFR 60 requirements are reviewed and considered in the development of the ESF design and then for verifying that those requirements have in fact been incorporated into the design.
5.	128	DOE should describe its design control process to assure that items and activities potentially important to safety or waste isolation for the design and construction of the exploratory shaft facility are identified as Quality-Level I. The description should include both criteria and methods to be used. It should also address plans for determining what previous data and analyses are needed to support Quality Level I items or activities and how DOE plans to validate these.

REVISED ESF OPEN ITEMS LIST

New Item No.	Relationship to Old Item No.	Statement of Open Item
ESF Performance Analysis		
6.	52,56,59,70,100	The CDSCP does not include sufficient and consistent conceptual design information on the proposed ESF. This does not allow the evaluation of the potential interference of proposed investigations with each other and the interference of construction operations in the two shafts and long drifts with these investigations. Also, demonstrate that there will be minimal interference - between the two exploratory shafts; - between the adjacent subsurface tests; and - between construction and testing activities.
7.	1,51,57,71	The CDSCP does not sufficiently consider the potentially adverse impacts resulting from the proposed locations of ES-1, ES-2 other shafts and ramp portals in areas which may be susceptible to surface water infiltration, sheet flow, and lateral and vertical erosion (Refs. 1 and 2). For the proposed locations, there is a possibility of (a) potentially significant and unmitigable long-term adverse impacts on the waste isolation capability of the site and/or (b) affecting the ability to adequately characterize the site. Also, provide an analysis of the potential effects of construction, erosion, flooding, and increase in shaft diameter on long term repository performance.
Shaft Location		
8.	29	Within the boundaries, the DOE needs to establish the properties, characteristics, and sample sizes that can be used in the evaluation of, "representativeness." A method for analyzing the data also needs to be established.

New Item No.	Relationship to Old Item No.	Statement of Open Item
9.	102	The extent of site exploration described in the CDSCP indicates that the DOE plans to explore only a small portion of the underground repository block through underground testing and drifting. Substantially more drifting may be necessary to reduce uncertainties about the presence of faults and other geologic and hydrologic conditions. In the CDSCP no exploratory drift is planned to cross the main waste storage area to the southern portions of the block, which based upon existing information appears to contain more faults and fractures than other parts of the block. Borehole penetrations into the main waste storage area (boreholes from the surface, horizontal core drilling or other means) may not provide the representative information needed to construct a reliable three-dimensional geologic model of the repository block and evaluate ranges of parameters that could affect repository performance.

Performance Assessment

New Item No.	Relationship to Old Item No.	Statement of Open Item
10.	73	The CDSCP (Section 8.4.1.1 states that current plans call for drilling approximately 300 to 350 shallow holes (50 to 150 ft. deep), and 45 to 80 exploratory holes (presumably deep). Several trenches are also planned to be excavated for site characterization. In addition, Section 8.4.2.5.1 includes a summary of proposed numerous activities that would involve drilling from or very close to ES-1. The individual, the cumulative and the synergistic effects of these holes have not been considered in the evaluation of the potential impacts of exploratory shaft construction and testing on the waste isolation integrity of the site (Section 8.4.2.6, and supporting references, in particular Fernandez et al., 1987; Case and Kelsall, 1987).
11.	84	Geomechanical analyses do not consider the effects of emplaced support components or the effect of elevated temperature on the support system

New Item No.	Relationship to Old Item No.	Statement of Open Item
12.	88	The description of far field analysis in the CDSCP does not address potential for thermally induced movement along faults or fractures.
13.	96	It is stated in the second paragraph on pg. 8.3.3.2-24 that "more conservatism has been added by the selection of the design-basis performance goals to be substantially less than the maximum allowable values." Although this is true immediately after closure, the two curves (Fig. 8.3.3.2-3) do converge relatively rapidly. Although no time scale is included, it can be inferred from Fernandez et al, 1987, Fig. 3-2, that the breakpoint in the Design Basis Performance Goals is at about 1000 years. Beyond that point the two curves are so close together a to leave very little safety margin.
14.	85	The first section of the next to last paragraph on pg. 8.3.2.2-55 expresses the anticipation that contingency measures might strongly emphasize constructibility based on semi-empirical rock mass classifications. These classifications bear no direct relation to the primary long-term repository performance requirements of containment and isolation. It is not clear, therefore, whether the selected criteria are appropriate for guiding emplacement decisions, and, specifically to perform system performance studies for off-normal conditions, as proposed in the first sentence of the last paragraph on pg. 8.3.2.2-55.
15.	91	The last tentative goal on pg. 8.3.2.5-21 indicates that high confidence is needed that ES-1 shafts will terminate no less than 15- m above ground-water table. It does not appear that this goal is reached under the present ES-1 design.
Seals		
16.	8,58,101	Identify construction procedures that will be used to minimize damage to the rock mass excavated.
17.	54,103	Discuss how the DOE would recognize the possible need for remedial measures to maintain postclosure isolation capabilities potentially altered by penetration of targeted geological/hydrological features. Plans should also be provided for the remedial actions that may be required to lower the adverse impacts of penetrating the target features.

New Item No.	Relationship to Old Item No.	Statement of Open Item
18.	2	Describe how the selected excavation technique and shaft design accounts for limitations and uncertainties in long term sealing considerations.
19.	3	Provide design specifications for the shaft construction and show how they deal with the factors affecting sealing.
20.	4,10,11,92,121	Describe the design, materials, durability, placement methods, and long-term performance of seals. Describe tests to be done, in both the laboratory and field environments to determine their long-term durability and their compatibility, both chemical and physical, to the host rock environment. This information, particularly concerning in situ seal testing, is necessary to evaluate effects of seal testing activities on the ability of the site to meet performance objectives (10 CFR 60.112 and 10 CFR 60.113). In addition, the start date of in situ seal testing should be chosen such that sufficient data for evaluating the license application will be available at the time of submittal of the application.
21.	5	Discuss the selected locations of any planned explorations or testing to be performed along the length of the shaft. Include discussion of data on sealing characteristics to be gathered and the limitations and uncertainties associated with the data.
22.	12	Describe remedial methods to be used if sealing methods are not adequate.
23.	15	Describe test and inspection procedures to be used after sealing of the shaft to assess the results of the sealing effort in controlling adverse effects.
24.	44,94	A decision and its implications on whether the DOE will remove the liner at permanent closure or use it as part of the long term sealing system has not been determined. Justification should be provided for the course of action considered appropriate.

New Item No.	Relationship to Old Item No.	Statement of Open Item
25.	9	Identify liner construction and placement technique. Include such information as: liner type, liner material testing and placement of liner. This information needs to be fully considered in application of any permanent sealing program.
26.	93	The CDSCP states that "The lack of aquifer above the waste emplacement horizon at the Yucca Mountain site, makes it unnecessary to install either permanent or temporary shaft or ramp seal components at the time of access construction." No evidence or substantiation is presented for the statement that neither operational nor permanent seals will be required.
27.	95	The statement near the end of the next to the last paragraph on pg. 8.3.3.1-4 that "boreholes that are upgradient or long distances from the repository may not require sealing" appears to be driven largely by the considerations of vertical downward flow in the pre-repository rock environment, and does not represent a conservative sealing approach.
28.	97	It is unclear whether a reasonably conservative design approach has been used to determine required backfill hydraulic conductivity.
29.	120	There are many inconsistencies in this section when compared with the details given in other sections of the CDSCP and reference documents. What are the potential impacts of such inconsistencies?

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New Item No.	Relationship to Old Item No.	Statement of Open Item
Testing		
30.	17	Describe test plans and procedures used to obtain adequate data on site characteristics that can be measured either directly or indirectly during construction of the exploratory shaft. For example: o Geologic mapping and rock mass characterization of the shaft walls o Measurements of rates and quantities of groundwater inflow and collection of groundwater samples for testing o Measurements of overbreakage during blasting o Rock mechanics testing of samples obtained during drill and blast operations
31.	34	During the DOE presentation on the rationale for selection of the site for the exploratory shaft, the DOE stated that the site chosen is representative of the repository block but indicated that discussion of the question of representativeness would be deferred. The NRC staff agrees that this should be an agenda item for a future meeting.
32.	36	The DOE delineated the underground layout of the exploratory shaft and drifts and stated that underground testing considerations heavily influenced the layout. The NRC cannot assess the adequacy of the planned tests and hence the testing layout until the test plans are provided prior to the NNWSI/NRC ESTP meeting.

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33.	104	In several activity descriptions, it is proposed that air coring will be used to drill holes to be used for permeability testing (e.g., Infiltration test, pg. 8.4-52; bulk permeability test, pg. 8.4-53; radial borehole tests, pg. 8.4-53; Calico Hills tests, pg. 8.4-54; diffusion tests, pg. 8.4-54. Aside from the potential technical difficulties associated with the feasibility of drilling such holes, this raises questions about the reliability of the permeability values thus obtained.
34.	107	Does this program include all drilling or only surface based drilling?
35.	45	A discussion of sealing materials and placement method and timing for exploratory boreholes from the ES will be provided in a future meeting on repository design.
36.	46	The testing program to characterize perched water zones will be discussed at the ESTP meeting.
37.	74	CDSCP's approach to characterizing the complex three-dimensional nature of fracture systems in the repository block appears to rely on fractal analysis of outcrop exposures and geologic mapping of ES-1, drifts and boreholes (excluding floors and working faces). Also the CDSCP limits the objectives of fracture network studies to providing fracture analyses to supporting hydrologic modeling. The approach and objective to characterization described in the CDSCP may not lead to sufficient descriptions of the fracture networks.
38.	113	Why is there no link (other than that indicated in Figure 8.3.2.1-1) established between this plan and Issue 1.12 - Repository Sealing?
39.	117	Use of mechanical excavation is considered not feasible in some parts of the document and plausible in other parts. The next to last paragraph on pg. 8.3.2.4-28 mentions the possibility that mechanical excavation may be used. Does this contradict other implications in the CDSCP (e.g., pg. 8.3.2.2-70) that mechanical excavation is not feasible?
40.	77	Section 8.3.1.15 does not present a clear testing rationale. Thermal and mechanical properties to be determined are not related to specific

New Item No.	Relationship to Old Item No.	Statement of Open Item
		individual tests.
41.	78	The testing program laid out in Section 8.3.1.15 is deficient in several respects. In some cases, important information that could be gained in testing is not identified. Also, some proposed tests are ill-defined, and others may not be able to provide required information.
42.	79	The discussion and use of statistics in this chapter is not clear. A statistical approach has been suggested to determine numbers of tests required to determine various rock properties, but the approach suggested is confusing and apparently overlooks several considerations that should be factors into such an approach. Also, needed confidences of "low," "medium," or "high" have been assigned without explaining the basis for such assignments. Bases for assigning the needed confidence of low, medium or high are not discussed.
43.	80	In order to examine the margin of safety engineered into the stability of emplacement holes from the standpoint of retrievability, the canister-scale heater experiment needs to be run beyond the average design heat load. The CDSCP does not include provisions for such testing. Also, no mention is made of testing of lined versus unlined holes, backfilled holes, etc.
44.	81	This experiment is one of the more important rock mechanics experiments proposed yet, virtually no detail is given regarding it. There seems to be a lack of integration between this experiment and the modeling activities and design.

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45.	82	Plate-load tests do not necessarily provide a means of determining in-situ (i.e., undisturbed) rock mass deformational properties. Data obtained from such tests may be useful in assessing spatial variability, effects of different excavation, procedure, etc. is part of the overall program to characterize deformational relations of the rock mass adjacent to underground openings but may not be useful in thermomechanical calculations.
46.	72	The rationale for the specification of information needs does not appear to ensure completeness of those information needs. Furthermore, the integration of testing with design and performance assessment appears to be lacking.
47.	75	The required integration of site-specific subsurface information with repository design is not considered in this section (e.g., not even among the qualifying factors listed in the next to last paragraph on pg. 8.3.1.4-90.
48.	105	The performance confirmation program has not been sufficiently well defined, and appropriate details are not included in the CDSCP. The discussion concerning confirmation, Issue 1.7. has not presented the strategy or a plan to meet the requirements set forth in Subpart F of 10 CFR 60 part 60.
49.	109	What role, if any, will the data presented in Chapter 2 play in the proposed model development and in scoping the amount of planned site specific in situ testing?
50.	99	Plans should be made to correlate persistence of geologic features from ES-1 to ES-2 which might provide preferential pathways and to develop a photographic record of ES-2 for possible future