

REPOSITORY DESIGN REQUIREMENTS
SHAFT COLLARS AND LININGS
PRECLOSURE PERIOD

I. GENERAL

1. Repository shafts are defined as all shafts that are used for the repository, including the exploratory shaft (ES) facility shafts after conversion for repository use.
2. The term "lining" applies below the collar only. The collar is a separate structure with separate design criteria.
3. The ESs will initially be fully furnished exploration shafts. These shafts will only become repository shafts if and when the site is selected for a repository, at which time the shafts will be stripped of non-repository quality items and converted to downcast ventilation shafts.
4. The repository shafts are entirely located in unsaturated-zone rocks. The shaft linings are not intended to act as seals or barriers to prevent water from entering the repository.
5. The repository shaft linings will be analyzed for appropriate combinations of the following effects:
 - o static ground pressure
 - o seismic effects from UNEs and design-basis earthquakes
 - o induced thermal stresses, strains, and displacements
6. The repository shaft linings are intended to:
 - o secure the ground against rockfall hazards for safety of personnel
 - o provide a safe and convenient method of supporting shaft equipment
 - o provide a smooth surface for efficient ventilation
7. The repository shaft linings are not intended to:
 - o resist hydrostatic loads from water pressure (precautions shall be taken to prevent the possibility of this occurrence)
 - o prevent local yielding of the shaft wall rock
 - o rigidly resist ground movements
 - o function as an item important to safety as defined by 10 CFR 60
8. It is not likely that full-length pilot boreholes will be available at the exploratory shaft locations prior to final design, so these shafts will serve as large-diameter exploration holes. It is possible that any initial design, however careful, will have to be altered as sinking progresses and actual ground conditions are encountered that are different than those expected. Subsequent repository shafts will have the benefit of a much more complete design data base than the ES, and more precise designs will be possible.

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9. The quantity of reinforcing steel used in the shaft linings will be minimized, consistent with calculated design requirements.

II. LINING

1. A concrete lining will be cast directly against the rock.
2. The lining will be designed to sustain the predicted static and dynamic loads without loss of function, and will have a minimum thickness of 12 inches. Definition of thermal stresses/strains at the shaft location is the responsibility of the conceptual repository designers.
3. If unstable ground conditions are encountered during sinking, the ground will be stabilized with suitable primary support prior to lining.
4. Joints will be provided between each pour to help localize possible horizontal cracks. These cracks may potentially result from tension induced by seismic or thermal loading.
5. Tensile cracking, which does not affect the performance of the lining, will be acceptable. The designer will determine whether or not predicted cracking will affect the maintainable performance.
6. The ES lining will be suitably instrumented to provide data for future design.
7. Permanent embedments will be considered part of the lining and designed accordingly.
8. Brow structures at station breakouts will be reinforced as required to support calculated rock loads. Hitches used for securing brows will be designed for the vertical component of the brow load.

III. COLLAR

1. A structural joint, providing isolation of the shaft lining from the collar, will be incorporated into the design. All structures located above the structural joint, including the collar, will be designed in accordance with appropriate surface design codes.
2. Collar structure will be reinforced in accordance with requirements as a headframe foundation. Collar will also be designed to withstand seismic loading.

IV. ALTERNATES FOR MODIFYING ES FOR USE IN THE REPOSITORY OPERATIONAL PHASE

Explanatory comment:

If future analyses, based on better definition of thermal loadings and rock properties, indicate that the ES liner's function in the repository will be impaired by thermal loading, provisions should be made for

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retrofitting the design. The designer should provide an evaluation of alternates for retrofitting. The function of the retrofit will be to ensure integrity of the ESs as downcast ventilation shafts.

A number of options which will perform the task of modifying the ES lining to repository quality are available. These include, but are not limited to: (1) inner steel lining, (2) rockbolts and wire mesh on top of primary lining, (3) vertically-oriented relief slots in the lining, and (4) complete removal of the ES facility liners and possible replacement with new liners. As part of the design, the Architect/Engineer should evaluate several retrofit options.

V. CONSTRUCTION SEQUENCE

1. ESs will be constructed by conventional (drill, blast, muck) techniques.
2. The designer shall specify the minimum gap between the curb pour of the lining and the shaft bottom required to prevent excessive loading due to elastic convergence of the shaft wall.
3. In the event that incompetent ground is encountered, it will be stabilized with primary support such as bolts and mesh prior to installing the lining.
4. Blast rounds will be carefully designed to minimize overbreak and damage to the formation.

ESF ENGINEERING CHANGE REQUEST

EGR NO. 005 PAGE 4 OF 4

SECTION 1. TO BE COMPLETED BY PARTICIPANT NOTING DEVIATION

SOURCE	<u>Sandia National Laboratories</u>	PARTICIPANT	<u>Thomas Hill</u>
WBS DESIGNATION	<u>1-2</u>	DATE	<u>01/08/88</u>
TITLE	<u>Exploratory Shaft</u>	ORIGINATOR	<u>Richardson</u>
DESCRIPTION	<u>Repository Design Requirements</u>	REV. NO.	<u>1</u>
<u>Shaft Collars and Linings - Preclosure Period</u>		REV. NO.	DATE

This ECR requests that the attached document be incorporated into requirements for the ESF design. Note that these have been discussed at a number of 1987 ICVG meetings and have the support of working group members. Also note suggested title change from "Criteria" to "Requirements" to reflect intent of document.

CAUSE OF DEVIATION N/A SEE COM-1, 1-25-88

SCOPE CHANGE YES NO SEE COM-1, 1-25-88

CONSTRUCTION IMPACT YES NO

PARTICIPANT
QA REP Richardson DATE 1/12/88 PARTICIPANT
TPO Thomas Hill DATE 1/12/88

SECTION 2. ACTION

1. PROCEED WITH ECR EVALUATION	Not Applicable	
2. PROCEED WITH WORK	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> NO	_____ DIRECTOR OF WIPD (OR DESIGNER)

3. TOTAL COSTS (increase/decrease)	ENGINEERING CONSTRUCTION TOTALS	ROM <u>Not Applicable</u>	BUDGET _____	PROJECTED _____
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4. SCHEDULING IMPACT	ENGINEERING CONSTRUCTION	None None	_____	None None
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5. PROCEED W.- DETAIL ENGINEERING	Not Applicable	
PROCEED W.- DETAIL ESTIMATE	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> NO	_____ DIRECTOR OF WIPD (OR DESIGNER)

6. FUNDING.

Not Applicable

CHANGE ORDER SPECIAL STUDIES
 NO FUNDED, PROJECTED ONLY

 DIRECTOR OF WIPD
 (OR DESIGNER)

7. APPROVED FOR BASELINING

 DIRECTOR OF WIPD
 (OR DESIGNER)



DOCUMENT TRANSMITTAL RECORD

N-QA-022
11/87

PLEASE SIGN AND RETURN BY 3/22/88 Transmittal Date 2/22/88

TO Name SEE REVERSE DISTRIBUTION LIST Organization _____

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Document Title EXPLORATORY SHAFT FACILITY SUBSYSTEM DESIGN Copy No. SEE DIST. LIST.
REQUIREMENTS DOCUMENT, NVO-309, VOLUME 2

ADD. DELETE. OR REPLACE AS DIRECTED:

REMOVE - Page 3 of the Index for Appendix D.

INSERT - Page 3 of the Index for Appendix D, Rev. 2.

INSERT - Repository Design Requirements Shaft Collars and Linings Preclosure Period, Rev. 2. Place this document at the back of Appendix D of the ESF-SDRD, Volume 2 (including ECR 005).

NOTE - NNWSI Project Cost/Schedule Change Request (C/SCR), Change Number 88/017 is attached for reference information only. DO NOT insert this document in the ESF/SDRD Manual.

Please sign to confirm the above instructions have been complied with and return transmittal to address below:

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HNWBI PROJECT COST/SCHEDULE CHANGE REQUEST (C/SCR)

2/17/88

NAD-001

CHANGE NO.	ORGANIZATION	ORIGINATOR	ORIGINATION DATE
88/017	SAIC	M. E. Spaeth	2/9/88

TITLE:

Incorporate Supplementary Requirements and Revised drawings to the Technical Baseline Exploratory Shaft Facility (ESF) Subsystems Design Requirements Document (SDRD)

EXPLANATION & REASON FOR CHANGE:

WBS: 1.2.6.1.1.T

- Change:
1. Add supplementary requirements for the ESF design into the SDRD entitled "Repository Design Requirements Shaft Collars and Linings Preclosure Period" per approved ESF Engineering Change Request (ECR) Number 005.
 2. Replace Appendix A, Sketch 5, SNL Drawing R07048A (1 sheet) with the new issue of SNL Drawing R07048A consisting of 15 sheets per approved ESF ECR Number 004.

Reason: The supplementary requirements and the revised drawings provides additional information in support of the ESF Title I Design.

Cost Impact: Not applicable

Schedule Impact: None

- Reference:
1. Letter, L. P. Skousen to M. E. Spaeth, February 9, 1988, Proposed Changes for the Exploratory Shaft Facility (ESF) Subsystems Design Requirements (SDRD) "Repository Design Requirements Shafts Collars and Linings Preclosure Period" (WMPO Action Item 88-922), NNA.880210.0016.
 2. Letter, L. P. Skousen, to M. E. Spaeth, February 9, 1988, Proposed Baseline Changes for the Exploratory Shaft Facility (ESF) Subsystems Design Requirements Document (SDRD) Sandia National Laboratories (SNL) Drawing R07048A (WMPO Action Item 88-923), NNA.880210.0017.

- Attachments:
1. Letter, NNA.880210.0016 (w/enclosures)
 2. Letter, NNA.880210.0017
 3. ESF ECR 004
 4. SNL Drawing R07048A Sheets 1 through 15.

RESPONSIBLE ORGANIZATION: M. E. Spaeth *M. E. Spaeth* DATE: 2/10/88

CCB SECRETARY: P. Merkley *P. Merkley* DATE: 2/17/88

APPROVAL: DIRECTOR WMPO C. P. BEEZ *C. P. Beez* DATE: 2/17/88

Distribution List for NWSI ESF Subsystem Design Requirements, Rev. 1

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<u>Item</u>	<u>Title</u>	<u>Prepared by</u>
24.	Stratigraphic and Structural Characteristics of Volcanic Rock in Core Hole USW G-4, Yucca Mountain, Nye County, Nevada	D. C. Muller, J. E. Kibler
25.	Analysis of the Elastic and Strength Properties of Yucca Mountain Tuff, Nevada	R. H. Price, S. J. Bauer
26.	Implication about In Situ Stress at Yucca Mountain	S. J. Bauer, J. F. Holland, D. K. Parrish
27.	Conceptual Hydrologic Model of Flow in the Unsaturated Zone, Yucca Mountain, Nevada	U. S. Geological Survey
28.	Technical Requirements For The Integrated Data System Of The NNWSI Project Exploratory Shaft Facility	EG&G Las Vegas Support Operations
29.	Repository Design Requirements Shaft Collars and Linings Preclosure Period	Sandia National Laboratories (Rev. 2)