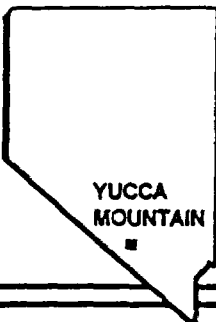


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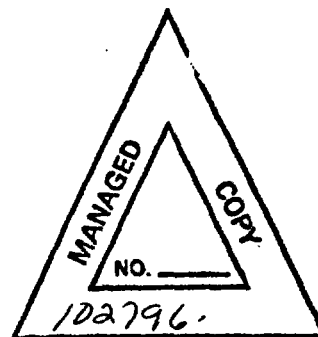


YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

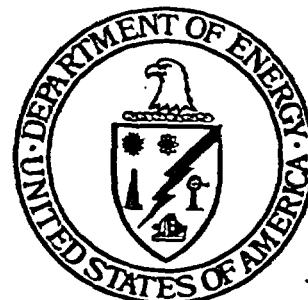
Document No. YMP/CM-0019
Revision 02
CI No. BAB000000
Date 04/22/95
WBS No. 1.2.1
QA Level QA - L

PROJECT BASELINE DOCUMENT

EXPLORATORY STUDIES FACILITY DESIGN REQUIREMENTS



**CHANGES TO THIS DOCUMENT REQUIRE PREPARATION
AND APPROVAL OF A CHANGE REQUEST IN ACCORDANCE
WITH PROJECT YAP-3.5Q**



UNITED STATES DEPARTMENT OF ENERGY
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT OFFICE

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YMP-217-R0
05/19/95

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
DOCUMENT CHANGE NOTICE

Page 4 of 4

1. Document Title:

Exploratory Studies Facilities Design Requirements (ESFDR) Document

2. Document Number:

YMP/CM-0019

The document identified in Blocks 1 and 2 has been changed. The changed pages attached to this DCN are identified in Block 7 opposite the latest DCN number in Block 3. The original issue of this document as modified by all applicable DCN's constitutes the current version of the document identified in Blocks 1 and 2.

3 DCN NO.	4 CR NO.	5 DOCUMENT Rev./ICN #	6 CR TITLE	7 AFFECTED PAGES	8			9 DATE
					CHANGE	ADD	DELETE	
014	95/242	Rev. 1, ICN-3	Modification to ESFDR Appendix B, Section B.2.6 for Radial Borehole Testing	ii, B-iii, B-18, B-19, B-20, B-21, & B-22	X			09/21/95
015	96/029	Rev. 2	Revision to ESFDR that includes detailed interpretation of 10CFR60 requirements and allocation of all requirements to each applicable CI	All	X			04/10/96

YMP-216-R1
09/18/95

**YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
EVALUATION SUMMARY, DIRECTIVE, AND DISPOSITION**

Page 1 of 2

CR No.:
96/029

CR Title:
Revision 2 to the Exploratory Studies Facility Design (ESFDR) Document (YMP/CM-0019)

Signatures on this document represent signers' knowledge that the applicable procedures have been read, understood, and complied with.

SECTION I. EVALUATION SUMMARY OF CCB MEMBERS AND EVALUATORS

CCB Members:

Name	Organization	Approve	Approve w/Conditions	Disapprove	No Recommendation
J. Adams	AMA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S. Brocoum	AMSL	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S. Jones	AMSP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
W. Dixon	AMESH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
R. Craun	AMEFO	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
W. Wilson	AMEFO/SO	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
R. Spence	YMQAD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
W. Kozai	PCTL	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Additional Evaluators:

		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CCB Secretary: Betty G. Cruz
Print Name

Betty G. Cruz
Signature

4-10-96
Date

SECTION II. CHANGE DIRECTIVE AND IMPLEMENTATION INSTRUCTIONS

- o The Change Request to revise the ESF Design Requirements Document, YMP/CM-0019, is approved.
- o The Document Originator shall submit a print ready copy of the revised ESF Design Requirements Document to the CCB Secretary in accordance with this directive.
- o The CCB Secretary shall:
 - ensure the document is prepared in accordance with this directive.
 - ensure the Configuration Information System and the CCB Register are updated to reflect this approved revision.

☒ See Documentation Continuation Page

SECTION III. DISPOSITION

☒ Approve ☐ Approved with Conditions ☐ Disapprove ☐ Elevate to next CCB Level

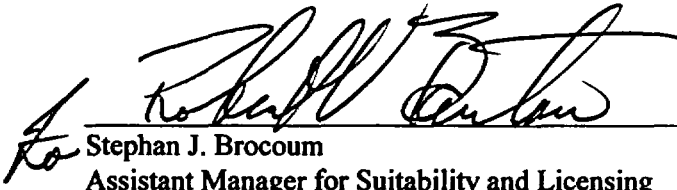
Comments: _____ Evaluation Method: 1

Wesley E. Barnes
Print Name

Wesley E. Barnes
Signature

4/19/96
Date

Block No.	Continuation Information
Sect. II	<p><i>Change Directive and Implementation Instructions (Cont'd.)</i></p> <ul style="list-style-type: none"><li>- prepare a Controlled Document Issuance Authorization form to transmit this directive and the revised ESF Design Requirements Document, YMP/CM-0019, to the Document Control Center in accordance with YAP-6.2Q.<li>o Any changes to the ESF Design Requirements Document, YMP/CM-0019, will require the submittal of a Change Request to the Project CCB.<li>o Upon release of the ESF Design Requirements Document, YMP/CM-0019, all Project Participants will be required to use it in performing applicable duties.


Stephan J. Brocoum
Assistant Manager for Suitability and Licensing
Yucca Mountain Site Characterization Office

3/29/96
Date

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TBD LOG

SECTION OR PARAGRAPH	RESPONSIBLE ORGANIZATION	SCHEDULE RESOLUTION DATE	BRIEF DESCRIPTION
-------------------------	-----------------------------	--------------------------------	----------------------

Currently there are no TBDs in any requirement statements in this Document.

TBV LOG

SECTION OR PARAGRAPH	RESPONSIBLE ORGANIZATION	SCHEDULED RESOLUTION DATE	BRIEF DESCRIPTION
Table A-1	YMSCO	TBD	Depth reduction factors to be applied to ground motions at the earth's surface.
Table A-2	YMSCO	TBD	Ground motion at the earth's surface for design of ESF permanent subsurface items.
Table A-3	YMSCO	TBD	Potential Repository peak accelerations.

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1. SCOPE

1.1 IDENTIFICATION

This document establishes the requirements and basic constraints imposed on the development of an architectural and engineering design for the Exploratory Studies Facility (ESF) in support of the Civilian Radioactive Waste Management System (CRWMS) - Yucca Mountain Site Characterization Project (YMP).

The development and control of this Exploratory Studies Facility Design Requirements (ESFDR) document is quality affecting work and is subject to the U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM) *Quality Assurance Requirements and Description* (QARD), DOE/RW-0333P. As part of the technical requirements baseline, the ESFDR is also subject to the *OCRWM Baseline Management Plan*, DOE/RW-0381P, controls. The ESFDR has been prepared and managed in accordance with the Technical Document Preparation Plan for the Preparation of MGDS Design Requirements Documents.

1.2 PURPOSE OF DOCUMENT

The purpose of this requirements document is to establish the design requirements for facilities, underground openings, utilities, and services as part of the ESF required to support the subsurface in situ tests specified in the *Site Design and Test Requirements Document* (SD&TRD), YMP/CM-0021. The ESFDR includes requirements for both surface and underground construction, utilities, and services. This document captures the existing baseline requirements. As this new ESFDR and the other documents in the hierarchy (see Section 1.3) mature, some of the requirements may be identified as needing to be moved to a more appropriate document.

1.3 SYSTEM OVERVIEW

The OCRWM Program Management System Manual, DOE/RW-0043, establishes the technical document hierarchy for the program, as illustrated in Figure 1-1.

- The ESFDR document provides the requirements for all systems and subsystems within the scope of the ESF. The applicable guidance and requirements contained in the technical requirements document hierarchy (Figure 1-1) were utilized and incorporated into the ESFDR. The flowdown from the higher tier documents runs from the Civilian Radioactive Waste Management Requirements Document (CRD), DOE/RW-0406P, into the *Mined Geologic Disposal System Requirements Document* (MGDS RD), DOE/RW-0404P, into the SD&TRD and on into the ESFDR. The ESFDR also contains design interface requirement inputs from the *Repository Design Requirements Document*, YMP/CM-0023, and the *Surface-Based Testing Facilities Requirements Document*, YMP/CM-0022.

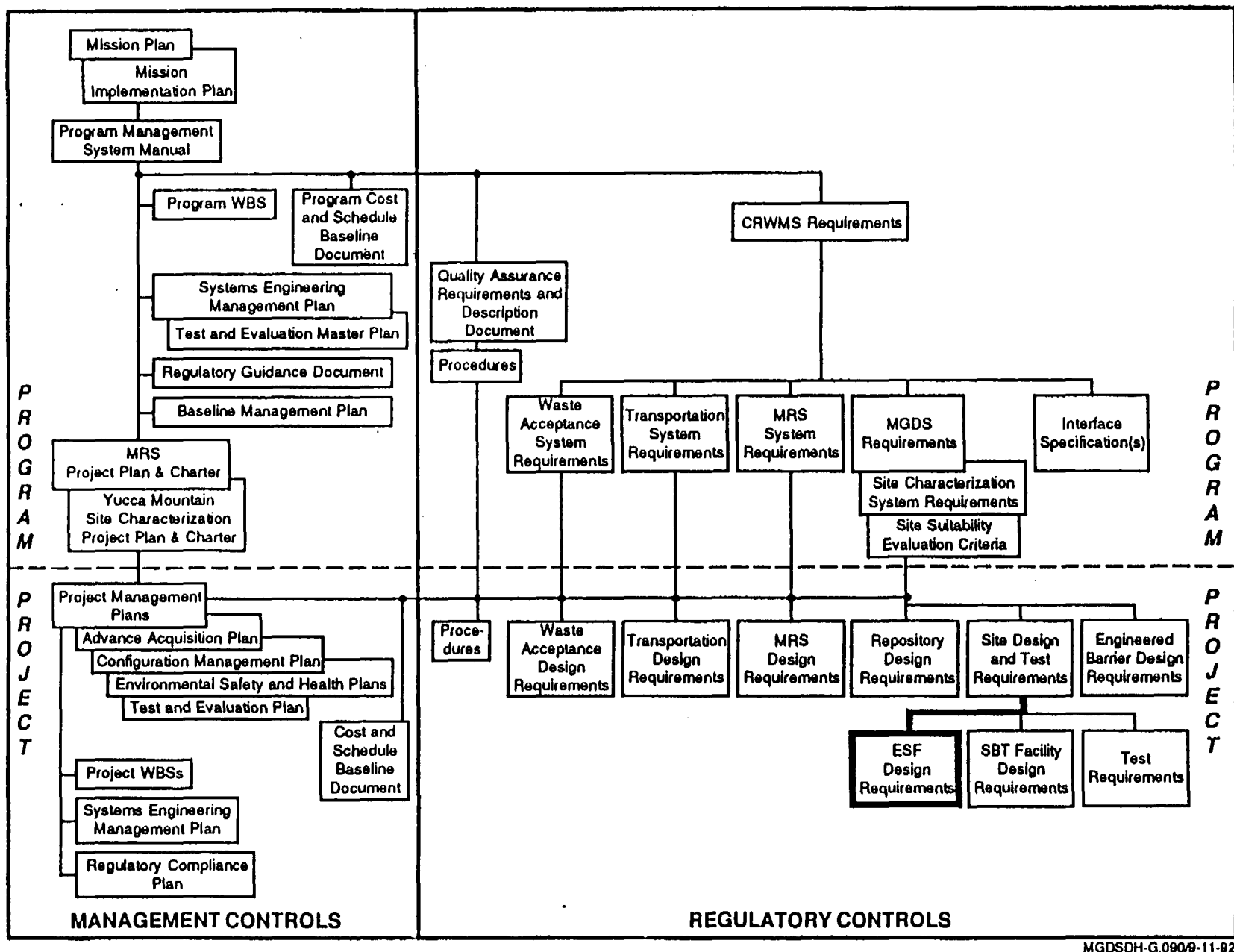


Figure 1-1 OCRWM Document Hierarchy

1.4

DOCUMENT ORGANIZATION AND DESCRIPTION

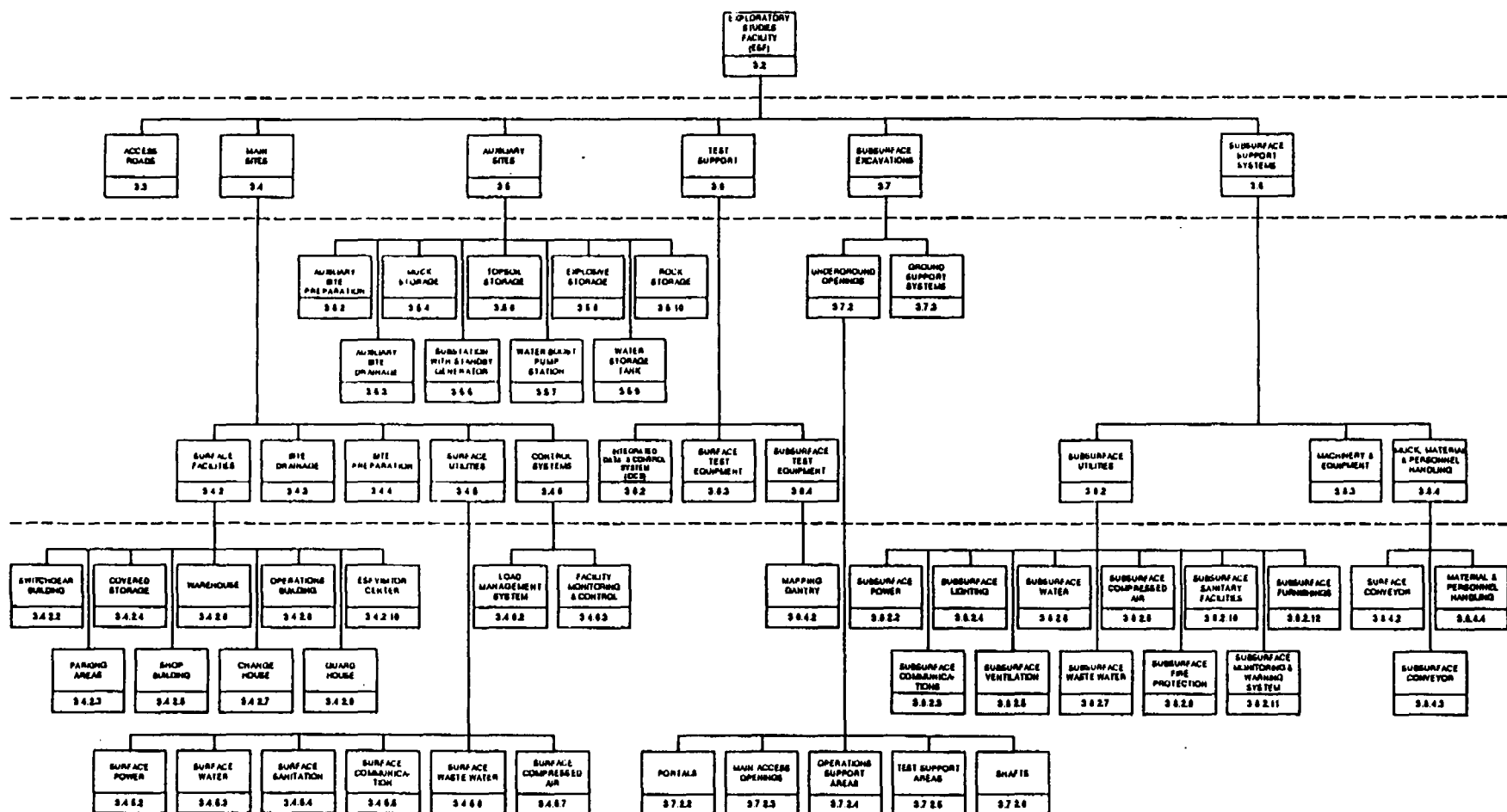
This document was developed to provide an allocated set of design requirements to each ESF configuration item (CI) identified in the Configuration Item Identification Site drawing (BAB000000-01717-1000-00002-01). This drawing has been replicated in Figure 1-2 and provides the ESFDR document section number that corresponds to each ESF CI. The drawing starts at the ESF level and goes to the lowest level ESF CI, identifying intermediate CI groupings. Each CI in this drawing has been given an individual section in this document and all section numbers are identified in Figure 1-2.

The specific ESF design requirements are presented in Sections 3.2 through 3.8 and in Appendices A and B. These design requirements were developed to support those CIs (Figure 1-2), consistent with their descriptions, that are provided in this document at the beginning of each CI section. The actual design and construction of each CI will be dependent upon the direction of the project management and the availability/ allocation of funding.

The requirements for the ESF have been divided into two categories. One of these categories is for requirements that are lower level and specific to a CI and therefore supported only by the appropriate CI(s). The other category is for those requirements that the ESF will meet as a system. These requirements may tend to be programmatic and/or very broad in scope. Where applicable, these high level requirements are decomposed and allocated to the applicable CIs which will provide specific support to the requirement. The incorporation of these design specific requirements will be the responsibility of the corresponding CI design. Design compliance with the high level ESF system types of requirements will not solely be the responsibility of the CI designers but will be an integrated effort with the System Engineering Organization which will help identify the specific requirement(s) to individual designs. Evidence that these requirements have been met will be the approval of the individual design packages.

For those portions of the CI design that are controlled by existing standards and codes, which are considered to be industry standard type of design, this document provides a "Code of Record" that identifies which version of these codes and standards the design is to be in compliance with. The design will be in compliance with all applicable safety standards and therefore these will also be listed in the "Code of Record."

All design requirements are presented in Section 3 of this document (which is written consistent with the section numbers identified in Figure 1-2). Section 3.2 contains all of the ESF system requirements as well as those common requirements that apply to each lower level CI. When a common group of individual CIs have a number of common requirements, these requirements are specified in the CI that is one level above these individual CIs. For example, the complete set of requirements for the Surface Power CI will be the combination of all of the requirements in Surface Power (Section 3.4.5.2), specific requirements in Surface Utilities (Section 3.4.5), specific requirements in Main Site (Section 3.4), and specific requirements in ESF (Section 3.2). Each CI contains explicit directions as to which other sections contain requirements that apply to that CI.



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Figure 1-2 Identification of ESF Configuration Items and ESFDR Section Numbers

1.4.1 DOCUMENT ORGANIZATION

This ESFDR document is organized as follows:

Section 1. Scope: This section presents an overview of the ESFDR document and describes its role within the OCRWM hierarchy.

Section 2. Applicable Documents: This section identifies documents that are specifically referenced in the Section 3 requirements as well as the Code of Record.

Section 3. Requirements: The definition of the ESF is presented in Section 3.1. The ESF system level requirements and all common requirements that apply to each CI are presented in Section 3.2. The requirements that apply to specific CIs are presented in Sections 3.3 through 3.8 and their corresponding subsections.

Section 4. Conformance Verification: This section addresses conformance verification and includes a cross-reference matrix to define verification of each requirement in Sections 3.2 through 3.8.

Section 5. Preparation for Operations: This section contains requirements for preparation of the system for acceptance and operations.

Section 6. Notes: This section contains explanatory material and is nonbinding on the ESFDR document development. Cross-references to the SD&TRD as well as Chapter I, Title 10, Part 60, Code of Federal Regulations (10 CFR 60) are provided in this section.

Appendix A: Detailed ESF seismic design requirements

Appendix B: Specific site characterization testing design requirements for the ESF.

Appendix C: Reserved

Appendix D: SD&TRD traceability matrix.

Appendix E: Reserved

Appendix F: Application of 10 CFR 60 Requirements to the Exploratory Studies Facility

1.4.2 REQUIREMENTS TRACEABILITY

Traceability of each requirement stated in Section 3.2 through 3.8 can be found in Section 6, Table 6-1 and Appendix D.

1.4.3

REQUIREMENTS TO BE DETERMINED OR VERIFIED

Some of the requirements contained in Section 3 and the Appendices need to be determined [TBD], or to be verified [TBV].

The following definitions apply to these terms:

TBD - Used to identify requirements that are yet to be specified.

TBV - Used to identify requirements which originate in the subject design requirements document that contains unqualified inputs (* indicates an unqualified quality affecting input).

2. APPLICABLE DOCUMENTS

This section identifies those documents that are specifically referenced in this requirements document. The ESF is to be designed in compliance with the applicable requirements from the latest versions of all Federal Laws, State Laws, and Local Ordinances in accordance with the precedence contained in this document. The specific issue/version of the required industry codes and standards are to be established and documented by the organization responsible for the design.

2.1 FEDERAL LAWS AND DOCUMENTS

2.1.1 U.S. CODE (USC) AND PUBLIC LAWS

Identifier

Title or Description

42 USC 10101 et seq

Nuclear Waste Policy Amendments Act of 1987

2.1.2 CODE OF FEDERAL REGULATIONS AND EXECUTIVE ORDERS

Identifier

Title or Description

A. 10 CFR 60

Disposal of High-Level Radioactive Wastes in Geologic Repositories

B. 27 CFR 55

Commerce in Explosives

C. 29 CFR 1910

Occupational Safety and Health Standards

D. 29 CFR 1926

Safety and Health Regulations for Construction

E. 30 CFR 57

Safety and Health Standards - Underground Metal and Nonmetal Mines

F. 33 CFR 323

Permits for Discharge of Dredged or Fill Material into Waters of the United States

G. 40 CFR 165

Regulations for the Acceptance of Certain Pesticides and Recommendation Procedures for the Disposal and Storage of Pesticides and Pesticides Containers

H. Executive Order 11988

Office of the President, 1977a. "Floodplain Management," 42 Federal Register 101, Washington, D.C.

2.1.3 OTHER DOCUMENTS, ORDERS, AND DIRECTIVES

	<u>Identifier</u>	<u>Title or Description</u>
A.	DOE Order 4330.4B	Maintenance Management Program
B.	DOE Order 4700.1	Project Management System
C.	DOE Order 5480.4	Environmental Protection, Safety and Health Protection Standards.
D.	DOE Order 5480.7A	Fire Protection
E.	DOE Order 6430.1A	General Design Criteria
F.	DOE/RW-0333P	Quality Assurance Requirements and Description
G.	DOD-HDBK-743	Anthropometry of U.S. Military
H.	YMP/91-14	Reclamation Implementation Plan
I.	YMP/93-02	Reference Information Base
J.	YMP/CM-0021	Site Design & Test Requirements Document
K.	YMP/CM-0022	Surface-Based Testing Facilities Requirements Document
L.	MIL-STD-882B	System Safety Program Requirements
M.	MIL-STD-1472D	Human Engineering Design Criteria for Military Systems, Equipments, and Facilities
N.	UCRL 15910	Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards, June 1, 1990
O.	UCRL 53526	Natural Phenomena Hazards Modeling Project: Seismic Hazard Models for Department of Energy
P.	NUREG 0700	Guidelines for Control Room Design Reviews
Q.	BLM Manual, Volume 34, 9100 Engineering	Section 9113 - Roads
R.	MOA, NS/RW 4/16/92	Memorandum of Agreement on Nuclear Safety Requirements Between the Office of Civilian Radioactive Waste Management and the Office of Nuclear Safety

2.2 STATE LAWS AND DOCUMENTS**2.2.1 STATE OF NEVADA**

<u>Identifier</u>	<u>Title or Description</u>
NAC 445/NRS 445	Nevada Water Pollution Control Law

2.3 LOCAL ORDINANCES

None were used for this document.

2.4 NON-GOVERNMENT DOCUMENTS**2.4.1 INDUSTRIAL AND PROFESSIONAL SOCIETY PUBLICATIONS****A. AMERICAN CONCRETE INSTITUTE (ACI)**

<u>Identifier</u>	<u>Title or Description</u>
ACI 318	Building Code Requirements for Reinforced Concrete

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

<u>Identifier</u>	<u>Title or Description</u>
1. ANSI/C2	National Electrical Safety Code
2. ANSI/HSF 100-1988	Visual Display Terminal Workstations

C. AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

<u>Identifier</u>	<u>Title or Description</u>
ASCE 7-88	Minimum Design Loads for Buildings and Other Structures

D. INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

Uniform Building Code

E. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

<u>Identifier</u>	<u>Title or Description</u>
NFPA 70	National Electrical Code

F. MITRE CORPORATION (MTR)

Identifier

Title or Description

MTR 10090

Guidelines for Designing User Interface Software

G. CRANE MANUFACTURERS ASSOCIATION OF AMERICA

Specification for Overhead Traveling Cranes

3. REQUIREMENTS

3.1 EXPLORATORY STUDIES FACILITY DEFINITION

The ESF is defined as those systems, subsystems, and components used for site characterization and performance confirmation testing at depth that allows manned access to the test area(s). The data will be used to determine the suitability of the Yucca Mountain Site for a potential repository of high-level nuclear waste. Specifically, the ESF consists of the following:

- ESF site,
- surface utilities,
- surface facilities,
- underground openings (ramp access, optional shaft access and other underground excavations),
- underground support systems,
- underground test support, and
- provisions for decommissioning and closure.

Some or all of the ESF may be incorporated into a potential repository. The YMP will conduct only those subsurface activities (in the ESF) necessary to characterize the Yucca Mountain Site to determine its suitability as a potential repository, and for developing an application to be submitted to the Nuclear Regulatory Commission (NRC) for construction authorization for a nuclear waste repository at the site. Subsurface lateral excavations and borings will be limited to those necessary to provide these data. The ESF also includes surface and underground facilities (including accesses and connecting drifts) and supporting systems required to support site characterization testing at depth.

- A. The mission of the ESF is to provide facilities for in situ site characterization for the MGDS, and to support in situ site characterization as required by DOE/OCRWM milestones and the *Site Characterization Plan*. The ESF also provides for the incorporation of subsurface and surface facilities into a potential repository. This section identifies and defines the functions the ESF will perform, provides the interrelationships of the functions, and that defines the architecture of the ESF and allocates the identified functions to this architecture. Table 3-1 provides a list of facilities to support subsurface testing. The specific functions are presented below for each element of this architecture.

Table 3-1 Exploratory Studies Facilities Functions

Function Title	Number
Provide Facilities to Support Subsurface Tests	1.4.1.2.1
Prepare Site(s)	1.4.1.2.1.1
Provide Access Roads	1.4.1.2.1.1.1
Provide Main Site(s)	1.4.1.2.1.1.2
Provide Auxiliary Site(s)	1.4.1.2.1.1.3
Provide Site Drainage	1.4.1.2.1.1.4
Provide Surface Utilities	1.4.1.2.1.2
Provide Power System	1.4.1.2.1.2.1
Provide Water System	1.4.1.2.1.2.2
Provide Sanitary System	1.4.1.2.1.2.3
Provide Communications System	1.4.1.2.1.2.4
Provide Surface Waste water System	1.4.1.2.1.2.5
Provide Compressed Air System	1.4.1.2.1.2.6
Provide Solid Waste Disposal System	1.4.1.2.1.2.7
Provide Surface Facilities	1.4.1.2.1.3
Provide Site Preparation for Surface Structures	1.4.1.2.1.3.1
Provide Permanent Test Support Buildings	1.4.1.2.1.3.2
Provide Temporary Structures	1.4.1.2.1.3.3
Provide Communications/Data Building	1.4.1.2.1.3.4
Provide Warehouse Facilities	1.4.1.2.1.3.5
Provide Shop Facilities	1.4.1.2.1.3.6
Provide Storage Facilities	1.4.1.2.1.3.7
Provide Ventilation System	1.4.1.2.1.3.8
Provide Parking Areas	1.4.1.2.1.3.9
Provide Underground Openings	1.4.1.2.1.4
Provide Shaft	1.4.1.2.1.4.1
Provide Collar	1.4.1.2.1.4.2
Provide Hoist System	1.4.1.2.1.4.3
Provide Ramps	1.4.1.2.1.4.4

Table 3-1 Exploratory Studies Facilities Functions (continued)

Function Title	Number
Provide Portal	1.4.1.2.1.4.5
Provide Underground Excavations	1.4.1.2.1.4.6
Provide Lining	1.4.1.2.1.4.7
Provide Stations	1.4.1.2.1.4.8
Provide Furnishings	1.4.1.2.1.4.9
Provide Operations Support Area	1.4.1.2.1.4.10
Provide Sump	1.4.1.2.1.4.11
Provide Test Area	1.4.1.2.1.4.12
Provide Underground Support Systems	1.4.1.2.1.5
Provide Power Distribution	1.4.1.2.1.5.1
Provide Lighting	1.4.1.2.1.5.2
Provide Ventilation Distribution	1.4.1.2.1.5.3
Provide Water Distribution	1.4.1.2.1.5.4
Provide Underground Waste water Collection	1.4.1.2.1.5.5
Provide Compressed Air Distribution	1.4.1.2.1.5.6
Provide Fire Protection	1.4.1.2.1.5.7
Provide Muck and Material handling	1.4.1.2.1.5.8
Provide Sanitary Facilities	1.4.1.2.1.5.9
Provide Monitoring and Warning	1.4.1.2.1.5.10
Provide Test Support	1.4.1.2.1.6
Provide for Data Collection	1.4.1.2.1.6.1
Provide Underground Test Support	1.4.1.2.1.6.2
Provide Decommissioning and Site Closure	1.4.1.2.1.7
Provide Decommissioning and Closure of Accesses and Underground Facilities	1.4.1.2.1.7.1
Provide Decommissioning and Closure of Surface Facilities	1.4.1.2.1.7.2

1. Provide Facilities to Support Subsurface Tests, ESF 1.4.1.2.1

Provide facilities for in situ site characterization for the MGDS and support in situ site characterization as required by DOE/OCRWM milestones and the SD&TRD.

Provide for incorporation of the ESF into a potential repository.

(a) Prepare Site(s) 1.4.1.2.1.1

Provide and prepare surface locations to support ESF activities.

i. Provide Access Roads 1.4.1.2.1.1.1

Provide access roads to accommodate all anticipated services in a safe and effective manner.

ii. Provide Main Site(s) 1.4.1.2.1.1.2

Provide main site(s) of adequate size, shape and grade to support all anticipated structures, systems, and components that will be located near the accesses.

iii. Provide Auxiliary Site(s) 1.4.1.2.1.1.3

Provide auxiliary site(s) of adequate size and shape to support anticipated functions.

iv. Provide Site Drainage 1.4.1.2.1.1.4

Provide measures to control ESF site drainage runoff.

(b) Provide Surface Utilities 1.4.1.2.1.2

Provide surface utility systems, subsystems, and facilities for the ESF, to support site preparation, construction, operations, and testing during site characterization.

i. Provide Power System 1.4.1.2.1.2.1

Provide an electrical system consisting of a standard electrical power distribution system, a standby electrical power system, and an uninterruptible power supply (UPS) system for the ESF.

ii. Provide Water System 1.4.1.2.1.2.2

Provide a water supply, storage, and distribution system for the ESF.

iii. Provide Sanitary System 1.4.1.2.1.2.3

Provide a sanitary system for the surface collection and disposal of underground and surface sanitary sewage during ESF activities.

iv. Provide Communications System 1.4.1.2.1.2.4

Provide a communications link internal and external to the ESF for use during ESF operations and testing.

v. Provide Surface Waste Water System 1.4.1.2.1.2.5

Provide a surface waste water system for collection, transfer, treatment, and disposal of nonsanitary underground water.

vi. Provide Compressed Air System 1.4.1.2.1.2.6

Provide compressed air production and distribution.

vii. Provide Solid Waste Disposal System 1.4.1.2.1.2.7

Provide for disposal of solid waste.

(c) Provide Surface Facilities 1.4.1.2.1.3

Provide surface buildings and/or supporting facilities for the ESF construction and operations.

Provide dust control and/or collection facilities.

Provide on-site transportation facilities for personnel, equipment, materials, and rock.

i. Provide Site Preparation for Surface Structures 1.4.1.2.1.3.1

Prepare sites with required services for surface structures.

ii. Provide Permanent Test Support Buildings 1.4.1.2.1.3.2

Provide test support facilities to meet the operational requirements of the principal investigators.

iii. Provide Temporary Structures 1.4.1.2.1.3.3

Provide temporary structures and their supporting equipment to support the ESF.

iv. Provide Communications/Data Building 1.4.1.2.1.3.4

Provide a communications/data building for the communications data collection and transmission equipment during the ESF operation and underground site characterization.

v. Provide Warehouse Facilities 1.4.1.2.1.3.5

Provide facilities for general warehousing in support of the ESF construction and operations.

vi. Provide Shop Facilities 1.4.1.2.1.3.6

Provide shop facilities and equipment for the routine maintenance, inspection, and repair of the ESF equipment, systems, structures, and components.

vii. Provide Storage Facilities 1.4.1.2.1.3.7

Provide storage for the anticipated equipment, supplies, and vehicles that will be used during construction and operation of the ESF.

viii. Provide Ventilation System 1.4.1.2.1.3.8

Provide a ventilation system to supply air to and exhaust air from the subsurface workings to meet the needs of construction and operation of the underground site characterization and testing program.

ix. Provide Parking Areas 1.4.1.2.1.3.9

Provide parking areas to support ESF operations and underground site characterization activities.

(d) Provide Underground Openings 1.4.1.2.1.4

Provide underground openings and accesses for the performance of in situ site characterization.

Provide for incorporation of underground openings into a potential repository.

i. Provide Optional Shaft (if required) 1.4.1.2.1.4.1

Provide an underground opening, in the configuration of a shaft, for in situ site characterization.

Provide for incorporation of the shaft into a potential repository.

ii. Provide Collar (if required) 1.4.1.2.1.4.2

Provide an adequate foundation for the headframe and accommodate penetrations and structural mountings for the optional shaft.

iii. Provide Hoist System (if required) 1.4.1.2.1.4.3

Provide for the transport of testing and construction personnel, materials, and construction equipment, and serve as an emergency egress during shaft operations and testing.

iv. Provide Ramps 1.4.1.2.1.4.4

Provide underground openings, each in the configuration of a ramp, for in situ site characterization and access to other underground excavations for the performance and support of in situ site characterization.

Provide for incorporation of the ramps into a potential repository.

v. Provide Portals 1.4.1.2.1.4.5

Provide adequate protection for ingress and egress and accommodate penetrations and structural mountings for each ramp.

vi. Provide Underground Excavations 1.4.1.2.1.4.6

Provide underground openings for in situ site characterization above, below, and at the potential repository horizon.

Provide for incorporation of the underground openings into a potential repository.

vii. Provide Lining 1.4.1.2.1.4.7

Provide structural and mechanical integrity, if required, for the optional shaft, and provide mounting for conveyance guide supports, utilities, and shaft instrumentation during ESF subsurface operations.

Provide structural and mechanical integrity for the ramp, if required, and mounting of conveyance supports, utilities, and ramp instrumentation during ESF subsurface operations.

viii. Provide Stations 1.4.1.2.1.4.8

Provide excavated space of adequate size and appropriate geometry to support underground construction and site characterization testing activities.

ix. Provide Furnishings 1.4.1.2.1.4.9

Provide structural support for the hardware (e.g., pipe, conduit, wiring, ventilation ducting) associated with the underground utility lines and other necessary underground services. These provisions are required during ESF subsurface operations and site characterization activities.

Provide for structural support and guides for the operation of the hoist conveyance.

x. Provide Operations Support Area 1.4.1.2.1.4.10

Provide excavated space of adequate size and appropriate geometry to support underground site characterization test activities.

xi. Provide Sump 1.4.1.2.1.4.11

Provide adequate space at or near the bottom of the optional shaft to accommodate in-shaft testing, shaft operation, and to collect and transfer waste water to the underground waste water collection system.

Provide adequate space within the ramp(s) to collect waste water for transfer to the underground waste water collection system.

xii. Provide Test Area 1.4.1.2.1.4.12

Provide excavated space of adequate size, appropriate layout, and appropriate opening geometry to conduct the necessary underground site characterization test activities, and house the necessary construction, test, and testing support equipment.

(e) Provide Underground Support Systems 1.4.1.2.1.5

Provide utilities for underground ESF construction, operations, in situ site characterization, and monitoring activities.

Provide facilities and equipment for the installation, operation, and maintenance of the underground services.

Provide underground transport services for personnel, equipment, and materials.

i. Provide Power Distribution 1.4.1.2.1.5.1

Provide a distribution system for electrical power to underground facilities.

ii. Provide Lighting 1.4.1.2.1.5.2

Provide a distribution system for underground lighting.

iii. Provide Ventilation Distribution 1.4.1.2.1.5.3

Provide a distribution system for ventilation air.

iv. Provide Water Distribution 1.4.1.2.1.5.4

Provide a water distribution system for underground facilities.

v. Provide Underground Waste Water Collection 1.4.1.2.1.5.5

Provide a system for underground waste water collection and treatment, as required.

vi. Provide Compressed Air Distribution 1.4.1.2.1.5.6

Provide a system for the distribution of compressed air throughout the underground ESF facility.

vii. Provide Fire Protection 1.4.1.2.1.5.7

Provide for the detection, warning, and suppression of fires in the ESF underground.

viii. Provide Muck and Material Handling 1.4.1.2.1.5.8

Provide for transport of excavated rock from the underground to the surface, and for materials and equipment between the ground surface and the underground.

ix. Provide Sanitary Facilities 1.4.1.2.1.5.9

Provide sanitary facilities for the work force at convenient locations throughout the underground.

x. Provide Monitoring and Warning 1.4.1.2.1.5.10

Provide monitoring and warning of underground environmental conditions dangerous to personnel.

(f) Provide Test Support 1.4.1.2.1.6

Provide the means for implementing characterization and performance confirmation testing plans.

i. Provide for Data Collection 1.4.1.2.1.6.1

Provide for incorporation of an Integrated Data and Control System (IDCS) into the ESF.

ii. Provide Underground Test Support 1.4.1.2.1.6.2

Provide adequate facilities to allow effective execution of tests.

(g) Provide Decommissioning and Site Closure 1.4.1.2.1.7

Provide for decommissioning and closure of the ESF.

i. Provide Decommissioning and Closure of Accesses and Underground Facilities 1.4.1.2.1.7.1

Provide for decommissioning and closure of the ESF accesses and underground facilities.

ii. Provide Decommissioning and Closure of Surface Facilities 1.4.1.2.1.7.2

Provide for decommissioning and closure of the ESF surface facilities.

B. Personnel flow requirements will be defined by the tasks and performance criteria that are required by the ESF site characterization tests defined by the SD&TRD.

C. Material flow requirements will be defined by the tasks and performance criteria required by the ESF site characterization tests prescribed by the SD&TRD.

3.1.1**INTERFACE DEFINITIONS**

The ESF consists of both surface and underground facilities and associated support equipment to provide the required facilities for all underground site characterization testing. Physical interfaces exist between the ESF and both the potential repository and the surface-based testing facilities. Full compliance with the ESF design requirements necessitates an evaluation and understanding by the designer of these interfaces. The ESF surface facilities, utilities, and equipment will interface with the ESF underground openings, utilities and equipment. The underground openings provided by the ESF will interface with, and may become an integral part of, the potential repository. Requirements to incorporate these interfaces into the design of the ESF are provided in the requirements of this document.

3.2 EXPLORATORY STUDIES FACILITY (ESF) (BAB000000)**3.2.1 DESCRIPTION**

This section contains two levels of requirements. Those that are to be applied to the ESF system as a whole and those that are to be applied to every lower level CI.

The requirements that are in Section 3.2.1.1 apply to the ESF as a system and will be verified at the ESF system level. If specific detailed requirements were needed to support these requirements, they were developed and placed in the appropriate CI section of this document.

The requirements in Section 3.2.1.2 potentially apply to every CI in Figure 1-2. These requirements will be referenced from within each of the CI sections.

3.2.1.1 ESF SYSTEM REQUIREMENTS**3.2.1.1.1 PROGRAM REQUIREMENTS**

3.2.1.1.1.A All ESF quality affecting activities shall be conducted under a quality assurance program in compliance with the OCRWM QARD.
[SD&TRD I.3.9][10CFR60.151, 10CFR60.152]

3.2.1.1.1.B PRECEDENCE OF COMPLIANCE DOCUMENTS

3.2.1.1.1.B.1 The general order of precedence for ESF requirements shall be:

A. Federal Laws and documents

1. Laws, Statutes, United States Codes, and Treaties
2. Codes of Federal Regulations and Executive Orders (including NRC Regulatory Guides and DOE Orders and Notices)
3. Other documents, orders, and directives

B. State Laws and Standards

State of Nevada

C. Local Ordinances

D. National and International Standards

[SD&TRD I.3.8.A]

3.2.1.1.1.B.2 For requirements addressing nuclear safety, the NRC requirements (i.e., CFRs issued by the NRC) shall take precedence over DOE requirements (i.e., DOE Orders or directives) only for activities over which the NRC has regulatory authority. However, DOE Orders, CFRs, or other standards may be used as a reference in meeting NRC requirements. For activities that are not regulated by the NRC, such as site characterization and research, and development studies, DOE nuclear safety

requirements shall take precedence unless exempted in accordance with the requirements of 10 CFR 820.

[SD&TRD I.3.8.B]

- 3.2.1.1.1.B.3** The order of precedence between 29 CFR 1910 (Occupational Safety and Health Administration) and 30 CFR 57 (Mine Safety and Health Administration) shall be as described in 3.2.1.1.2.4.I.

[SD&TRD I.3.8.C]

3.2.1.1.1.C EXPLORATORY STUDIES FACILITY DECOMMISSIONING AND CLOSURE

The following provisions will be made for decommissioning and closure of the ESF if the site is found unsuitable as a repository.

- 3.2.1.1.1.C.1** The ESF facilities (systems and subsystems) shall be placed into a permanently nonoperable and safe condition.

[DERIVED][SD&TRD I.3.7.2.2.D.1.B, I.3.7.2.3.D.1.E, I.3.7.2.5.D.1.10]

- 3.2.1.1.1.C.2** The ESF shall be designed, constructed, and operated to not preclude meeting restoration requirements of applicable federal, state, and local codes.

[DERIVED][SD&TRD I.3.3.12]

- 3.2.1.1.1.C.3** Subsurface accesses, drifts, and rooms shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material.

[SD&TRD I.3.7.2.5.D.1.10]

- 3.2.1.1.1.C.4** The ground at each site shall be restored to a contour and revegetated compatible with its initial condition.

[DERIVED][SD&TRD I.3.7.2.1.D.1.E]

- 3.2.1.1.1.D** The design of ESF computer systems shall provide for the intercompatibility of resources, including hardware and software. The design goal is to allow for the common use of databases and information with other CRWMS elements.

[SD&TRD I.3.3.10.B]

3.2.1.1.2 SYSTEM QUALITY FACTORS

The ESF design organization establishes and executes a reliability, availability and maintainability program for the critical support systems of the ESF. The critical support systems of the ESF include surface and subsurface power, IDCS, surface and subsurface communications, subsurface monitoring and warning system, subsurface fire protection, facility monitoring and control system, subsurface ventilation, surface and subsurface water, surface and subsurface compressed air, subsurface lighting, and surface and subsurface waste water handling systems.

3.2.1.1.2.1 RELIABILITY

3.2.1.1.2.1.A Standard equipment shall be analyzed and rated according to manufacturer and industry reliability data.
[DERIVED][SD&TRD I.3.2.2.2.B]

3.2.1.1.2.1.B Equipment reliability, capital costs, and maintenance costs shall be considered in design, procurement, and installation of ESF equipment and systems.
[DERIVED][SD&TRD I.3.2.2.2.B]

3.2.1.1.2.1.C A failure modes and effects analysis shall be performed for ESF critical support systems whose failure can result in personnel injury or illness.
[SD&TRD I.3.2.2.2.A]

3.2.1.1.2.1.C.1 Based on a failure modes and effects analysis, designs shall be developed to ensure reliability that minimizes safety hazards to the extent possible. Under such design conditions, failures shall minimize personnel injury or occupational illness.
[DERIVED][SD&TRD I.3.2.2.2.A]

3.2.1.1.2.1.C.2 If designs cannot be developed to requirements resulting from failures modes and effects analysis, then the reliability of systems shall be shown by analysis to minimize the probability of injury or illness to personnel.
[SD&TRD I.3.2.2.2.A]

3.2.1.1.2.1.C.3 In demonstrating system reliability, MIL-STD-882B shall be considered in the design, where applicable.
[SD&TRD I.3.2.2.2.A]

3.2.1.1.2.2 AVAILABILITY

3.2.1.1.2.2.A The ESF availability shall be 85%, computed by the products of the individual availability of the critical support systems.
[DERIVED][SD&TRD I.3.2.2.1.A]

3.2.1.1.2.2.B The ESF design shall allow for ESF operation on a three-shifts-per-day, seven-days-per-week schedule throughout the ESF operational phases.
[DERIVED][SD&TRD I.3.2.2.1.B]

3.2.1.1.2.3 MAINTAINABILITY

3.2.1.1.2.3.A In the selection of equipment that will require maintenance, consideration shall be given to the availability and cost of replacement materials and parts, and the need for equipment manufacturer's technical services.
[DERIVED][SD&TRD I.3.2.2.2.B]

3.2.1.1.2.3.B The ESF will be designed and constructed so that facilities and equipment are easily and economically maintained.

- 3.2.1.1.2.3.B.1** The design (size and arrangement of interior corridors) shall accommodate initial equipment installation and facility operations.
[SD&TRD I.3.2.2.3.C.1.a]
- 3.2.1.1.2.3.B.2** The design shall incorporate use of easily maintained features and durable materials.
[SD&TRD I.3.2.2.3.C.1.b]
- 3.2.1.1.2.3.B.3** The design shall consider ease of replacement of installed equipment (i.e., without structure modifications).
[SD&TRD I.3.2.2.3.C.1.c, I.3.2.2.3.E.1]
- 3.2.1.1.2.3.B.4** The design shall consider the accessibility of installed equipment and building systems for the performance of maintenance.
[SD&TRD I.3.2.2.3.A, I.3.2.2.3.C.1.d, I.3.2.2.3.E.1]
- 3.2.1.1.2.3.B.5** The design shall consider life cycle costs in selection of features, systems, and finishes.
[SD&TRD I.3.2.2.3.C.1.e]
- 3.2.1.1.2.3.B.6** The design shall make provisions for maintenance instructions and as-built drawings, especially the location of underground and otherwise concealed utility lines.
[SD&TRD I.3.2.2.3.C.1.f]
- 3.2.1.1.2.3.C** ESF facilities, subsystems, and equipment shall be designed with a mean downtime that is consistent with the availability requirement specified in this document. The mean downtime shall include the mean time to repair, disruptive preventive maintenance time, logistics delay time, administrative delay time, and safety delay time.
[SD&TRD I.3.2.2.3.D]
- 3.2.1.1.2.3.D** Facilities and equipment designs shall support the on-line maintenance concept that limits maintenance actions to those necessary to ensure safety, prevent system degradation, and restore security monitoring. This concept consists of remove and replace actions, minor servicing, minor repairs, or repair of items which cannot easily be removed from service for maintenance.
[SD&TRD I.3.5.1.A.1.a]
- 3.2.1.1.2.3.E** Maintenance shall be equipment intensive, rather than personnel intensive, and shall rely on technology to reduce maintenance requirements.
[DERIVED][SD&TRD I.3.5.1.A.1.b]
- 3.2.1.1.2.3.F** Newly designed equipment or systems shall incorporate built-in test equipment and/or automated test equipment only where it can be demonstrated to significantly reduce the on-site maintenance workload.
[SD&TRD I.3.5.1.A.1.c]
- 3.2.1.1.2.3.G** Where cost effective, components such as pumps, motors, fans, and transformers used for similar functions in various parts of the system, shall be of identical manufacture and model to facilitate interchangeability.
[SD&TRD I.3.3.5, I.3.3.8.1.D]

- 3.2.1.1.2.3.H** The ESF equipment shall be designed to be maintainable using standard tools, lubricants, cleaners, test equipment, etc.
[DERIVED][SD&TRD I.3.5.1.2.A]
- 3.2.1.1.2.4** **SYSTEM SAFETY**
- 3.2.1.1.2.4.A** All workplaces shall be designed to be free from recognized hazards that are likely to cause death or serious physical harm to employees. "Free from recognized hazards" means that the identified hazards are eliminated or mitigated to the point that they no longer pose a serious threat.
[SD&TRD I.3.3.6.1.A, I.3.3.12]
- 3.2.1.1.2.4.B** The order of precedence for satisfying system safety requirements and resolving identified hazards (MIL-STD-882B may be used as a reference) are as follows:
- 3.2.1.1.2.4.B.1** The first priority shall be to eliminate hazards by design. If an identified hazard cannot be eliminated, the associated risk shall be reduced to an acceptable level through design selection.
[SD&TRD I.3.3.6.2.A]
- 3.2.1.1.2.4.B.2** If identified hazards cannot be eliminated, or their associated risk cannot be adequately reduced through design selection, that risk shall be reduced through the use of fixed, automatic, or other protective safety design features or devices. Provisions shall be made for periodic functional checks of safety devices, where applicable.
[SD&TRD I.3.3.6.2.B]
- 3.2.1.1.2.4.B.3** When neither design nor safety devices can effectively eliminate identified hazards or adequately reduce associated risk, devices shall be used to detect the condition and to produce an adequate warning signal to alert personnel of the hazard. Warning signals and their application shall be designed to minimize the probability of incorrect personnel reaction to the signal and shall be standardized within like types of systems.
[SD&TRD I.3.3.6.2.C]
- 3.2.1.1.2.4.B.4** Training and procedures shall be used to minimize residual hazards which cannot be eliminated by design selection and safety/warning devices.
[SD&TRD I.3.3.6.2.D]
- 3.2.1.1.2.4.C** Safety labels and placards shall be designed and displayed as required in the applicable safety standards identified in this section.
[SD&TRD I.3.3.6.5.A, I.3.3.6.5.B, I.3.3.6.5.C]
- 3.2.1.1.2.4.D** Alerting devices, emergency doors and exits, and equipment provided for use in hazard areas and the environment around surface workspaces, shall be designed in accordance with the appropriate safety standards.
[SD&TRD I.3.3.6.5.C]
- 3.2.1.1.2.4.E** To protect servicing and maintenance personnel, tag-out and lock-out fixtures shall be provided.
[SD&TRD I.3.3.6.7.B]

- 3.2.1.1.2.4.F** Where the possibility exists for the eyes or body of any person to be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the immediate work area for emergency use in accordance with the applicable standards.
[DERIVED][SD&TRD I.3.3.6.7.F]
- 3.2.1.1.2.4.G** Redundant components for all systems that monitor potential life threatening conditions shall be installed in accordance with applicable federal and State of Nevada regulations.
[DERIVED][SD&TRD I.3.3.6.1.B, I.3.3.12]
- 3.2.1.1.2.4.H** 30 CFR 57 shall apply only to subsurface facilities and equipment and to those mining-related surface facilities and equipment specifically addressed therein.
[SD&TRD I.3.3.6.2.E.1, I.3.3.6.2.E.3, I.3.3.6.3.B, I.3.3.12]
- 3.2.1.1.2.4.I** 29 CFR 1910 and 29 CFR 1926 shall apply to all other surface facilities and equipment. 29 CFR 1910 and 29 CFR 1926 shall also apply to subsurface facilities and equipment not addressed by 30 CFR 57.
[SD&TRD I.3.3.6.2.E.2, I.3.3.12]
- 3.2.1.1.2.5 HUMAN FACTORS ENGINEERING**
- 3.2.1.1.2.5.A** The ESF computer terminals, visual displays, and visual display terminal workstations shall be designed, procured, and integrated using ANSI/HFS Std. No. 100-1988 Section 5 as a reference.
[SD&TRD I.3.3.7.1]
- 3.2.1.1.2.5.B** Sizing and layout for equipment and facilities shall be compatible with the using personnel (use MIL-STD-1472D Section 5.6.3.2 as a reference, and see DOD-HDBK-743 for special populations).
[SD&TRD I.3.3.7.2]
- 3.2.1.1.2.5.C** The design, selection, and integration of equipment, controls, and indicators shall use MIL-STD-1472D Section 5 or applicable industry standards as a reference.
[SD&TRD I.3.3.7.3, I.3.3.7.8, I.3.3.7.9, I.3.3.7.10]
- 3.2.1.1.2.5.D** The design, selection, and acquisition of operational and transportation vehicles and material handling equipment shall consider human interface requirements using MIL-STD-1472D Section 5.12.2 as a reference.
[SD&TRD I.3.3.7.4]
- 3.2.1.1.2.5.E** All ESF buildings shall be designed and constructed to accommodate the physically handicapped as required by General Services Administration Uniform Federal Accessibility Standards.
[SD&TRD I.3.3.7.5.A]
- 3.2.1.1.2.5.F** The design, selection, and construction of all ESF facilities shall consider accessibility and useability of facilities and equipment by physically handicapped personnel, both visitors and employees. As a minimum, the criteria and requirements specified in DOE Order 6430.1A, 1300-13, shall be considered for all facility and equipment designs.
[SD&TRD I.3.3.7.5.B]

3.2.1.1.2.6 HABITABILITY

- 3.2.1.1.2.6.A** The ESF facilities shall be designed with environmental controls that provide comfortable and appropriate workspace as defined in the appropriate standards. The interaction of temperature, humidity, air velocity, exposure time, clothing requirements, and levels of physical exertion must be considered when determining environmental conditions.
- [SD&TRD I.3.2.1.1.1.A]

3.2.1.1.2.7 PORTABILITY AND LOAD CARRYING

- 3.2.1.1.2.7.A** Equipment and components that are developed for the operation or maintenance of the ESF and that must be moved for maintenance or other purposes shall be designed, procured, or integrated with other ESF equipment and components to facilitate movement by taking into account such things as weight, lifting aids, lifting frequency, lifting height, object size and weight distribution, distance to be moved, obstacles, number of personnel, etc.
- [SD&TRD I.3.2.6]

3.2.1.1.2.8 NAMEPLATES AND MARKINGS

- 3.2.1.1.2.8.A** Equipment and equipment components which require personnel to locate, identify, interpret, follow procedures, or avoid hazards shall be labeled. The only exception to this requirement is where it is obvious to the user what the equipment component is, and what the equipment or equipment component is used for.
- [SD&TRD I.3.3.3.A, I.3.3.3.B, I.3.3.3.C, I.3.3.3.D, I.3.3.3.E, I.3.3.3.F, I.3.3.7.7]

3.2.1.1.3 SYSTEM SUPPORT**3.2.1.1.3.1 MAINTENANCE**

- The basic premise of the program maintenance concept is to minimize the likelihood of, and mitigate the effects of failures using preventive maintenance and inspections. When failures do occur, the goal is to provide the ability to restore full operational capability as quickly as possible through a proactive corrective maintenance program.
- 3.2.1.1.3.1.A** ESF facilities, systems, and components shall be designed to permit periodic testing, inspection, and maintenance, as necessary, to ensure their continued functioning and readiness.
- [SD&TRD I.3.5.1.A]
- 3.2.1.1.3.1.B** Maintenance shall take advantage of shutdowns and off-duty cycles to perform preventive maintenance necessary to lessen the downtime of equipment and facilities.
- [SD&TRD I.3.2.2.3.B]
- 3.2.1.1.3.1.C** A lifting device, having the capability to remove and install equipment that weighs more than the limits for human portability, shall be provided.
- [SD&TRD I.3.2.2.3.E.2]

- 3.2.1.1.3.1.D** Maintenance facilities, equipment, and tools shall be provided based on the criteria specified by DOE Order 4330.4B.
[SD&TRD I.3.3.12.ab, I.3.5.1.A.1.d]
- 3.2.1.1.3.2** **LOGISTICS**
- 3.2.1.1.3.2.A** The Integrated Logistics Program will focus on ensuring supportability is designed into the ESF. The following logistics elements shall be considered in the ESF design:
- Spares and repair parts commonality,
 - Life cycle supportability,
 - Test and/or support equipment for designed items,
 - Quantity and type of consumables,
 - Procurement lead time,
 - Training requirements.
- [SD&TRD I.3.5.1.1, I.3.5.2]
- 3.2.1.1.3.2.B** Surplus government equipment shall be considered for fulfilling the requirements of the ESF facilities and equipment in accordance with the appropriate procedures.
[SD&TRD I.3.3.9]
- 3.2.1.1.3.2.C** Sufficient parts shall be maintained in inventory for items to be repaired in place by qualified repair personnel with technical data.
[SD&TRD I.3.2.2.3.D.1]
- 3.2.1.1.3.2.D** An inventory management system shall be implemented to control supplies and spare parts associated with the operation, closure, and decommissioning of the ESF.
[SD&TRD I.3.3.8.2]
- 3.2.1.1.3.3** **DOCUMENTATION**
- Technical data consist of the engineering, technical, and logistic data required to support operational and maintenance requirements.
- 3.2.1.1.3.3.A** Methods shall be established to ensure that applicable regulatory requirements and the design basis are correctly translated into specifications, drawings, manuals, procedures and instructions.
[SD&TRD I.3.4.3]
- 3.2.1.1.3.3.B** The ESF shall maximize the use of off-the-shelf vendor documentation for technical, maintenance and operations manuals.
[SD&TRD I.3.4.3]
- 3.2.1.1.3.3.C** All specifications for facility construction and for equipment development and procurement shall be prepared in accordance with the guidelines of the Construction Specification Institute format, tailored for the application.
[SD&TRD I.3.4.1.A]

3.2.1.1.3.4 TRAINING

3.2.1.1.3.4.A The ESF shall provide facilities and provisions for equipment, manuals and training aids to support training programs established for both DOE and contractor personnel. The training activities shall include, but are not limited to, the following:

- Equipment maintenance training based on the criteria specified by DOE Order 4330.4B;
- Development of a training requirements document used for operations and maintenance training for the facilities, hardware, and software;
- Qualification and proficiency training, testing, and certification of personnel involved in activities important to safety, as required by the QARD.

[SD&TRD I.3.3.12.ab, I.3.6.2.1.A, I.3.6.2.1.B, I.3.6.2.1.C]

3.2.1.1.4 TEST CONSTRAINTS

3.2.1.1.4.A Test areas shall be separated so they are not affected by the excavation disturbed zone and any thermal, mechanical, chemical, and hydrological interactions.

[DERIVED][SD&TRD I.3.7.2.5.C.1.D, I.3.7.2.5.C.1.E][10CFR60.15(c)(1)]

3.2.1.1.4.B The number of ESF exploratory boreholes in support of site characterization testing shall be limited and their locations coordinated with the repository design.

[DERIVED][SD&TRD I.3.7.2.5.C.2][10CFR60.15(c)(2)]

3.2.1.1.4.C The ESF test organization shall document and maintain all records as identified below:

- Surveys of the underground facility excavations, shafts, and boreholes referenced to readily identifiable surface features or monuments;
- A description of the materials encountered;
- Instrument locations, readings, and analysis;
- Geologic maps and geologic cross-section.

[DERIVED][SD&TRD I.3.7.2.5.D.1.7][10CFR60.72(a), 10CFR60.72(b)]

3.2.1.1.4.D The ESF site characterization testing shall include performance confirmation tests as early as possible.

[SD&TRD I.3.7.2.5.D.3.2][10CFR60.137, 10CFR60.74(b)]

3.2.1.1.4.E The ESF shall be designed so that the thermal effects of ESF testing do not result in temperatures in excess of 115 degrees Celsius in either the Topopah Spring Welded Unit 3 (TSw3) or Calico Hills non-welded (CHn) units.

[DERIVED]

3.2.1.2 REQUIREMENTS APPLICABLE TO ALL ESF CIs**3.2.1.2.1 ENVIRONMENTS****3.2.1.2.1.1 SURFACE CONDITIONS**

- 3.2.1.2.1.1.A** The ESF surface facilities and equipment shall be designed with features that minimize the growth of fungus, bacteria, and algae.
[SD&TRD I.3.2.3.1.A]
- 3.2.1.2.1.1.B** Earthquake design parameters for surface facilities shall be calculated in accordance with the information in Appendix A.
[DERIVED][SD&TRD I.3.2.3.1.E, I.3.3.12]
- 3.2.1.2.1.1.C** The ESF surface facilities shall be designed to withstand 75 mph (high winds) prevailing winds with maximum gusts up to 97 mph.
[SD&TRD I.3.2.3.1.C]
- 3.2.1.2.1.1.D** The ESF surface facilities and equipment shall be designed with appropriate grounding to withstand and minimize the potential for damage due to a direct lightning strike.
[DERIVED][SD&TRD I.3.2.3.1.A]
- 3.2.1.2.1.1.E** The ESF surface facilities and equipment shall be designed to withstand maximum daily precipitation levels of 2.18 inches within a 24 hour period.
[SD&TRD I.3.2.3.1.J, I.3.3.12.at]
- 3.2.1.2.1.1.F** The ESF surface facilities and equipment shall be designed to withstand and operate in temperatures ranging from a low of -14 degrees F to a high of 108 degrees F.
[DERIVED][SD&TRD I.3.2.3.1.I]
- 3.2.1.2.1.1.G** The ESF surface facilities and equipment shall be designed to withstand maximum loads caused by snow fall of 10 inches maximum in a 24 hour period.
[SD&TRD I.3.2.3.1.B, I.3.2.3.1.J, I.3.3.12.at]
- 3.2.1.2.1.1.H** The ESF surface facilities and equipment shall be designed to withstand and operate in a relative humidity environment of 13 to 71%.
[DERIVED][SD&TRD I.3.2.3.1.A]
- 3.2.1.2.1.1.I** The ESF surface facilities and equipment shall be designed to withstand the loads caused by a 100 year probable maximum flood local storm identified in the *Reference Information Base*, YMP/93-02.
[SD&TRD I.3.2.3.1.F]
- 3.2.1.2.1.1.J** The ESF surface facilities and equipment shall be designed to withstand and operate in an environment with sand and dust.
[SD&TRD I.3.2.3.1.A]

3.2.1.2.1.2 SUBSURFACE CONDITIONS

3.2.1.2.1.2.A The permanent and temporary items of the ESF shall be designed to withstand the applicable seismic environment specified in Appendix A.
[DERIVED][SD&TRD I.3.2.3.1A, I.3.7.2.5.D.2.6][10CFR60.131(b)(1)]

3.2.1.2.1.2.B The ESF subsurface facilities and equipment shall be designed to withstand and operate in a dusty environment.
[SD&TRD I.3.2.3.1.A]

3.2.1.2.1.2.C The ESF subsurface facilities and equipment shall be designed to withstand and operate in temperatures ranging from a low of 50 degrees F to a high of 70 degrees F.
[DERIVED][SD&TRD I.3.2.3.1.I]

3.2.1.2.1.2.D The ESF subsurface facilities and equipment shall be designed to withstand and operate in a relative humidity environment of 13 to 71%.
[DERIVED][SD&TRD I.3.2.3.1.A]

3.2.1.2.2 SERVICE LIFE

3.2.1.2.2.A The ESF non-permanent items shall be designed for a 25 year maintainable service life.
[DERIVED][SD&TRD I.3.2.2.4.A]

3.2.1.2.2.B The ESF permanent items shall be designed for a 150-year maintainable service life.
[DERIVED][SD&TRD I.3.2.2.4.B, I.3.7.2.5.D.2.2, I.3.7.2.5.D.2.16, I.3.7.2.5.D.2.18]
[10CFR60.3(a), 10CFR60.3(b), 10CFR60.111(b)(1), 10CFR60.133(c), 10CFR60.133(e)(1)]

3.2.1.2.3 ESF CONSTRAINTS

3.2.1.2.3.A ESF construction and operation activities shall be evaluated and monitored as necessary for the purpose of assessing the effects of those activities on the future suitability of the site for a potential repository.
[DERIVED][SD&TRD I.3.7.2.1.C.1.B, I.3.7.2.2.C.1.B, I.3.7.2.3.C.1.B, I.3.7.2.4.C.1.B, I.3.7.2.5.C.1.B, I.3.7.2.6.C.1.B][10 FR60.15(c)(1)]

3.2.1.2.3.B Tracers, fluids, and materials to be used at the ESF shall first be reviewed for potential adverse impacts to waste isolation and site characterization testing. These substances are subject to establishment of controls, and shall only be used following review and approval, and only in those areas where use has been approved. Such substances include, but are not limited to, the following:

- Concrete and other cementitious materials, such as shotcrete and grout
- Ground support materials, including chemical/resin anchorages
- Water and any additives to water for identification (tracers) or construction, operation, or testing
- Hydrocarbons and solvents

- Organic materials

- Combustible materials.

[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10CFR60.15(c)(1)]

3.2.1.2.3.C

The presence of combustible materials underground during construction and operation shall be controlled and limited.

[DERIVED][SD&TRD I.3.7.2.1.C.1.B, I.3.7.2.2.C.1.B, I.3.7.2.3.C.1.B, I.3.7.2.4.C.1.A, I.3.7.2.5.C.1.B, I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

3.2.1.2.3.D

Within the Conceptual Controlled Area Boundary, the quantity of water used in surface site preparation, construction, and operations shall not exceed an average of two gallons per square yard of application per day, when averaged over five years (excluding water used to mix concrete or shotcrete) or an amount as determined by analysis. The amount of water used for subsurface construction and operation shall be consistent with the amount determined by analysis.

[DERIVED][SD&TRD I.3.7.2.1.C.1.B, I.3.7.2.2.C.1.B, I.3.7.2.3.C.1.B, I.3.7.2.4.C.1.A, I.3.7.2.5.C.1.B, I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

3.2.1.2.3.E

Spills shall be cleaned up to the extent practical. Spilled material and contaminated material (including soil) shall be disposed of in accordance with federal and state requirements, and unrecovered spills will be reported in accordance with tracers, fluids, and materials procedures.

[DERIVED][SD&TRD I.3.7.2.1.C.1.B, I.3.7.2.2.C.1.B, I.3.7.2.3.C.1.B, I.3.7.2.4.C.1.A, I.3.7.2.5.C.1.B, I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

3.2.1.2.3.F

Dust, vibration, and traffic near sensitive areas shall be controlled during design, construction, and operation (e.g., testing, environmental).

[SD&TRD I.3.7.2.1.C.1.C, I.3.7.2.2.C.1.C, I.3.7.2.3.C.1.C, I.3.7.2.4.C.1.B, I.3.7.2.5.C.1.C, I.3.7.2.6.C.1.C][10CFR60.15(c)(1)]

3.2.1.2.3.G

All excavation blasting shall be designed to control overbreak to minimize impacts to waste isolation and/or site characterization testing.

[DERIVED][SD&TRD I.3.7.2.1.C.1.A, I.3.7.2.2.C.1.A, I.3.7.2.3.C.1.A, I.3.7.2.5.C.1.A, I.3.7.2.6.C.1.A][10CFR60.15(c)(1)]

3.2.1.2.3.H

All explosives and blasting agents shall be obtained from a qualified supplier, per 27 CFR 55, to limit adverse impacts on in situ site characterization and to limit blasting residue.

[DERIVED][SD&TRD I.3.7.2.1.C.1.A, I.3.7.2.2.C.1.A, I.3.7.2.3.C.1.A, I.3.7.2.5.C.1.A, I.3.7.2.6.C.1.A][10CFR60.15(c)(1)]

3.2.1.2.3.I

Surface construction and/or the location of surface facilities shall avoid the impoundment of surface water which would have adverse effects on the ability of the site to isolate waste.

[DERIVED][SD&TRD I.3.7.2.1.C.1.B, I.3.7.2.2.C.1.B, I.3.7.2.3.C.1.B, I.3.7.2.4.C.1.A, I.3.7.2.5.C.1.B, I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

3.2.1.2.4 COMPLIANCE

3.2.1.2.4.A The ESF shall be designed in compliance with the applicable requirements contained in the Uniform Building Code.

[DERIVED][SD&TRD I.3.2.3.1.D]

3.2.1.2.4.B The ESF shall be designed in compliance with the applicable requirements contained in ACI 318 Building Code Requirements for Reinforced Concrete Code.

[SD&TRD I.3.3.12.ar]

3.2.1.2.4.C The ESF shall be designed in compliance with the applicable requirements contained in DOE Order 6430.1A.

[SD&TRD I.3.3.12.af]

3.2.1.2.4.D The ESF shall be designed in compliance with the applicable requirements contained in DOE Order 5480.7A.

SD&TRD I.3.3.12.ae]

3.3 ACCESS ROADS (BABA00000)

The complete set of Access Roads CI requirements is obtained by combining the applicable requirements from Sections 3.2.1.2 and 3.3.1.

3.3.1 DESCRIPTION

The Access Roads provide vehicular access through the development of new roads, improvements, and usage of existing Nevada Test Site (NTS) roads. There are two types of access roads: local-rural and resource. The main function of the Access Roads CI is to provide access between the Main Site CI (North Portal CI), Auxiliary Sites CI, South Portal, and the NTS.

The ESF Access Roads CI also supports the SBT CI test effort by providing access to common use facilities at the Main Site CI. Specific trails to provide access to Borehole CIs, trenches, and other remote areas are the responsibility of the SBT access roads.

The sole purpose of the Access Roads CI is to support the site characterization effort; it is not designed for incorporation into a potential Repository CI. The Access Roads CI is neither a permanent item nor a Q CI; however, it does contain quality assurance requirements. These requirements are stated in terms of controls governing design, construction, and operation. Control requirements are identified by the 10 CFR 60.15(c)(1) source reference.

3.3.1.A An all-weather local-rural access road shall be provided to the North Portal Pad from the H road.

[SD&TRD I.3.7.2.1.B.1.2.A]

3.3.1.B Resource access roads shall be provided to the Auxiliary Site CIs from the H road. The applicable Auxiliary Site CIs are the Muck Storage, Topsoil Storage, Rock Storage, Water Storage and Water Boost Pump Station.

[SD&TRD I.3.7.2.1.B.1.3.A]

3.3.1.C The Access Roads CI shall provide access to common use facilities at the main site for SBT.

[SD&TRD I.3.7.2.1.B.2.1.A]

3.3.1.D The portion of the existing H road that serves as the main interface with the NTS shall be improved to an all-weather local-rural road to support site characterization activities.

NOTE: It is not required to bring the existing portions of the H road into compliance with current standards.

[SD&TRD I.3.7.2.1.B.2.4.A]

3.3.1.E Muck haulage in the vicinity of the main site shall be separated from personnel access for safety considerations.

[DERIVED][SD&TRD I.3.7.2.1.D.1.F]

- 3.3.1.F** Fluids and materials shall be controlled during design, construction, and operation.
[DERIVED][SD&TRD I.3.7.2.1.C.1.B][10CFR60.15(c)(1)]
- 3.3.1.G** Dust, vibration, and traffic near sensitive areas shall be controlled during design, construction, and operation (e.g., testing, environmental). Construction and operation constraints may be imposed so that a test is isolated from construction or mining activities because the test is sensitive to vibration, dust, and traffic.
[SD&TRD I.3.7.2.1.C.1.C][10CFR60.15(c)(1)]
- 3.3.1.H** New roads shall be constructed to provide access to all surface areas designated to support the ESF.
[DERIVED][SD&TRD I.3.7.2.1.D.1.A]
- 3.3.1.I** Existing roads shall be relocated or refurbished to provide access to all surface areas designated to support the ESF.
[DERIVED][SD&TRD I.3.7.2.1.D.1.A]
- 3.3.1.J** The access roads shall be designed for adequate drainage and flood control without sacrificing the structural integrity or safety of the roads.
[DERIVED][SD&TRD I.3.7.2.1.D.1.E]
- 3.3.1.K** Existing roads shall be incorporated into the ESF if this incorporation can be shown to be cost effective.
[DERIVED][SD&TRD I.3.7.2.1.D.1.G]
- 3.3.1.L** Existing roads shall be incorporated into the ESF if they do not reduce the performance of the site or validity of the investigations.
[DERIVED][SD&TRD I.3.7.2.1.D.1.G]
- 3.3.1.M** Access roads shall meet the requirements of all anticipated service during the site characterization phase, including site security, safety, and anticipated loads during ESF operations.
[DERIVED][SD&TRD I.3.7.2.1.D.1.A]
- 3.3.1.N** The access roads design shall be based on the ESF population study for determination of average daily traffic.
[DERIVED][SD&TRD I.3.7.2.1.D.1.A]
- 3.3.1.O** Access roads used for hauling heavy loads shall be identified as such.
[DERIVED][SD&TRD I.3.7.2.1.D.1.B]
- 3.3.1.P** Access roads used for hauling heavy loads shall be designed to handle the anticipated heavy loads.
[DERIVED][SD&TRD I.3.7.2.1.D.1.B]
- 3.3.1.Q** Access roads used by normal vehicle traffic to reach facilities and activity sites shall be identified as such.
[DERIVED][SD&TRD I.3.7.2.1.D.1.C]

- 3.3.1.R** Access roads used by normal vehicle traffic shall be designed to not exceed alignment and grades that permit safe operation.
[DERIVED][SD&TRD I.3.7.2.1.D.1.C]
- 3.3.1.S** Access to the USW G-4 borehole shall be preserved.
[DERIVED][SD&TRD I.3.7.2.1.D.1.H]
- 3.3.1.T** As a minimum, the design load for roads shall be HS-20 truck, as specified in the American Association of State Highway and Transportation Officials standard.
[SD&TRD I.3.7.2.1.D.2.C]
- 3.3.1.U** Designs for local-rural roads shall be asphaltic concrete paved.
[DERIVED][SD&TRD I.3.7.2.1.D.2.D]
- 3.3.1.V** Design of resource access roads shall include a surface of 12 inches of select fill.
[DERIVED][SD&TRD I.3.7.2.1.D.3.C]
- 3.3.1.W** Access roads shall be designed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December, 1988).
[SD&TRD I.3.3.11.A.d]
- 3.3.1.X** The design of the access roads shall be in compliance with all applicable requirements in the Air Quality Operating Permit, AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k, I.3.7.2.1.D.1.D]
- 3.3.1.Y** The design of access roads shall be in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]
- 3.3.1.Z** The design of the access roads shall be in compliance with all applicable requirements in the *Floodplain Assessment of Site Characterization Activities at the Yucca Mountain Site, Nye County, Nevada* (Floodplain Assessment) (YMP/92-30).
[DERIVED][SD&TRD I.3.2.3.1.G.1, I.3.2.3.1.G.2, I.3.3.11.A.u]
- 3.3.1.AA** The design of access roads shall be in compliance with all applicable requirements in the Stormwater Discharge Permit Application.
[DERIVED][SD&TRD I.3.3.11.A.e, I.3.3.11.A.w]
- 3.3.1.AB** Design load for resource access roads shall be a minimum of light-duty maintenance vehicles.
[DERIVED][SD&TRD I.3.7.2.1.D.3.B]
- 3.3.1.AC** Design of local-rural access roads shall be in accordance with the appropriate sections of State of Nevada Department of Transportation Road Design Division Design Manual.
[SD&TRD I.3.7.2.1.D.2.B]

3.3.1.AD Design of local-rural access roads shall be in accordance with the appropriate sections of AASHTO GDHS-84.

[SD&TRD I.3.7.2.1.D.2.A]

3.3.1.AE Design of resource access roads on BLM and Air Force property, shall be in accordance with BLM requirements contained in BLM Manual Section 9100, Engineering; and Section 9113, Roads.

[SD&TRD I.3.7.2.1.D.3.A]

3.4 MAIN SITES (BABB00000)

The complete set of Main Sites CI requirements is obtained by combining the requirements from Sections 3.2.1.2 and 3.4.1.1.

3.4.1 DESCRIPTION

The Main Sites are defined as the surface area locations that accommodate the layout and construction of utilities and facilities, structures, systems, and services for operation and testing of subsurface in situ site characterization of the ESF.

3.4.1.1 MAIN SITES CI REQUIREMENTS

3.4.1.1.A The Main Sites shall provide a security system to protect the surface facilities in accordance with applicable standards.

[DERIVED][SD&TRD I.3.2.7.1]

3.4.1.1.B The Main Sites security system shall be designed to include means to test and maintain intrusion alarms, emergency alarms, communications equipment, physical barriers, site lighting, and other security-related devices or equipment.

[SD&TRD I.3.5.1.A.2]

3.4.1.1.C Surface facilities and their locations shall facilitate the flow of material and personnel within the ESF site, and support adequate ESF site security, including controlled access and emergency response.

[DERIVED][SD&TRD I.3.7.2.2.B.1.5.A]

3.4.1.1.D The Main Sites security system shall protect experiments, tests, equipment, and monitoring and control systems from unauthorized access.

[DERIVED][SD&TRD I.3.2.7.1]

3.4.1.1.E Access to general parking areas from the working areas of the ESF shall be controlled to prevent unauthorized removal of material and property.

[DERIVED][SD&TRD I.3.2.7.2]

3.4.1.2 APPLICABLE REQUIREMENTS FOR EVERY CI WITHIN THE MAIN SITES CI

None

3.4.2 SURFACE FACILITIES (BABBA0000)

The complete set of Surface Facilities CI requirements is obtained by combining the requirements from Sections 3.2.1.2 and 3.4.2.1.1.

3.4.2.1 DESCRIPTION

The Surface Facilities are defined as the facilities, structures, systems, and services for the surface buildings and structures that are required for the support of ESF operations and in situ site characterization.

3.4.2.1.1 SURFACE FACILITIES CI REQUIREMENTS

3.4.2.1.1.A The surface facilities shall provide the following accommodations:

- switchgear building,
- parking areas,
- covered storage area,
- shop building,
- warehouse building,
- operations building,
- change house building,
- guard house, and
- an ESF visitor center.

[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A, I.3.7.2.2.B.2.1.A, I.3.7.2.2.D.1.F]

3.4.2.1.1.B The surface facilities shall accommodate space for equipment and operations listed below:

- Administration,
- Operations and engineering staff,
- Training/Underground safety,
- Visitors,
- Environmental monitoring, health and safety,
- Security,
- Storage/warehouse,
- Shop/maintenance,
- Fire/emergency (and associated vehicles),
- Change room,
- Compressed air,
- Computer control system/Data collection systems,
- Ramp portals,
- Surface mobile equipment (as required),
- Electrical power,
- Treatment of subsurface water,
- Communications.

[DERIVED][SD&TRD I.3.7.2.2.B.2.1.A, I.3.7.2.2.D.1.F]

3.4.2.1.1.C The site layout shall include provisions to accommodate future expansion.

[DERIVED][SD&TRD I.3.2.5]

3.4.2.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SURFACE FACILITIES CI

3.4.2.1.2.A All surface building facilities (except parking areas and covered storage) shall be complete with heating, ventilation, and air conditioning (HVAC), water, plumbing and sanitary facilities, power, lighting, and a communication system.

[DERIVED][SD&TRD I.3.2.1.1.2.A, I.3.2.1.1.3.A]

3.4.2.1.2.B	The surface facilities shall be equipped with fire protection systems. [DERIVED][SD&TRD I.3.2.3.2.1.A]
3.4.2.1.2.C	RESERVED
3.4.2.1.2.D	RESERVED
3.4.2.1.2.E	Protection shall be provided to ensure separation of potable and non-potable water systems. [DERIVED][SD&TRD I.3.3.6.5.B]
3.4.2.1.2.F	Non-potable water lines shall be clearly marked to prevent consumption of the non-potable water by personnel. [DERIVED][SD&TRD I.3.3.6.5.B]
3.4.2.1.2.G	Population studies shall be conducted by the design organization to determine the estimated number of personnel in each of the surface facilities. [DERIVED][SD&TRD I.3.7.2.2.D.1.F]
3.4.2.1.2.H	The inhabited surface facilities shall have restrooms, water heating, space heating, and ventilation or air conditioning. [DERIVED][SD&TRD I.3.2.1.1.1.A, I.3.3.7.13]
3.4.2.1.2.I	The surface facilities shall accommodate the number of personnel estimated from the ESF population study during ESF operation and testing phases. [DERIVED][SD&TRD I.3.7.2.2.B.2.1.A, I.3.7.2.2.D.1.F]
3.4.2.1.2.J	The surface facilities shall be designed and constructed so as not to preclude later additions. [SD&TRD I.3.2.5]
3.4.2.1.2.K	RESERVED
3.4.2.1.2.L	The surface facility emergency lighting systems shall be designed to provide light following the loss of normal utility power, for a minimum duration that exceeds the evacuation time estimated in the safety analysis, and meet the applicable electrical design standards. [DERIVED][SD&TRD I.3.3.6.6.C]
3.4.2.2	SWITCHGEAR BUILDING (BABBA000) The complete set of Switchgear Building CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.2.1.
3.4.2.2.1	DESCRIPTION The Switchgear Building is defined as the facilities, systems, and services that will be utilized for housing the primary 12.47 kV switchgear and paralleling switchgear generator control panels. The electrical switchgear building is complete with HVAC, plumbing, water, sanitary facilities, electrical power, lighting, communications, and fire protection as required for appropriate coverage. In addition, the following will be located in the switchgear building: mechanical room, restrooms, and equipment room.

3.4.2.2.1.A The switchgear building shall be designed to accommodate the surface electrical power switchgear.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.B, I.3.7.2.2.B.1.6.A]

3.4.2.3 PARKING AREAS (BABBAB000)

The complete set of Parking Areas CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.3.1.

3.4.2.3.1 DESCRIPTION

The Parking Areas are defined as the spaces and allowances for vehicle parking required to support operation and testing in the ESF. Parking areas shall accommodate automobiles, vans, buses, haulage trucks, tractor trailers and emergency vehicles.

3.4.2.3.1.A Parking area ease of access shall be ensured, while limiting the amount of surface area required.

[DERIVED][SD&TRD I.3.7.2.2.D.1.D, I.3.7.2.2.D.1.F]

3.4.2.3.1.B All parking areas shall be located to ensure personnel safety and to prevent obstruction of the ESF operational activities.

[DERIVED][SD&TRD I.3.3.6.3.A]

3.4.2.3.1.C RESERVED

3.4.2.3.1.D As a minimum, the parking areas shall accommodate the following types of vehicles:

- Automobiles,
- Vans,
- Buses,
- Haulage trucks,
- Tractor trailers (18 wheel and larger),
- Emergency vehicles (ambulance and underground rescue truck).

[DERIVED][SD&TRD I.3.7.2.2.D.1.F]

3.4.2.3.1.E The parking areas shall be sloped to provide controlled drainage.

[DERIVED][SD&TRD I.3.7.2.2.D.1.C]

3.4.2.3.1.F Dedicated parking for emergency vehicles shall be located such that the vehicles can be accessed quickly.

[DERIVED][SD&TRD I.3.7.2.2.B.1.6.C]

3.4.2.3.1.G The Parking Area shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.

[DERIVED][SD&TRD I.3.3.11.A.k]

3.4.2.4 COVERED STORAGE (BABBAC000)

The complete set of Covered Storage CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.4.1.

3.4.2.4.1 DESCRIPTION

The Covered Storage is defined as facilities, systems, and services for the safe storage and dispensing of ESF materials, equipment, and supplies that require moderate protection from the environment and are not stored in the open areas of the storage facilities.

3.4.2.4.1.A The covered storage shall include provisions for the separate storage of private and DOE equipment.

[DERIVED][SD&TRD I.3.3.9]

3.4.2.4.1.B The covered storage shall include provisions for the separate storage of test equipment and drilling equipment.

[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]

3.4.2.4.1.C The covered storage facilities shall be sized to accommodate the inventory needs of the ESF operations and, as a minimum, accommodate the following:

- General equipment,
- Pipe and pipe racks,
- Sheet steel and steel shapes,
- Lumber,
- Cement and admixtures,
- Coarse and fine aggregate,
- Reinforcing steel,
- Wire and cable reels,
- Compressed gas bottles,
- Drilling rigs/equipment,
- Test equipment.

[DERIVED][SD&TRD I.3.7.2.2.B.1.5.A]

3.4.2.4.1.D The covered storage facility shall protect the designated storage equipment and supplies against direct sunlight and the environments identified in Section 3.2.1.2.1.

[DERIVED][SD&TRD I.3.7.2.2.D.1.F]

3.4.2.5 SHOP BUILDING (BABBAD000)

The complete set of Shop Building CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.5.1.

3.4.2.5.1 DESCRIPTION

The Shop Building is defined as the facilities, systems, and services for routine maintenance and repair of the construction and testing equipment designated for the ESF, including ground maintenance and transportation equipment. The Shop Building facilities are complete with space heating, ventilation or air-conditioning, water, compressed air, plumbing and sanitary facilities, electrical power, lighting, communications, and fire protection systems as required for appropriate coverage. The design provides space flexibility to accommodate anticipated equipment installations and to allow test related activities to proceed independently from other ESF repairs.

- 3.4.2.5.1.A** The shop shall provide for separate storage of chemicals and flammable materials in accordance with applicable standards.
[DERIVED][SD&TRD I.3.3.6.3.C]
- 3.4.2.5.1.B** The shop shall provide an area for welding operations in accordance with applicable standards.
[DERIVED][SD&TRD I.3.3.6.7.E, I.3.3.12]
- 3.4.2.5.1.C** The shop building shall provide accommodations where test apparatus (for use in the ESF site characterization testing under the direction of the ESF Test Coordination Office and the principal investigators) can be assembled, stored, repaired, tested, and disassembled.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]
- 3.4.2.5.1.D** The shop building shall provide space to accommodate the following types of activities and services: routine equipment maintenance and repair, maintenance equipment storage, and operations spare parts storage.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]
- 3.4.2.5.1.E** The shop shall provide cranes sized to support the maintenance needs of the ESF.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.2.5.1.F** The shop shall accommodate space for routine electrical and mechanical equipment repair and maintenance.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.2.5.1.G** The shop shall have, as a minimum, separate restrooms for men and women, an office, a service bay, storage space for maintenance supplies, and locker/change space.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.2.5.1.H** The shop shall provide air conditioning to the office area and restrooms.
[DERIVED][SD&TRD I.3.2.1.1.2.A]
- 3.4.2.5.1.I** The shop facility shall include a concrete wash pad with suitable controls to ensure that wash water enters the proper sewage system and is treated accordingly.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.2.5.1.J** The shop shall provide multiple high bays consistent with the maintenance requirements analysis.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.2.5.1.K** The shop facility shall be sized to provide office space for test support functions, and scientific, maintenance, and ESF operations personnel consistent with the results from ESF population study.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.2.6** **WAREHOUSE (BABBAE000)**
- The complete set of Warehouse CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.6.1.

3.4.2.6.1	DESCRIPTION
	The Warehouse is defined as the facilities, systems, and services for the safe storage and dispensing of ESF materials that require indoor storage, and are not stored in open areas of the storage facilities. The facility provides for receipt and inspection of materials and equipment, shipping, and inventory controls.
3.4.2.6.1.A	The warehouse facilities shall be secured (fences, gates, and lockups) and integrated with the overall site security. [DERIVED][SD&TRD I.3.7.2.2.D.1.A]
3.4.2.6.1.B	The warehouse shall provide a chemical storage area which will comply with applicable standards. [DERIVED][SD&TRD I.3.3.6.3.C]
3.4.2.6.1.C	The warehouse shipping and receiving facility design shall be compatible with requirements for handling, storage, and shipment of items that are important to safety as specified in Section 13.0 of the QARD. [DERIVED][SD&TRD I.3.5.3.2.C]
3.4.2.6.1.D	The warehouse storage facilities shall provide a climate controlled environment for designated stored equipment and supplies. [DERIVED][SD&TRD I.3.5.3.1]
3.4.2.6.1.E	The warehouse shall include provisions for separate storage of private and DOE equipment. [DERIVED][SD&TRD I.3.5.3.2.C]
3.4.2.6.1.F	The warehouse shall include provisions for the separate storage of test equipment and ESF equipment. [DERIVED][SD&TRD I.3.5.4]
3.4.2.6.1.G	The warehouse facility shall be sized to accommodate space for shipping and receiving materials and equipment, and the inventory needs for ESF operations and site characterization. [DERIVED][SD&TRD I.3.5.3.1]
3.4.2.6.1.H	The warehouse shall provide space to accommodate offices. [DERIVED][SD&TRD I.3.7.2.2.D.1.F]
3.4.2.6.1.I	The warehouse, office areas, and restrooms shall be air conditioned. [DERIVED][SD&TRD I.3.2.1.1.2.A]
3.4.2.6.1.J	The warehouse shall accommodate space for storage of critical components requiring controlled access. [DERIVED][SD&TRD I.3.5.3.2.C]
3.4.2.6.1.K	The warehouse facility shall accommodate space for the storage of all spare parts and replaceable equipment in an environment conducive to their safekeeping and protection. [SD&TRD I.3.5.3.1]

- 3.4.2.6.1.L** The warehouse facility shall provide space for receipt of maintenance and repair materials and tools, and shipment and return receipt of items shipped off-site for repair.
[SD&TRD I.3.5.3.2.A]
- 3.4.2.6.1.M** The warehouse shipping and receiving facilities shall be designed with door openings and aisles adequate for movement of items to be shipped into and out of the facility.
[SD&TRD I.3.5.3.2.B]
- 3.4.2.7** **CHANGE HOUSE (BABBAF000)**
- The complete set of Change House CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.7.1.
- 3.4.2.7.1** **DESCRIPTION**
- The Change House is defined as the facilities, systems and services required to support personnel requiring accommodations for showering, changing clothes, training, first aid, mine rescue, and access control offices, to support ESF operations, scientific operations, visitors, and maintenance personnel for the site characterization program. The Change House facilities are complete with HVAC, water, plumbing and sanitary facilities, power, lighting, communications and fire protection systems as required for appropriate coverage.
- 3.4.2.7.1.A** The change house shall accommodate space for protective equipment such as helmets, face shields, safety shoes, hearing protection devices, and respiratory protectors.
[DERIVED][SD&TRD I.3.3.6.4.A, I.3.7.2.2.B.1.6.A]
- 3.4.2.7.1.B** The change house shall provide raised flooring and duct banks to accommodate the use of computer resources.
[SD&TRD I.3.3.10.A]
- 3.4.2.7.1.C** The change house shall accommodate the following:
- Offices,
 - Change rooms,
 - First aid and underground rescue apparatus center,
 - Scientific and test support personnel,
 - ESF support functions, including training.
- [DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.2.7.1.D** The change house facility shall be designed with separate change rooms for men and women.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.2.7.1.E** **RESERVED**

- 3.4.2.7.1.F** The change house locker facilities shall be sized to accommodate both personal and work-related clothing and equipment for the ESF operations, maintenance, and underground testing personnel.
[DERIVED][SD&TRD I.3.3.6.4.C]
- 3.4.2.7.1.G** The change house shall include a first aid structure that provide at least 19 square meters (200 square feet) for the first aid facility, plus 4.6 square meters (50 square feet) for storage.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.C]
- 3.4.2.7.1.H** The change house shall accommodate space for the underground monitoring, warning, and rescue operations system.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.C]
- 3.4.2.7.1.I** The change house shall be designed with a system to control access to underground openings in accordance with the applicable design standards.
[SD&TRD I.3.7.2.2.B.1.5.B]
- 3.4.2.7.1.J** The change house access control system shall restrict entry into the underground to qualified and trained personnel with appropriate identification.
[SD&TRD I.3.7.2.2.B.1.5.B]
- 3.4.2.7.1.K** The change house access control system shall be equipped with an alarm system to notify personnel of unauthorized entry.
[SD&TRD I.3.7.2.2.B.1.5.B]
- 3.4.2.7.1.L** The change house access control system shall generate documented proof of all personnel entering and exiting the underground.
[SD&TRD I.3.7.2.2.B.1.5.B]
- 3.4.2.7.1.M** The change house access control system shall restrict access to the underground based on the maximum occupancy limit established in the safety analysis.
[SD&TRD I.3.7.2.2.B.1.5.B]
- 3.4.2.7.1.N** The change house access control system shall provide positive verification that personnel entering the underground are equipped with all required safety equipment.
[SD&TRD I.3.7.2.2.B.1.5.B]
- 3.4.2.7.1.O** The change house access control system shall have provisions to limit access within the underground based on the individuals qualifications.
[SD&TRD I.3.7.2.2.B.1.5.B]
- 3.4.2.7.1.P** The change room facility shall be sized to provide all necessary personnel and underground visitors with a place to bathe, change, and dry clothes.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.C]
- 3.4.2.7.1.Q** The change house shall provide space to accommodate monitor/control equipment, and a fire detection control system.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.C]

- 3.4.2.7.1.R** The change house access control system shall have provisions to interface with the existing DOE IMBAAAC system. [SD&TRD I.3.2.5]

3.4.2.8 OPERATIONS BUILDING (BABBAG000)

The complete set of Operations Building CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.8.1.

3.4.2.8.1 DESCRIPTION

The Operations Building is defined as the facilities, systems, and services that will be utilized for offices supporting ESF scientific, technical, and maintenance personnel for the site characterization program. Included are the IDCS central operations that are required to support ESF operations and testing.

- 3.4.2.8.1.A** The areas for housing IDCS systems shall be equipped (as a minimum) as follows:

- Expandable power distribution system,
- Acoustical treatment to reduce noise,
- Power failure lighting,
- Interior air cleaning/filtering,
- Air conditioning as required,
- UPS System, as required.

[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]

- 3.4.2.8.1.B** The operations building shall be sized to accommodate space for the following:

- Administration,
- Operations, engineering, and testing staff,
- Central monitoring and control system,
- Communication and Data Center.

[DERIVED][SD&TRD I.3.7.2.2.D.1.F]

- 3.4.2.8.1.C** The operations building shall provide an environmentally controlled area to accommodate IDCS equipment and maintain a nominal temperature and humidity environment as required by the equipment specifications.

[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]

3.4.2.9 GUARD HOUSE (BABBAH000)

The complete set of Guard House CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.9.1.

3.4.2.9.1 DESCRIPTION

The Guard House is defined as the facilities, systems and services dedicated to the site security operations at the ESF and located in a strategic position to control access to the site.

- 3.4.2.9.1.A** The guard house shall provide control for all points of personnel and vehicle access into the ESF in accordance with applicable security standards and the ESF security analysis.
[SD&TRD I.3.2.7.3]
- 3.4.2.10** **ESF VISITOR CENTER (BABBAI000)**
- The complete set of ESF Visitor Center CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.2.1.2, and 3.4.2.10.1.
- 3.4.2.10.1** **DESCRIPTION**
- The ESF Visitor Center is defined as the facilities, systems and services to accommodate visitors to the site ranging from small gatherings to groups of approximately 50 people. The facility will provide for general public presentations, scientific conferences, and governmental agencies review meetings.
- 3.4.2.10.1.A** The ESF visitor center shall be sized to accommodate a minimum capacity of 50 visitors.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.2.10.1.B** The ESF visitor center shall accommodate space for scientific presentations and conferences.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.3** **SITE DRAINAGE (BABBB0000)**
- The complete set of Site Drainage CI requirements is obtained by combining the requirements from Sections 3.2.1.2 and 3.4.3.1.
- 3.4.3.1** **DESCRIPTION**
- Site Drainage is defined as the facilities, systems, and services, that consist of items and measures utilized to control drainage and runoff water to preclude damage by impounding, erosion, or flooding, and prevent water from entering the ramp, portal, or shaft collar.
- 3.4.3.1.A** Site drainage shall be controlled to reduce the potential for flooding of the underground facility, whether resulting from the occupancy and modification of flood plains or from the failure of existing or planned man-made surface water impoundments.
[DERIVED][SD&TRD I.3.7.2.2.D.1.C]
- 3.4.3.1.B** The site drainage system shall be designed to avoid blockage of natural surface water drainage ways and to avoid creation of surface water impoundments that could impact postclosure performance.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.3.1.C** The site drainage system shall be designed to protect the ramp, ramp-portal, shaft, and shaft-collar areas from water inflow as a result of the probable maximum flood.
[DERIVED][SD&TRD I.3.2.3.1.G.1]

- 3.4.3.1.D** The site drainage system shall provide water drainage for all surface facility sites.
[DERIVED][SD&TRD I.3.7.2.2.D.1.C]
- 3.4.3.1.E** Site Drainage shall be designed in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]
- 3.4.3.1.F** The Site Drainage System shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k]
- 3.4.3.1.G** The Site Drainage System shall be designed in compliance with all applicable requirements in the Stormwater Discharge Permit Application.
[DERIVED][SD&TRD I.3.3.11.A.e, I.3.3.11.A.w]
- 3.4.3.1.H** The Site Drainage System shall be designed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December 1988).
[SD&TRD I.3.3.11.A.d]
- 3.4.4** **SITE PREPARATION (BABBC0000)**
- The complete set of Site Preparation CI requirements is obtained by combining the requirements from Sections 3.2.1.2 and 3.4.4.1.
- 3.4.4.1** **DESCRIPTION**
- Site preparation is defined as the facilities, systems, and services for preparing the earth surface by clearing; grubbing; topsoil removal; cut, fill, and compaction; rough grading; and preliminary drainage control in preparation for construction of facilities and utilities for the ESF.
- 3.4.4.1.A** The site preparation shall utilize the following excavation methods to limit the damage to the underlying rock mass:
- Ripping in high lithophysae material,
 - Bench blast in low lithophysae material.
- [DERIVED][SD&TRD I.3.7.2.2.C.1.A][10CFR60.15(c)(1)]
- 3.4.4.1.B** RESERVED
- 3.4.4.1.C** The site preparation shall store topsoil in the topsoil auxiliary site.
[DERIVED][SD&TRD I.3.7.2.2.B.1.3.B]
- 3.4.4.1.D** Site preparation activities shall disturb only the amount of land necessary to support construction and operation.
[DERIVED][SD&TRD I.3.7.2.2.D.1.D]

- 3.4.4.1.E** Sites shall be cleared of unusable roads, utilities, and structures that interfere with the ESF.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.4.1.F** RESERVED
- 3.4.4.1.G** The site preparation shall ensure each site is furnished with utility services appropriate to the structure. As a minimum, services shall include power, water, fire protection, communications, sanitary waste, and parking allowances.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.4.1.H** Site Preparation shall be designed in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]
- 3.4.4.1.I** The Site Preparation System shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k]
- 3.4.4.1.J** Site Preparation shall be designed in compliance with all applicable requirements in the Floodplain Assessment.
[DERIVED][SD&TRD I.3.2.3.1.G.1, I.3.2.3.1.G.2, I.3.3.11.A.u]
- 3.4.4.1.K** The Site Preparation System shall be designed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December 1988).
[SD&TRD I.3.3.11.A.d]
- 3.4.4.1.L** The site preparation shall clear, grade, and stabilize all building sites, utility corridors, and storage areas for excavated rock..
[DERIVED][SD&TRD I.3.7.2.2.B.1.3.B]
- 3.4.4.1.M** All coordinates shall be in accordance with the Nevada State Plane Coordinate System and be traceable to existing first-order control points in or around Area 25.
[DERIVED][SD&TRD I.3.3.1.A, I.3.3.1.B]
- 3.4.5** **SURFACE UTILITIES (BABBD0000)**
- The complete set of Surface Utilities CI requirements is obtained by combining the requirements from Sections 3.2.1.2 and 3.4.5.1.1.
- 3.4.5.1** **DESCRIPTION**
- The Surface Utilities are defined as the surface facilities, systems, and services necessary to meet the needs of ESF activities. These include provisions for electrical power, water, sewage, communications, subsurface waste water, compressed air, and solid waste disposal.

3.4.5.1.1 SURFACE UTILITIES CI REQUIREMENTS

3.4.5.1.1.A The surface utilities shall provide services consistent with the utility analysis to meet the needs of ESF operations and in situ site characterization.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A, I.3.7.2.2.B.2.1.A]

3.4.5.1.1.B The surface utilities shall include, as a minimum, the following systems:

1. Water
Water piping
Water tanks
Tracer injection system
Booster station
Fire protection.
2. Power
Primary surface power
Secondary surface power
Substations(s)
Standby generators (including fuel tanks)
UPS.
3. Communications
Microwave support
Communications shelter
Telephone support.
4. Sewage.
5. Waste water disposal.
6. Air compressor system.

[DERIVED][SD&TRD I.3.7.2.2.D.1.F, I.3.7.2.2.B.1.3.A]

3.4.5.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SURFACE UTILITIES CI

3.4.5.1.2.A The surface utility systems shall not unnecessarily restrict foot, vehicular, or ramp portal and/or shaft collar traffic; obstruct ventilation; or cause health and safety concerns.

[DERIVED][SD&TRD I.3.2.1.1.2.A]

3.4.5.1.2.B The surface utilities shall be designed to provide the minimum utility services such as power, potable water, fire protection water, communications, and sanitary waste, to each surface facility building.

[DERIVED][SD&TRD I.3.7.2.2.D.1.F]

3.4.5.1.2.C The service facilities and equipment required for maintaining and installing underground services shall be provided to support ESF operation and in situ site characterization.

[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]

- 3.4.5.1.2.D** The surface utilities shall be designed to provide the minimum utilities identified in the surface utility analysis.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F, I.3.7.2.2.B.2.1.A]
- 3.4.5.1.2.E** An analysis shall be conducted by the design organization to determine what utilities are required for the surface facilities.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]
- 3.4.5.2** **SURFACE POWER (BABBD A000)**
- The complete set of Surface Power CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.5.1.2, and 3.4.5.2.1.
- 3.4.5.2.1** **DESCRIPTION**
- Surface Power is defined as the facilities, systems, and services that supply electrical power to the ESF site. These systems include, but are not limited to: ESF site substation(s), distribution systems, extension of the existing overhead power line to the booster pump station, surface lighting, a standby power generation system, fuel storage system, power distribution to the facilities, and air compressor system.
- 3.4.5.2.1.A** The surface facilities power distribution system shall be designed, as a minimum, to provide power to surface-mounted equipment listed below:
- Hoists and controls,
 - Air compressor(s),
 - Ventilation fans, as required,
 - Communications equipment, as required,
 - Main water supply pump(s),
 - Shaft-work-deck winches and miscellaneous motors,
 - Temporary facilities,
 - Lights,
 - Muck discharge transport conveyors,
 - Ventilation air heaters (if required).
- [DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.5.2.1.B** The electrical system shall include provisions to accommodate tie-in of the proposed transmission line between the connection to the nearest suitable existing power supply and the main substation to be located at the ESF site.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]
- 3.4.5.2.1.C** The power distribution system shall provide electrical power from the main ESF substation(s) to the surface and subsurface facilities.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.5.2.1.D** All electrical power wiring shall be kept physically separated from data and communications wiring to prevent induced interference.
[DERIVED][SD&TRD I.3.3.2.A]
- 3.4.5.2.1.E** **RESERVED**

- 3.4.5.2.1.F** The standby power generators shall have sufficient output to provide power to ventilation fans, back up the UPS, and other loads as required.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.5.2.1.G** The surface power system shall provide a main substation(s) to supply normal electrical power to the surface and subsurface facilities.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]
- 3.4.5.2.1.H** The utility services shall include minimal backup for the primary power line to support critical systems and testing continuity (determined by analysis).
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.5.2.1.I** The surface power system shall make use of existing NTS transformers and switchgear when available.
[DERIVED][SD&TRD I.3.3.9]
- 3.4.5.2.1.J** The interconnection between the standby power and the main power distribution system shall allow the generating capacity of the standby system to be increased without modification to the interconnection.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.5.2.1.K** RESERVED
- 3.4.5.2.1.L** The minimum critical standby power shall provide a minimum excess capacity of (10%) margin over the predicted load.
[DERIVED][SD&TRD I.3.3.6.9.A]
- 3.4.5.2.1.M** Power distribution for the ESF, including the primary substation and secondary distribution systems, transmission lines, and feeder cables, shall have sufficient capacity to meet load requirements at points of usage throughout the operations areas.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.5.2.1.N** Suitable switching and protective devices shall be provided in the electrical system to prevent damage to the equipment in case of power failure or faults.
[DERIVED][SD&TRD I.3.3.6.9.B, I.3.3.12.ap]
- 3.4.5.2.1.O** The power system shall provide meters to allow control and monitoring by the Facility Monitoring and Control System.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.B]
- 3.4.5.2.1.P** The power system shall provide surge protection and a grounding system to maximize personnel and equipment safety.
[DERIVED][SD&TRD I.3.3.6.9.B, I.3.3.12.ap]
- 3.4.5.2.1.Q** Electrical power systems shall provide the necessary power, during both normal and peak demands, for the operation of the ESF.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]

- 3.4.5.2.1.R** In the event of a power outage the standby power system shall provide all necessary power to systems and subsystems that are required to meet safety, critical testing operations, and security requirements.
[DERIVED][SD&TRD I.3.3.6.1.A]
- 3.4.5.2.1.S** The standby power system shall maintain power to those systems essential to evacuation, fire control, flood control, and critical in situ site characterization testing.
[DERIVED][SD&TRD I.3.3.6.1.A]
- 3.4.5.2.1.T** The standby power system shall include generators, fuel supplies, necessary fuel piping, conduit and wire, cutouts, concrete work, and weatherproof enclosures.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A, I.3.7.2.3.B.1.2.C]
- 3.4.5.2.1.U** The standby power generators shall provide power to the underground operation following the loss of primary power within the allowable delay time dictated in the safety analysis.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A, I.3.7.2.3.B.1.2.C]
- 3.4.5.2.1.V** A UPS system shall provide necessary power to systems and subsystems that cannot tolerate a loss of power incident.
[DERIVED][SD&TRD I.3.3.6.3.D]
- 3.4.5.2.1.W** A UPS system shall be provided to service, as a minimum, the monitoring systems (e.g., fire, smoke, gas), communications systems, data collection systems, and those instruments and tests requiring continuous power.
[DERIVED][SD&TRD I.3.3.6.3.D]
- 3.4.5.2.1.X** The electrical system shall withstand windblown dust and other natural phenomena.
[DERIVED][SD&TRD I.3.2.3.1.A, I.3.3.12]
- 3.4.5.2.1.Y** The Power System shall be designed in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]
- 3.4.5.2.1.Z** The Standby Generator System shall be designed in compliance with all applicable requirements stipulated in the Air Quality Operating Permit AP 9611-0573.
[DERIVED][SD&TRD I.3.3.11.A.k, I.3.3.12.l]
- 3.4.5.2.1.AA** The Standby Generator System shall be designed in compliance with all applicable requirements in the General Discharge Permit Application, issued by the Nevada Division of Environmental Protection.
[DERIVED][SD&TRD I.3.3.11.A.e, I.3.3.11.A.w]
- 3.4.5.2.1.AB** The Surface Power System shall be routed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December 1988).
[SD&TRD I.3.3.11.A.d]

- 3.4.5.2.1.AC** The surface power system shall have a minimum availability of 98.27%.
[SD&TRD I.3.2.2.1.A]
- 3.4.5.3** **SURFACE WATER (BABDBE000)**
- The complete set of Surface Water CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.5.1.2, and 3.4.5.3.1.
- 3.4.5.3.1** **DESCRIPTION**
- Surface Water is defined as the facilities, systems, and services that supply and distribute the potable and non-potable water for the ESF.
- 3.4.5.3.1.A** The water system shall provide adequate resistance to water hammer and other destructive events as well as protective devices to prevent loss of water into the site.
[DERIVED][SD&TRD I.3.7.2.2.D.1.C]
- 3.4.5.3.1.B** Protection shall be provided to ensure separation of potable and non-potable water systems.
[DERIVED][SD&TRD I.3.3.6.5.B]
- 3.4.5.3.1.C** Non-potable water lines shall be clearly marked to prevent consumption of the non-potable water by personnel.
[DERIVED][SD&TRD I.3.3.6.5.B]
- 3.4.5.3.1.D** RESERVED
- 3.4.5.3.1.E** Tracers added to the water system shall be of a composition and concentration compatible with the waste water disposal system.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.3.1.F** Permanent records of water use shall be maintained.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.3.1.G** All tracers and substances added shall be approved, as specified in the *Tracers, Fluids, and Materials Management Procedure*, to ensure that they will not significantly compromise site characterization testing, repository testing, or waste isolation.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.3.1.H** Piping or other appropriate control measures shall limit possible water inflow to the ESF following a pipe rupture.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.3.1.I** The water supply, storage, and distribution systems, subsystems, and components shall have sufficient capacity to supply and distribute potable and non-potable water in accordance with all anticipated needs and services for ESF operation and testing.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]

- 3.4.5.3.1.J** The water supply, storage, and distribution systems and subsystems shall meet the needs of fire protection during ESF operations under routine emergency and maximum credible firewater demand conditions.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.5.3.1.K** The potable water system shall provide water to the surface facilities and have adequate treatment systems to ensure that water quality is appropriate for its intended use.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]
- 3.4.5.3.1.L** The non-potable water system shall provide water to the underground for ESF operations, fire protection systems, and ESF testing.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]
- 3.4.5.3.1.M** The route of the water line shall be adequately marked to minimize the possibility of damage from future construction activities.
[DERIVED][SD&TRD I.3.4.2]
- 3.4.5.3.1.N** The water distribution system shall be of sufficient size and capacity to simultaneously provide for fire protection and process water throughout the ESF, in accordance with all anticipated needs and services for testing and operation of the ESF.
[DERIVED][SD&TRD I.3.2.3.2.1.B, I.3.7.2.2.B.1.6.A]
- 3.4.5.3.1.O** The water system shall provide meters to monitor the surface and subsurface water usage (inflow).
[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.3.1.P** All water used during operation and construction of the ESF shall be provided with chemical tracers except for potable drinking water, water used for fill compaction and general surface construction, water used for fire protection, and water used for surface dust suppression.
- Note: The delineation between surface and subsurface construction is the mountain side of the portal (or collar) interface. Subsurface construction is comprised of those areas where the excavation penetrates this interface and extends into the mountain; surface construction is comprised of those areas not penetrating this interface.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.3.1.Q** The Water System shall be designed in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]
- 3.4.5.3.1.R** The Surface Water System shall be designed in compliance with all applicable requirements in the Potable Water Permit and the corresponding approval letter (9/3/93) of this permit.
[DERIVED][SD&TRD I.3.3.11.A.g, I.3.3.11.A.x, I.3.3.12.o, I.3.3.12.p]

- 3.4.5.3.1.S** The Surface Water System shall be routed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December 1988).
[DERIVED][SD&TRD I.3.3.11.A.d]
- 3.4.5.3.1.T** The design of the Surface Water System shall comply with all applicable requirements in the Underground Injection Permit, NEV89031.
[DERIVED][SD&TRD I.3.3.11.A.h, I.3.3.11.A.p]
- 3.4.5.3.1.U** The surface water system shall have a minimum availability of 99.17%.
[SD&TRD I.3.2.2.1.A]
- 3.4.5.3.1.V** The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.4** **SURFACE SANITATION (BABBD000)**
- The complete set of Surface Sanitation CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.5.1.2, and 3.4.5.4.1.
- 3.4.5.4.1** **DESCRIPTION**
- Surface Sanitation is defined as the facilities, systems and services that provide for the surface collection and disposal of surface sanitary sewage for the support of ESF operations. Land disturbance areas shall be minimized.
- 3.4.5.4.1.A** Sewage effluent discharges shall not adversely affect site characterization activities.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.4.1.B** The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]
- 3.4.5.4.1.C** The Surface sanitation system shall dispose waste through collection piping from all buildings and trailers to a sanitary waste disposal system located outside the perimeter of the potential repository subsurface facility.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B, I.3.7.2.2.D.1.F, I.3.7.2.3.B.1.2.D]
[10CFR60.15(c)(1)]
- 3.4.5.4.1.D** The sanitary waste disposal system shall accommodate the sewage for ESF operations and testing personnel.
[DERIVED][SD&TRD I.3.7.2.2.B.1.5.A]
- 3.4.5.4.1.E** **RESERVED**
- 3.4.5.4.1.F** The surface sanitation system shall have provisions to dispose of all liquid waste in an environmentally acceptable manner.
[DERIVED][SD&TRD I.3.7.2.2.D.1.F]

- 3.4.5.4.1.G** The Sanitation System shall be designed in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]
- 3.4.5.4.1.H** The Sanitation System shall be designed to comply with the drawings that make up the sewage disposal plan presented and agreed to with the State of Nevada. These drawings are:

BABB00000-01717-2100-20010-02
BABBD000-01717-2100-20032-02
BABBD000-01717-2100-20033-01
BABBD000-01717-2100-20034-01
BABBD000-01717-2100-20040-00
BABBD000-01717-2100-20042-00
BABBD000-01717-2100-20043-00
BABBD000-01717-2100-20041-00
BABBD000-01717-2100-20044-00
[DERIVED][SD&TRD I.3.3.11.A.e, I.3.3.11.A.v, I.3.3.11.A.w, I.3.3.12.k]
- 3.4.5.4.1.I** The Surface Sanitation System shall be designed in compliance with all applicable requirements in the Treatment Works Permit, which was obtained in support of Nevada Administrative Code (NAC) 445A.283-.292.
[DERIVED][SD&TRD I.3.3.11.A.e, I.3.3.11.A.w]
- 3.4.5.4.1.J** The Surface Sanitation System shall be designed in compliance with all applicable requirements in the Potable Water Permit and the corresponding approval letter (9/3/93) of this permit.
[DERIVED][SD&TRD I.3.3.11.A.g, I.3.3.12.o, I.3.3.12.p]
- 3.4.5.4.1.K** Design of the sanitary and sewage collection and treatment systems shall conform to the requirements and stipulations of NAC 455.750-.828.
[DERIVED][SD&TRD I.3.3.11.A.v]
- 3.4.5.4.1.L** The Surface Sanitation System shall be routed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December 1988).
[DERIVED][SD&TRD I.3.3.11.A.d]
- 3.4.5.5** **SURFACE COMMUNICATION (BABBD000)**
- The complete set of Surface Communication CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.5.1.2, and 3.4.5.5.1.
- 3.4.5.5.1** **DESCRIPTION**
- Surface Communication is defined as the facilities, systems and services that provide equipment for linking the surface areas, the underground areas and the facilities with each other, and with all outside commercial communications systems.

- 3.4.5.5.1.A** The Yucca Mountain Site Characterization Office (YMSCO) shall interface with the NTS for telephone system and utility compatibility.
[DERIVED][SD&TRD I.3.3.8.1.D]
- 3.4.5.5.1.B** At least one telephone with the capability of reaching off-site emergency numbers shall be located in each building, trailer, and hoist operator station.
[DERIVED][SD&TRD I.3.3.7.12]
- 3.4.5.5.1.C** A telephone link shall be available to permit communication between any underground mine pager phone and the surface commercial telephone network, except for phones that require dedicated communications.
[DERIVED][SD&TRD I.3.3.7.12]
- 3.4.5.5.1.D** All electrical power wiring shall be kept physically separated from data and communications wiring to prevent induced interference.
[DERIVED][SD&TRD I.3.3.2.A, I.3.3.2.B]
- 3.4.5.5.1.E** Phone jacks and phone service shall be provided as required for communication service to support testing needs.
[DERIVED][SD&TRD I.3.3.7.12]
- 3.4.5.5.1.F** Communications capability in and between the surface and the underground facilities (ramps, shafts, and underground openings) shall be established and suitable safety alarm systems shall be provided where required.
[DERIVED][SD&TRD I.3.3.7.11, I.3.7.2.2.B.1.6.A]
- 3.4.5.5.1.G** RESERVED
- 3.4.5.5.1.H** The communications system shall provide adequate facilities for the transfer of data, via modem or other computer interface, from the ESF site to the outside communications network.
[DERIVED][SD&TRD I.3.3.7.12]
- 3.4.5.5.1.I** A public address system shall be provided for emergency announcements and general paging.
[DERIVED][SD&TRD I.3.3.7.11]
- 3.4.5.5.1.J** The ESF FM radio system shall be installed and integrated with the NTS FM radio system to provide communications to security and maintenance personnel and to serve as a backup communication system.
[DERIVED][SD&TRD I.3.3.7.12]
- 3.4.5.5.1.K** An intercom system shall have provisions for a multichannel connection as required to support testing needs.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]
- 3.4.5.5.1.L** The Communications system shall provide communications to NTS law enforcement, medical, fire-fighting, and emergency agencies in the local Nye County area.
[DERIVED][SD&TRD I.3.3.6.1.B, I.3.3.12.af]

3.4.5.5.1.M RESERVED

3.4.5.5.1.N The surface communication system shall have a minimum availability of 99.50%.
[SD&TRD I.3.2.2.1.A]

3.4.5.6 SURFACE WASTE WATER (BABBDE000)

The complete set of Surface Waste Water CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.5.1.2, and 3.4.5.6.1.

3.4.5.6.1 DESCRIPTION

Surface Waste Water is defined as the facilities, systems and services that provide surface equipment for collection, transfer, treatment, and disposal of liquid non-sanitary wastes generated underground in the ESF during operations.

3.4.5.6.1.A The surface waste water collection system shall discharge subsurface waste water into a waste water pond located outside the potential repository block, and at least 213 meters away from the site characterization activities
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.B, I.3.7.2.3.B.1.6.B]

3.4.5.6.1.B The sump shall be equipped with waste water collection and transfer facilities.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.B]

3.4.5.6.1.C The surface waste water system interfaces to the subsurface waste water system and shall provide for the collection, transfer, pumping, and disposal of expected water and credible water inflows out of the underground and into the waste water pond.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.B, I.3.7.2.3.B.1.6.B]

3.4.5.6.1.D The waste water system shall provide meters to monitor the underground waste water disposal (outflow).
[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10CFR60.15(c)(1)]

3.4.5.6.1.E The Waste Water System shall be designed in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]

3.4.5.6.1.F The Surface Waste Water System shall be designed in compliance with all applicable requirements in the General Discharge Permit Application, issued by the Nevada Division of Environmental Protection.
[DERIVED][SD&TRD I.3.3.11.A.e, I.3.3.11.A.w]

3.4.5.6.1.G The Surface Waste Water System shall be routed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December 1988).
[DERIVED][SD&TRD I.3.3.11.A.d]

3.4.5.6.1.H The surface waste water system shall have a minimum availability of 99.58%.
[SD&TRD I.3.2.2.1.A]

3.4.5.6.1.I The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.
[DERIVED][SD&TRD I.3.7.2.2.C.1.B][10CFR60.15(c)(1)]

3.4.5.7 SURFACE COMPRESSED AIR (BABBD000)

The complete set of Surface Compressed Air CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.5.1.2, and 3.4.5.7.1.

3.4.5.7.1 DESCRIPTION

Surface Compressed Air is defined as the facilities, systems and services that provide the production and distribution of compressed air to support ESF testing and operation activities.

3.4.5.7.1.A The surface compressed air system shall not contain chemical tracers.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]

3.4.5.7.1.B The compressed air system shall provide compressed air throughout the designated areas of the ESF with flow rates and pressures to support operation of the facilities, site characterization testing requirements, and drilling requirements including additional drift excavation.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]

3.4.5.7.1.C The compressed air system shall provide conditioned and filtered air at a pressure and flow rate that meets drilling and test apparatus requirements.
[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A]

3.4.5.7.1.D The compressed air distribution system shall be designed to accommodate variable loads and system maintenance.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]

3.4.5.7.1.E The Compressor site shall be protected against the flood caused by a 50-year storm.
[DERIVED][SD&TRD I.3.2.3.1.F]

3.4.5.7.1.F The surface compressed air system shall have a minimum availability of 99.75%.
[SD&TRD I.3.2.2.1.A]

3.4.6 CONTROL SYSTEMS (BABBE0000)

All Control Systems CI requirements have been allocated to lower level CIs.

3.4.6.1 DESCRIPTION

The Control Systems are defined as the structures, systems, and services comprised of the Facility Monitoring & Control System and the Load Management System which are provided to support ESF operations.

3.4.6.1.1 CONTROL SYSTEMS CI REQUIREMENTS

(No requirements have been identified at this time.)

3.4.6.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE CONTROL SYSTEMS CI

(No requirements have been identified at this time.)

3.4.6.2 LOAD MANAGEMENT SYSTEM (BABBEA000)

The complete set of Load Management System CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.6.1.2, and 3.4.6.2.1.

3.4.6.2.1 DESCRIPTION

The Load Management System is defined as the structures, systems, and services for interconnection of all site power users and sources (with the exception of the main substation) for the purpose of monitoring power availability and usage and adjusting usage through prioritized load shedding when availability is about to fall below usage.

3.4.6.2.1.A The load management system shall selectively monitor and control the facility power available to each system when the usage exceeds thresholds required to sustain critical systems.

[SD&TRD I.3.7.2.2.B.1.4.B]

3.4.6.3 FACILITY MONITORING & CONTROL (BABBE000)

The complete set of Facility Monitoring & Control CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.4.6.1.2, and 3.4.6.3.1.

3.4.6.3.1 DESCRIPTION

Facility Monitoring & Control includes the necessary hardware and software to monitor data from the surface and subsurface electrical power, surface and subsurface conveyors, surface facilities HVAC systems, subsurface ventilation, surface and subsurface process water, surface and subsurface waste water, surface and subsurface compressed air, subsurface fire protection, and subsurface monitoring.

3.4.6.3.1.A The Facility Monitoring & Control system shall be integrated with the IDCS.

[DERIVED][SD&TRD I.3.7.2.2.B.1.4.B]

3.4.6.3.1.B The Facility Monitoring & Control system shall provide monitors for the underground ventilation system, as a minimum, for the following:

- Noise,
- Dust,
- Radon/progeny,
- Ammonia,
- Nitrogen dioxide,
- Nitrous oxides,
- Sulfur dioxide,
- Hydrogen sulfide,

- Methane,
- Oxygen,
- Carbon monoxide,
- Carbon dioxide,
- Air temperature,
- Humidity,
- Air velocity and volume flow,

as required by applicable regulations.

[DERIVED][SD&TRD I.3.3.6.1.B]

3.4.6.3.1.C

The Facility Monitoring & Control system shall interface to the communications system to alert the underground personnel of hazardous conditions and alert the rescue operations system.

[DERIVED][SD&TRD I.3.7.2.2.B.1.6.C]

3.4.6.3.1.D

The Facility Monitoring & Control system shall initiate the alarm systems to indicate when the various monitored conditions exceed specified limits.

[DERIVED][SD&TRD I.3.3.7.11]

3.4.6.3.1.E

The facility monitoring and control system shall provide redundant systems for critical systems or components as required by applicable regulations.

[DERIVED][SD&TRD I.3.3.7.11]

3.4.6.3.1.F

The ventilation monitoring systems shall be designed to support ventilation monitoring requirements for site characterization tests and health and safety requirements.

[DERIVED][SD&TRD I.3.3.7.11]

3.4.6.3.1.G

The Facility Monitoring & Control system shall provide an alarm to alert on-site personnel of possibly dangerous environmental and safety situations.

[DERIVED][SD&TRD I.3.3.7.11]

3.4.6.3.1.H

The surface Facility Monitoring & Control system shall have a minimum availability of 98.90%.

[SD&TRD I.3.2.2.1.A]

3.5 AUXILIARY SITES (BABC00000)

The complete set of Auxiliary Sites CI requirements is obtained by combining the requirements from Sections 3.2.1.2 and 3.5.1.1

3.5.1 DESCRIPTION

The Auxiliary Sites are defined as the facilities, systems, and services to accommodate areas prepared for ESF purposes not fulfilled by the Main Sites.

3.5.1.1 AUXILIARY SITES CI REQUIREMENTS**3.5.1.1.A The Auxiliary sites shall accommodate space for the storage of materials and activities listed below:**

- Borrow material (fill),
- Explosives,
- Muck and rock storage,
- Water storage tank(s),
- Water booster pump station,
- Top soil storage.

[DERIVED][SD&TRD I.3.7.2.3.B.1.2.A, I.3.7.2.3.B.1.6.A, I.3.7.2.3.B.2.4.A]

3.5.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE AUXILIARY SITES CI**3.5.1.2.A The auxiliary site storage areas shall be sized to accommodate all excavation material determined to be required by analysis.**

[DERIVED][SD&TRD I.3.7.2.3.B.1.2.A, I.3.7.2.3.B.1.6.A]

3.5.1.2.B All auxiliary sites shall be protected against the flood caused by a 100-year storm except as specified below:

1. Batch plant site, which shall be protected against a 10-year storm.
2. Booster pump building site, which shall be protected against a 50-year storm.

[DERIVED][SD&TRD I.3.2.3.1.F, I.3.7.2.3.D.1.D]

3.5.2 AUXILIARY SITE PREPARATION (BABCA0000)

The complete set of Auxiliary Site Preparation CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.5.1.2, and 3.5.2.1.

3.5.2.1 DESCRIPTION

Auxiliary Site Preparation is defined as the facilities, systems, and services for preparing the earth surface by clearing; grubbing; topsoil removal; cut, fill, and compaction; rough grading; and preliminary drainage control in preparation for construction of facilities and utilities for the ESF.

- 3.5.2.1.A** Sites shall be cleared of unusable roads, utilities, and structures that interfere with the ESF.
[DERIVED][SD&TRD I.3.7.2.3.B.2.2.A]
- 3.5.2.1.B** The auxiliary site excavated rock storage areas shall be cleared, graded, and stabilized.
[DERIVED][SD&TRD I.3.7.2.3.D.1.C]
- 3.5.2.1.C** Site preparation activities shall disturb only the amount of land necessary to support construction and operation.
[DERIVED][SD&TRD I.3.7.2.3.D.1.A]
- 3.5.2.1.D** Auxiliary site preparation shall be in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]
- 3.5.2.1.E** Auxiliary site preparation shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k]
- 3.5.2.1.F** Auxiliary Site Preparation shall be designed in compliance with all applicable requirements in the Floodplain Assessment.
[DERIVED][SD&TRD I.3.2.3.1.G.1, I.3.2.3.1.G.2, I.3.3.11.A.u]
- 3.5.2.1.G** The Auxiliary Site Preparation System shall be designed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December 1988).
[SD&TRD I.3.3.11.A.d]
- 3.5.2.1.H** All coordinates shall be in accordance with the Nevada State Plane Coordinate System and be traceable to existing first-order control points in or around Area 25.
[DERIVED][SD&TRD I.3.3.1.A, I.3.3.1.B]
- 3.5.3** **AUXILIARY SITE DRAINAGE (BABCB0000)**
- The complete set of Auxiliary Site Drainage CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.5.1.2, and 3.5.3.1.
- 3.5.3.1** **DESCRIPTION**
- Auxiliary Site Drainage is defined as the facilities, systems, and services that consist of items and measures utilized to control drainage and runoff water to preclude damage by impounding, erosion, or flooding.
- 3.5.3.1.A** The auxiliary site drainage system shall be designed to control the water flow and reduce the potential for flooding of the underground facility.
[DERIVED][SD&TRD I.3.7.2.3.D.1.D]

- 3.5.3.1.B** The surface drainage system shall be designed to avoid blockage of natural surface water drainage ways and to avoid creation of surface water impoundments that could impact postclosure performance and site characterization testing.
[DERIVED][SD&TRD I.3.7.2.3.C.1.B, I.3.7.2.3.D.1.D][10CFR60.15(c)(1)]
- 3.5.3.1.C** Auxiliary Site Drainage shall be designed in compliance with all applicable requirements in the Biological Opinion.
[DERIVED][SD&TRD I.3.3.11.A.c, I.3.3.11.A.s]
- 3.5.3.1.D** Auxiliary site drainage shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k]
- 3.5.3.1.E** The Auxiliary Site Drainage System shall be designed in compliance with all applicable requirements in the Stormwater Discharge Permit Application.
[DERIVED][SD&TRD I.3.3.11.A.e, I.3.3.11.A.w]
- 3.5.3.1.F** The Auxiliary Site Drainage System shall be designed in compliance with the results of the archaeological surveys performed as part of Stipulation 4 in the Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation (December 1988).
[SD&TRD I.3.3.11.A.d]
- 3.5.4** **MUCK STORAGE (BABCC0000)**
- The complete set of Muck Storage CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.5.1.2, and 3.5.4.1.
- 3.5.4.1** **DESCRIPTION**
- Muck Storage is defined as the structures, systems, and services consisting of preparing the area to receive subsurface muck from ESF excavations.
- 3.5.4.1.A** The muck storage area shall be sized to accommodate the calculated worst-case excavated muck transported from the subsurface.
[DERIVED][SD&TRD I.3.7.2.3.B.1.6.A]
- 3.5.4.1.B** The muck storage site shall provide equipment or facilities for controlling dust generated as a result from muck displacement/storage.
[DERIVED][SD&TRD I.3.7.2.3.D.1.B]
- 3.5.4.1.C** Muck haulage in the vicinity of the main site shall be separated from personnel access for safety considerations.
[DERIVED][SD&TRD I.3.3.6.1.A]
- 3.5.4.1.D** The Muck Storage system shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k]

- 3.5.4.1.E** The Muck Storage System shall be designed in compliance with all applicable requirements in the Floodplain Assessment.
[DERIVED][SD&TRD I.3.2.3.1.G.1, I.3.2.3.1.G.2, I.3.3.11.A.u]

3.5.5 SUBSTATION WITH STANDBY GENERATOR (BABCD0000)

The substation with standby generator requirements are identified in the Surface power section (3.4.5.2). The requirements were integrated together with the surface power because the systems are integral with each other to provide all the necessary power for the ESF.

3.5.6 TOPSOIL STORAGE (BABCE0000)

The complete set of Topsoil Storage CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.5.1.2, and 3.5.6.1.

3.5.6.1 DESCRIPTION

Topsoil Storage is defined as the area for the storage of topsoil originating from various ESF systems.

- 3.5.6.1.A** The Topsoil storage shall be designed to accommodate the calculated worst-case quantity of excavated top soil.
[DERIVED][SD&TRD I.3.7.2.3.D.1.C]

- 3.5.6.1.B** The Topsoil Storage system shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k]

- 3.5.6.1.C** The Topsoil Storage System shall be designed in compliance with all applicable requirements in the Floodplain Assessment.
[DERIVED][SD&TRD I.3.2.3.1.G.1, I.3.2.3.1.G.2, I.3.3.11.A.u]

- 3.5.6.1.D** The Topsoil Storage System shall be designed in compliance with all applicable requirements in the *Reclamation Implementation Plan*.
[DERIVED][SD&TRD I.3.3.11.A.f, I.3.3.12.a]

3.5.7 WATER BOOST PUMP STATION (BABCF0000)

The complete set of Water Boost Pump Station CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.5.1.2, and 3.5.7.1.

3.5.7.1 DESCRIPTION

The Water Boost Pump Station is defined as the structures, systems, and services including pumps, piping, tanks, buildings, utilities, and equipment required to convey sufficient quantities of water from the well source to the storage tanks located above the ESF main site.

- 3.5.7.1.A** The water booster pump station shall be designed to maintain the minimum reserve capacity of water in the storage tank to support the potable and non-potable water needs and services for ESF operation and testing.
[DERIVED][SD&TRD I.3.7.2.3.B.2.4.B]
- 3.5.7.1.B** The water booster pump station shall supply water to the potable and non potable storage tank(s) with flow rates that ensure the water tanks are filled within the minimum time needed to support all the ESF anticipated water needs and meet all applicable fire protection standards.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.7.1.C** The water booster pump station shall supply water to the storage tanks to meet the needs of fire protection during ESF operations under routine emergency and maximum credible firewater demand conditions.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.7.1.D** The water booster pump station shall provide protective devices to prevent loss of water into the site.
[DERIVED][SD&TRD I.3.3.6.3.D, I.3.7.2.3.C.1.B][10 CFR 60.15(c)(1)]
- 3.5.7.1.E** The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.
[DERIVED][SD&TRD I.3.7.2.3.C.1.B][10CFR60.15(c)(1)]
- 3.5.7.1.F** The water booster pump station shall provide meters to measure the quantity of water pumped into the storage tanks.
[DERIVED][SD&TRD I.3.7.2.3.B.1.4.A]
- 3.5.7.1.G** The pumping systems shall include provisions for both manual and automatic operations.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.8** **EXPLOSIVE STORAGE (BABCG0000)**
- The Auxiliary site explosive storage facility does not have any requirements allocated at this time because the NTS storage facility has been determined to be adequate for storing the ESF explosives.
- 3.5.9** **WATER STORAGE TANK (BABCH0000)**
- The complete set of Water Storage Tank CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.5.1.2, and 3.5.9.1.
- 3.5.9.1** **DESCRIPTION**
- The Water Storage Tanks are defined as the structures, systems, and services comprising containers for both potable and non-potable water from well J-13 to the ESF water distribution system.

- 3.5.9.1.A** The water storage tank(s) shall have sufficient capacity to supply and distribute potable and non-potable water in accordance with all anticipated needs and services for ESF operation and testing.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.9.1.B** The water storage tank(s) shall provide the water for all ESF potable and non-potable water.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.9.1.C** The water storage tank(s) shall be sized to meet the needs of fire protection during operations under routine emergency and maximum credible firewater demand conditions.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.9.1.D** The water storage tank(s) shall have adequate volume for simultaneous normal peak usage and fire protection demands.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.9.1.E** The water storage tank(s) shall provide devices to prevent loss of water into the site.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.9.1.F** The water storage tank shall provide non-potable water to the water system for underground operation and testing.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.B]
- 3.5.9.1.G** The water storage tank(s) shall be provided with meters to monitor the total amounts of water used for various operations.
[DERIVED][SD&TRD I.3.7.2.3.B.1.4.A]
- 3.5.9.1.H** Water storage tanks shall be located, or protection provided, to preclude water inflow to the ESF following a possible tank failure.
[DERIVED][SD&TRD, I.3.7.2.3.C.1.B][10CFR60.15(c)(1)]
- 3.5.9.1.I** The Water Storage Tank System shall be designed in compliance with all applicable requirements in the Potable Water Permit and the corresponding approval letter (9/3/93) of this permit.
[DERIVED][SD&TRD I.3.3.11.A.g, I.3.3.12.o, I.3.3.12.p, I.3.7.2.3.D.1.H]
- 3.5.9.1.J** The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.
[DERIVED][SD&TRD I.3.7.2.3.C.1.B][10CFR60.15(c)(1)]
- 3.5.10** **ROCK STORAGE (BABCI0000)**
- The complete set of Rock Storage CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.5.1.2, and 3.5.10.1.
- 3.5.10.1** **DESCRIPTION**
- Rock Storage is defined as the area used to store rock originating from the starter tunnel, highwall, and pad rock excavations.

- 3.5.10.1.A** The rock storage area shall be sized to accommodate all excavated rock from the starter tunnel, high wall, and pad construction.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.A, I.3.7.2.3.D.1.C]
- 3.5.10.1.B** The capacity of surface rock storage areas shall include allowance for overbreak and swell.
[DERIVED][SD&TRD I.3.7.2.3.B.1.2.A]
- 3.5.10.1.C** The Rock Storage system shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k]
- 3.5.10.1.D** The Rock Storage System shall be designed in compliance with all applicable requirements in the Floodplain Assessment.
[DERIVED][SD&TRD I.3.2.3.1.G.1, I.3.2.3.1.G.2, I.3.3.11.A.u]

3.6 TEST SUPPORT (BABD00000)

All Test Support CI requirements have been allocated to lower level CIs.

3.6.1 DESCRIPTION

Test Support is defined as the structures, systems, and services to perform those activities associated with test equipment including but not limited to installation and maintenance, test execution, test data recording, and test analysis for in situ site characterization to be performed within the Yucca Mountain ESF. The IDCS is included within Test Support.

3.6.1.1 TEST SUPPORT CI REQUIREMENTS

None identified at this time.

3.6.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE TEST SUPPORT CI

None identified at this time.

3.6.2 INTEGRATED DATA AND CONTROL SYSTEM (IDCS) (BABDA0000)

The complete set of IDCS CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.6.1.2, and 3.6.2.1.

3.6.2.1 DESCRIPTION

The IDCS consists of the necessary hardware, software, and equipment to collect, process, store, and disseminate data associated with site characterization tests, utilities, and facilities operations in the ESF.

3.6.2.1.A Interface control will be established between the following:**3.6.2.1.A.1 The IDCS designers and the facility designers for support requirements for the building housing the IDCS.**

[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A, I.3.7.2.6.B.1.4.A]

3.6.2.1.A.2 The facility designers and the IDCS designers for electrical and mechanical cable and terminating requirements between the instruments and the IDCS.

[DERIVED][SD&TRD I.3.7.2.2.B.1.4.A, I.3.7.2.6.B.1.4.A]

3.6.2.1.A.3 The IDCS designer and the users of the IDCS to minimize the potential for interference with the collection of data due to IDCS limitations (such as storage capacity, data rates, timing, redundancy).

[DERIVED]

3.6.2.1.B The IDCS shall collect data from ESF facilities operations and utilities equipment.

[DERIVED][SD&TRD I.3.7.2.4.B.1.2.A, I.3.7.2.4.B.1.3.A, I.3.7.2.4.B.1.6.A]

- 3.6.2.1.C** The IDCS shall interface with the ESF monitoring, warning, and alarm systems.
[DERIVED][SD&TRD I.3.7.2.4.B.1.2.A, I.3.7.2.4.B.1.6.A]
- 3.6.2.1.D** The IDCS shall provide monitoring and control functions for site characterization test equipment, utilities, and facilities operations equipment.
[DERIVED][SD&TRD I.3.7.2.4.B.1.2.A, I.3.7.2.4.B.1.6.A]
- 3.6.2.1.E** A UPS system shall be provided to data collection systems and those instruments and tests requiring continuous power.
[DERIVED]
- 3.6.2.1.F** The IDCS shall be removed, to the extent practicable, after its final use.
[DERIVED][SD&TRD I.3.7.2.4.C.1.A][10CFR60.15(c)(1)]
- 3.6.2.1.G** The IDCS shall collect data from participant site characterization test equipment, including data from:
- Site characterization tests (including performance confirmation testing),
 - Calibration checks,
 - Checkout, installation, and acceptance tests.
- [DERIVED][SD&TRD I.3.7.2.4.B.1.5.A, I.3.7.2.4.B.2.2.A]
- 3.6.2.1.H** The IDCS shall provide signal processing, including instrument excitation, for site characterization test instruments.
[DERIVED][SD&TRD I.3.7.2.4.D.1.B]
- 3.6.2.1.H.1** The IDCS shall process collected test data through analog/digital conversions, engineering unit data conversion algorithms, and participant-specified alarm limits.
[DERIVED][SD&TRD I.3.7.2.4.D.1.B]
- 3.6.2.1.I** The IDCS shall process utilities and facilities operations data to provide monitoring, alarm, and control capabilities.
[DERIVED][SD&TRD I.3.7.2.4.D.1.C]
- 3.6.2.1.J** The IDCS shall provide storage for test data (including raw and converted data), system performance data, system configuration data, and utilities and facilities operations interface data.
[DERIVED][SD&TRD I.3.7.2.4.D.1.A]
- 3.6.2.1.J.1** The IDCS shall provide limited local storage of test data at each test location.
[DERIVED][SD&TRD I.3.7.2.4.D.1.A]
- 3.6.2.1.J.2** The IDCS shall provide on-line storage for the most recent 30 days of collected data of all types.
[DERIVED][SD&TRD I.3.7.2.4.D.1.A]
- 3.6.2.1.J.3** The IDCS shall provide off-line storage for archived test data for the life of the project.
[DERIVED][SD&TRD I.3.7.2.4.D.1.A]

- 3.6.2.1.J.4** The IDCS shall provide non-volatile back-up storage for data of all types.
[DERIVED][SD&TRD I.3.7.2.4.D.1.A]
- 3.6.2.1.K** The IDCS shall accommodate external data entry.
[DERIVED][SD&TRD I.3.7.2.4.B.2.1.A, I.3.7.2.4.D.1.E]
- 3.6.2.1.K.1** The IDCS shall provide interfaces for external data acquisition equipment to accommodate electronic data transfer.
[DERIVED][SD&TRD I.3.7.2.4.D.1.E]
- 3.6.2.1.K.2** The IDCS shall accommodate manual entry of data.
[DERIVED][SD&TRD I.3.7.2.4.D.1.E]
- 3.6.2.1.L** The IDCS shall include provisions for user peripherals, including monitors, data entry terminals, printers, and plotters.
[DERIVED][SD&TRD I.3.7.2.4.D.1.D]
- 3.6.2.1.M** The IDCS shall provide equipment and software diagnostics.
[DERIVED]
- 3.6.2.1.N** The IDCS shall provide secure access to data of all types.
[DERIVED][SD&TRD I.3.7.2.4.D.1.F]
- 3.6.2.1.O** The IDCS shall provide capability for unattended operations.
[DERIVED]
- 3.6.2.1.P** Critical communications and data circuits shall be protected or shielded from electromagnetic interference from sources within the ESF, and from external sources to the extent specified by manufacturers of sensitive data processing and communications equipment used in the system.
[SD&TRD I.3.3.2.A]
- 3.6.2.1.Q** The IDCS shall have a minimum availability of 95.53%.
[DERIVED][SD&TRD I.3.2.2.1.A]
- 3.6.3** **SURFACE TEST EQUIPMENT (BABDB0000)**
- 3.6.3.1** **DESCRIPTION**
None defined at this time.
- 3.6.4** **SUBSURFACE TEST EQUIPMENT (BABDC0000)**
All Subsurface Test Equipment CI requirements have been allocated to lower level CIs.
- 3.6.4.1** **DESCRIPTION**
The Subsurface Test Equipment consists of the Mapping Gantry.

3.6.4.1.1 SUBSURFACE TEST EQUIPMENT CI REQUIREMENTS

None defined at this time.

3.6.4.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SUBSURFACE TEST EQUIPMENT CI

None defined at this time.

3.6.4.2 MAPPING GANTRY (BABDCA000)

The complete set of Mapping Gantry CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.6.4.1.2 and 3.4.6.2.1.

3.6.4.2.1 DESCRIPTION

The Geologic Mapping Gantry and supporting trailing floor support systems are defined as those systems, subsystems, equipment, and components that support the trailing floor supports, attached drill/cleaning platform, supplemental ground support platform, and utilities to meet the needs of test analysis for in situ characterization to be performed within the Yucca Mountain ESF.

The boundaries for the Geologic Mapping Gantry system are from TBM Car #3 and #4, respectively. The Geologic Mapping Gantry system shares interfaces with the following TBM systems or subsystems:

- Water Distribution system,
- Subsurface Muck Conveyor system,
- Power Distribution system,
- Lighting system,
- Ventilation system,
- IDCS, and
- Monitoring and Warning system.

The Geologic Mapping Gantry system will include:

- Dust suppression system,
- Integrated ventilation system,
- Integrated subsurface conveyor system,
- Integrated power distribution system,
- Monitoring and warning system,
- IDCS,
- Integrated water distribution system,
- Integrated compressed air system,
- Drill/cleaning system platform,
- Supplemental ground supporting system,
- Integrated electrical system,
- Integrated piping system, and
- Associated miscellaneous equipment.

- 3.6.4.2.1.A** Allowances shall be made in the design to enable the IDCS to pass through the Mapping Gantry.
[DERIVED]
- 3.6.4.2.1.B** The Mapping Gantry shall be designed to operate in the underground opening developed by the Main Access Opening CI (see Section 3.7.2.3).
[DERIVED]
- 3.6.4.2.1.C** The Mapping Gantry shall support the testing needs identified in Appendix B of this document.
[DERIVED]
- 3.6.4.2.1.D** The Mapping Gantry equipment supports shall be designed to avoid resonance resulting from the harmony between the natural frequency of the structure and the operating frequency of reciprocating or rotating equipment supported on the structure.
[DERIVED][I.3.2.3.2.3]
- 3.6.4.2.1.E** The Mapping Gantry shall be designed to not interfere with the operation of the TBM.
[DERIVED]
- 3.6.4.2.1.F** Movement of the Mapping Gantry shall be integrated into the TBM control system.
[DERIVED]
- 3.6.4.2.1.G** The Mapping Gantry shall have safety labels and placards.
[DERIVED][SD&TRD I.3.3.6.5.A]

3.7 SUBSURFACE EXCAVATIONS (BABE00000)

All Subsurface Excavations CI requirements have been allocated to lower level CIs.

3.7.1 DESCRIPTION

The Subsurface Excavations are comprised of the underground openings and the installed ground support system. The Subsurface Excavations provide underground access for site characterization and are developed consistent with the design of the potential repository.

3.7.1.1 SUBSURFACE EXCAVATIONS CI REQUIREMENTS

None identified at this time.

3.7.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SUBSURFACE EXCAVATIONS CI**3.7.1.2.A All subsurface design bases shall be consistent with the results of site characterization.**

[DERIVED][SD&TRD I.3.7.2.5.D.2.5][10CFR60.130]

3.7.1.2.B Records shall be developed and maintained, including as-built documentation, for the following:

- Locations and amount of seepage;
- Details of equipment, methods, progress, and sequence of work;
- Construction problems;
- Anomalous conditions encountered;
- Location and description of structural support systems;
- Location and description of dewatering systems;
- Details, methods of emplacement, and locations of seals used.

[DERIVED][SD&TRD I.3.7.2.5.D.1.7][10 CFR 60.72(a), 10 CFR 60.72(b)]

3.7.1.2.C Puddled or pooled water entering the underground opening through flooding or perched water zones during construction shall be removed to the extent practical.

[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10 CFR 60.15(c)(1)]

3.7.1.2.D Any cleaning of ESF walls during construction to facilitate photogrammetry, mapping, or other testing shall be done using compressed air/mist and control procedures to limit water saturation.

[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10 CFR 60.15(c)(1)]

3.7.2 UNDERGROUND OPENINGS (BABEA0000)

The complete set of Underground Openings CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.7.1.2, and 3.7.2.1.1.

3.7.2.1 DESCRIPTION

The Underground Openings are the spaces created by mechanical excavation or drilling and blasting including those zones within the rock mass altered by that process (approximately 1.5 meters (5 feet) beyond the excavated surface). The Underground Openings have been defined as a permanent item.

3.7.2.1.1 UNDERGROUND OPENINGS CI REQUIREMENTS

3.7.2.1.1.A The location and alignment of boreholes shall be provided on subsurface drawings.
[DERIVED]

3.7.2.1.1.B The underground openings shall be provided with adequate width and clearance to permit the largest piece of equipment to be transported to and from the underground facility, and to minimize the interference with underground site characterization.
[DERIVED][SD&TRD I.3.7.2.5.D.2.22]

3.7.2.1.1.C OPERATIONAL SEALS

Operational seals are any engineered structure including the material placed in an underground opening and/or the peripheral rock for the purpose of controlling the flow of water and/or gas during the life of the ESF and through the preclosure phase of the potential repository. The Underground Openings CI has been defined as a permanent item.

3.7.2.1.1.C.1 Operational seals for shafts, ramps and boreholes shall be designed so that following permanent closure they do not become pathways that compromise the geologic repository's ability to isolate waste.
[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10CFR60.15(c)(1)]

3.7.2.1.1.C.2 Operational seals shall be provided where necessary to control the spread of water and gas into the facility.
[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10CFR60.15(c)(1)]

3.7.2.1.1.D All coordinates shall be in accordance with the Nevada State Plane Coordinate System and be traceable to existing first-order control points in or around Area 25.
[DERIVED][SD&TRD I.3.3.1.A, I.3.3.1.B]

3.7.2.1.1.E All surface-drilled exploratory boreholes associated with the ESF and located within the potential repository block, including MPBHs, if required, shall be drilled in compliance with *Surface-Based Testing Facilities Requirements Document* requirements.
[DERIVED]

3.7.2.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE UNDERGROUND OPENINGS CI

3.7.2.1.2.A RESERVED

- 3.7.2.1.2.B** The ESF underground openings CIs design, construction, and in situ testing shall be planned and coordinated with the repository design.
[DERIVED][SD&TRD I.3.7.2.5.B.2.2.B][10CFR60.15(c)(4)]
- 3.7.2.1.2.C** Permanent ESF items shall be designed, constructed, and maintained consistent with the quality controls and record keeping requirements expected for permanent items that are part of a potential repository.
[SD&TRD I.3.4.5, I.3.4.6A]
- 3.7.2.1.2.D** Appropriate gravity drainage and/or pumping systems shall be incorporated for draining water away from testing and other work areas to suitable collection points for further treatment and/or disposal.
[DERIVED][SD&TRD I.3.7.2.5.C.1.D][10CFR60.15(c)(1)]
- 3.7.2.1.2.E** Methods for dust control and cleaning of walls in the underground portion of the ESF shall be designed to limit adverse effects on the accuracy and reliability of information from site characterization and on waste isolation.
[DERIVED][SD&TRD I.3.7.2.5.C.1.D][10CFR60.15(c)(1)]
- 3.7.2.1.2.F** The construction of the underground facility shall incorporate use of mechanical excavation or controlled drill-and-blast methods.
[DERIVED][SD&TRD I.3.7.2.5.D.2.20][10CFR60.133(f)]
- 3.7.2.1.2.G** RESERVED
- 3.7.2.1.2.H** Capabilities for plugging or grouting temporary water inflow areas during construction shall be available.
[DERIVED]
- 3.7.2.1.2.I** To the extent practicable, drilling with water into known large-aperture fractures shall be avoided.
[DERIVED]
- 3.7.2.2** **PORTALS (BABEAA000)**
- The complete set of Portals CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.7.1.2, 3.7.2.1.2, and 3.7.2.2.1.
- 3.7.2.2.1** **DESCRIPTION**
- Portals are defined as the rock face and retaining structure at the surface entrance of a ramp. The structure provides ground and utility support and overhead protection for ingress into and egress from the ramp during ESF operations.
- 3.7.2.2.1.A** The portal shall provide access and protection for safe ingress and egress of personnel, material and equipment to and from the subsurface.
[DERIVED][SD&TRD I.3.3.12, I.3.7.2.5.D.2.22]
- 3.7.2.2.1.B** The surface elevation at the ramp portals shall be above the high-water mark of the probable maximum flood.
[DERIVED][SD&TRD I.3.2.3.1.G.2]

3.7.2.3 MAIN ACCESS OPENINGS (BABEAD000)

The complete set of Main Access Openings CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.7.1.2, 3.7.2.1.2, and 3.7.2.3.1.

3.7.2.3.1 DESCRIPTION

The Main Access Openings consist of the North and South Ramps and the Main Drift Connection. The Main Access Openings are mechanically excavated to a minimum of a 7.62 meter (25 foot) diameter opening. The Main Access Openings have been defined as a permanent item.

3.7.2.3.1.A A minimum of two accesses shall be incorporated into the underground ESF to ensure adequate alternative routes of egress. A method of refuge shall be provided while a second opening to the surface is being developed.
[DERIVED][SD&TRD I.3.3.6.1.B, I.3.3.6.2.E.2, I.3.3.12]

3.7.2.3.1.B A ramp shall provide safe access between the ground surface and the underground to meet the needs of site characterization testing, emergency egress, ventilation intake and exhaust, major muck handling, fuel transfer, and primary transport of heavy equipment.
[DERIVED][SD&TRD I.3.3.6.1.A, I.3.3.12]

3.7.2.3.1.C A ramp shall serve as emergency egress from the underground during ESF operations and underground testing and shall be capable of evacuating all underground personnel to safety within one hour.
[DERIVED][SD&TRD I.3.3.6.1.A, I.3.3.12]

3.7.2.3.1.D The main access opening shall be designed for a 7.62 meter (25 foot) diameter opening constructed by mechanical excavation.
[DERIVED]

3.7.2.3.1.E The main access opening CI shall be designed and constructed consistent with the orientation, depth, and layout of the repository design.
[DERIVED][SD&TRD I.3.7.2.5.B.2.2.A, I.3.7.2.5.B.2.2.E, I.3.7.2.5.B.2.3.A, I.3.7.2.5.B.2.3.B, I.3.7.2.5.B.2.3.D, I.3.7.2.5.C.2, I.3.7.2.5.C.3, I.3.7.2.5.D.1.3, I.3.7.2.5.D.1.8, I.3.7.2.5.D.2.1, I.3.7.2.5.D.2.3, I.3.7.2.5.D.2.5, I.3.7.2.5.D.2.13, I.3.7.2.5.D.2.14, I.3.7.2.5.D.2.15, I.3.7.2.5.D.2.16, I.3.7.2.5.D.2.17, I.3.7.2.5.D.2.18, I.3.7.2.5.D.2.23, I.3.7.2.5.D.3.2, I.3.7.2.5.D.3.6, I.3.7.2.5.D.3.7, I.3.7.2.5.D.3.8][10CFR60.21(c)(1)(ii)(d), 10CFR60.111(b)(1), 10CFR60.112, 10CFR60.113(a)(1)(i)(A), 10CFR60.113(a)(1)(i)(B), 10CFR60.113(a)(1)(ii)(B), 10CFR60.130, 10CFR60.133(a)(1), 10CFR60.133(a)(2), 10CFR60.133(b), 10CFR60.133(c), 10CFR60.133(d), 10CFR60.133(e)(1), 10CFR60.133(i), 10CFR60.137, 10CFR60.141(a), 10CFR60.141(b), 10CFR60.141(c), 10CFR60.141(d), 10CFR60.15(b), 10CFR60.15(c)(2), 10CFR60.15(c)(3)]

3.7.2.4 OPERATIONS SUPPORT AREAS (BABEAE000)

The complete set of Operations Support Areas CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.7.1.2, 3.7.2.1.2, and 3.7.2.4.1.

3.7.2.4.1	DESCRIPTION
	The Operations Support Areas consist of facilities to support the ESF operations, including refuge stations, sumps, and stationary equipment alcoves. Refuge chambers and test alcoves may be combined in some cases.
3.7.2.4.1.A	The operations support areas required for rock handling and for miscellaneous support functions shall be located away from in situ site characterization testing to minimize interruptions. [DERIVED][SD&TRD I.3.7.2.5.C.1.D][10CFR60.15(c)(1)]
3.7.2.4.1.B	RESERVED
3.7.2.4.1.C	RESERVED
3.7.2.4.1.D	Twice the drift diameter shall be the minimum stand-off between drifts to preclude interference between tests, except where required otherwise by specific test requirements. [SD&TRD I.3.3.12, I.3.7.2.5.C.1.D, I.3.7.2.5.D.2.21][10CFR60.15(c)(1)]
3.7.2.4.1.E	RESERVED
3.7.2.4.1.F	To limit adverse effects, the ESF shall be designed so that ESF support areas are separated from possible ESF testing areas unless permission to colocate the areas is obtained from the Test Coordination Office. [DERIVED][SD&TRD I.3.7.2.5.C.1.D][10CFR60.15(c)(1)]
3.7.2.4.1.G	RESERVED
3.7.2.4.1.H	A refuge chamber shall be provided with sufficient capacity and facilities to accommodate personnel and visitors underground in accordance with the applicable MSHA requirements. [DERIVED][SD&TRD I.3.3.6.1.A, I.3.3.12]
3.7.2.5	TEST SUPPORT AREAS (BABEAF000)
	The complete set of Test Support Areas CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.7.1.2, 3.7.2.1.2, and 3.7.2.5.1.
3.7.2.5.1	DESCRIPTION
	The Test Support Areas consist of facilities used to support the site characterization activities. Test alcoves and refuge chambers may be combined in some cases. Subsurface utilities such as electric power, compressed air, water, and waste water lines will be provided to support testing as required.
3.7.2.5.1.A	RESERVED
3.7.2.5.1.B	RESERVED

3.7.2.5.1.C The test support areas shall be designed to support the required tests identified in Appendix B.

[DERIVED][SD&TRD I.3.7.2.5.B.1.4.A, I.3.7.2.5.D.1.8, I.3.7.2.5.D.2.1, I.3.7.2.5.D.3.2, I.3.7.2.5.D.3.3, I.3.7.2.5.D.3.4, I.3.7.2.5.D.3.6, I.3.7.2.5.D.3.7, I.3.7.2.5.D.3.8][10CFR60.137, 10CFR60.140(b), 10CFR60.140(c), 10CFR60.141(a), 10CFR60.141(b), 10CFR60.141(c), 10CFR60.141(d), 10CFR60.15(b), 10CFR60.74(b)]

3.7.2.6 SHAFTS [OPTIONAL] (BABEAG000)

The complete set of Shafts CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.7.1.2, 3.7.2.1.2, and 3.7.2.6.1.

3.7.2.6.1 DESCRIPTION

The Shaft access will consist of systems, subsystems, and components which are comprised of a vertical engineered opening within a circular zone whose radius is defined as the sum of the radius of the finished shaft, the lining thickness, and a nominal 1.5 meters (5 feet) beyond the lining, that connects the surface with the targeted horizons.

3.7.2.6.1.A The surface elevation at the shaft collar shall be above the high-water mark of the probable maximum flood.

[DERIVED][SD&TRD I.3.2.3.1.G.2]

3.7.2.6.1.B The shaft collar shall prevent significant water inflow from a flooding event during site characterization.

[DERIVED]

3.7.2.6.1.C The hoisting system capacities shall be consistent with the requirements of ESF operations and site characterization and emergency egress needs.

[DERIVED][SD&TRD I.3.3.6.3.A.2, I.3.3.12, I.3.7.2.5.D.2.22]

3.7.2.6.1.D Openings shall be designed considering the predicted thermal and thermomechanical response of the host rock, surrounding strata, and groundwater system to meet the performance objectives of the potential repository.

[DERIVED][SD&TRD I.3.7.2.5.B.2.2.E][10CFR60.133(i)]

3.7.2.6.1.E Shaft design shall accommodate the applicable testing requirements in Appendix B.

[DERIVED][SD&TRD I.3.7.2.4.B.1.5.A]

3.7.3 GROUND SUPPORT SYSTEMS (BABEE0000)

The complete set of Ground Support Systems CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.7.1.2, and 3.7.3.1.

3.7.3.1 DESCRIPTION

The Ground Support Systems are the structures installed within the excavated opening, or reinforcement made to the rock surrounding the opening, with the intention of controlling the configuration and stability of the opening, and to provide protection for personnel and equipment against potential falls of loose rock from the

back and walls of the excavated opening. This includes the ground support system installed throughout the main access openings and in the transition zones for the operations support and test support areas. The transition zone length is approximately 2.5 times the main access opening diameter measured perpendicular from the centerline of the main access opening. The ground support system in the aforementioned areas are permanent items. The Q classification of any ESF CI is determined by a classification analysis for that CI.

- 3.7.3.1.A** The ground support system shall be designed to include provisions for installation of instrumentation and data collection units as specified by testing requirements.
[DERIVED][SD&TRD I.3.7.2.5.B.1.4.A]
- 3.7.3.1.B** The ground support system design shall limit the use of pressure grouting and shall obtain prior approval from the Test Coordination Office before usage.
[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10CFR 60.15(c)(1)]
- 3.7.3.1.C** RESERVED
- 3.7.3.1.D** The ground support system shall be compatible with the excavation methods and equipment.
[DERIVED]
- 3.7.3.1.E** The ground support system shall incorporate the use of noncombustible and heat resistant materials in the design.
[DERIVED][SD&TRD I.3.7.2.5.D.2.9][10CFR60.131(b)(3)(ii)]
- 3.7.3.1.F** The ground support system shall be designed to permit periodic inspection, monitoring, testing, and maintenance, as necessary, to evaluate their readiness and to ensure their continued function.
[DERIVED][SD&TRD I.3.7.2.5.D.2.11, I.3.7.2.5.D.2.19]
[10CFR60.131(b)(6), 10CFR60.133(e)(2)]
- 3.7.3.1.G** The ground support system shall be designed and installed throughout the main access openings and all alcove transition zones to reduce the potential for deleterious rock movement or fracturing.
[DERIVED][SD&TRD I.3.7.2.5.D.2.19][10CFR60.133(e)(2)]
- 3.7.3.1.H** RESERVED
- 3.7.3.1.I** The ground support system shall be designed to accommodate the anticipated ground conditions at the main access opening, the operations support areas, and the test support areas, utilizing the available site data at that time.
[SD&TRD I.3.7.2.5.D.2.5][10CFR60.130]
- 3.7.3.1.J** The ground support system shall be designed to have the capability to be supplemented as required when identified through additional site characterization data and analyses.
[SD&TRD I.3.7.2.5.D.1.8, I.3.7.2.5.D.3.6, I.3.7.2.5.D.3.8]
[10CFR60.141(a), 10CFR60.141(b), 10CFR60.141(d)]

- 3.7.3.1.K** The ground support system shall be designed with sufficient flexibility to allow adjustments where necessary to accommodate specific site conditions encountered during excavation or identified through in situ monitoring and testing.
[DERIVED][SD&TRD I.3.7.2.5.D.2.15][10CFR60.133(b)]
- 3.7.3.1.L** The ground support system shall be designed to meet the predicted thermal and thermomechanical response of the host rock, surrounding strata, and groundwater system for the site characterization heater tests.
[SD&TRD I.3.7.2.5.B.2.2.E][10CFR60.133(i)]

3.8 SUBSURFACE SUPPORT SYSTEMS (BABF00000)

All Subsurface Support Systems CI requirements were allocated to lower level CIs.

3.8.1 DESCRIPTION

The Subsurface Support Systems include the systems, subsystems, and components which provide utilities, machinery and equipment, and muck, material, and personnel handling. Utilities include power, communications, lighting, ventilation, water, underground waste water removal, compressed air, fire protection, sanitary facilities, furnishings, and the subsurface monitoring and warning system.

3.8.1.1 SUBSURFACE SUPPORT SYSTEMS CI REQUIREMENTS

No requirements are identified at this time.

3.8.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SUBSURFACE SUPPORT SYSTEMS CI**3.8.1.2.A RESERVED****3.8.1.2.B RESERVED****3.8.1.2.C The service facilities and equipment required for maintaining underground services shall be provided to support ESF operation and in situ site characterization.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]****3.8.2 SUBSURFACE UTILITIES (BABFA0000)**

All Subsurface Utilities CI requirements were allocated to lower level CIs.

3.8.2.1 DESCRIPTION

The Subsurface Utilities include power, communications, lighting, ventilation, water, underground waste water removal, compressed air, fire protection, sanitary facilities, furnishings, and the subsurface monitoring and warning systems.

3.8.2.1.1 SUBSURFACE UTILITIES CI REQUIREMENTS**3.8.2.1.1.A The ESF shall provide underground utilities, which include as a minimum:**

- Power,
- Communications,
- Lighting,
- Ventilation,
- Water,
- Underground waste water removal,
- Compressed air,
- Fire protection,
- Materials and rock and muck handling,
- Sanitation, and

- Safety monitoring and warning subsystems,

required to meet the needs of the underground site characterization testing program during ESF operations.

[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SUBSURFACE UTILITIES CI

- 3.8.2.1.2.A** The underground utilities for the ESF shall not preclude monitoring and investigation of in situ testing.

[DERIVED]

- 3.8.2.1.2.B** Subsurface utility systems, when installed, shall not restrict foot, vehicular, or shaft and ramp conveyance traffic.

[DERIVED][SD&TRD I.3.2.2.3.C.1.a, I.3.2.2.3.C.1.b, I.3.2.2.3.C.1.c, I.3.2.2.3.C.1.d, I.3.3.12.af]

- 3.8.2.1.2.C** Subsurface utility systems, when installed, shall not obstruct ventilation.

[DERIVED][SD&TRD I.3.2.2.3.C.1.a, I.3.2.2.3.C.1.b, I.3.2.2.3.C.1.c, I.3.2.2.3.C.1.d, I.3.3.12.af]

- 3.8.2.1.2.D** To the extent practical, underground utility systems and associated furnishings (hangers, brackets, etc.) shall be removed following final use.

[DERIVED][SD&TRD I.3.3.12.af, I.3.7.2.6.D.1.B]

- 3.8.2.1.2.E** The distribution of utilities shall support flexibility in the siting of the final testing locations.

[DERIVED][SD&TRD I.3.7.2.6.B.1.4.A, I.3.7.2.6.B.1.5.A]

- 3.8.2.1.2.F** Subsurface utilities requiring remote monitoring and control shall provide the necessary equipment to interface with the subsurface monitoring and control system and the IDCS.

[DERIVED][SD&TRD I.3.7.2.6.B.1.2.A, I.3.7.2.6.B.1.4.B]

- 3.8.2.1.2.G** Subsurface utilities shall support the testing utility requirements in Appendix B.

[DERIVED][SD&TRD I.3.7.2.6.B.1.4.A, I.3.7.2.6.B.1.4.B]

3.8.2.2 SUBSURFACE POWER (BABFAA000)

The complete set of Subsurface Power CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.2.1.

3.8.2.2.1 DESCRIPTION

Subsurface Power includes those systems, subsystems, and components necessary for the control and distribution of electrical power to underground systems.

- 3.8.2.2.1.A** Electrical standby power shall be provided to the ventilation system to retain operational function when primary power is lost. A reduced level of ventilation necessary to support critical activities is acceptable.

[DERIVED][SD&TRD I.3.3.12.af]

- 3.8.2.2.1.B** All electrical power wiring must be kept physically separated from data and communications wiring to prevent induced interference.
[DERIVED][SD&TRD I.3.3.2.A, I.3.3.12.af]
- 3.8.2.2.1.C** Power distribution for the ESF, including the primary substation and secondary distribution systems, transmission lines, and feeder cables, shall have sufficient capacity to meet load requirements at points of usage throughout the operations areas.
[DERIVED][SD&TRD I.3.3.12.af]
- 3.8.2.2.1.D** Suitable switching and protective devices shall be provided in the electrical system to prevent damage to the equipment in case of power failure or faults.
[DERIVED][SD&TRD I.3.3.12.af]
- 3.8.2.2.1.E** Metering shall be provided to establish the demand and consumption of power.
[DERIVED][SD&TRD I.3.3.12.af]
- 3.8.2.2.1.F** Surge protection shall be provided.
[DERIVED][SD&TRD I.3.3.12.af]
- 3.8.2.2.1.G** A grounding system shall be provided for personnel safety and equipment protection.
[DERIVED][SD&TRD I.3.3.12.af]
- 3.8.2.2.1.H** The underground electrical power system shall provide the necessary power to meet the normal and peak demands of ESF operations and site characterization activities of the subsurface facility.
[DERIVED][SD&TRD I.3.3.12.af, I.3.7.2.6.B.1.5.A]
- 3.8.2.2.1.I** Stand-by power to the underground systems shall provide all necessary power to systems and subsystems that are required to operate in the event of a power outage, based on safety or operational requirements for the operation of the ESF.
[DERIVED][SD&TRD I.3.3.12.af, I.3.7.2.6.B.1.5.A]
- 3.8.2.2.1.J** The underground UPS system(s) shall ensure continuity of power to the IDCS, sensor systems, safety instruments and controls, communications, and all systems and subsystems that cannot tolerate a power interruption (see ESFDR Appendix B).
[DERIVED][SD&TRD I.3.3.12.af, I.3.7.2.6.B.1.5.A]
- 3.8.2.2.1.K** The underground power distribution system shall have one primary power feed (steel armored, wire armored, or other approved cable) and one alternate power feed (steel armored, wire armored, or other approved cable).
[DERIVED][SD&TRD I.3.3.12.af, I.3.7.2.6.B.1.5.A]
- 3.8.2.2.1.L** One power feed shall be installed in each access, as necessary, and adequate switching shall be provided.
[DERIVED][SD&TRD I.3.3.12.af, I.3.7.2.6.B.1.5.A]

- 3.8.2.2.1.M** Underground high voltage (1000 Volts or more) feeders supplying mobile equipment shall have a ground check circuit to continuously monitor the grounding circuit to ensure continuity.
[DERIVED][SD&TRD I.3.3.12.c, I.3.3.12.d, I.3.3.12.af, I.3.7.2.6.B.1.5.A]
- 3.8.2.2.1.N** Underground substations supplying power to 480V, 3-phase loads shall be resistance grounded.
[DERIVED][SD&TRD I.3.3.12.af]
- 3.8.2.2.1.O** Utility lines, steel supports, and other conducting structures supporting electrical systems, shall be electrically bonded and reliably connected to the subsurface electrical safety grounding network.
[DERIVED][SD&TRD I.3.3.12.af]
- 3.8.2.2.1.P** The power distribution system shall be designed to minimize interference with testing activities.
[DERIVED][SD&TRD I.3.3.12.af, I.3.7.2.6.B.1.4.A]
- 3.8.2.2.1.Q** The subsurface power system shall have a minimum availability of 98.81%.
[DERIVED][SD&TRD I.3.2.2.1.A]
- 3.8.2.3** **SUBSURFACE COMMUNICATIONS (BABFAB000)**
- The complete set of Subsurface Communications CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.3.1.
- 3.8.2.3.1** **DESCRIPTION**
- Subsurface Communications includes those systems, subsystems, and components that provide for telephone, public address, and radio communications in the ESF underground areas (ramps, stations, refuge chambers, alcoves, test areas, and shop areas).
- 3.8.2.3.1.A** Communications capability in and between the surface and the underground facilities (ramps, shafts, and underground openings) shall be established and suitable safety alarm systems shall be provided where required.
[DERIVED][SD&TRD I.3.3.6.1.B, I.3.7.2.6.B.1.5.A]
- 3.8.2.3.1.B** RESERVED
- 3.8.2.3.1.C** A public address system shall be provided for emergency announcements and general paging.
[DERIVED][SD&TRD I.3.3.12.j]
- 3.8.2.3.1.D** Access to the public address system shall include, as a minimum, the control center, each shaft collar and ramp portal, and the telephone system.
[DERIVED][SD&TRD I.3.3.12.j]
- 3.8.2.3.1.E** RESERVED

- 3.8.2.3.1.F** The ESF FM radio system shall be installed and integrated with the NTS FM radio system to provide communications to security and maintenance personnel and to serve as a backup communication system.
[DERIVED][SD&TRD I.3.3.6.1.B, I.3.3.12.j]
- 3.8.2.3.1.G** A telephone link shall be available to permit communication between any underground mine pager phone and the surface commercial telephone network, except for phones that require dedicated communications.
[DERIVED][SD&TRD I.3.3.6.1.B, I.3.3.12.j]
- 3.8.2.3.1.H** RESERVED
- 3.8.2.3.1.I** RESERVED
- 3.8.2.3.1.J** Phone jacks and phone service shall be provided as required for communication service as indicated in ESFDR, Appendix B.
[DERIVED][SD&TRD I.3.7.2.6.B.1.4.A]
- 3.8.2.3.1.K** RESERVED
- 3.8.2.3.1.L** RESERVED
- 3.8.2.3.1.M** The subsurface communications system shall have a minimum availability of 99.50%.
[DERIVED][SD&TRD I.3.2.2.1.A]
- 3.8.2.3.2** **SHAFT COMMUNICATION SYSTEM REQUIREMENTS**
- 3.8.2.3.2.A** A hoist call-response signaling system and a battery powered telephone system shall be provided in each shaft station, shaft collar, bottom of shaft, and hoist operator's station.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.2.3.2.B** A communications system shall be provided between the shaft cage and the hoist operator's station.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.2.3.2.C** The communications system for the underground areas shall be tied into the hoisting system control room and ramp control buildings.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.2.4** **SUBSURFACE LIGHTING (BABFAC000)**
- The complete set of Subsurface Lighting CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.4.1.
- 3.8.2.4.1** **DESCRIPTION**
- Subsurface Lighting includes those systems, subsystems, and components that provide illumination for ESF subsurface operation to include portal entrances,

ramps, refuge chambers, support and test alcoves, test drifts, underground shop areas, IDCS, testing equipment, and the subsurface muck conveyor system.

- 3.8.2.4.1.A** Lighting shall be provided at each testing area and alcove, refuge chamber, and at the shaft and ramp station areas.
[DERIVED][SD&TRD I.3.2.1.1.3.A]
- 3.8.2.4.1.B** Temporary lighting shall be provided for special needs such as mapping, photography, and work lights near instrumentation junction boxes.
[DERIVED][SD&TRD I.3.2.1.1.3.A]
- 3.8.2.4.1.C** Exit lighting with battery backup shall be provided to identify direction of evacuation to refuge chambers and/or shaft and ramp stations.
[DERIVED][SD&TRD I.3.3.6.2.E.2, I.3.3.6.6.C, I.3.3.12.af]
- 3.8.2.4.1.D** Emergency lighting with battery backup that is charged continuously by facility power, and actuates automatically, shall be provided in each shop, testing area, refuge chamber, and shaft and ramp station areas.
[DERIVED][SD&TRD I.3.3.6.6.B]
- 3.8.2.4.1.E** The lighting provided in each testing area shall be based on specific test requirements for that area.
[DERIVED][SD&TRD I.3.2.1.1.3.A]
- 3.8.2.4.1.F** RESERVED
- 3.8.2.4.1.G** The subsurface lighting system shall have a minimum availability of 99.49%.
[DERIVED][SD&TRD I.3.2.2.1.A]
- 3.8.2.5** **SUBSURFACE VENTILATION (BABFAD000)**
- The complete set of Subsurface Ventilation CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.5.1.
- 3.8.2.5.1** **DESCRIPTION**
- Subsurface Ventilation includes those systems, subsystems, and components that allow fresh air, conditioned if required, to be supplied to, and exhaust air to be removed from the underground areas to meet the needs of ESF subsurface operations.
- 3.8.2.5.1.A** RESERVED
- 3.8.2.5.1.B** RESERVED
- 3.8.2.5.1.C** The ventilation distribution system shall be maintained to support initial construction of a potential repository until this can be replaced by the potential repository facilities.
[DERIVED]
- 3.8.2.5.1.D** RESERVED

- 3.8.2.5.1.E** RESERVED
- 3.8.2.5.1.F** The ventilation system shall minimize leakage to the extent practicable.
[DERIVED][SD&TRD I.3.2.1.1.2.A]
- 3.8.2.5.1.G** RESERVED
- 3.8.2.5.1.H** RESERVED
- 3.8.2.5.1.I** RESERVED
- 3.8.2.5.1.J** Underground ventilation shall dilute and/or remove particulate matter, blasting fumes (if drill-and-blast is used), and other flammable and noxious gases from the working areas, and shall divert exhaust air to the exhaust opening(s), all in conformance with applicable federal and state regulations.
[DERIVED][SD&TRD I.3.2.1.1.2.D]
- 3.8.2.5.1.K** RESERVED
- 3.8.2.5.1.L** Dust control/collection facilities shall be provided at potential underground dust-generation areas (e.g., working faces, rock-handling transfer points, processing areas) to minimize airborne particulates.
[DERIVED][SD&TRD I.3.2.1.1.2.D]
- 3.8.2.5.1.M** RESERVED
- 3.8.2.5.1.N** RESERVED
- 3.8.2.5.1.O** The ventilation system shall support the ventilation monitoring requirements for site characterization tests and health and safety requirements.
[SD&TRD I.3.3.11.B, I.3.3.12.m]
- 3.8.2.5.1.P** RESERVED
- 3.8.2.5.1.Q** The subsurface ventilation system shall have a minimum availability of 98.95%.
[DERIVED][SD&TRD I.3.2.2.1.A]
- 3.8.2.6** **SUBSURFACE WATER (BABFAE000)**
- The complete set of Subsurface Water CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.6.1.
- 3.8.2.6.1** **DESCRIPTION**
- Subsurface Water includes those systems, subsystems, and components that distribute water within the underground facility. The skid mounted tracer injection system is included in the Subsurface Water CI.
- 3.8.2.6.1.A** Management of water entering the ESF shall include quantity and water balance.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

- 3.8.2.6.1.B** Piping shall be designed to preclude or limit water inflow into the ESF following a pipe rupture.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.6.1.C** All joints in fluid-carrying columns shall be sealed and proof-tested.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.6.1.D** Fluid-carrying piping shall be designed to prevent damage caused by water hammer.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.6.1.E** All water used underground during operation and construction of the ESF shall be provided with chemical tracers as required by testing.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.6.1.F** The water distribution system shall be of sufficient size and capacity to simultaneously provide for fire protection and process water throughout the ESF, in accordance with all anticipated needs and services for ESF subsurface operations.
[DERIVED][SD&TRD I.3.2.3.2.1.B, I.3.3.12.af]
- 3.8.2.6.1.G** The subsurface water system shall have a minimum availability of 98.94%.
[DERIVED][SD&TRD I.3.2.2.1.A]
- 3.8.2.6.1.H** The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.7** **SUBSURFACE WASTE WATER (BABFAF000)**
- The complete set of Subsurface Waste Water CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.7.1.
- 3.8.2.7.1** **DESCRIPTION**
- Subsurface Waste Water includes those systems, subsystems, and components that collect, control, and transfer subsurface waste water from the underground to the surface waste water system. Subsurface Waste Water equipment includes pipe, valves, fittings, pumps, collection sumps, waste water storage tank, controls and warning condition switches.
- 3.8.2.7.1.A** The underground waste water collection system shall provide for collection, treatment (as required), and transfer of waste water and groundwater inflow to the surface waste water system.
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.B, I.3.7.2.6.B.1.3.B, I.3.7.2.6.B.1.5.A]
- 3.8.2.7.1.B** Piping shall be designed to preclude or limit water inflow into the ESF following a pipe rupture.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.7.1.C** All joints in fluid-carrying columns shall be sealed and proof-tested.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

- 3.8.2.7.1.D** Fluid-carrying piping shall be designed to prevent damage caused by water hammer.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.7.1.E** The pumping systems shall provide for measurement of the water volume.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A, I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.7.1.F** The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.7.1.G** Puddled or pooled water, entering the underground opening through flooding or perched water zones, shall be removed to the extent practical.
[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]
- 3.8.2.7.1.H** The underground waste water collection system shall utilize construction materials that are resistant to erosive and corrosive effects, if economically practicable; otherwise, suitable monitoring of corrosion and erosion effects and/or treatment facilities for credible groundwater inflows shall be available to control possible contamination and to reduce damage to pumping/piping systems from erosion or corrosion.
[DERIVED][SD&TRD I.3.2.3.1.A, I.3.7.2.6.B.1.5.A]
- 3.8.2.7.1.I** Provisions shall be made for cleaning the sumps.
[DERIVED][SD&TRD I.3.2.2.3.C.1.b, I.3.7.2.6.B.1.5.A]
- 3.8.2.7.1.J** The sumps shall be designed to prevent exfiltration.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.2.7.1.K** Underground water handling and control, including pumping systems, shall be designed for all credible inflows, including inflow from penetration of fault structures or from perched water horizons, use of fire protection sprinklers, and from water line breakage.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.2.7.1.L** The underground waste water collection system shall have full operating redundancy or shall have storage capacity to allow installation of spares.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.2.7.1.M** The underground waste water collection system shall control standing water to reduce air/water contact surfaces where ventilation air will be flowing in order to control humidity in air and to maintain the quality of the ventilation air being supplied.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.2.7.1.N** The subsurface waste water system shall have a minimum availability of 99.58%.
[DERIVED][SD&TRD I.3.2.2.1.A]

3.8.2.7.2 SHAFT WASTE WATER SYSTEM REQUIREMENTS

3.8.2.7.2.A The size and depth of the shaft sump shall be sufficient to accommodate the required operation of the shaft equipment.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.7.2.B The shaft sump shall not penetrate the Calico Hills (CH) unit unless authorization to do so is given by the YMSCO.
[DERIVED]

3.8.2.7.2.C The sump shall be equipped with underground waste water collection facilities.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.8 SUBSURFACE COMPRESSED AIR (BABFAG000)

The complete set of Subsurface Compressed Air CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.8.1.

3.8.2.8.1 DESCRIPTION

Subsurface Compressed Air includes those systems, subsystems, and components necessary to distribute compressed air, which is received from the surface compressed air system, throughout the underground facility.

3.8.2.8.1.A The Subsurface Compressed Air CI shall receive compressed air from the Surface Compressed Air CI (BABBD000).
[DERIVED][SD&TRD I.3.7.2.2.B.1.6.A]

3.8.2.8.1.B The compressed air system shall provide compressed air throughout the designated areas of the ESF with flow rates and pressures to support operations of the facilities, site characterization testing requirements, and drilling requirements including additional drift excavation.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.8.1.C Compressed air shall be conditioned as required and a quantity maintained to meet drilling and test apparatus requirements (see ESFDR, Appendix B).
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.8.1.D All compressed air used during operation and construction of the ESF shall be provided with chemical tracers only upon request by the ESF Test Coordinator.
[DERIVED][SD&TRD I.3.3.11.B, I.3.7.2.6.B.1.5.A]

3.8.2.8.1.E The subsurface compressed air system shall have a minimum availability of 99.41%.
[DERIVED][SD&TRD I.3.2.2.1.A]

3.8.2.9 SUBSURFACE FIRE PROTECTION (BABFAH000)

The complete set of Subsurface Fire Protection CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.9.1.

3.8.2.9.1 DESCRIPTION

Subsurface Fire Protection includes the systems, subsystems, and components that provide detection, warning, and suppression to extinguish fires within the underground facilities.

- 3.8.2.9.1.A** Water shall be used as the fire suppressing agent only after detailed analysis has been made of its effects on overall site characterization and individual testing activities.

[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

- 3.8.2.9.1.B** The underground portion of the ESF shall incorporate a fire protection system to detect, warn, control, and limit the impact of credible fires in the ESF.

[DERIVED][SD&TRD I.3.2.3.2.1.B]

- 3.8.2.9.1.C** RESERVED

- 3.8.2.9.1.D** If water is used as a fire suppressant, the distribution system shall have, as a minimum, fire hose outlets located along the main access openings at intervals to meet the applicable safety requirements.

[DERIVED][SD&TRD I.3.2.3.2.1.B]

- 3.8.2.9.1.E** The subsurface fire protection system shall have a minimum availability of 99.14%.

[DERIVED][SD&TRD I.3.2.2.1.A]

- 3.8.2.9.1.F** Fire suppression agents shall be selected for compatibility with intended use and approved for use based on their impacts on the in situ site characterization testing program.

[DERIVED][SD&TRD I.3.7.2.5.C.1.B][10 CFR 60.15(c)(1)]

3.8.2.10 SUBSURFACE SANITARY FACILITIES (BABFAI000)

The complete set of Subsurface Sanitary Facilities CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.10.1.

3.8.2.10.1 DESCRIPTION

The Subsurface Sanitary Facilities include those systems, subsystems, and components which provide for the collection and disposal of human waste within the underground facilities.

- 3.8.2.10.1.A** The amount of chronic water losses (subsurface infiltration) shall not exceed the amount determined by analysis.

[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

- 3.8.2.10.1.B** Toilets shall be provided underground to accommodate the collection of wastes from a maximum occupancy per shift.

[DERIVED][SD&TRD I.3.2.1.1.1.B, I.3.3.12.ad]

3.8.2.10.1.C Toilet facilities shall be located at convenient, noninterfering locations relative to operations, site characterization testing, and monitoring.
[DERIVED][SD&TRD I.3.2.1.1.1.B, I.3.3.12.ad]

3.8.2.11 SUBSURFACE MONITORING & WARNING SYSTEM (BABFAJ000)

The complete set of Subsurface Monitoring & Warning System CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.11.1.

3.8.2.11.1 DESCRIPTION

The Subsurface Monitoring & Warning System includes those systems, subsystems, and components required to monitor underground environmental conditions and to alert on-site personnel of possible dangerous situations to ensure a safe and healthful working environment.

3.8.2.11.1.A Monitoring systems shall provide the capability to interface with the IDCS for data transfer.

[DERIVED][SD&TRD I.3.7.2.4.B.1.6.A]

3.8.2.11.1.B Sufficient facilities shall be provided which alert on-site personnel of possible dangerous environmental and safety situations.

[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.11.1.C Alarm systems shall indicate when the various monitored conditions exceed specified limits. Redundant systems shall be installed as required by applicable regulations, and shall include either whole systems or critical components within the system, to the extent practical.

[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.11.1.D A life safety alarm system shall be provided between the underground and surface.

[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.11.1.E The underground ventilation system shall be monitored, as a minimum, for the following:

- Noise,
- Dust,
- Radon/progeny,
- Ammonia,
- Nitrogen dioxide,
- Nitrous oxides,
- Sulfur dioxide,
- Hydrogen sulfide,
- Methane,
- Oxygen,
- Carbon monoxide,
- Carbon dioxide,
- Air temperature,
- Humidity, and
- Air velocity and volume flow,

as required by applicable federal and State of Nevada regulations.
[DERIVED][SD&TRD I.3.3.11.A.k, I.3.7.2.6.B.1.5.A, I.3.2.1.1.2.B, I.3.2.1.1.2.D, I.3.3.6.1.B]

3.8.2.11.1.F The subsurface monitoring and warning system shall have a minimum availability of 99.50%.

[DERIVED][SD&TRD I.3.2.2.1.A]

3.8.2.12 SUBSURFACE FURNISHINGS (BABFAK000)

The complete set of Subsurface Furnishings CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.2.1.2, and 3.8.2.12.1.

3.8.2.12.1 DESCRIPTION

Subsurface Furnishings include fabricated brackets which are fixed to the ramp wall or other structural support members and underground utilities. Utility brackets include provisions to facilitate installation of ventilation and ramp utilities. The Subsurface Furnishings CI also includes the invert segments that form the ramp and main drift roadbed.

3.8.2.12.1.A All furnishings shall allow readily performed inspection and maintenance.

[DERIVED][SD&TRD I.3.5.1.A]

3.8.2.12.1.B Furnishings shall provide for mounting the following utilities and cables underground:

- Electrical power,
- Compressed air,
- Water,
- Communications,
- Underground instrumentation,
- Instrumentation and IDCS cabling,
- Underground waste water handling system,
- Ventilation.

[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.12.1.C Steel supports and other conducting structures supporting electrical systems shall be electrically bonded and reliably connected to the subsurface electrical safety grounding network.

[DERIVED][SD&TRD I.3.3.6.9.B, I.3.3.12.ap]

3.8.2.12.1.D The ramp roadway shall be designed to sustain impact and heavy moving loads from equipment and material transport.

[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.2.12.1.E Any fill or other construction materials used in the floors of the drifts within the ESF in areas that may adversely impact implementation of postclosure sealing, shall be removable.

[DERIVED][SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

3.8.3 MACHINERY & EQUIPMENT (BABFB0000)

The complete set of Machinery & Equipment CI requirements is obtained by combining the requirements from Sections 3.2.1.2 and 3.8.3.1.1.

3.8.3.1 DESCRIPTION

The excavating Machinery & Equipment includes all equipment necessary to support drill and blast tunnel construction functions - drilling, bolting, loading, hauling, charging and other support functions. Fluids used in the equipment include diesel fuel, motor oil, engine coolant, grease, hydraulic oil, transmission oil, rock drill oil, gear box oil, rust inhibitor, brake fluid and battery acid.

3.8.3.1.1 MACHINERY & EQUIPMENT CI REQUIREMENTS

No requirements are identified at this time.

3.8.4 MUCK, MATERIAL & PERSONNEL HANDLING (BABFC0000)

All Muck, Material & Personnel Handling CI requirements have been allocated to lower level CIs.

3.8.4.1 DESCRIPTION

Muck, Material & Personnel Handling is defined as those systems, subsystems, structures, equipment, and components that transport excavated rock (muck), materials (including supplies and fuel), and equipment between the surface and underground to meet the needs of construction and underground site characterization testing.

3.8.4.1.1 MUCK, MATERIAL & PERSONNEL HANDLING CI REQUIREMENTS

No requirements are identified at this time.

3.8.4.1.2 APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE MUCK, MATERIAL & PERSONNEL HANDLING CI

3.8.4.1.2.A The conveyors and/or transport system shall incorporate fail-safe devices and be designed with adequate safety factors as per applicable regulations.

[DERIVED][SD&TRD I.3.3.6.1.A, I.3.3.12.j]

3.8.4.1.2.B The muck handling system shall provide for collecting excavated rock at the shaft or ramp station, surge capacity, measuring, and loading the rock for conveyance.

[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.4.1.2.C The muck and material handling systems shall be designed, installed, tested, operated, and maintained in conformance with applicable regulations.

[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.4.2 SURFACE CONVEYOR (BABFCA000)

The complete set of Surface Conveyor CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.4.1.2, and 3.8.4.2.1.

3.8.4.2.1 DESCRIPTION

The Surface Conveyor is defined as those systems, subsystems, structures, equipment, and components that transport excavated rock (muck) between the transfer tower number one and the muck stockpile stacking system to meet the needs of construction and underground site characterization testing.

3.8.4.2.1.A The surface conveyor shall receive muck from the subsurface conveyor.
[DERIVED][SD&TRD I.3.7.2.6.B.1.3.A]

3.8.4.2.1.B The surface conveyor system shall provide muck to the muck storage CI.
[SD&TRD I.3.7.2.6.B.1.3.A]

3.8.4.2.1.C Surface rock handling equipment shall meet required rates for excavation and rock removal.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.4.2.1.D The muck handling equipment at the muck storage location shall meet the maximum muck handling capacity of the surface conveyor.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.4.2.1.E The surface conveyor shall be designed to minimize the spillage of excavated rock during handling.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.4.2.1.F The surface conveyor shall be designed to allow spilled material to be placed back onto the conveyor.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.4.2.1.G The muck handling system design shall accommodate handling of oversize material at the transfer points.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

3.8.4.2.1.H The design of the surface conveyor shall accommodate the routes of existing and planned access roads.
[DERIVED]

3.8.4.2.1.I The surface conveyor system shall be designed and constructed with means of mitigating hydrocarbons leakage and spillage.
[SD&TRD I.3.7.2.6.C.1.B][10CFR60.15(c)(1)]

3.8.4.2.1.J The surface conveyor shall be sized and designed for ESF construction and underground site characterization needs.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]

- 3.8.4.2.1.K** The Surface Conveyor System shall be designed in compliance with all applicable requirements in the Air Quality Operating Permit AP 9999-0076.
[DERIVED][SD&TRD I.3.3.11.A.k]
- 3.8.4.2.1.L** The Surface Conveyor System shall be designed in compliance with all applicable requirements stipulated in the Air Quality Operating Permit AP 9611-0573.
[DERIVED][SD&TRD I.3.3.11.A.k, I.3.3.12.l]
- 3.8.4.3** **SUBSURFACE CONVEYOR (BABFCB000)**
- The complete set of Subsurface Conveyor CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.4.1.2, and 3.8.4.3.1.
- 3.8.4.3.1** **DESCRIPTION**
- Subsurface Conveyor is defined as those systems, subsystems, structures, equipment, and components that transport excavated rock (muck) between the underground and the transfer tower number one to meet the needs of construction and underground site characterization testing.
- 3.8.4.3.1.A** Routes for the subsurface conveyor system shall be selected to avoid active test areas wherever possible.
[DERIVED][SD&TRD I.3.7.2.6.C.1.C][10CFR60.15(c)(1)]
- 3.8.4.3.1.B** **RESERVED**
- 3.8.4.3.1.C** The conveyors shall include smoke and heat detection systems.
[DERIVED][SD&TRD I.3.3.12.j]
- 3.8.4.3.1.D** The subsurface conveyor system shall be sized and designed for ESF construction and underground site characterization needs.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.4.3.1.E** The subsurface conveyor system design shall accommodate handling of oversize material at the transfer points.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.4.3.1.F** The subsurface conveyor shall be designed to minimize the spillage of excavated rock during handling.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.4.3.1.G** The subsurface conveyor shall provide capabilities for gathering and removing spillage.
[DERIVED][SD&TRD I.3.7.2.6.B.1.5.A]
- 3.8.4.4** **MATERIAL & PERSONNEL HANDLING (BABFCC000)**
- The complete set of Material & Personnel Handling CI requirements is obtained by combining the requirements from Sections 3.2.1.2, 3.8.1.2, 3.8.4.1.2, and 3.8.4.4.1.

3.8.4.4.1 DESCRIPTION

Material & Personnel Handling is defined as those systems, subsystems, structures, equipment, and components that transport excavated rock (muck) which is not transported by conveyors, materials (including supplies and fuel), and equipment between the surface and underground to meet the needs of construction and underground site characterization testing. This includes any transferring at the ramp station.

The material handling system includes material handling equipment, loading and unloading stations, transfer point structures, and buildings to accommodate all the necessary equipment and instrumentation, hydraulic power units, air compressor system, control room electrical and motor control center, and an area for repairs and laydown. Since the system for moving personnel from work places and test areas will be coupled with the movement of supplies and construction materials in the ESF this definition is extended to include all equipment, conveyances, and other appurtenances required to efficiently move personnel from the surface to all areas of the subsurface ESF and back to the surface.

3.8.4.4.1.A RESERVED

3.8.4.4.1.B The underground material and personnel handling systems shall be sufficiently sized to sustain construction, operations, and testing.
[DERIVED][SD&TRD I.3.7.2.6.B.1:5.A]

3.8.4.4.1.C The material and personnel handling system(s) shall have appropriate safety features, as required by analysis and applicable federal, State of Nevada, and local regulations.
[DERIVED][SD&TRD I.3.3.6.1.A, I.3.3.12.c]

3.8.4.4.1.D Routes for the material handling system shall be selected to avoid active test areas wherever possible.
[DERIVED][SD&TRD I.3.7.2.6.C.1.C][10CFR60.15(c)(1)]

4. CONFORMANCE VERIFICATION

4.1 RESPONSIBILITIES

This section relates the requirements of this document to the compliance methods of Section 4.2 that shall be used to verify the requirements. The conformance to the equipment requirements shall be as required in the verification cross-reference table of Section 4.3.

4.2 METHODS

Inspections to verify compliance with requirements shall be conducted using the measurement techniques described below. Documentation of compliance with Section 3 shall be accomplished with a compliance and allocation matrix (Table 4-1) that provides correlation between specification requirements and the results of the inspection performed. The elements of the inspection are:

- A. Analysis.** Analysis involves the processing of accumulated results and conclusions, intended to provide proof that verification of a requirement has been accomplished. The analytical results may be comprised of a compilation or interpretation of existing information or derived from lower level examinations, tests, demonstrations, or analyses.

Example: Verifying compliance with the groundwater travel time requirement will require integration of the results of multiple studies involving models, test data, and other information.

- B. Examination.** Examination consists of investigation, without the use of special laboratory appliances, procedures, supplies, or services, to determine conformance to those specified requirements which can be determined by such investigations. Examination is generally nondestructive and includes, but is not limited to, visual, auditory, olfactory, tactile, and other investigations; simple physical manipulation; gauging; and measurement.

Example: Visual inspection of a road to verify drainage ditches and culverts are present.

- C. Test.** A test denotes the determination of the properties or elements of items (or components thereof) by technical means, including functional operation, the application of established principles and procedures and the collection of quantitative data. The analysis of data derived from testing is an integral part of the method.

Example: Measurements to verify radiologic shielding effects.

- D. Demonstration.** Demonstration differs from test by directness of approach in the verification of a requirement and is accomplished without the use of instrumentation or special equipment. Thus, operation of a representative item in or near its use environment would be defined as a demonstration rather than a test. Demonstration attempts to verify, qualitatively, the performance of a

function, whereas Test involves verifying performance within a specific range of measurement.

Example: Deliberate cut off of an electric power source to verify automatic operation of emergency lighting.

4.3

CROSS-REFERENCE

Table 4-1 correlates the requirements of Section 3.2 with the method to be used to verify compliance with the requirements. Documentation of conformance will be accomplished through the use of detailed procedures developed and performed on all procured, constructed, and developed equipment.

4.4

VERIFICATION

Documentation of compliance shall be accomplished through the use of detailed verification procedures developed in accordance with guidance provided in the equipment and developed equipment.

Table 4-1 Conformance Verification Matrix

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.2	EXPLORATORY STUDIES FACILITY (ESF) (BAB000000)	X				
3.2.1	DESCRIPTION	X				
3.2.1.1	ESF SYSTEM REQUIREMENTS	X				
3.2.1.1.1	PROGRAM REQUIREMENTS	X				
3.2.1.1.1.A				X		
3.2.1.1.1.B	PRECEDENCE OF COMPLIANCE DOCUMENTS	X				
3.2.1.1.1.B.1				X		
3.2.1.1.1.B.2				X		
3.2.1.1.1.B.3				X		
3.2.1.1.1.C	EXPLORATORY STUDIES FACILITY DECOMMISSIONING AND CLOSURE	X				
3.2.1.1.1.C.1				X		
3.2.1.1.1.C.2				X		
3.2.1.1.1.C.3				X		
3.2.1.1.1.C.4				X		
3.2.1.1.1.D				X		
3.2.1.1.2	SYSTEM QUALITY FACTORS	X				
3.2.1.1.2.1	RELIABILITY	X				
3.2.1.1.2.1.A			X			
3.2.1.1.2.1.B			X			
3.2.1.1.2.1.C			X			
3.2.1.1.2.1.C.1			X			
3.2.1.1.2.1.C.2			X			
3.2.1.1.2.1.C.3			X			
3.2.1.1.2.2	AVAILABILITY	X				
3.2.1.1.2.2.A			X		X	
3.2.1.1.2.2.B				X		
3.2.1.1.2.3	MAINTAINABILITY	X				
3.2.1.1.2.3.A			X			
3.2.1.1.2.3.B		X				
3.2.1.1.2.3.B.1			X	X	X	
3.2.1.1.2.3.B.2			X	X	X	
3.2.1.1.2.3.B.3			X	X	X	
3.2.1.1.2.3.B.4			X	X	X	
3.2.1.1.2.3.B.5			X	X	X	
3.2.1.1.2.3.B.6			X	X	X	
3.2.1.1.2.3.C				X		
3.2.1.1.2.3.D				X	X	

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.2.1.1.2.3.E				X	X	
3.2.1.1.2.3.F				X	X	
3.2.1.1.2.3.G				X		
3.2.1.1.2.3.H				X		
3.2.1.1.2.4	SYSTEM SAFETY	X				
3.2.1.1.2.4.A				X		
3.2.1.1.2.4.B		X				
3.2.1.1.2.4.B.1				X		
3.2.1.1.2.4.B.2				X		
3.2.1.1.2.4.B.3				X	X	
3.2.1.1.2.4.B.4		X				
3.2.1.1.2.4.C				X		
3.2.1.1.2.4.D				X	X	
3.2.1.1.2.4.E				X		
3.2.1.1.2.4.F				X	X	
3.2.1.1.2.4.G			X	X		
3.2.1.1.2.4.H				X		
3.2.1.1.2.4.I				X		
3.2.1.1.2.5	HUMAN FACTORS ENGINEERING	X				
3.2.1.1.2.5.A				X		
3.2.1.1.2.5.B				X	X	
3.2.1.1.2.5.C				X	X	
3.2.1.1.2.5.D				X	X	
3.2.1.1.2.5.E				X		
3.2.1.1.2.5.F				X		
3.2.1.1.2.6	HABITABILITY	X				
3.2.1.1.2.6.A					X	
3.2.1.1.2.7	PORTABILITY AND LOAD CARRYING	X				
3.2.1.1.2.7.A		X				
3.2.1.1.2.8	NAMEPLATES AND MARKINGS	X				
3.2.1.1.2.8.A				X		
3.2.1.1.3	SYSTEM SUPPORT	X				
3.2.1.1.3.1	MAINTENANCE	X				
3.2.1.1.3.1.A			X	X	X	
3.2.1.1.3.1.B			X		X	
3.2.1.1.3.1.C				X		
3.2.1.1.3.1.D				X		
3.2.1.1.3.2	LOGISTICS	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.2.1.1.3.2.A			X			
3.2.1.1.3.2.B				X		
3.2.1.1.3.2.C				X	X	
3.2.1.1.3.2.D				X	X	
3.2.1.1.3.3	DOCUMENTATION	X				
3.2.1.1.3.3.A				X		
3.2.1.1.3.3.B				X		
3.2.1.1.3.3.C				X		
3.2.1.1.3.4	TRAINING	X				
3.2.1.1.3.4.A				X		
3.2.1.1.4	TEST CONSTRAINTS	X				
3.2.1.1.4.A			X	X		
3.2.1.1.4.B			X			
3.2.1.1.4.C		X				
3.2.1.1.4.D			X	X		
3.2.1.1.4.E			X		X	
3.2.1.2	REQUIREMENTS APPLICABLE TO ALL ESF CIs	X				
3.2.1.2.1	ENVIRONMENTS	X				
3.2.1.2.1.1	SURFACE CONDITIONS	X				
3.2.1.2.1.1.A				X		
3.2.1.2.1.1.B				X		
3.2.1.2.1.1.C			X			
3.2.1.2.1.1.D			X			
3.2.1.2.1.1.E			X			
3.2.1.2.1.1.F			X			
3.2.1.2.1.1.G			X			
3.2.1.2.1.1.H			X			
3.2.1.2.1.1.I			X	X		
3.2.1.2.1.1.J				X		
3.2.1.2.1.2	SUBSURFACE CONDITIONS	X				
3.2.1.2.1.2.A			X			
3.2.1.2.1.2.B				X		
3.2.1.2.1.2.C			X			
3.2.1.2.1.2.D			X			
3.2.1.2.2	SERVICE LIFE	X				
3.2.1.2.2.A			X	X		
3.2.1.2.2.B			X	X		
3.2.1.2.3	ESF CONSTRAINTS	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.2.1.2.3.A				X		
3.2.1.2.3.B			X			
3.2.1.2.3.C				X		
3.2.1.2.3.D			X			
3.2.1.2.3.E				X		
3.2.1.2.3.F			X	X		
3.2.1.2.3.G			X			
3.2.1.2.3.H			X			
3.2.1.2.3.I			X			
3.2.1.2.4	COMPLIANCE	X				
3.2.1.2.4.A			X			
3.2.1.2.4.B			X			
3.2.1.2.4.C			X			
3.2.1.2.4.D			X			
3.3	ACCESS ROADS (BABA00000)	X				
3.3.1	DESCRIPTION	X				
3.3.1.A			X			
3.3.1.B				X		
3.3.1.C				X		
3.3.1.D				X		
3.3.1.E				X		
3.3.1.F				X		
3.3.1.G				X		
3.3.1.H				X		
3.3.1.I				X		
3.3.1.J			X	X		
3.3.1.K			X			
3.3.1.L			X			
3.3.1.M			X			
3.3.1.N			X			
3.3.1.O				X		
3.3.1.P				X		
3.3.1.Q				X		
3.3.1.R				X		
3.3.1.S				X		
3.3.1.T			X			
3.3.1.U				X		
3.3.1.V				X		
3.3.1.W				X		

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.3.1.X				X		
3.3.1.Y			X			
3.3.1.Z			X			
3.3.1.AA			X			
3.3.1.AB			X			
3.3.1.AC			X			
3.3.1.AD			X			
3.3.1.AE			X			
3.4	MAIN SITES (BABBB00000)	X				
3.4.1	DESCRIPTION	X				
3.4.1.1	MAIN SITES CI REQUIREMENTS	X				
3.4.1.1.A				X		
3.4.1.1.B				X	X	
3.4.1.1.C				X	X	
3.4.1.1.D				X		
3.4.1.1.E				X	X	
3.4.1.2	APPLICABLE REQUIREMENTS FOR EVERY CI WITHIN THE MAIN SITES CI	X				
3.4.2	SURFACE FACILITIES (BABBA0000)	X				
3.4.2.1	DESCRIPTION	X				
3.4.2.1.1	SURFACE FACILITIES CI REQUIREMENTS	X				
3.4.2.1.1.A				X		
3.4.2.1.1.B			X	X		
3.4.2.1.1.C				X		
3.4.2.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SURFACE FACILITIES CI	X				
3.4.2.1.2.A				X	X	
3.4.2.1.2.B				X	X	
3.4.2.1.2.C	RESERVED	X				
3.4.2.1.2.E				X		
3.4.2.1.2.F				X		
3.4.2.1.2.G			X	X		
3.4.2.1.2.H				X		
3.4.2.1.2.I			X	X		
3.4.2.1.2.J				X		
3.4.2.1.2.K	RESERVED	X				
3.4.2.1.2.L			X	X		

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.4.2.2	SWITCHGEAR BUILDING (BABBA000)	X				
3.4.2.2.1	DESCRIPTION	X				
3.4.2.2.1.A				X		
3.4.2.3	PARKING AREAS (BABBAB000)	X				
3.4.2.3.1	DESCRIPTION	X				
3.4.2.3.1.A				X		
3.4.2.3.1.B				X		
3.4.2.3.1.C	RESERVED	X				
3.4.2.3.1.D				X		
3.4.2.3.1.E				X		
3.4.2.3.1.F				X		
3.4.2.3.1.G				X		
3.4.2.4	COVERED STORAGE (BABBAC000)	X				
3.4.2.4.1	DESCRIPTION	X				
3.4.2.4.1.A				X		
3.4.2.4.1.B				X		
3.4.2.4.1.C				X		
3.4.2.4.1.D				X		
3.4.2.5	SHOP BUILDING (BABBAD000)	X				
3.4.2.5.1	DESCRIPTION	X				
3.4.2.5.1.A				X		
3.4.2.5.1.B				X		
3.4.2.5.1.C				X		
3.4.2.5.1.D				X		
3.4.2.5.1.E			X	X	X	
3.4.2.5.1.F				X	X	
3.4.2.5.1.G				X		
3.4.2.5.1.H				X	X	
3.4.2.5.1.I				X		
3.4.2.5.1.J				X		
3.4.2.5.1.K				X		
3.4.2.6	WAREHOUSE (BABBAE000)	X				
3.4.2.6.1	DESCRIPTION	X				
3.4.2.6.1.A				X		
3.4.2.6.1.B				X		
3.4.2.6.1.C				X		
3.4.2.6.1.D				X		
3.4.2.6.1.E				X		

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.4.2.6.1.F				X		
3.4.2.6.1.G			X	X		
3.4.2.6.1.H				X		
3.4.2.6.1.I				X	X	
3.4.2.6.1.J				X		
3.4.2.6.1.K				X		
3.4.2.6.1.L				X		
3.4.2.6.1.M				X		
3.4.2.7	CHANGE HOUSE (BABBAF000)	X				
3.4.2.7.1	DESCRIPTION	X				
3.4.2.7.1.A				X		
3.4.2.7.1.B				X		
3.4.2.7.1.C				X		
3.4.2.7.1.D				X		
3.4.2.7.1.E	RESERVED	X				
3.4.2.7.1.F				X		
3.4.2.7.1.G				X		
3.4.2.7.1.H				X	X	
3.4.2.7.1.I				X		
3.4.2.7.1.J				X	X	
3.4.2.7.1.K				X	X	
3.4.2.7.1.L				X	X	
3.4.2.7.1.M				X	X	
3.4.2.7.1.N				X	X	
3.4.2.7.1.O				X	X	
3.4.2.7.1.P				X		
3.4.2.7.1.Q				X	X	
3.4.2.7.1.R				X		
3.4.2.8	OPERATIONS BUILDING (BABBA000)	X				
3.4.2.8.1	DESCRIPTION	X				
3.4.2.8.1.A				X		
3.4.2.8.1.B				X		
3.4.2.8.1.C			X	X		
3.4.2.9	GUARD HOUSE (BABBAH000)	X				
3.4.2.9.1	DESCRIPTION	X				
3.4.2.9.1.A				X		
3.4.2.10	ESF VISITOR CENTER (BABBAI000)	X				
3.4.2.10.1	DESCRIPTION	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.4.2.10.1.A				X		
3.4.2.10.1.B				X		
3.4.3	SITE DRAINAGE (BABBB0000)	X				
3.4.3.1	DESCRIPTION	X				
3.4.3.1.A				X		
3.4.3.1.B			X	X		
3.4.3.1.C			X	X		
3.4.3.1.D				X		
3.4.3.1.E			X			
3.4.3.1.F				X		
3.4.3.1.G			X			
3.4.3.1.H				X		
3.4.4	SITE PREPARATION (BABBC0000)	X				
3.4.4.1	DESCRIPTION	X				
3.4.4.1.A			X	X		
3.4.4.1.B	RESERVED	X				
3.4.4.1.C				X		
3.4.4.1.D			X	X		
3.4.4.1.E				X		
3.4.4.1.F	RESERVED	X				
3.4.4.1.G				X		
3.4.4.1.H			X			
3.4.4.1.I				X		
3.4.4.1.J			X			
3.4.4.1.K				X		
3.4.4.1.L				X		
3.4.4.1.M				X		
3.4.5	SURFACE UTILITIES (BABBD0000)	X				
3.4.5.1	DESCRIPTION	X				
3.4.5.1.1	SURFACE UTILITIES CI REQUIREMENTS	X				
3.4.5.1.1.A				X	X	
3.4.5.1.1.B				X		
3.4.5.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SURFACE UTILITIES CI	X				
3.4.5.1.2.A				X	X	
3.4.5.1.2.B				X		
3.4.5.1.2.C				X		
3.4.5.1.2.D			X	X		

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.4.5.1.2.E			X	X		
3.4.5.2	SURFACE POWER (BABBD A000)	X				
3.4.5.2.1	DESCRIPTION	X				
3.4.5.2.1.A				X		
3.4.5.2.1.B				X		
3.4.5.2.1.C				X		
3.4.5.2.1.D				X		
3.4.5.2.1.E	RESERVED	X				
3.4.5.2.1.F			X		X	
3.4.5.2.1.G				X		
3.4.5.2.1.H			X	X	X	
3.4.5.2.1.I			X			
3.4.5.2.1.J			X	X		
3.4.5.2.1.K	RESERVED	X				
3.4.5.2.1.L			X	X		
3.4.5.2.1.M			X	X	X	
3.4.5.2.1.N			X	X	X	
3.4.5.2.1.O				X	X	
3.4.5.2.1.P				X	X	
3.4.5.2.1.Q				X	X	
3.4.5.2.1.R				X		
3.4.5.2.1.S				X		
3.4.5.2.1.T				X		
3.4.5.2.1.U			X		X	
3.4.5.2.1.V				X	X	
3.4.5.2.1.W				X	X	
3.4.5.2.1.X				X		
3.4.5.2.1.Y			X			
3.4.5.2.1.Z				X		
3.4.5.2.1.AA				X		
3.4.5.2.1.AB				X		
3.4.5.2.1.AC			X	X		
3.4.5.3	SURFACE WATER (BABBD B000)	X				
3.4.5.3.1	DESCRIPTION	X				
3.4.5.3.1.A				X		
3.4.5.3.1.B				X		
3.4.5.3.1.C				X		
3.4.5.3.1.D	RESERVED	X				
3.4.5.3.1.E			X		X	

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.4.5.3.1.F				X		
3.4.5.3.1.G			X	X		
3.4.5.3.1.H			X			
3.4.5.3.1.I			X			
3.4.5.3.1.J			X			
3.4.5.3.1.K			X		X	
3.4.5.3.1.L				X		
3.4.5.3.1.M				X		
3.4.5.3.1.N			X		X	
3.4.5.3.1.O				X		
3.4.5.3.1.P			X	X		
3.4.5.3.1.Q			X			
3.4.5.3.1.R				X		
3.4.5.3.1.S				X		
3.4.5.3.1.T			X			
3.4.5.3.1.U			X	X		
3.4.5.3.1.V			X			
3.4.5.4	SURFACE SANITATION (BABBD000)	X				
3.4.5.4.1	DESCRIPTION	X				
3.4.5.4.1.A			X	X		
3.4.5.4.1.B			X			
3.4.5.4.1.C				X		
3.4.5.4.1.D			X	X		
3.4.5.4.1.E	RESERVED	X				
3.4.5.4.1.F				X		
3.4.5.4.1.G			X			
3.4.5.4.1.H			X			
3.4.5.4.1.I				X		
3.4.5.4.1.J				X		
3.4.5.4.1.K			X	X		
3.4.5.4.1.L				X		
3.4.5.5	SURFACE COMMUNICATION (BABBD000)	X				
3.4.5.5.1	DESCRIPTION	X				
3.4.5.5.1.A				X		
3.4.5.5.1.B				X	X	
3.4.5.5.1.C				X	X	
3.4.5.5.1.D				X		

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.4.5.5.1.E				X	X	
3.4.5.5.1.F				X	X	
3.4.5.5.1.G	RESERVED	X				
3.4.5.5.1.H				X	X	
3.4.5.5.1.I				X	X	
3.4.5.5.1.J				X	X	
3.4.5.5.1.K				X	X	
3.4.5.5.1.L				X		
3.4.5.5.1.M	RESERVED	X				
3.4.5.5.1.N			X	X		
3.4.5.6	SURFACE WASTE WATER (BABBE000)	X				
3.4.5.6.1	DESCRIPTION	X				
3.4.5.6.1.A			X	X		
3.4.5.6.1.B				X	X	
3.4.5.6.1.C				X		
3.4.5.6.1.D				X		
3.4.5.6.1.E			X			
3.4.5.6.1.F				X		
3.4.5.6.1.G				X		
3.4.5.6.1.H			X	X		
3.4.5.6.1.I			X			
3.4.5.7	SURFACE COMPRESSED AIR (BABBD000)	X				
3.4.5.7.1	DESCRIPTION	X				
3.4.5.7.1.A				X		
3.4.5.7.1.B			X	X	X	
3.4.5.7.1.C			X	X		
3.4.5.7.1.D				X	X	
3.4.5.7.1.E			X			
3.4.5.7.1.F			X	X		
3.4.6	CONTROL SYSTEMS (BABBE000)	X				
3.4.6.1	DESCRIPTION	X				
3.4.6.1.1	CONTROL SYSTEMS CI REQUIREMENTS	X				
3.4.6.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE CONTROL SYSTEMS CI	X				
3.4.6.2	LOAD MANAGEMENT SYSTEM (BABBEA000)	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.4.6.2.1	DESCRIPTION	X				
3.4.6.2.1.A			X		X	
3.4.6.3	FACILITY MONITORING & CONTROL SYSTEM (BABBE000)	X				
3.4.6.3.1	DESCRIPTION	X				
3.4.6.3.1.A				X	X	
3.4.6.3.1.B			X	X	X	
3.4.6.3.1.C				X	X	
3.4.6.3.1.D				X	X	
3.4.6.3.1.E				X	X	
3.4.6.3.1.F			X	X		
3.4.6.3.1.G				X	X	
3.4.6.3.1.H			X	X		
3.5	AUXILIARY SITES (BABCO000)	X				
3.5.1	DESCRIPTION	X				
3.5.1.1	AUXILIARY SITES CI REQUIREMENTS	X				
3.5.1.1.A			X	X		
3.5.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE AUXILIARY SITES CI	X				
3.5.1.2.A			X			
3.5.1.2.B			X			
3.5.2	AUXILIARY SITE PREPARATION (BABCA000)	X				
3.5.2.1	DESCRIPTION	X				
3.5.2.1.A				X		
3.5.2.1.B				X		
3.5.2.1.C			X	X		
3.5.2.1.D			X			
3.5.2.1.E				X		
3.5.2.1.F			X			
3.5.2.1.G				X		
3.5.2.1.H				X		
3.5.3	AUXILIARY SITE DRAINAGE (BABCB000)	X				
3.5.3.1	DESCRIPTION	X				
3.5.3.1.A				X		
3.5.3.1.B			X	X		
3.5.3.1.C			X			

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.5.3.1.D				X		
3.5.3.1.E			X			
3.5.3.1.F				X		
3.5.4	MUCK STORAGE (BABCC0000)	X				
3.5.4.1	DESCRIPTION	X				
3.5.4.1.A			X		X	
3.5.4.1.B				X		
3.5.4.1.C				X		
3.5.4.1.D				X		
3.5.4.1.E			X			
3.5.5	SUBSTATION WITH STANDBY GENERATOR (BABCD0000)	X				
3.5.6	TOPSOIL STORAGE (BABCE0000)	X				
3.5.6.1	DESCRIPTION	X				
3.5.6.1.A			X	X		
3.5.6.1.B				X		
3.5.6.1.C			X			
3.5.6.1.D			X			
3.5.7	WATER BOOST PUMP STATION (BABCFO000)	X				
3.5.7.1	DESCRIPTION	X				
3.5.7.1.A			X			
3.5.7.1.B				X		
3.5.7.1.C			X			
3.5.7.1.D				X		
3.5.7.1.E			X			
3.5.7.1.F				X	X	
3.5.7.1.G				X	X	
3.5.8	EXPLOSIVE STORAGE (BABCG0000)	X				
3.5.9	WATER STORAGE TANK (BABCH0000)	X				
3.5.9.1	DESCRIPTION	X				
3.5.9.1.A			X			
3.5.9.1.B				X		
3.5.9.1.C			X			
3.5.9.1.D			X		X	
3.5.9.1.E				X		
3.5.9.1.F				X		
3.5.9.1.G				X	X	
3.5.9.1.H			X	X		

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.5.9.1.I				X		
3.5.9.1.J			X			
3.5.10	ROCK STORAGE (BABCI0000)	X				
3.5.10.1	DESCRIPTION	X				
3.5.10.1.A			X	X		
3.5.10.1.B			X			
3.5.10.1.C				X		
3.5.10.1.D			X			
3.6	TEST SUPPORT (BABD00000)	X				
3.6.1	DESCRIPTION	X				
3.6.1.1	TEST SUPPORT CI REQUIREMENTS	X				
3.6.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE TEST SUPPORT CI	X				
3.6.2	INTEGRATED DATA AND CONTROL SYSTEM (IDCS) (BABDA0000)	X				
3.6.2.1	DESCRIPTION	X				
3.6.2.1.A		X				
3.6.2.1.A.1				X		
3.6.2.1.A.2				X		
3.6.2.1.A.3			X			
3.6.2.1.B			X		X	
3.6.2.1.C			X			
3.6.2.1.D			X			
3.6.2.1.E			X			
3.6.2.1.F				X		
3.6.2.1.G			X		X	
3.6.2.1.H			X			
3.6.2.1.H.1			X			
3.6.2.1.I			X		X	
3.6.2.1.J			X			
3.6.2.1.J.1			X			
3.6.2.1.J.2			X			
3.6.2.1.J.3			X			
3.6.2.1.J.4			X			
3.6.2.1.K			X		X	
3.6.2.1.K.1			X			
3.6.2.1.K.2			X		X	
3.6.2.1.L			X	X	X	
3.6.2.1.M			X			

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.6.2.1.N			X		X	
3.6.2.1.O			X		X	
3.6.2.1.P			X			
3.6.2.1.Q			X			
3.6.3	SURFACE TEST EQUIPMENT (BABDB0000)	X				
3.6.3.1	DESCRIPTION	X				
3.6.4	SUBSURFACE TEST EQUIPMENT (BABDC0000)	X				
3.6.4.1	DESCRIPTION	X				
3.6.4.1.1	SUBSURFACE TEST EQUIPMENT CI REQUIREMENTS	X				
3.6.4.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SUBSURFACE TEST EQUIPMENT CI	X				
3.6.4.2	MAPPING GANTRY (BABDCA000)	X				
3.6.4.2.1	DESCRIPTION	X				
3.6.4.2.1.A				X		
3.6.4.2.1.B				X		
3.6.4.2.1.C			X			
3.6.4.2.1.D			X			
3.6.4.2.1.E			X	X		
3.6.4.2.1.F			X			
3.6.4.2.1.G			X	X		
3.7	SUBSURFACE EXCAVATIONS (BABE00000)	X				
3.7.1	DESCRIPTION	X				
3.7.1.1	SUBSURFACE EXCAVATIONS CI REQUIREMENTS	X				
3.7.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SUBSURFACE EXCAVATIONS CI	X				
3.7.1.2.A			X	X		
3.7.1.2.B		X				
3.7.1.2.C				X		
3.7.1.2.D				X		
3.7.2	UNDERGROUND OPENINGS (BABEA0000)	X				
3.7.2.1	DESCRIPTION	X				
3.7.2.1.1	UNDERGROUND OPENINGS CI REQUIREMENTS	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.7.2.1.1.A				X		
3.7.2.1.1.B				X		
3.7.2.1.1.C	OPERATIONAL SEALS	X				
3.7.2.1.1.C.1			X			
3.7.2.1.1.C.2				X		
3.7.2.1.1.D				X		
3.7.2.1.1.E				X		
3.7.2.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE UNDERGROUND OPENINGS CI	X				
3.7.2.1.2.B				X		
3.7.2.1.2.C			X			
3.7.2.1.2.D			X	X		
3.7.2.1.2.E			X			
3.7.2.1.2.F			X	X		
3.7.2.1.2.G	RESERVED	X				
3.7.2.1.2.H				X		
3.7.2.1.2.I				X		
3.7.2.2	PORTALS (BABEAA000)	X				
3.7.2.2.1	DESCRIPTION	X				
3.7.2.2.1.A			X	X		
3.7.2.2.1.B			X	X		
3.7.2.3	MAIN ACCESS OPENINGS (BABEAD000)	X				
3.7.2.3.1	DESCRIPTION	X				
3.7.2.3.1.A				X		
3.7.2.3.1.B				X	X	
3.7.2.3.1.C				X	X	
3.7.2.3.1.D			X			
3.7.2.3.1.E			X			
3.7.2.4	OPERATIONS SUPPORT AREAS (BABEAE000)	X				
3.7.2.4.1	DESCRIPTION	X				
3.7.2.4.1.A				X		
3.7.2.4.1.B	RESERVED	X				
3.7.2.4.1.C	RESERVED	X				
3.7.2.4.1.D				X		
3.7.2.4.1.E	RESERVED	X				
3.7.2.4.1.F			X	X		
3.7.2.4.1.G	RESERVED	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.7.2.4.1.H				X		
3.7.2.5	TEST SUPPORT AREAS (BABEAF000)	X				
3.7.2.5.1	DESCRIPTION	X				
3.7.2.5.1.A	RESERVED	X				
3.7.2.5.1.B	RESERVED	X				
3.7.2.5.1.C			X			
3.7.2.6	SHAFTS [OPTIONAL] (BABEAG000)	X				
3.7.2.6.1	DESCRIPTION	X				
3.7.2.6.1.A			X	X		
3.7.2.6.1.B				X		
3.7.2.6.1.C			X			
3.7.2.6.1.D			X	X		
3.7.2.6.1.E			X			
3.7.3	GROUND SUPPORT SYSTEMS (BABEE0000)	X				
3.7.3.1	DESCRIPTION	X				
3.7.3.1.A				X		
3.7.3.1.B			X	X		
3.7.3.1.C	RESERVED	X				
3.7.3.1.D			X			
3.7.3.1.E			X			
3.7.3.1.F			X			
3.7.3.1.G			X	X		
3.7.3.1.H	RESERVED	X				
3.7.3.1.I			X			
3.7.3.1.J			X			
3.7.3.1.K			X	X		
3.7.3.1.L			X			
3.8	SUBSURFACE SUPPORT SYSTEMS (BABF00000)	X				
3.8.1	DESCRIPTION	X				
3.8.1.1	SUBSURFACE SUPPORT SYSTEMS CI REQUIREMENTS	X				
3.8.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SUBSURFACE SUPPORT SYSTEMS CI	X				
3.8.1.2.A	RESERVED	X				
3.8.1.2.B	RESERVED	X				
3.8.1.2.C				X		

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.8.2	SUBSURFACE UTILITIES (BABFA0000)	X				
3.8.2.1	DESCRIPTION	X				
3.8.2.1.1	SUBSURFACE UTILITIES CI REQUIREMENTS	X				
3.8.2.1.1.A			X	X		
3.8.2.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE SUBSURFACE UTILITIES CI	X				
3.8.2.1.2.A				X	X	
3.8.2.1.2.B				X		
3.8.2.1.2.C				X		
3.8.2.1.2.D				X		
3.8.2.1.2.E			X	X		
3.8.2.1.2.F			X	X		
3.8.2.1.2.G			X			
3.8.2.2	SUBSURFACE POWER (BABFAA000)	X				
3.8.2.2.1	DESCRIPTION	X				
3.8.2.2.1.A				X	X	
3.8.2.2.1.B				X		
3.8.2.2.1.C			X		X	
3.8.2.2.1.D			X	X		
3.8.2.2.1.E				X	X	
3.8.2.2.1.F				X	X	
3.8.2.2.1.G				X	X	
3.8.2.2.1.H				X		
3.8.2.2.1.I			X			
3.8.2.2.1.J				X	X	
3.8.2.2.1.K			X			
3.8.2.2.1.L				X	X	
3.8.2.2.1.M				X	X	
3.8.2.2.1.N				X		
3.8.2.2.1.O				X		
3.8.2.2.1.P			X	X		
3.8.2.2.1.Q			X			
3.8.2.3	SUBSURFACE COMMUNICATIONS (BABFAB000)	X				
3.8.2.3.1	DESCRIPTION	X				
3.8.2.3.1.A			X			
3.8.2.3.1.B	RESERVED	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.8.2.3.1.C				X	X	
3.8.2.3.1.D			X	X		
3.8.2.3.1.E	RESERVED	X				
3.8.2.3.1.F				X	X	
3.8.2.3.1.G				X	X	
3.8.2.3.1.H	RESERVED	X				
3.8.2.3.1.I	RESERVED	X				
3.8.2.3.1.J				X	X	
3.8.2.3.1.K	RESERVED	X				
3.8.2.3.1.L	RESERVED	X				
3.8.2.3.1.M			X			
3.8.2.3.2	SHAFT COMMUNICATION SYSTEM REQUIREMENTS	X				
3.8.2.3.2.A			X	X		
3.8.2.3.2.B			X	X		
3.8.2.3.2.C				X	X	
3.8.2.4	SUBSURFACE LIGHTING (BABFAC000)	X				
3.8.2.4.1	DESCRIPTION	X				
3.8.2.4.1.A				X		
3.8.2.4.1.B				X		
3.8.2.4.1.C				X	X	
3.8.2.4.1.D				X	X	
3.8.2.4.1.E				X		
3.8.2.4.1.F	RESERVED	X				
3.8.2.4.1.G			X			
3.8.2.5	SUBSURFACE VENTILATION (BABFAD000)	X				
3.8.2.5.1	DESCRIPTION	X				
3.8.2.5.1.A	RESERVED	X				
3.8.2.5.1.B	RESERVED	X				
3.8.2.5.1.C			X	X		
3.8.2.5.1.D	RESERVED	X				
3.8.2.5.1.E	RESERVED	X				
3.8.2.5.1.F				X	X	
3.8.2.5.1.G	RESERVED	X				
3.8.2.5.1.H	RESERVED	X				
3.8.2.5.1.I	RESERVED	X				
3.8.2.5.1.J			X			
3.8.2.5.1.K	RESERVED	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.8.2.5.1.L			X	X		
3.8.2.5.1.M	RESERVED	X				
3.8.2.5.1.N	RESERVED	X				
3.8.2.5.1.O			X	X		
3.8.2.5.1.P	RESERVED	X				
3.8.2.5.1.Q			X			
3.8.2.6	SUBSURFACE WATER (BABFAE000)	X				
3.8.2.6.1	DESCRIPTION	X				
3.8.2.6.1.A			X	X		
3.8.2.6.1.B				X		
3.8.2.6.1.C				X		
3.8.2.6.1.D				X		
3.8.2.6.1.E				X		
3.8.2.6.1.F			X	X		
3.8.2.6.1.G			X			
3.8.2.6.1.H			X			
3.8.2.7	SUBSURFACE WASTE WATER (BABFAF000)	X				
3.8.2.7.1	DESCRIPTION	X				
3.8.2.7.1.A				X		
3.8.2.7.1.B				X		
3.8.2.7.1.C				X		
3.8.2.7.1.D				X		
3.8.2.7.1.E				X		
3.8.2.7.1.F			X			
3.8.2.7.1.G			X	X		
3.8.2.7.1.H				X		
3.8.2.7.1.I			X	X		
3.8.2.7.1.J				X		
3.8.2.7.1.K			X	X		
3.8.2.7.1.L				X		
3.8.2.7.1.M				X		
3.8.2.7.1.N			X			
3.8.2.7.2	SHAFT WASTE WATER SYSTEM REQUIREMENTS	X				
3.8.2.7.2.A				X		
3.8.2.7.2.B		X				
3.8.2.7.2.C				X		
3.8.2.8	SUBSURFACE COMPRESSED AIR (BABFAG000)	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.8.2.8.1	DESCRIPTION	X				
3.8.2.8.1.A			X	X		
3.8.2.8.1.B			X	X		
3.8.2.8.1.C			X			
3.8.2.8.1.D				X		
3.8.2.8.1.E			X			
3.8.2.9	SUBSURFACE FIRE PROTECTION (BABFAH000)	X				
3.8.2.9.1	DESCRIPTION	X				
3.8.2.9.1.A			X			
3.8.2.9.1.B				X	X	
3.8.2.9.1.C	RESERVED	X				
3.8.2.9.1.D				X		
3.8.2.9.1.E			X			
3.8.2.9.1.F			X			
3.8.2.10	SUBSURFACE SANITARY FACILITIES (BABFAI000)	X				
3.8.2.10.1	DESCRIPTION	X				
3.8.2.10.1.A			X			
3.8.2.10.1.B				X		
3.8.2.10.1.C				X		
3.8.2.11	SUBSURFACE MONITORING & WARNING SYSTEM (BABFAJ000)	X				
3.8.2.11.1	DESCRIPTION	X				
3.8.2.11.1.A				X	X	
3.8.2.11.1.B				X	X	
3.8.2.11.1.C			X	X		
3.8.2.11.1.D				X		
3.8.2.11.1.E			X	X	X	
3.8.2.11.1.F			X			
3.8.2.12	SUBSURFACE FURNISHINGS (BABFAK000)	X				
3.8.2.12.1	DESCRIPTION	X				
3.8.2.12.1.A				X		
3.8.2.12.1.B				X		
3.8.2.12.1.C			X	X		
3.8.2.12.1.D			X			
3.8.2.12.1.E				X		
3.8.3	MACHINERY & EQUIPMENT (BABFB0000)	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.8.3.1	DESCRIPTION	X				
3.8.3.1.1	MACHINERY & EQUIPMENT CI REQUIREMENTS	X				
3.8.4	MUCK, MATERIAL, & PERSONNEL HANDLING (BABFC0000)	X				
3.8.4.1	DESCRIPTION	X				
3.8.4.1.1	MUCK, MATERIAL & PERSONNEL HANDLING CI REQUIREMENTS	X				
3.8.4.1.2	APPLICABLE REQUIREMENTS FOR EACH CI WITHIN THE MUCK, MATERIAL & PERSONNEL HANDLING CI	X				
3.8.4.1.2.A				X		
3.8.4.1.2.B				X		
3.8.4.1.2.C			X	X		
3.8.4.2	SURFACE CONVEYOR (BABFCA000)	X				
3.8.4.2.1	DESCRIPTION	X				
3.8.4.2.1.A			X	X		
3.8.4.2.1.B				X		
3.8.4.2.1.C			X			
3.8.4.2.1.D			X			
3.8.4.2.1.E			X	X		
3.8.4.2.1.F			X			
3.8.4.2.1.G				X		
3.8.4.2.1.H			X	X		
3.8.4.2.1.I			X	X		
3.8.4.2.1.J			X	X		
3.8.4.2.1.K				X		
3.8.4.2.1.L				X		
3.8.4.3	SUBSURFACE CONVEYOR (BABFCB000)	X				
3.8.4.3.1	DESCRIPTION	X				
3.8.4.3.1.A			X			
3.8.4.3.1.B	RESERVED	X				
3.8.4.3.1.C				X		
3.8.4.3.1.D			X			
3.8.4.3.1.E				X		
3.8.4.3.1.F			X	X		
3.8.4.3.1.G			X	X		
3.8.4.4	MATERIAL & PERSONNEL HANDLING (BABFCC000)	X				

Table 4-1 Conformance Verification Matrix (continued)

REQUIREMENT		VERIFICATION METHOD CODE				
PARAGRAPH	TITLE	N/A	ANALYSIS	EXAM	DEMO	TEST
3.8.4.4.1	DESCRIPTION	X				
3.8.4.4.1.A	RESERVED	X				
3.8.4.4.1.B				X	X	
3.8.4.4.1.C			X	X		
3.8.4.4.1.D				X		

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5. PREPARATION FOR OPERATIONS

Not Applicable

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6. NOTES

6.1 GLOSSARY

Accessible environment - the atmosphere, land surface, surface water, oceans, and the portion of the lithosphere that is outside the controlled area.

Access roads - features needed to provide vehicular access, as required, to all surface areas designated to support the ESF.

Administrative delay time - that portion of downtime during which maintenance is delayed for administrative reasons.

Applicable documents - all Federal Laws and Documents, U.S. Department of Energy, U.S. Department of Interior, State Laws and Documents, and Non-Government Documents that establish the boundaries for ESF operations.

Architecture - that part of the physical system actually built, found, or selected to perform a function subject to its stated requirements.

Change process - procedures required to make changes to this document.

Civilian Radioactive Waste Management System (CRWMS) - the composite of the sites, and all facilities, systems, equipment, materials, information, activities, and the personnel required to perform those activities necessary to manage Spent Nuclear Fuel and High-level Radioactive Waste disposal.

Commission - the Nuclear Regulatory Commission or its duly authorized representatives.

Communications/data building - facilities, systems, and services for the communications, data collection, and transmissions that are required to support construction and testing.

Communications system - systems, subsystems, and components that provide equipment and services for linking the surface areas, the underground areas and the facilities with each other, and with all outside commercial communications systems.

Compressed air distribution system - systems, subsystems, and components that distribute compressed air throughout the underground ESF facility. The compressed air distribution system distributes compressed air from the compressed air system.

Compressed air system - systems, subsystems, and components that provide the production and distribution of compressed air throughout the ESF. The compressed air system supplies compressed air to the compressed air distribution system.

Controlled area - surface location, to be marked by suitable monuments, extending horizontally no more than 10 kilometers in any direction from the outer boundary of the underground facility and the underlying subsurface, which area has been

committed to use as a geologic repository and from which incompatible activities would be restricted following permanent closure.

Creep and shrinkage - a specified minimum dimensional change allowed for concrete and masonry structures changes.

Decommissioning and closure - activities enacted to place the ESF facilities (systems and subsystems) into a permanently nonoperable and safe condition.

Disposal - the isolation of radioactive wastes from the accessible environment. Disposal means the emplacement in a repository of high-level waste, spent nuclear fuel, or other highly radioactive material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste.

Exploratory Studies Facility Site(s) - surface systems, subsystems and components located on Government-owned land necessary for the development of the surface and underground facilities and supporting systems required to support site characterization testing at depth. Site systems, subsystems, and components are composed of general civil improvements and comprise the main site(s), auxiliary site(s), access roads, and site drainage.

Fire protection system - systems, subsystems, and components that provide detection, warning, and suppression, as required, to extinguish fire(s) within the underground facilities.

Function - a primary statement of purpose; definition of what a system or subsystem must accomplish to meet the system mission.

Functional analysis - the first step in the Systems Engineering process that defines a baseline of functions and function performance requirements which must be met in order to adequately accomplish the operation, support, test, and production requirements of a system.

Furnishings - structural steel sets consisting of buntions attached to fabricated brackets, which are fixed to the shaft wall or to other structural members. Also included are the shaft guides, fixed guide brackets and backers, conveyance chairs, crash beams, various enclosures or blockouts required to support instrumentation and cabling, and utility brackets to facilitate installation of shaft utilities such as electrical power, communications, compressed air, water, and waste water removal.

Geologic repository - a system which is intended to be used for, or may be used for, the disposal of radioactive wastes in excavated geologic media. A geologic repository includes: 1) the geologic repository operations area; and 2) the portion of the geologic setting that provides isolation of the radioactive waste.

Geologic Repository Operations Area - a high-level radioactive waste facility that is part of a geologic repository, including both surface and subsurface areas, where waste handling activities are conducted.

High-level radioactive Waste - 1) irradiated reactor fuel, 2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and

the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and 3) solids into which such liquid wastes have been converted.

Hoist house - accommodates the hoist(s), the necessary equipment and instrumentation for the hoist, air compressor system, control room, electrical and motor control centers, and an area for repairs and lay down.

Hoist system - systems and components for the transportation of personnel and equipment between the surface and subsurface to meet the needs of shaft construction and underground site characterization testing. The hoist system includes the rope winding equipment (hoist), conveyance, headframe, rope, dumping system, and hoist house.

Important to safety - with reference to structures, systems, and components means those engineered structures, systems, and components essential to the prevention or mitigation of an accident that could result in a radiation dose to the whole body, or any organ, of 0.5 rem or greater at or beyond the nearest boundary of the unrestricted area at any time until the completion of permanent closure.

Input - anything that is acted upon by a function to produce desired outputs. Inputs can be classified as either internal or external. Inputs that originate from outside a particular system are considered to be external. Inputs that are outputs from functions within a particular system are considered to be internal.

Integrated Data and Control System - hardware components and associated computer software necessary to acquire, store and disseminate data collected in connection with testing operations and construction and operations monitoring in the ESF.

Lighting system - systems, subsystems, and components that provide for the illumination of the ESF underground areas (shafts, ramps, stations, refuge chamber(s), alcoves, test areas, and shop areas).

Lining - components (e.g., concrete) which are provided to maintain the integrity of the intended opening.

Main site(s) - located on the surface, accommodates structures, systems, and components for construction of ramps and/or shaft(s), but does not include initial construction and test support facilities.

Maintainable - A maintainable item is designed to be repairable/replaceable without large investments of time or expense. The availability of a component is a direct function of its maintainability and failure frequency.

Mean Time To Repair - the mean or average elapsed time to perform scheduled and unscheduled maintenance. (Excludes logistics delay time and administrative delay time.)

Monitoring and warning systems - systems required to monitor underground environmental conditions (e.g., water, noise, dust, toxic and flammable gases,

smoke, radon/radon daughters) and to alert on-site personnel of possible dangerous situations so as to ensure a safe and healthful working environment.

Muck and material handling systems - systems, subsystems, structures, equipment, and components that transport excavated rock (muck), materials (including supplies and fuel), and equipment between the ground surface and the underground to meet the needs of construction and underground site characterization testing. This includes any transferring at a shaft or ramp station. The material handling system includes material handling equipment, loading and unloading stations, transfer point structures, and buildings to accommodate all the necessary equipment and instrumentation, hydraulic power units, air compressor system, control room, electrical and motor control centers, and an area for repairs and lay down. The muck handling system includes the muck pockets, skip loaders, bottom cleanout systems, and the appropriate conveyances.

Off-normal - a condition caused by accident, equipment or software failure, natural phenomena, or other unanticipated event.

Operations support areas - are the following underground openings: drift(s); refuge room(s); operations administration area; underground shop(s); lunch room(s); storage facility(ies); maintenance shop(s); areas for power distribution, fuel storage, and equipment storage; and other underground openings, but excluding those included in Test Areas.

Other temporary structures - systems and services that will be utilized for the offices, change rooms, first aid and mine rescue apparatus center, security offices, and space required to support ESF construction, scientific operations, and maintenance personnel for the site characterization program, including site preparation.

Output - anything that leaves the system or function after it has been acted upon by that function.

Overall utilization - the product of scheduled utilization, availability, and worker productivity.

Parking areas - spaces and allowances for vehicle parking required to support construction, operation, and testing in the ESF.

pH - a number expressing both acidity and alkalinity on a scale whose values run from 0 to 14. A value of 7 indicates neutrality, values less than 7 indicate acidity, and numbers greater than 7 indicate alkalinity.

Physical barriers - fences, building walls, ceilings, floors and any other physical obstruction constructed in a manner and of materials suitable for the purpose for which the obstruction is intended.

Preclosure period - the period where ESF personnel have access to the underground portion of the facility.

Portal - the rock face and retaining structure at the surface entrance of the ramp. The structure provides ground and utility support and overhead protection for ingress and egress into the ramp during construction and operations.

Postclosure period - the time following the sealing of the facility thus not allowing access by facility personnel to the underground portion of the facility.

Power distribution system - systems, subsystems, and components that distribute electrical power to underground systems.

Power system - systems, subsystems, components, and structures that supply electrical power to the ESF site.

Protected area - any area encompassed by physical barriers and to which access is controlled.

Ramp access - systems, subsystems, and components which are comprised of an engineered opening that connects the ground surface with the underground. The system provides safe and controlled access to the targeted horizons for personnel, equipment, underground service systems, and materials required for development of the underground drifts and excavations, as well as underground testing operations. A ramp access will serve as the primary muck removal opening for test area development and will include the site characterization testing activities.

Repository - any system licensed by the Commission that is intended to be used for, or may be used for, the permanent deep geologic disposal of high-level radioactive waste and spent nuclear fuel, whether or not such system is designed to permit the recovery, for a limited period during initial operation, of any materials placed in such system. Such term includes both surface and subsurface areas at which high-level radioactive waste and spent nuclear fuel handling activities are conducted.

Requirements allocation - the further decomposition of system level requirements until a level is reached at which a specific hardware item or software routine can fulfill the needed functional/performance requirements.

Sanitary facilities - the system that provides for human waste collection within the underground facilities.

Sanitary system - systems, subsystems, and components that provide for the surface collection and disposal of underground and surface sanitary sewage for the support of ESF operations.

Scheduled utilization - the ratio of scheduled operating hours per year to total hours per year.

Security - as used in this document, pertains to the installation of equipment and deployment of personnel that invokes physical protection, barriers, and underground access controls for the ESF.

Shaft access - systems, subsystems, and components which are comprised of the vertical engineered opening that connects the surface with the targeted horizons and shaft stations. The system provides safe and controlled access to the targeted horizons for personnel, equipment, and underground service systems, as well as underground in-shaft testing operations.

Shaft collar - the foundation at the uppermost portion of the shaft used to support the headframe and shaft construction activities.

Shop - facilities, systems, and services for the routine maintenance and repair of the construction and testing equipment designated for the ESF, and of the ground maintenance equipment.

Site drainage system - items and measures utilized to control drainage and runoff water to preclude damage by erosion or flooding.

Solid waste disposal system - systems and subsystems required for collection, transport and disposal of nonhazardous solid waste during the ESF construction, operation, testing and closure activities.

Spent nuclear fuel - fuel which has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not separated by reprocessing, and includes: intact, nondefective fuel assemblies; failed fuel assemblies in canisters; fuel assemblies in canisters; consolidated fuel rods in canisters; nonfuel assembly hardware inserted in power fuel assemblies, including, but not limited to, control rod assemblies, burnable poison assemblies, thimble plug assemblies, neutron source assemblies, instrumentation assemblies; fuel channels attached to power fuel assemblies; and nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in canisters.

Stations - the initial underground openings at predetermined horizons adjacent to the shaft.

Storage facilities - areas, structures, and supporting services to store equipment, supplies, and vehicles in a yard-type environment.

Sump - the area at the bottom of the shaft, below the adjacent horizontal excavation, and/or the area(s) within the ramp, that contains, collects, and transfers underground waste water to the underground waste water collection system.

Surface facilities - temporary and permanent facilities, systems, and services for the surface buildings and temporary structures that are required for the support of ESF operations and in situ site characterization.

Surface and Subsurface - delineation between surface and subsurface construction is the mountain side of the portal (or collar) interface. Subsurface construction is comprised of those areas where the excavation penetrates this interface and extends into the mountain; surface construction is comprised of those areas not penetrating this interface.

Surface utilities - surface systems, subsystems, structures, and components necessary to meet the needs of Participant organizations in carrying out ESF activities. These include provisions for power, water, sewage, communications, mine waste water, compressed air, and solid waste disposal.

System quality factors - include reliability, maintainability, inspectability, availability, and service life.

Surface waste water system - systems, subsystems, and components that provide equipment for collection, transfer, treatment, and disposal of liquid nonsanitary wastes generated underground in the ESF during construction and operations.

TBD, "to be determined" - used to identify requirements that are yet to be specified (for which source documentation does not exist and must be developed).

TBV, "to be verified" - used to identify requirements which originate in the subject Design Requirements Document that contains unqualified inputs (for which source documentation is required and has not been developed) (* indicates an unqualified quality affecting input).

Test areas - openings excavated off the ESF access stations at the Upper Demonstration Breakout Room, the Main Test Level, CH, and other areas as required for conducting underground site characterization tests at the potential repository horizon and the other geologic horizon(s).

Test support - activities associated with test equipment including but not limited to installation and maintenance, test execution, test data recording, and test analysis for in situ site characterization to be performed within the Yucca Mountain ESF.

Test support facilities - surface facilities that accommodate the principal investigators' testing apparatus for equipment assembly, checkout, and repair. This may involve the use of temporary structures.

Underground excavations - underground openings that extend more than five feet beyond the accesses and which comprise the excavations at the proposed test levels and the preferred repository horizon, based on the needs for underground site characterization.

Underground Openings - shaft access, ramp access and other underground excavations.

Underground support systems, subsystems, and components - utilities and provisions for power, communications, lighting, ventilation, water, underground waste water removal, compressed air, fire protection, materials and muck handling, sanitation, and safety monitoring and warning required to meet the needs of the underground site characterization testing program during construction and operation.

Underground waste water collection system - systems, subsystems, and components that collect, control, and transfer to the surface waste water system, the waste water that flows into the shaft(s)/ramps and underground facilities.

Ventilation distribution system - systems, subsystems, and components that allow fresh air, conditioned if required, to be supplied to, and exhaust air to be removed from, the underground areas to meet the needs of underground construction and site characterization testing. The ventilation distribution system distributes air supplied by the ventilation system.

Ventilation system - surface systems, subsystems, and components that supply fresh air, conditioned if required, to the ventilation distribution system, which in turn supply fresh air to, and removes exhaust air from the ESF underground areas.

Warehouse - the facilities, systems, and services for the safe storage and dispensing of ESF materials that require indoor storage and are not stored in the open areas of the Storage Facilities.

Water distribution system - systems, subsystems, and components that distribute water within the underground facility. The water distribution system receives water from the water system.

Water system - systems, subsystems, and components that supply and distribute the potable and non-potable water for the ESF.

Work Platforms - any powered platforms, manlifts, stands, and bridges, as long as they are fitted with proper safety devices.

Worker productivity - the average fraction of a work period in which required work is performed; time waiting for resources, break time, dress-out time, and other nonproductive time is not included.

6.2

ACRONYMS AND ABBREVIATIONS

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CH	Calico Hills
CHn	Calico Hills non-welded
CI	Configuration Item
CRWMS	Civilian Radioactive Waste Management System
DOE	U.S. Department of Energy
ESF	Exploratory Studies Facility
ESFDR	Exploratory Studies Facility Design Requirements
FM	Frequency Modulation
HVAC	Heating, Ventilation, and Air Conditioning
IDCS	Integrated Data and Control System
kV	Kilovolts
MGDS	Mined Geologic Disposal System
MIL-STD	Military Standard
MPBH	Multipurpose Boreholes
MTR	Mitre Corporation
NFPA	National Fire Protection Association
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NUREG	U.S. Nuclear Regulatory Agency
OCRWM	Office of Civilian Radioactive Waste Management
OSHA	Occupational Safety and Health Administration
pH	a number that expresses acidity or alkalinity
QARD	Quality Assurance Requirements and Description
SD&TRD	Site Design and Test Requirements Document
TBD	To be determined
TBV	To be verified
TSw2	Topopah Spring Welded Unit 2
TSw3	Topopah Spring Welded Unit 3

UCRL	University of California Research Laboratory
UPS	Uninterruptible Power Supply
USC	U.S. Code
YMP	Yucca Mountain Site Characterization Project

6.3 RESERVED

6.4 REQUIREMENTS CROSS-REFERENCE

Table 6-1 provides a cross-reference between the ESFDR, the regulatory source and documents, and the sections in the SD&TRD which they support or are derived from.

Table 6-1 Requirements Cross-Reference List

SOURCE	SD&TRD	ESFDR
	I.3.2.2.2.B	3.2.1.1.2.1.A
	I.3.2.2.2.B	3.2.1.1.2.1.B
	I.3.2.2.1.A	3.2.1.1.2.2.A
	I.3.2.2.1.B	3.2.1.1.2.2.B
	I.3.2.2.2.B	3.2.1.1.2.3.A
	I.3.2.2.3.A	3.2.1.1.2.3.B.4
	I.3.6.2.1.C	3.2.1.1.3.4.A
	DERIVED	3.2.1.1.4.E
	I.3.2.2.4.A	3.2.1.2.2.A
	I.3.7.2.1.D.1.A	3.3.1.H
	I.3.7.2.1.D.1.A	3.3.1.I
	I.3.7.2.1.D.1.G	3.3.1.K
	I.3.7.2.1.D.1.G	3.3.1.L
	I.3.7.2.1.D.1.A	3.3.1.M
	I.3.7.2.1.D.1.A	3.3.1.N
	I.3.7.2.1.D.1.B	3.3.1.O
	I.3.7.2.1.D.1.B	3.3.1.P
	I.3.7.2.1.D.1.C	3.3.1.Q
	I.3.7.2.1.D.1.C	3.3.1.R
	I.3.7.2.1.D.1.H	3.3.1.S
	I.3.7.2.1.D.2.C	3.3.1.T
	I.3.7.2.1.D.3.C	3.3.1.V
	I.3.7.2.1.D.3.B	3.3.1.AB
	I.3.7.2.2.D.1.A	3.4.2.6.1.A
	I.3.2.2.1.A	3.4.5.2.1.AC
	I.3.2.2.1.A	3.4.5.3.1.U
	I.3.2.2.1.A	3.4.5.5.1.N
	I.3.7.2.3.B.1.6.B	3.4.5.6.1.A
	I.3.7.2.3.B.1.6.B	3.4.5.6.1.C
	I.3.2.2.1.A	3.4.5.6.1.H
	I.3.2.2.1.A	3.4.5.7.1.F
	I.3.2.2.1.A	3.4.6.3.1.H
	DERIVED	3.6.2.1.A.3
	DERIVED	3.6.2.1.E
	DERIVED	3.6.2.1.M
	DERIVED	3.6.2.1.O
	I.3.2.2.1.A	3.6.2.1.Q
	DERIVED	3.6.4.2.1.A
	DERIVED	3.6.4.2.1.B
	DERIVED	3.6.4.2.1.C

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
	DERIVED	3.6.4.2.1.E
	DERIVED	3.6.4.2.1.F
	DERIVED	3.7.2.1.1.A
	DERIVED	3.7.2.1.1.E
	DERIVED	3.7.2.1.2.H
	DERIVED	3.7.2.1.2.I
	DERIVED	3.7.2.3.1.D
	I.3.7.2.5.D.2.21	3.7.2.4.1.D
	DERIVED	3.7.2.6.1.B
	I.3.3.6.3.A.2	3.7.2.6.1.C
	DERIVED	3.7.3.1.D
	DERIVED	3.8.2.1.2.A
	I.3.2.2.1.A	3.8.2.2.1.Q
	I.3.2.2.1.A	3.8.2.3.1.M
	I.3.2.2.1.A	3.8.2.4.1.G
	DERIVED	3.8.2.5.1.C
	I.3.2.2.1.A	3.8.2.5.1.Q
	I.3.2.2.1.A	3.8.2.6.1.G
	I.3.2.2.1.A	3.8.2.7.1.N
	DERIVED	3.8.2.7.2.B
	I.3.2.2.1.A	3.8.2.8.1.E
	I.3.2.2.1.A	3.8.2.9.1.E
	I.3.2.2.1.A	3.8.2.11.1.F
	DERIVED	3.8.4.2.1.H
	DERIVED	A.1
	DERIVED	A.2
	DERIVED	A.3
	DERIVED	A.4
	DERIVED	A.5
	DERIVED	B.2.1.3.A
	DERIVED	B.2.1.3.B
	DERIVED	B.2.1.3.C
	DERIVED	B.2.2.3.A
	DERIVED	B.2.2.3.B.1
	DERIVED	B.2.2.3.B.2
	DERIVED	B.2.2.3.B.3
	DERIVED	B.2.2.3.C.1
	DERIVED	B.2.2.3.C.2
	DERIVED	B.2.2.3.C.3
	DERIVED	B.2.3.3.A

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
	DERIVED	B.2.3.3.B.1
	DERIVED	B.2.3.3.B.2
	DERIVED	B.2.3.3.B.3
	DERIVED	B.2.3.3.B.4
	DERIVED	B.2.3.3.B.5
	DERIVED	B.2.3.3.C.1
	DERIVED	B.2.3.3.C.2
	DERIVED	B.2.3.3.C.3
	DERIVED	B.2.3.3.C.4
	DERIVED	B.2.3.3.D
	DERIVED	B.2.3.3.E.1
	DERIVED	B.2.3.3.E.2
	DERIVED	B.2.3.3.E.3
	DERIVED	B.2.4.3.A
	DERIVED	B.2.4.3.B
	DERIVED	B.2.4.3.C
	DERIVED	B.2.4.3.D
	DERIVED	B.2.4.3.E
	DERIVED	B.2.5.3.A
	DERIVED	B.2.5.3.B
	DERIVED	B.3.3.A
	DERIVED	B.3.3.B
	DERIVED	B.3.3.C
	DERIVED	B.3.4.A
	DERIVED	B.3.4.B
	DERIVED	B.3.4.C
	DERIVED	B.3.4.D
	DERIVED	B.3.5.A
	DERIVED	B.3.5.B
	DERIVED	B.3.6.A
	DERIVED	B.3.6.B
	DERIVED	B.3.9.A
	DERIVED	B.3.9.B
	DERIVED	B.3.9.C
	DERIVED	B.3.10.A
	DERIVED	B.3.10.B
	DERIVED	B.3.11.A
	DERIVED	B.3.11.B
	DERIVED	B.3.11.C
	DERIVED	B.3.11.D

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
	DERIVED	B.3.11.E
	DERIVED	B.3.12
	DERIVED	B.3.13.A
	DERIVED	B.3.13.B
	DERIVED	B.3.14
	DERIVED	B.3.15
	DERIVED	B.3.16
	DERIVED	B.4.3.A
	DERIVED	B.4.3.B
	DERIVED	B.4.3.C
	DERIVED	B.4.3.D
	DERIVED	B.4.3.E
	DERIVED	B.5.3.A
	DERIVED	B.5.3.B
	DERIVED	B.5.3.C
	DERIVED	B.6.3.A
	DERIVED	B.6.3.B
	DERIVED	B.6.3.C
	DERIVED	B.6.3.D
	DERIVED	B.6.3.E
	DERIVED	B.7.3.A
	DERIVED	B.7.3.B
	DERIVED	B.7.3.C
	DERIVED	B.7.3.D
	DERIVED	B.7.3.E
	DERIVED	B.7.3.F
	DERIVED	B.7.3.G
	DERIVED	B.7.3.H
	DERIVED	B.7.3.I
	DERIVED	B.8.3.A
	DERIVED	B.8.3.A.1
	DERIVED	B.8.3.A.2
	DERIVED	B.8.3.A.3
	DERIVED	B.8.3.B
	DERIVED	B.8.3.B.1
	DERIVED	B.8.3.B.2
	DERIVED	B.8.3.C
	DERIVED	B.9.3.A
	DERIVED	B.9.3.A.1
	DERIVED	B.9.3.A.2

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
	DERIVED	B.9.3.A.3
	DERIVED	B.9.3.A.4
	DERIVED	B.9.3.B
	DERIVED	B.9.3.C
	DERIVED	B.9.3.D
	DERIVED	B.9.3.E
	DERIVED	B.10.3.A
	DERIVED	B.10.3.B
	DERIVED	B.10.3.B.1
	DERIVED	B.10.3.B.2
	DERIVED	B.10.3.B.3
	DERIVED	B.10.3.C
	DERIVED	B.10.3.D
	DERIVED	B.10.3.E
	DERIVED	B.11.3.A
	DERIVED	B.11.3.B
	DERIVED	B.11.3.C
	DERIVED	B.11.3.D
	DERIVED	B.12.3.A.1
	DERIVED	B.12.3.A.2
	DERIVED	B.12.3.B
	DERIVED	B.12.3.C
	DERIVED	B.12.3.D
	DERIVED	B.12.3.E
	DERIVED	B.13.3.A
	DERIVED	B.13.3.B
	DERIVED	B.13.3.C
	DERIVED	B.13.3.C.1
	DERIVED	B.13.3.C.2
	DERIVED	B.13.3.D
	DERIVED	B.13.3.E
	DERIVED	B.13.3.F
	DERIVED	B.13.3.G
	DERIVED	B.13.3.H
	DERIVED	B.13.3.I
	DERIVED	B.13.3.J
	DERIVED	B.13.3.K
	DERIVED	B.14.3.A
	DERIVED	B.14.3.A.1
	DERIVED	B.14.3.A.2

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
	DERIVED	B.14.3.B
	DERIVED	B.15.3.A.1
	DERIVED	B.15.3.A.2
	DERIVED	B.15.3.A.3
	DERIVED	B.15.3.B
	DERIVED	B.15.3.B.1
	DERIVED	B.15.3.C
	DERIVED	B.15.3.D
	DERIVED	B.15.3.E
	DERIVED	B.17.3.A
	DERIVED	B.17.3.B
	DERIVED	B.17.3.C
	DERIVED	B.17.3.D
	DERIVED	B.18.3.A
	DERIVED	B.18.3.A.1
	DERIVED	B.18.3.A.2
	DERIVED	B.18.3.A.3
	DERIVED	B.18.3.B
	DERIVED	B.18.3.C
	DERIVED	B.18.3.D
	DERIVED	B.19.3.A
	DERIVED	B.19.3.B
	DERIVED	B.19.3.C
	DERIVED	B.19.3.D
	DERIVED	B.19.3.E
	DERIVED	B.19.3.F
	DERIVED	B.19.3.G
	DERIVED	B.19.3.H
	DERIVED	B.19.3.I
	DERIVED	B.19.3.J
	DERIVED	B.20.3.A
	DERIVED	B.20.3.A.1
	DERIVED	B.20.3.A.2
	DERIVED	B.20.3.A.3
	DERIVED	B.20.3.A.4
	DERIVED	B.20.3.B
	DERIVED	B.20.3.C
	DERIVED	B.20.3.D
	DERIVED	B.20.3.E
	DERIVED	B.20.3.F

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
	DERIVED	B.20.3.G
	DERIVED	B.20.3.H
	DERIVED	B.21.3.A
	DERIVED	B.21.3.A.1
	DERIVED	B.21.3.A.2
	DERIVED	B.21.3.A.3
	DERIVED	B.21.3.A.4
	DERIVED	B.21.3.B
	DERIVED	B.21.3.C
	DERIVED	B.22.3.A
	DERIVED	B.22.3.A.1
	DERIVED	B.22.3.A.2
	DERIVED	B.22.3.A.3
	DERIVED	B.22.3.A.4
	DERIVED	B.22.3.B
	DERIVED	B.22.3.C
	DERIVED	B.23.3.A
	DERIVED	B.23.3.B
	DERIVED	B.23.3.C
	DERIVED	B.23.3.D
	DERIVED	B.24.3.A
	DERIVED	B.24.3.A.1
	DERIVED	B.24.3.A.2
	DERIVED	B.24.3.A.3
	DERIVED	B.24.3.A.4
	DERIVED	B.24.3.A.5
	DERIVED	B.24.3.A.6
	DERIVED	B.24.3.B
	DERIVED	B.24.3.C
	DERIVED	B.25.3.A.1
	DERIVED	B.25.3.A.2
	DERIVED	B.25.3.A.3
	DERIVED	B.25.3.B
	DERIVED	B.25.3.B.1
	DERIVED	B.25.3.C
	DERIVED	B.25.3.D
	DERIVED	B.26.3.A
	DERIVED	B.26.3.A.1
	DERIVED	B.26.3.A.2
	DERIVED	B.26.3.A.3

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
	DERIVED	B.26.3.B
	DERIVED	B.26.3.C
	DERIVED	B.26.3.D.1
	DERIVED	B.26.3.D.2
	DERIVED	B.26.3.E
	DERIVED	B.26.3.F
	DERIVED	B.27.3.A
	DERIVED	B.27.3.B
	DERIVED	B.27.3.C
	DERIVED	B.27.3.D
	DERIVED	B.27.3.E
	DERIVED	B.27.3.F
	DERIVED	B.28.3.A
	DERIVED	B.29.3.A
	DERIVED	B.29.3.A.1
	DERIVED	B.29.3.A.2
	DERIVED	B.29.3.B
	DERIVED	B.29.3.B.1
	DERIVED	B.29.3.B.2
	DERIVED	B.29.3.B.3
	DERIVED	B.29.3.B.4
	DERIVED	B.29.3.B.5
	DERIVED	B.29.3.C
	DERIVED	B.29.3.D
02/27/90 DOE Letter	I.3.7.2.5.D.2.23	3.7.2.3.1.E
10CFR20	I.3.2.2.2.A	3.2.1.1.2.1.C
10CFR20	I.3.2.2.2.A	3.2.1.1.2.1.C.1
10CFR20	I.3.2.2.2.A	3.2.1.1.2.1.C.2
10CFR20	I.3.2.2.2.A	3.2.1.1.2.1.C.3
10CFR60 Subpart G	I.3.9	3.2.1.1.1.A
10CFR60.111(b)(1)	I.3.7.2.5.D.2.2	3.2.1.2.2.B
10CFR60.111(b)(1)	I.3.7.2.5.D.2.3	3.7.2.3.1.E
10CFR60.112	I.3.7.2.5.C.3	3.7.2.3.1.E
10CFR60.113(a)(1)(i)(A)	I.3.7.2.5.B.2.3.A	3.7.2.3.1.E
10CFR60.113(a)(1)(i)(B)	I.3.7.2.5.B.2.3.B	3.7.2.3.1.E
10CFR60.113(a)(1)(ii)(B)	I.3.7.2.5.B.2.3.D	3.7.2.3.1.E
10CFR60.130	I.3.7.2.5.D.2.5	3.7.1.2.A
10CFR60.130	I.3.7.2.5.D.2.5	3.7.2.3.1.E
10CFR60.130	I.3.7.2.5.D.2.5	3.7.3.1.I
10CFR60.131(b)(1)	I.3.7.2.5.D.2.6	3.2.1.2.1.2.A

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
10CFR60.131(b)(3)(ii)	I.3.7.2.5.D.2.9	3.7.3.1.E
10CFR60.131(b)(6)	I.3.7.2.5.D.2.11	3.7.3.1.F
10CFR60.133(a)(1)	I.3.7.2.5.D.2.13	3.7.2.3.1.E
10CFR60.133(a)(2)	I.3.7.2.5.D.2.14	3.7.2.3.1.E
10CFR60.133(b)	I.3.7.2.5.D.2.15	3.7.2.3.1.E
10CFR60.133(b)	I.3.7.2.5.D.2.15	3.7.3.1.K
10CFR60.133(c)	I.3.7.2.5.D.2.16	3.2.1.2.2.B
10CFR60.133(c)	I.3.7.2.5.D.2.16	3.7.2.3.1.E
10CFR60.133(d)	I.3.7.2.5.D.2.17	3.7.2.3.1.E
10CFR60.133(e)(1)	I.3.7.2.5.D.2.18	3.2.1.2.2.B
10CFR60.133(e)(1)	I.3.7.2.5.D.2.18	3.7.2.3.1.E
10CFR60.133(e)(2)	I.3.7.2.5.D.2.19	3.7.3.1.F
10CFR60.133(e)(2)	I.3.7.2.5.D.2.19	3.7.3.1.G
10CFR60.133(f)	I.3.7.2.5.D.2.20	3.7.2.1.2.F
10CFR60.133(i)	I.3.7.2.5.B.2.2.E	3.7.2.3.1.E
10CFR60.133(i)	I.3.7.2.5.B.2.2.E	3.7.2.6.1.D
10CFR60.133(i)	I.3.7.2.5.B.2.2.E	3.7.3.1.L
10CFR60.137	I.3.7.2.5.D.3.2	3.2.1.1.4.D
10CFR60.137	I.3.7.2.5.D.3.2	3.7.2.3.1.E
10CFR60.137	I.3.7.2.5.D.3.2	3.7.2.5.1.C
10CFR60.140(b)	I.3.7.2.5.D.3.3	3.7.2.5.1.C
10CFR60.140(c)	I.3.7.2.5.D.3.4	3.7.2.5.1.C
10CFR60.141(a)	I.3.7.2.5.D.1.8	3.7.2.3.1.E
10CFR60.141(a)	I.3.7.2.5.D.1.8	3.7.2.5.1.C
10CFR60.141(a)	I.3.7.2.5.D.1.8	3.7.3.1.J
10CFR60.141(b)	I.3.7.2.5.D.3.6	3.7.2.3.1.E
10CFR60.141(b)	I.3.7.2.5.D.3.6	3.7.2.5.1.C
10CFR60.141(b)	I.3.7.2.5.D.3.6	3.7.3.1.J
10CFR60.141(c)	I.3.7.2.5.D.3.7	3.7.2.3.1.E
10CFR60.141(c)	I.3.7.2.5.D.3.7	3.7.2.5.1.C
10CFR60.141(d)	I.3.7.2.5.D.3.8	3.7.2.3.1.E
10CFR60.141(d)	I.3.7.2.5.D.3.8	3.7.2.5.1.C
10CFR60.141(d)	I.3.7.2.5.D.3.8	3.7.3.1.J
10CFR60.15(b)	I.3.7.2.5.D.2.1	3.7.2.3.1.E
10CFR60.15(b)	I.3.7.2.5.D.2.1	3.7.2.5.1.C
10CFR60.15(c)(1)	I.3.7.2.5.C.1.E	3.2.1.1.4.A
10CFR60.15(c)(1)	I.3.7.2.5.C.1.D	3.2.1.1.4.A
10CFR60.15(c)(1)	I.3.7.2.1.C.1.B	3.2.1.2.3.A
10CFR60.15(c)(1)	I.3.7.2.2.C.1.B	3.2.1.2.3.A
10CFR60.15(c)(1)	I.3.7.2.3.C.1.B	3.2.1.2.3.A

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
10CFR60.15(c)(1)	I.3.7.2.4.C.1.B	3.2.1.2.3.A
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.2.1.2.3.A
10CFR60.15(c)(1)	I.3.7.2.5.C.1.B	3.2.1.2.3.A
10CFR60.15(c)(1)	I.3.7.2.5.C.1.B	3.2.1.2.3.B
10CFR60.15(c)(1)	I.3.7.2.5.C.1.B	3.2.1.2.3.C
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.2.1.2.3.C
10CFR60.15(c)(1)	I.3.7.2.4.C.1.A	3.2.1.2.3.C
10CFR60.15(c)(1)	I.3.7.2.3.C.1.B	3.2.1.2.3.C
10CFR60.15(c)(1)	I.3.7.2.2.C.1.B	3.2.1.2.3.C
10CFR60.15(c)(1)	I.3.7.2.1.C.1.B	3.2.1.2.3.C
10CFR60.15(c)(1)	I.3.7.2.1.C.1.B	3.2.1.2.3.D
10CFR60.15(c)(1)	I.3.7.2.5.C.1.B	3.2.1.2.3.D
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.2.1.2.3.D
10CFR60.15(c)(1)	I.3.7.2.4.C.1.A	3.2.1.2.3.D
10CFR60.15(c)(1)	I.3.7.2.2.C.1.B	3.2.1.2.3.D
10CFR60.15(c)(1)	I.3.7.2.3.C.1.B	3.2.1.2.3.D
10CFR60.15(c)(1)	I.3.7.2.5.C.1.B	3.2.1.2.3.E
10CFR60.15(c)(1)	I.3.7.2.3.C.1.B	3.2.1.2.3.E
10CFR60.15(c)(1)	I.3.7.2.2.C.1.B	3.2.1.2.3.E
10CFR60.15(c)(1)	I.3.7.2.1.C.1.B	3.2.1.2.3.E
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.2.1.2.3.E
10CFR60.15(c)(1)	I.3.7.2.4.C.1.A	3.2.1.2.3.E
10CFR60.15(c)(1)	I.3.7.2.4.C.1.B	3.2.1.2.3.F
10CFR60.15(c)(1)	I.3.7.2.5.C.1.C	3.2.1.2.3.F
10CFR60.15(c)(1)	I.3.7.2.3.C.1.C	3.2.1.2.3.F
10CFR60.15(c)(1)	I.3.7.2.1.C.1.C	3.2.1.2.3.F
10CFR60.15(c)(1)	I.3.7.2.2.C.1.C	3.2.1.2.3.F
10CFR60.15(c)(1)	I.3.7.2.6.C.1.C	3.2.1.2.3.F
10CFR60.15(c)(1)	I.3.7.2.5.C.1.A	3.2.1.2.3.G
10CFR60.15(c)(1)	I.3.7.2.2.C.1.A	3.2.1.2.3.G
10CFR60.15(c)(1)	I.3.7.2.1.C.1.A	3.2.1.2.3.G
10CFR60.15(c)(1)	I.3.7.2.6.C.1.A	3.2.1.2.3.G
10CFR60.15(c)(1)	I.3.7.2.3.C.1.A	3.2.1.2.3.G
10CFR60.15(c)(1)	I.3.7.2.2.C.1.A	3.2.1.2.3.H
10CFR60.15(c)(1)	I.3.7.2.3.C.1.A	3.2.1.2.3.H
10CFR60.15(c)(1)	I.3.7.2.5.C.1.A	3.2.1.2.3.H
10CFR60.15(c)(1)	I.3.7.2.6.C.1.A	3.2.1.2.3.H
10CFR60.15(c)(1)	I.3.7.2.1.C.1.A	3.2.1.2.3.H
10CFR60.15(c)(1)	I.3.7.2.2.C.1.B	3.2.1.2.3.I
10CFR60.15(c)(1)	I.3.7.2.3.C.1.B	3.2.1.2.3.I

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
10CFR60.15(c)(1)	1.3.7.2.5.C.1.B	3.2.1.2.3.I
10CFR60.15(c)(1)	1.3.7.2.4.C.1.A	3.2.1.2.3.I
10CFR60.15(c)(1)	1.3.7.2.1.C.1.B	3.2.1.2.3.I
10CFR60.15(c)(1)	1.3.7.2.6.C.1.B	3.2.1.2.3.I
10CFR60.15(c)(1)	1.3.7.2.1.C.1.B	3.3.1.F
10CFR60.15(c)(1)	1.3.7.2.1.C.1.C	3.3.1.G
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.2.5.1.I
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.3.1.B
10CFR60.15(c)(1)	1.3.7.2.2.C.1.A	3.4.4.1.A
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.3.1.E
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.3.1.F
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.3.1.G
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.3.1.H
10CFR60.15(c)(1)	1.3.7.2.5.C.1.B	3.4.5.3.1.O
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.3.1.P
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.3.1.V
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.4.1.A
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.4.1.B
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.4.1.C
10CFR60.15(c)(1)	1.3.7.2.5.C.1.B	3.4.5.6.1.D
10CFR60.15(c)(1)	1.3.7.2.2.C.1.B	3.4.5.6.1.I
10CFR60.15(c)(1)	1.3.7.2.3.C.1.B	3.5.3.1.B
10CFR60.15(c)(1)	1.3.7.2.3.C.1.B	3.5.7.1.D
10CFR60.15(c)(1)	1.3.7.2.3.C.1.B	3.5.7.1.E
10CFR60.15(c)(1)	1.3.7.2.3.C.1.B	3.5.9.1.H
10CFR60.15(c)(1)	1.3.7.2.3.C.1.B	3.5.9.1.J
10CFR60.15(c)(1)	1.3.7.2.4.C.1.A	3.6.2.1.F
10CFR60.15(c)(1)	1.3.7.2.5.C.1.B	3.7.1.2.C
10CFR60.15(c)(1)	1.3.7.2.5.C.1.B	3.7.1.2.D
10CFR60.15(c)(1)	1.3.7.2.5.C.1.B	3.7.2.1.1.C.1
10CFR60.15(c)(1)	1.3.7.2.5.C.1.B	3.7.2.1.1.C.2
10CFR60.15(c)(1)	1.3.7.2.5.C.1.D	3.7.2.1.2.D
10CFR60.15(c)(1)	1.3.7.2.5.C.1.D	3.7.2.1.2.E
10CFR60.15(c)(1)	1.3.7.2.5.C.1.D	3.7.2.4.1.A
10CFR60.15(c)(1)	1.3.7.2.5.C.1.D	3.7.2.4.1.D
10CFR60.15(c)(1)	1.3.7.2.5.C.1.D	3.7.2.4.1.F
10CFR60.15(c)(1)	1.3.7.2.5.C.1.B	3.7.3.1.B
10CFR60.15(c)(1)	1.3.7.2.6.C.1.B	3.8.2.6.1.A
10CFR60.15(c)(1)	1.3.7.2.6.C.1.B	3.8.2.6.1.B
10CFR60.15(c)(1)	1.3.7.2.6.C.1.B	3.8.2.6.1.C

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.6.1.D
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.6.1.E
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.6.1.H
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.7.1.B
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.7.1.C
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.7.1.D
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.7.1.E
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.7.1.F
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.7.1.G
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.9.1.A
10CFR60.15(c)(1)	I.3.7.2.5.C.1.B	3.8.2.9.1.F
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.10.1.A
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.2.12.1.E
10CFR60.15(c)(1)	I.3.7.2.6.C.1.B	3.8.4.2.1.I
10CFR60.15(c)(1)	I.3.7.2.6.C.1.C	3.8.4.3.1.A
10CFR60.15(c)(1)	I.3.7.2.6.C.1.C	3.8.4.4.1.D
10CFR60.15(c)(2)	I.3.7.2.5.C.2	3.2.1.1.4.B
10CFR60.15(c)(2)	I.3.7.2.5.C.2	3.7.2.3.1.E
10CFR60.15(c)(3)	I.3.7.2.5.B.2.2.A	3.7.2.3.1.E
10CFR60.15(c)(4)	I.3.7.2.5.B.2.2.B	3.7.2.1.2.B
10CFR60.151	I.3.9	3.2.1.1.1.A
10CFR60.152	I.3.9	3.2.1.1.1.A
10CFR60.21(c)(1)(ii)(D)	I.3.7.2.5.D.1.3	3.7.2.3.1.E
10CFR60.3(a)	I.3.2.2.4.B	3.2.1.2.2.B
10CFR60.3(b)	I.3.2.2.4.B	3.2.1.2.2.B
10CFR60.72(a)	I.3.7.2.5.D.1.7	3.2.1.1.4.C
10CFR60.72(a)	I.3.7.2.5.D.1.7	3.7.1.2.B
10CFR60.72(b)	I.3.7.2.5.D.1.7	3.2.1.1.4.C
10CFR60.72(b)	I.3.7.2.5.D.1.7	3.7.1.2.B
10CFR60.74(b)	I.3.7.2.5.D.3.2	3.2.1.1.4.D
10CFR60.74(b)	I.3.7.2.5.D.3.2	3.7.2.5.1.C
10CFR960.3-4	I.3.7.2.5.D.1.10	3.2.1.1.1.C.1
10CFR960.3-4	I.3.7.2.2.D.1.B	3.2.1.1.1.C.1
10CFR960.3-4	I.3.7.2.3.D.1.E	3.2.1.1.1.C.1
10CFR960.3-4	I.3.7.2.5.D.1.10	3.2.1.1.1.C.3
10CFR960.3-4	I.3.7.2.1.D.1.E	3.2.1.1.1.C.4
10CFR960.3-4	I.3.7.2.1.D.1.E	3.3.1.J
10CFR960.3-4	I.3.7.2.1.D.2.D	3.3.1.U
10CFR960.3-4	I.3.7.2.1.D.1.D	3.3.1.X
10CFR960.3-4	I.3.7.2.2.D.1.D	3.4.2.3.1.A

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
10CFR960.3-4	I.3.7.2.2.B.1.3.B	3.4.4.1.C
10CFR960.3-4	I.3.7.2.2.D.1.D	3.4.4.1.D
10CFR960.3-4	I.3.7.2.2.B.1.3.B	3.4.4.1.L
10CFR960.3-4	I.3.7.2.3.B.1.6.A	3.5.1.1.A
10CFR960.3-4	I.3.7.2.3.B.1.6.A	3.5.1.2.A
10CFR960.3-4	I.3.7.2.3.D.1.D	3.5.1.2.B
10CFR960.3-4	I.3.7.2.3.D.1.C	3.5.2.1.B
10CFR960.3-4	I.3.7.2.3.D.1.A	3.5.2.1.C
10CFR960.3-4	I.3.7.2.3.D.1.D	3.5.3.1.A
10CFR960.3-4	I.3.7.2.3.D.1.D	3.5.3.1.B
10CFR960.3-4	I.3.7.2.3.B.1.6.A	3.5.4.1.A
10CFR960.3-4	I.3.7.2.3.D.1.B	3.5.4.1.B
10CFR960.3-4	I.3.7.2.3.D.1.C	3.5.6.1.A
10CFR960.3-4	I.3.7.2.3.D.1.C	3.5.10.1.A
10CFR960.3-4	I.3.7.2.6.D.1.B	3.8.2.1.2.D
16USC1531	I.3.3.11.A.c	3.3.1.Y
16USC1531	I.3.3.11.A.c	3.4.3.1.E
16USC1531	I.3.3.11.A.c	3.4.4.1.H
16USC1531	I.3.3.11.A.c	3.4.5.2.1.Y
16USC1531	I.3.3.11.A.c	3.4.5.3.1.Q
16USC1531	I.3.3.11.A.c	3.4.5.4.1.G
16USC1531	I.3.3.11.A.c	3.4.5.6.1.E
16USC1531	I.3.3.11.A.c	3.5.2.1.D
16USC1531	I.3.3.11.A.c	3.5.3.1.C
16USC470	I.3.3.11.A.d	3.3.1.W
16USC470	I.3.3.11.A.d	3.4.3.1.H
16USC470	I.3.3.11.A.d	3.4.4.1.K
16USC470	I.3.3.11.A.d	3.4.5.2.1.AB
16USC470	I.3.3.11.A.d	3.4.5.3.1.S
16USC470	I.3.3.11.A.d	3.4.5.4.1.L
16USC470	I.3.3.11.A.d	3.4.5.6.1.G
16USC470	I.3.3.11.A.d	3.5.2.1.G
16USC470	I.3.3.11.A.d	3.5.3.1.F
1992 MOA NS/RW	I.3.8.B	3.2.1.1.1.B.2
29CFR1910	I.3.8.C	3.2.1.1.1.B.3
29CFR1910	I.3.3.6.1.B	3.2.1.1.2.4.G
29CFR1910	I.3.3.6.2.E.2	3.2.1.1.2.4.I
29CFR1910	I.3.7.2.1.D.1.F	3.3.1.E
29CFR1910	I.3.3.6.1.B	3.4.5.5.1.L
29CFR1910	I.3.3.6.1.B	3.4.6.3.1.B

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
29CFR1910	I.3.3.6.1.B	3.7.2.3.1.A
29CFR1910	I.3.3.6.2.E.2	3.7.2.3.1.A
29CFR1910	I.3.3.12.c	3.8.2.2.1.M
29CFR1910	I.3.3.6.1.B	3.8.2.3.1.A
29CFR1910	I.3.3.6.1.B	3.8.2.3.1.F
29CFR1910	I.3.3.6.1.B	3.8.2.3.1.G
29CFR1910	I.3.3.6.2.E.2	3.8.2.4.1.C
29CFR1910	I.3.2.1.1.1.B	3.8.2.10.1.B
29CFR1910	I.3.2.1.1.1.B	3.8.2.10.1.C
29CFR1910	I.3.3.6.1.B	3.8.2.11.1.E
29CFR1910	I.3.3.6.2.e.2	3.8.4.2.1.C
29CFR1910	I.3.3.12.c	3.8.4.4.1.C
29CFR1910, Subpart D	I.3.3.6.3.A	3.4.2.3.1.B
29CFR1910, Subpart E	I.3.3.6.5.C	3.2.1.1.2.4.C
29CFR1910, Subpart E	I.3.3.6.5.C	3.2.1.1.2.4.D
29CFR1910, Subpart E	I.3.3.6.3.A	3.4.2.3.1.B
29CFR1910, Subpart G	I.3.3.6.3.A	3.4.2.3.1.B
29CFR1910, Subpart H	I.3.3.6.3.C	3.4.2.5.1.A
29CFR1910, Subpart H	I.3.3.6.3.C	3.4.2.6.1.B
29CFR1910, Subpart I	I.3.3.6.4.A	3.4.2.7.1.A
29CFR1910, Subpart J	I.3.3.6.5.A	3.2.1.1.2.4.C
29CFR1910, Subpart J	I.3.3.6.3.A	3.4.2.3.1.B
29CFR1910, Subpart J	I.3.3.6.5.A	3.6.4.2.1.G
29CFR1910, Subpart Q	I.3.3.6.7.E	3.4.2.5.1.B
29CFR1910, Subpart S	I.3.3.6.9.A	3.4.5.2.1.L
29CFR1910, Subparts H, O	I.3.3.6.3.D	3.4.5.2.1.V
29CFR1910, Subparts H, O	I.3.3.6.3.D	3.4.5.2.1.W
29CFR1910, Subparts H, O	I.3.3.6.3.D	3.5.7.1.D
29CFR1910.132(a)	I.3.3.6.4.C	3.4.2.7.1.F
29CFR1910.141	I.3.2.1.1.1.A	3.2.1.1.2.6.A
29CFR1910.141	I.3.2.1.1.1.A	3.4.2.1.2.H
29CFR1910.147	I.3.3.6.7.B	3.2.1.1.2.4.E
29CFR1910.151(c)	I.3.3.6.7.F	3.2.1.1.2.4.F
29CFR1910.94	I.3.2.1.1.2.B	3.8.2.11.1.E
29CFR1926	I.3.3.6.5.A	3.2.1.1.2.4.C
29CFR1926	I.3.3.6.5.C	3.2.1.1.2.4.C
29CFR1926	I.3.3.6.5.C	3.2.1.1.2.4.D
29CFR1926	I.3.3.6.7.B	3.2.1.1.2.4.E
29CFR1926	I.3.3.6.7.F	3.2.1.1.2.4.F
29CFR1926	I.3.3.6.1.B	3.2.1.1.2.4.G

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
29CFR1926	I.3.3.6.2.E.2	3.2.1.1.2.4.I
29CFR1926	I.3.3.6.7.E	3.4.2.5.1.B
29CFR1926	I.3.3.6.9.A	3.4.5.2.1.L
29CFR1926	I.3.3.6.1.B	3.4.5.5.1.L
29CFR1926	I.3.3.6.1.B	3.4.6.3.1.B
29CFR1926	I.3.3.6.5.A	3.6.4.2.1.G
29CFR1926	I.3.3.6.1.B	3.7.2.3.1.A
29CFR1926	I.3.3.6.2.E.2	3.7.2.3.1.A
29CFR1926	I.3.3.12.d	3.8.2.2.1.M
29CFR1926	I.3.3.6.1.B	3.8.2.3.1.A
29CFR1926	I.3.3.6.1.B	3.8.2.3.1.F
29CFR1926	I.3.3.6.1.B	3.8.2.3.1.G
29CFR1926	I.3.3.6.2.E.2	3.8.2.4.1.C
29CFR1926	I.3.3.6.1.B	3.8.2.11.1.E
29CFR1926	I.3.3.6.2.e.2	3.8.4.2.1.C
29CFR1926, Subpart E	I.3.3.6.4.A	3.4.2.7.1.A
29CFR1926.800(c)	I.3.7.2.2.B.1.5.B	3.4.2.7.1.I
29CFR1926.800(c)	I.3.7.2.2.B.1.5.B	3.4.2.7.1.J
29CFR1926.800(c)	I.3.7.2.2.B.1.5.B	3.4.2.7.1.K
29CFR1926.800(c)	I.3.7.2.2.B.1.5.B	3.4.2.7.1.L
29CFR1926.800(c)	I.3.7.2.2.B.1.5.B	3.4.2.7.1.M
29CFR1926.800(c)	I.3.7.2.2.B.1.5.B	3.4.2.7.1.N
29CFR1926.800(c)	I.3.7.2.2.B.1.5.B	3.4.2.7.1.O
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.2.1.1.2.4.A
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.4.5.2.1.R
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.4.5.2.1.S
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.5.4.1.C
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.7.2.3.1.B
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.7.2.3.1.C
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.7.2.4.1.H
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.8.4.1.2.A
29USC651 et seq. [OSHA]	I.3.3.6.1.A	3.8.4.4.1.C
29USC654(a) [OSHA]	I.3.3.6.1.A	3.2.1.1.2.4.A
29USC654(a) [OSHA]	I.3.3.6.1.A	3.4.5.2.1.R
29USC654(a) [OSHA]	I.3.3.6.1.A	3.4.5.2.1.S
29USC654(a) [OSHA]	I.3.3.6.1.A	3.5.4.1.C
29USC654(a) [OSHA]	I.3.3.6.1.A	3.7.2.3.1.B
29USC654(a) [OSHA]	I.3.3.6.1.A	3.7.2.3.1.C
29USC654(a) [OSHA]	I.3.3.6.1.A	3.7.2.4.1.H
29USC654(a) [OSHA]	I.3.3.6.1.A	3.8.4.1.2.A

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
29USC654(a) [OSHA]	I.3.3.6.1.A	3.8.4.4.1.C
29USC654(b) [OSHA]	I.3.3.6.1.A	3.2.1.1.2.4.A
29USC654(b) [OSHA]	I.3.3.6.1.A	3.4.5.2.1.R
29USC654(b) [OSHA]	I.3.3.6.1.A	3.4.5.2.1.S
29USC654(b) [OSHA]	I.3.3.6.1.A	3.5.4.1.C
29USC654(b) [OSHA]	I.3.3.6.1.A	3.7.2.3.1.B
29USC654(b) [OSHA]	I.3.3.6.1.A	3.7.2.3.1.C
29USC654(b) [OSHA]	I.3.3.6.1.A	3.7.2.4.1.H
29USC654(b) [OSHA]	I.3.3.6.1.A	3.8.4.1.2.A
29USC654(b) [OSHA]	I.3.3.6.1.A	3.8.4.4.1.C
30CFR36	I.3.2.3.1.D	3.2.1.2.4.A
30CFR57	I.3.8.C	3.2.1.1.1.B.3
30CFR57	I.3.3.6.1.B	3.2.1.1.2.4.G
30CFR57	I.3.3.6.2.E.1	3.2.1.1.2.4.H
30CFR57	I.3.3.6.3.B	3.2.1.1.2.4.H
30CFR57	I.3.3.6.2.E.3	3.2.1.1.2.4.H
30CFR57	I.3.3.6.2.E.2	3.2.1.1.2.4.I
30CFR57	I.3.7.2.1.D.1.F	3.3.1.E
30CFR57	I.3.2.3.2.1.B	3.4.5.3.1.N
30CFR57	I.3.3.6.1.B	3.4.5.5.1.L
30CFR57	I.3.3.6.1.B	3.4.6.3.1.B
30CFR57	I.3.3.6.1.B	3.7.2.3.1.A
30CFR57	I.3.3.6.2.E.2	3.7.2.3.1.A
30CFR57	I.3.3.12.j	3.7.2.4.1.H
30CFR57	I.3.3.6.1.B	3.8.2.3.1.A
30CFR57	I.3.3.12.j	3.8.2.3.1.C
30CFR57	I.3.3.12.j	3.8.2.3.1.D
30CFR57	I.3.3.6.1.B	3.8.2.3.1.F
30CFR57	I.3.3.12.j	3.8.2.3.1.F
30CFR57	I.3.3.6.1.B	3.8.2.3.1.G
30CFR57	I.3.3.12.j	3.8.2.3.1.G
30CFR57	I.3.3.6.2.E.2	3.8.2.4.1.C
30CFR57	I.3.2.3.2.1.B	3.8.2.6.1.F
30CFR57	I.3.2.3.2.1.B	3.8.2.9.1.B
30CFR57	I.3.2.3.2.1.B	3.8.2.9.1.D
30CFR57	I.3.2.1.1.1.B	3.8.2.10.1.B
30CFR57	I.3.2.1.1.1.B	3.8.2.10.1.C
30CFR57	I.3.3.6.1.B	3.8.2.11.1.E
30CFR57	I.3.3.12.j	3.8.4.1.2.A
30CFR57	I.3.3.6.2.e.2	3.8.4.2.1.C

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
30CFR57	I.3.3.12.j	3.8.4.3.1.C
30CFR57, Subpart B	I.3.7.2.5.D.2.22	3.7.2.1.1.B
30CFR57, Subpart B	I.3.7.2.5.D.2.22	3.7.2.2.1.A
30CFR57, Subpart B	I.3.7.2.5.D.2.22	3.7.2.6.1.C
30CFR57, Subpart D	I.3.2.1.1.2.D	3.8.2.5.1.J
30CFR57, Subpart D	I.3.2.1.1.2.D	3.8.2.5.1.L
30CFR57, Subpart D	I.3.2.1.1.2.D	3.8.2.11.1.E
30CFR57, Subpart K	I.3.3.6.9.B	3.4.5.2.1.N
30CFR57, Subpart K	I.3.3.6.9.B	3.4.5.2.1.P
30CFR57, Subpart K	I.3.3.6.9.B	3.8.2.12.1.C
30CFR57, Subpart N	I.3.3.6.4.A	3.4.2.7.1.A
30CFR57.11058	I.3.7.2.2.B.1.5.B	3.4.2.7.1.I
30CFR57.11058	I.3.7.2.2.B.1.5.B	3.4.2.7.1.J
30CFR57.11058	I.3.7.2.2.B.1.5.B	3.4.2.7.1.K
30CFR57.11058	I.3.7.2.2.B.1.5.B	3.4.2.7.1.L
30CFR57.11058	I.3.7.2.2.B.1.5.B	3.4.2.7.1.M
30CFR57.11058	I.3.7.2.2.B.1.5.B	3.4.2.7.1.N
30CFR57.11058	I.3.7.2.2.B.1.5.B	3.4.2.7.1.O
30CFR57.12016	I.3.3.6.7.B	3.2.1.1.2.4.E
30CFR57.5005(a)	I.3.3.6.4.A	3.4.2.7.1.A
33CFR323	I.3.3.12.k	3.4.5.4.1.H
33USC1251 et seq. [FWPCA]	I.3.3.11.A.e	3.3.1.AA
33USC1251 et seq. [FWPCA]	I.3.3.11.A.e	3.4.3.1.G
33USC1251 et seq. [FWPCA]	I.3.3.11.A.e	3.4.5.2.1.AA
33USC1251 et seq. [FWPCA]	I.3.3.11.A.e	3.4.5.4.1.H
33USC1251 et seq. [FWPCA]	I.3.3.11.A.e	3.4.5.4.1.I
33USC1251 et seq. [FWPCA]	I.3.3.11.A.e	3.4.5.6.1.F
33USC1251 et seq. [FWPCA]	I.3.3.11.A.e	3.5.3.1.E
40CFR141	I.3.3.12.o	3.4.5.3.1.R
40CFR141	I.3.3.12.o	3.4.5.4.1.J
40CFR141	I.3.3.12.o	3.5.9.1.I
40CFR141	I.3.7.2.3.D.1.H	3.5.9.1.I
40CFR143	I.3.3.12.p	3.4.5.3.1.R
40CFR143	I.3.3.12.p	3.4.5.4.1.J
40CFR143	I.3.7.2.3.D.1.H	3.5.9.1.I
40CFR143	I.3.3.12.p	3.5.9.1.I
40CFR144	I.3.3.11.A.p	3.4.5.3.1.T
40CFR50	I.3.3.12.l	3.4.5.2.1.Z
40CFR50	I.3.3.12.l	3.8.4.2.1.L
40CFR60	I.3.3.12.m	3.8.2.5.1.O

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
41CFR101-19.603	I.3.3.7.5.A	3.2.1.1.2.5.E
42USC10101 et seq.	I.3.3.11.A.f	3.5.6.1.D
42USC10132(b)(1)(D)(iii) [NWP]	I.3.7.2.1.D.1.E	3.2.1.1.1.C.4
42USC10132(b)(1)(D)(iii) [NWP]	I.3.7.2.1.D.1.E	3.3.1.J
42USC10132(b)(1)(D)(iii) [NWP]	I.3.7.2.1.D.2.D	3.3.1.U
42USC10133(a) [NWP]	I.3.7.2.1.D.1.E	3.2.1.1.1.C.4
42USC10133(a) [NWP]	I.3.7.2.1.D.1.E	3.3.1.J
42USC10133(a) [NWP]	I.3.7.2.1.D.2.D	3.3.1.U
42USC10133(b)(1)(A)(iii) [NWP]	I.3.7.2.5.D.1.10	3.2.1.1.1.C.1
42USC10133(b)(1)(A)(iii) [NWP]	I.3.7.2.5.D.1.10	3.2.1.1.1.C.3
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.B	3.6.2.1.H
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.B	3.6.2.1.H.1
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.C	3.6.2.1.I
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.A	3.6.2.1.J
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.A	3.6.2.1.J.1
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.A	3.6.2.1.J.2
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.A	3.6.2.1.J.3
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.A	3.6.2.1.J.4
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.E	3.6.2.1.K
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.E	3.6.2.1.K.1
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.E	3.6.2.1.K.2
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.D	3.6.2.1.L
42USC10133(c)(1) (NWP)	I.3.7.2.4.D.1.F	3.6.2.1.N
42USC10133(c)(1) [NWP]	I.3.3.11.B	3.4.6.3.1.F
42USC10133(c)(1) [NWP]	I.3.3.11.B	3.8.2.5.1.O
42USC10133(c)(1) [NWP]	I.3.3.11.B	3.8.2.8.1.D
42USC300f et seq. [SDWA]	I.3.3.11.A.g	3.4.5.3.1.R
42USC300f et seq. [SDWA]	I.3.3.11.A.h	3.4.5.3.1.T
42USC300f et seq. [SDWA]	I.3.3.11.A.g	3.4.5.4.1.J
42USC300f et seq. [SDWA]	I.3.3.11.A.g	3.5.9.1.I
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.3.1.X
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.4.2.3.1.G
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.4.3.1.F
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.4.4.1.I
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.4.5.2.1.Z
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.5.2.1.E
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.5.3.1.D
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.5.4.1.D
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.5.6.1.B
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.5.10.1.C

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.8.2.11.1.E
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.8.4.2.1.K
42USC7401 et seq. [CAA]	I.3.3.11.A.k	3.8.4.2.1.L
50CFR17	I.3.3.11.A.s	3.3.1.Y
50CFR17	I.3.3.11.A.s	3.4.3.1.E
50CFR17	I.3.3.11.A.s	3.4.4.1.H
50CFR17	I.3.3.11.A.s	3.4.5.2.1.Y
50CFR17	I.3.3.11.A.s	3.4.5.3.1.Q
50CFR17	I.3.3.11.A.s	3.4.5.4.1.G
50CFR17	I.3.3.11.A.s	3.4.5.6.1.E
50CFR17	I.3.3.11.A.s	3.5.2.1.D
50CFR17	I.3.3.11.A.s	3.5.3.1.C
ACI 318	I.3.3.12.ar	3.2.1.2.4.B
ANSI C2	I.3.3.6.9.B	3.4.5.2.1.N
ANSI C2	I.3.3.12.ap	3.4.5.2.1.N
ANSI C2	I.3.3.6.9.B	3.4.5.2.1.P
ANSI C2	I.3.3.12.ap	3.4.5.2.1.P
ANSI C2	I.3.3.6.9.B	3.8.2.12.1.C
ANSI C2	I.3.3.12.ap	3.8.2.12.1.C
ANSI/ASCE 7-88	I.3.2.3.1.J	3.2.1.2.1.1.E
ANSI/ASCE 7-88	I.3.3.12.at	3.2.1.2.1.1.E
ANSI/ASCE 7-88	I.3.2.3.1.J	3.2.1.2.1.1.G
ANSI/ASCE 7-88	I.3.3.12.at	3.2.1.2.1.1.G
ANSI/HFS 100-1988 Section 5	I.3.3.7.1	3.2.1.1.2.5.A
ANSI/NFPA 70	I.3.3.6.9.B	3.4.5.2.1.N
ANSI/NFPA 70	I.3.3.6.9.B	3.4.5.2.1.P
ANSI/NFPA 70	I.3.3.6.9.B	3.8.2.12.1.C
ASHRAE	I.3.2.1.1.2.A	3.4.2.1.2.A
ASHRAE	I.3.2.1.1.2.A	3.4.2.5.1.H
ASHRAE	I.3.2.1.1.2.A	3.4.2.6.1.I
ASHRAE	I.3.2.1.1.2.A	3.4.5.1.2.A
ASHRAE	I.3.2.1.1.2.A	3.8.2.5.1.F
BCP-00-94-0005	I.3.2.2.4.B	3.2.1.2.2.B
BLM Manual, Section 9113	I.3.7.2.1.D.3.A	3.3.1.AE
BLM Manual, Section 9113	I.3.3.12.al	3.5.6.1.D
CRD	I.3.8.A	3.2.1.1.1.B.1
CRD	I.3.3.10.B	3.2.1.1.1.D
CRD	I.3.2.2.2.A	3.2.1.1.2.1.C
CRD	I.3.2.2.2.A	3.2.1.1.2.1.C.1
CRD	I.3.2.2.2.A	3.2.1.1.2.1.C.2

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
CRD	I.3.2.2.2.A	3.2.1.1.2.1.C.3
CRD	I.3.5.1.A.1.c	3.2.1.1.2.3.F
CRD	I.3.3.5	3.2.1.1.2.3.G
CRD	I.3.3.8.1.D	3.2.1.1.2.3.G
CRD	I.3.3.6.2.A	3.2.1.1.2.4.B.1
CRD	I.3.3.6.2.B	3.2.1.1.2.4.B.2
CRD	I.3.3.6.2.C	3.2.1.1.2.4.B.3
CRD	I.3.3.6.2.D	3.2.1.1.2.4.B.4
CRD	I.3.3.6.5.B	3.2.1.1.2.4.C
CRD	I.3.2.6	3.2.1.1.2.7.A
CRD	I.3.3.3.F	3.2.1.1.2.8.A
CRD	I.3.5.2	3.2.1.1.3.2.A
CRD	I.3.3.9	3.2.1.1.3.2.B
CRD	I.3.3.8.2	3.2.1.1.3.2.D
CRD	I.3.4.1.A	3.2.1.1.3.3.C
CRD	I.3.6.2.1.B	3.2.1.1.3.4.A
CRD	I.3.2.3.1.A	3.2.1.2.1.1.A
CRD	I.3.2.3.1.A	3.2.1.2.1.1.D
CRD	I.3.2.3.1.B	3.2.1.2.1.1.G
CRD	I.3.2.3.1.A	3.2.1.2.1.1.H
CRD	I.3.2.3.1.A	3.2.1.2.1.1.J
CRD	I.3.2.3.1.A	3.2.1.2.1.2.A
CRD	I.3.2.3.1.A	3.2.1.2.1.2.B
CRD	I.3.2.3.1.A	3.2.1.2.1.2.D
CRD	I.3.7.2.1.B.1.2.A	3.3.1.A
CRD	I.3.7.2.1.B.1.3.A	3.3.1.B
CRD	I.3.7.2.1.B.2.1.A	3.3.1.C
CRD	I.3.7.2.1.B.2.4.A	3.3.1.D
CRD	I.3.7.2.2.B.1.5.A	3.4.1.1.C
CRD	I.3.7.2.2.B.2.1.A	3.4.2.1.1.A
CRD	I.3.7.2.2.B.1.4.A	3.4.2.1.1.A
CRD	I.3.7.2.2.B.2.1.A	3.4.2.1.1.A
CRD	I.3.7.2.2.D.1.F	3.4.2.1.1.A
CRD	I.3.7.2.2.B.2.1.A	3.4.2.1.1.B
CRD	I.3.7.2.2.D.1.F	3.4.2.1.1.B
CRD	I.3.7.2.2.B.2.1.A	3.4.2.1.1.B
CRD	I.3.2.5	3.4.2.1.1.C
CRD	I.3.2.1.1.3.A	3.4.2.1.2.A
CRD	I.3.2.1.1.2.A	3.4.2.1.2.A
CRD	I.3.3.6.5.B	3.4.2.1.2.E

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
CRD	I.3.3.6.5.B	3.4.2.1.2.F
CRD	I.3.7.2.2.D.1.F	3.4.2.1.2.G
CRD	I.3.7.2.2.B.2.1.A	3.4.2.1.2.I
CRD	I.3.7.2.2.D.1.F	3.4.2.1.2.I
CRD	I.3.7.2.2.B.2.1.A	3.4.2.1.2.I
CRD	I.3.2.5	3.4.2.1.2.J
CRD	I.3.7.2.2.B.1.4.B	3.4.2.2.1.A
CRD	I.3.7.2.2.B.1.6.A	3.4.2.2.1.A
CRD	I.3.7.2.2.D.1.F	3.4.2.3.1.A
CRD	I.3.7.2.2.D.1.F	3.4.2.3.1.D
CRD	I.3.7.2.2.B.1.6.C	3.4.2.3.1.F
CRD	I.3.3.9	3.4.2.4.1.A
CRD	I.3.7.2.2.B.1.4.A	3.4.2.4.1.B
CRD	I.3.7.2.2.B.1.5.A	3.4.2.4.1.C
CRD	I.3.7.2.2.D.1.F	3.4.2.4.1.D
CRD	I.3.7.2.2.B.1.4.A	3.4.2.5.1.C
CRD	I.3.7.2.2.B.1.4.A	3.4.2.5.1.D
CRD	I.3.7.2.2.D.1.F	3.4.2.5.1.E
CRD	I.3.7.2.2.D.1.F	3.4.2.5.1.F
CRD	I.3.7.2.2.D.1.F	3.4.2.5.1.G
CRD	I.3.2.1.1.2.A	3.4.2.5.1.H
CRD	I.3.7.2.2.D.1.F	3.4.2.5.1.J
CRD	I.3.7.2.2.D.1.F	3.4.2.5.1.K
CRD	I.3.5.3.1	3.4.2.6.1.D
CRD	I.3.5.4	3.4.2.6.1.F
CRD	I.3.5.3.1	3.4.2.6.1.G
CRD	I.3.7.2.2.D.1.F	3.4.2.6.1.H
CRD	I.3.2.1.1.2.A	3.4.2.6.1.I
CRD	I.3.5.3.1	3.4.2.6.1.K
CRD	I.3.7.2.2.B.1.6.A	3.4.2.7.1.A
CRD	I.3.3.10.A	3.4.2.7.1.B
CRD	I.3.7.2.2.B.1.6.A	3.4.2.7.1.C
CRD	I.3.7.2.2.B.1.6.A	3.4.2.7.1.D
CRD	I.3.7.2.2.B.1.6.C	3.4.2.7.1.G
CRD	I.3.7.2.2.B.1.6.C	3.4.2.7.1.H
CRD	I.3.7.2.2.B.1.6.C	3.4.2.7.1.P
CRD	I.3.7.2.2.B.1.6.C	3.4.2.7.1.Q
CRD	I.3.2.5	3.4.2.7.1.R
CRD	I.3.7.2.2.B.1.4.A	3.4.2.8.1.A
CRD	I.3.7.2.2.D.1.F	3.4.2.8.1.B

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
CRD	I.3.7.2.2.B.1.4.A	3.4.2.8.1.C
CRD	I.3.7.2.2.D.1.F	3.4.2.10.1.A
CRD	I.3.7.2.2.D.1.F	3.4.2.10.1.B
CRD	I.3.7.2.2.B.1.3.B	3.4.4.1.C
CRD	I.3.7.2.2.D.1.F	3.4.4.1.E
CRD	I.3.7.2.2.D.1.F	3.4.4.1.G
CRD	I.3.7.2.2.B.1.3.B	3.4.4.1.L
CRD	I.3.7.2.2.B.2.1.A	3.4.5.1.1.A
CRD	I.3.7.2.2.B.1.6.A	3.4.5.1.1.A
CRD	I.3.7.2.2.B.2.1.A	3.4.5.1.1.A
CRD	I.3.7.2.2.B.1.3.A	3.4.5.1.1.B
CRD	I.3.7.2.2.D.1.F	3.4.5.1.1.B
CRD	I.3.2.1.1.2.A	3.4.5.1.2.A
CRD	I.3.7.2.2.D.1.F	3.4.5.1.2.B
CRD	I.3.7.2.2.B.1.6.A	3.4.5.1.2.C
CRD	I.3.7.2.2.B.2.1.A	3.4.5.1.2.D
CRD	I.3.7.2.2.D.1.F	3.4.5.1.2.D
CRD	I.3.7.2.2.B.2.1.A	3.4.5.1.2.D
CRD	I.3.7.2.2.B.1.4.A	3.4.5.1.2.E
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.A
CRD	I.3.7.2.2.B.1.4.A	3.4.5.2.1.B
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.C
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.F
CRD	I.3.7.2.2.B.1.4.A	3.4.5.2.1.G
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.H
CRD	I.3.3.9	3.4.5.2.1.I
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.J
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.M
CRD	I.3.7.2.2.B.1.4.B	3.4.5.2.1.O
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.Q
CRD	I.3.7.2.3.B.1.2.C	3.4.5.2.1.T
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.T
CRD	I.3.7.2.3.B.1.2.C	3.4.5.2.1.U
CRD	I.3.7.2.2.B.1.6.A	3.4.5.2.1.U
CRD	I.3.2.3.1.A	3.4.5.2.1.X
CRD	I.3.3.6.5.B	3.4.5.3.1.B
CRD	I.3.3.6.5.B	3.4.5.3.1.C
CRD	I.3.7.2.2.B.1.6.A	3.4.5.3.1.I
CRD	I.3.7.2.2.D.1.F	3.4.5.3.1.J
CRD	I.3.7.2.2.D.1.F	3.4.5.3.1.K

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
CRD	I.3.7.2.2.B.1.6.A	3.4.5.3.1.L
CRD	I.3.7.2.2.B.1.6.A	3.4.5.3.1.N
CRD	I.3.7.2.3.B.1.2.D	3.4.5.4.1.C
CRD	I.3.7.2.2.D.1.F	3.4.5.4.1.C
CRD	I.3.7.2.2.B.1.5.A	3.4.5.4.1.D
CRD	I.3.7.2.2.D.1.F	3.4.5.4.1.F
CRD	I.3.3.8.1.D	3.4.5.5.1.A
CRD	I.3.7.2.2.B.1.6.A	3.4.5.5.1.F
CRD	I.3.7.2.2.B.1.4.A	3.4.5.5.1.K
CRD	I.3.7.2.2.B.1.6.B	3.4.5.6.1.A
CRD	I.3.7.2.2.B.1.6.B	3.4.5.6.1.B
CRD	I.3.7.2.2.B.1.6.B	3.4.5.6.1.C
CRD	I.3.7.2.2.B.1.4.A	3.4.5.7.1.A
CRD	I.3.7.2.2.B.1.6.A	3.4.5.7.1.B
CRD	I.3.7.2.2.B.1.4.A	3.4.5.7.1.C
CRD	I.3.7.2.2.B.1.6.A	3.4.5.7.1.D
CRD	I.3.7.2.2.B.1.4.B	3.4.6.2.1.A
CRD	I.3.7.2.2.B.1.4.B	3.4.6.3.1.A
CRD	I.3.7.2.2.B.1.6.C	3.4.6.3.1.C
CRD	I.3.3.11.B	3.4.6.3.1.F
CRD	I.3.7.2.3.B.2.4.A	3.5.1.1.A
CRD	I.3.7.2.3.B.1.2.A	3.5.1.1.A
CRD	I.3.7.2.3.B.1.2.A	3.5.1.2.A
CRD	I.3.7.2.3.B.2.2.A	3.5.2.1.A
CRD	I.3.7.2.3.B.2.4.B	3.5.7.1.A
CRD	I.3.7.2.3.B.1.2.B	3.5.7.1.B
CRD	I.3.7.2.3.B.1.2.B	3.5.7.1.C
CRD	I.3.7.2.3.B.1.4.A	3.5.7.1.F
CRD	I.3.7.2.3.B.1.2.B	3.5.7.1.G
CRD	I.3.7.2.3.B.1.2.B	3.5.9.1.A
CRD	I.3.7.2.3.B.1.2.B	3.5.9.1.B
CRD	I.3.7.2.3.B.1.2.B	3.5.9.1.C
CRD	I.3.7.2.3.B.1.2.B	3.5.9.1.D
CRD	I.3.7.2.3.B.1.2.B	3.5.9.1.E
CRD	I.3.7.2.3.B.1.2.B	3.5.9.1.F
CRD	I.3.7.2.3.B.1.4.A	3.5.9.1.G
CRD	I.3.7.2.3.B.1.2.A	3.5.10.1.A
CRD	I.3.7.2.3.B.1.2.A	3.5.10.1.B
CRD	I.3.7.2.6.B.1.4.A	3.6.2.1.A.1
CRD	I.3.7.2.2.B.1.4.A	3.6.2.1.A.1

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
CRD	I.3.7.2.2.B.1.4.A	3.6.2.1.A.2
CRD	I.3.7.2.6.B.1.4.A	3.6.2.1.A.2
CRD	I.3.7.2.4.B.1.3.A	3.6.2.1.B
CRD	I.3.7.2.4.B.1.2.A	3.6.2.1.B
CRD	I.3.7.2.4.B.1.6.A	3.6.2.1.B
CRD	I.3.7.2.4.B.1.6.A	3.6.2.1.C
CRD	I.3.7.2.4.B.1.2.A	3.6.2.1.C
CRD	I.3.7.2.4.B.1.2.A	3.6.2.1.D
CRD	I.3.7.2.4.B.1.6.A	3.6.2.1.D
CRD	I.3.7.2.4.B.2.2.A	3.6.2.1.G
CRD	I.3.7.2.4.B.1.5.A	3.6.2.1.G
CRD	I.3.7.2.4.B.2.1.A	3.6.2.1.K
CRD	I.3.7.2.5.B.2.2.B	3.7.2.1.2.B
CRD	I.3.4.6.A	3.7.2.1.2.C
CRD	I.3.7.2.5.B.2.2.A	3.7.2.3.1.E
CRD	I.3.7.2.5.B.2.2.E	3.7.2.3.1.E
CRD	I.3.7.2.5.B.2.3.D	3.7.2.3.1.E
CRD	I.3.7.2.5.B.2.3.A	3.7.2.3.1.E
CRD	I.3.7.2.5.B.2.3.B	3.7.2.3.1.E
CRD	I.3.7.2.5.B.1.4.A	3.7.2.5.1.C
CRD	I.3.7.2.5.B.2.2.E	3.7.2.6.1.D
CRD	I.3.7.2.4.B.1.5.A	3.7.2.6.1.E
CRD	I.3.7.2.5.B.1.4.A	3.7.3.1.A
CRD	I.3.7.2.5.B.2.2.E	3.7.3.1.L
CRD	I.3.7.2.6.B.1.5.A	3.8.1.2.C
CRD	I.3.7.2.6.B.1.5.A	3.8.2.1.1.A
CRD	I.3.7.2.6.B.1.4.A	3.8.2.1.2.E
CRD	I.3.7.2.6.B.1.5.A	3.8.2.1.2.E
CRD	I.3.7.2.6.B.1.2.A	3.8.2.1.2.F
CRD	I.3.7.2.6.B.1.4.B	3.8.2.1.2.F
CRD	I.3.7.2.6.B.1.4.A	3.8.2.1.2.G
CRD	I.3.7.2.6.B.1.4.B	3.8.2.1.2.G
CRD	I.3.7.2.6.B.1.5.A	3.8.2.2.1.H
CRD	I.3.7.2.6.B.1.5.A	3.8.2.2.1.I
CRD	I.3.7.2.6.B.1.5.A	3.8.2.2.1.J
CRD	I.3.7.2.6.B.1.5.A	3.8.2.2.1.K
CRD	I.3.7.2.6.B.1.5.A	3.8.2.2.1.L
CRD	I.3.7.2.6.B.1.5.A	3.8.2.2.1.M
CRD	I.3.7.2.6.B.1.4.A	3.8.2.2.1.P
CRD	I.3.7.2.6.B.1.5.A	3.8.2.3.1.A

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
CRD	I.3.7.2.6.B.1.4.A	3.8.2.3.1.J
CRD	I.3.7.2.6.B.1.5.A	3.8.2.3.2.A
CRD	I.3.7.2.6.B.1.5.A	3.8.2.3.2.B
CRD	I.3.7.2.6.B.1.5.A	3.8.2.3.2.C
CRD	I.3.2.1.1.3.A	3.8.2.4.1.A
CRD	I.3.2.1.1.3.A	3.8.2.4.1.B
CRD	I.3.3.6.6.B	3.8.2.4.1.D
CRD	I.3.2.1.1.3.A	3.8.2.4.1.E
CRD	I.3.2.1.1.2.A	3.8.2.5.1.F
CRD	I.3.3.11.B	3.8.2.5.1.O
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.1.A
CRD	I.3.7.2.2.B.1.6.B	3.8.2.7.1.A
CRD	I.3.7.2.6.B.1.3.B	3.8.2.7.1.A
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.1.E
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.1.H
CRD	I.3.2.3.1.A	3.8.2.7.1.H
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.1.I
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.1.J
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.1.K
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.1.L
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.1.M
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.2.A
CRD	I.3.7.2.6.B.1.5.A	3.8.2.7.2.C
CRD	I.3.7.2.2.B.1.6.A	3.8.2.8.1.A
CRD	I.3.7.2.6.B.1.5.A	3.8.2.8.1.B
CRD	I.3.7.2.6.B.1.5.A	3.8.2.8.1.C
CRD	I.3.7.2.6.B.1.5.A	3.8.2.8.1.D
CRD	I.3.3.11.B	3.8.2.8.1.D
CRD	I.3.2.1.1.1.B	3.8.2.10.1.B
CRD	I.3.2.1.1.1.B	3.8.2.10.1.C
CRD	I.3.7.2.4.B.1.6.A	3.8.2.11.1.A
CRD	I.3.7.2.6.B.1.5.A	3.8.2.11.1.B
CRD	I.3.7.2.6.B.1.5.A	3.8.2.11.1.C
CRD	I.3.7.2.6.B.1.5.A	3.8.2.11.1.D
CRD	I.3.7.2.6.B.1.5.A	3.8.2.11.1.E
CRD	I.3.7.2.6.B.1.5.A	3.8.2.12.1.B
CRD	I.3.7.2.6.B.1.5.A	3.8.2.12.1.D
CRD	I.3.7.2.6.B.1.5.A	3.8.4.1.2.B
CRD	I.3.7.2.6.B.1.5.A	3.8.4.1.2.C
CRD	I.3.7.2.6.B.1.3.A	3.8.4.2.1.A

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
CRD	I.3.7.2.6.B.1.3.A	3.8.4.2.1.B
CRD	I.3.7.2.6.B.1.5.A	3.8.4.2.1.D
CRD	I.3.7.2.6.B.1.5.A	3.8.4.2.1.E
CRD	I.3.7.2.6.B.1.5.A	3.8.4.2.1.F
CRD	I.3.7.2.6.B.1.5.A	3.8.4.2.1.G
CRD	I.3.7.2.6.B.1.5.A	3.8.4.2.1.J
CRD	I.3.7.2.6.B.1.5.A	3.8.4.3.1.D
CRD	I.3.7.2.6.B.1.5.A	3.8.4.3.1.E
CRD	I.3.7.2.6.B.1.5.A	3.8.4.3.1.F
CRD	I.3.7.2.6.B.1.5.A	3.8.4.3.1.G
CRD	I.3.7.2.6.B.1.5.A	3.8.4.4.1.B
CRD 3.2.5.4.A	I.3.2.2.4.B	3.2.1.2.2.B
CRD 3.5.1.1.A	I.3.5.1.A.1.b	3.2.1.1.2.3.E
CRD 3.5.1.1.A	I.3.5.1.A.1.b	3.2.1.1.2.3.E
CRD Appendix A	I.3.2.2.4.B	3.2.1.2.2.B
DOD-HDBK-743A	I.3.3.7.2	3.2.1.1.2.5.B
DOE 4330.4A	I.3.3.12.ab	3.2.1.1.3.1.D
DOE 4330.4A	I.3.3.12.ab	3.2.1.1.3.4.A
DOE 4330.4A, I, 3.1.4	I.3.6.2.1.A	3.2.1.1.3.4.A
DOE 4330.4A, I, 3.5	I.3.5.1.A.1.d	3.2.1.1.3.1.D
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.b	3.2.1.1.2.3.B.2
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.c	3.2.1.1.2.3.B.3
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.d	3.2.1.1.2.3.B.4
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.e	3.2.1.1.2.3.B.5
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.f	3.2.1.1.2.3.B.6
DOE 4700.1 Ch V Pt A.2.q	I.3.5.1.A	3.2.1.1.3.1.A
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.B	3.2.1.1.3.1.B
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.c	3.8.2.1.2.B
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.d	3.8.2.1.2.B
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.b	3.8.2.1.2.B
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.d	3.8.2.1.2.C
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.c	3.8.2.1.2.C
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.b	3.8.2.1.2.C
DOE 4700.1 Ch V Pt A.2.q	I.3.2.2.3.C.1.b	3.8.2.7.1.I
DOE 4700.1 Ch V Pt A.2.q	I.3.5.1.A	3.8.2.12.1.A
DOE 5480.4	I.3.3.12.ad	3.8.2.10.1.B
DOE 5480.4	I.3.3.12.ad	3.8.2.10.1.C
DOE 5480.4, Att. 2, 2.e.(8)(a)	I.3.2.1.1.1.B	3.8.2.10.1.B
DOE 5480.4, Att. 2, 2.e.(8)(a)	I.3.2.1.1.1.B	3.8.2.10.1.C
DOE 5480.7A	I.3.3.12.ae	3.2.1.2.4.D

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
DOE 6430.1A	I.3.3.12.af	3.2.1.2.4.C
DOE 6430.1A	I.3.7.2.1.D.2.B	3.3.1.AC
DOE 6430.1A	I.3.7.2.1.D.2.A	3.3.1.AD
DOE 6430.1A	I.3.2.7.1	3.4.1.1.A
DOE 6430.1A	I.3.2.7.1	3.4.1.1.D
DOE 6430.1A	I.3.2.7.2	3.4.1.1.E
DOE 6430.1A	I.3.2.3.2.1.A	3.4.2.1.2.B
DOE 6430.1A	I.3.7.2.2.D.1.C	3.4.2.3.1.E
DOE 6430.1A	I.3.2.7.3	3.4.2.9.1.A
DOE 6430.1A	I.3.7.2.2.D.1.C	3.4.3.1.A
DOE 6430.1A	I.3.7.2.2.D.1.C	3.4.3.1.D
DOE 6430.1A	I.3.3.1.A	3.4.4.1.M
DOE 6430.1A	I.3.3.1.A	3.4.4.1.M
DOE 6430.1A	I.3.3.1.B	3.4.4.1.M
DOE 6430.1A	I.3.7.2.2.D.1.C	3.4.5.3.1.A
DOE 6430.1A	I.3.2.3.2.1.B	3.4.5.3.1.N
DOE 6430.1A	I.3.3.12.af	3.4.5.5.1.L
DOE 6430.1A	I.3.3.1.B	3.5.2.1.H
DOE 6430.1A	I.3.3.1.A	3.5.2.1.H
DOE 6430.1A	I.3.3.1.A	3.5.2.1.H
DOE 6430.1A	I.3.3.1.B	3.7.2.1.1.D
DOE 6430.1A	I.3.3.1.A	3.7.2.1.1.D
DOE 6430.1A	I.3.3.1.A	3.7.2.1.1.D
DOE 6430.1A	I.3.3.12.af	3.8.2.1.2.B
DOE 6430.1A	I.3.3.12.af	3.8.2.1.2.C
DOE 6430.1A	I.3.3.12.af	3.8.2.1.2.D
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.A
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.B
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.C
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.D
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.E
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.F
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.G
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.H
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.I
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.J
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.K
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.L
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.M
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.N

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.O
DOE 6430.1A	I.3.3.12.af	3.8.2.2.1.P
DOE 6430.1A	I.3.3.12.af	3.8.2.4.1.C
DOE 6430.1A	I.3.3.12.af	3.8.2.6.1.F
DOE 6430.1A	I.3.2.3.2.1.B	3.8.2.6.1.F
DOE 6430.1A	I.3.2.3.2.1.B	3.8.2.9.1.B
DOE 6430.1A	I.3.2.3.2.1.B	3.8.2.9.1.D
DOE 6430.1A, 0110-99.04	I.3.2.2.3.C.1.a	3.2.1.1.2.3.B.1
DOE 6430.1A, 0110-99.04	I.3.2.2.3.C.1.a	3.8.2.1.2.B
DOE 6430.1A, 0110-99.04	I.3.2.2.3.C.1.a	3.8.2.1.2.C
DOE 6430.1A, 0111-2.3.2	I.3.2.3.1.J	3.2.1.2.1.1.E
DOE 6430.1A, 0111-2.3.2	I.3.2.3.1.J	3.2.1.2.1.1.G
DOE 6430.1A, 0111-2.8.1	I.3.2.3.2.3	3.6.4.2.1.D
DOE 6430.1A, 0111-2.8.4	I.3.2.3.1.I	3.2.1.2.1.1.F
DOE 6430.1A, 0111-2.8.4	I.3.2.3.1.I	3.2.1.2.1.2.C
DOE 6430.1A, 0111-99.0.2	I.3.2.3.1.C	3.2.1.2.1.1.C
DOE 6430.1A, 0111-99.0.2	I.3.2.3.1.C	3.2.1.2.1.1.C
DOE 6430.1A, 0111-99.0.2	I.3.2.3.1.C	3.2.1.2.1.1.C
DOE 6430.1A, 0111-99.0.2	I.3.2.3.1.C	3.2.1.2.1.1.C
DOE 6430.1A, 0111-99.0.2	I.3.2.3.1.C	3.2.1.2.1.1.C
DOE 6430.1A, 0111-99.0.2	I.3.2.3.1.C	3.2.1.2.1.1.C
DOE 6430.1A, 0111-99.0.3	I.3.2.3.1.F	3.2.1.2.1.1.I
DOE 6430.1A, 0111-99.0.3	I.3.2.3.1.F	3.4.5.7.1.E
DOE 6430.1A, 0111-99.0.3	I.3.2.3.1.F	3.5.1.2.B
DOE 6430.1A, 0200-99.8.1	I.3.3.2.A	3.4.5.2.1.D
DOE 6430.1A, 0200-99.8.1	I.3.3.2.A	3.4.5.5.1.D
DOE 6430.1A, 0200-99.8.1	I.3.3.2.A	3.6.2.1.P
DOE 6430.1A, 0200-99.8.1	I.3.3.2.A	3.8.2.2.1.B
DOE 6430.1A, 1300-12.4.11	I.3.3.3.B	3.2.1.1.2.8.A
DOE 6430.1A, 1300-12.4.11	I.3.3.3.A	3.2.1.1.2.8.A
DOE 6430.1A, 1300-12.4.11	I.3.3.3.C	3.2.1.1.2.8.A
DOE 6430.1A, 1300-12.4.11	I.3.3.3.D	3.2.1.1.2.8.A
DOE 6430.1A, 1300-12.4.11	I.3.3.3.E	3.2.1.1.2.8.A
DOE 6430.1A, 1300-12.4.5	I.3.3.6.4.A	3.4.2.7.1.A
DOE 6430.1A, 1300-13	I.3.3.7.5.B	3.2.1.1.2.5.F
DOE 6430.1A, 1300-3.5	I.3.2.2.3.C.1.a	3.2.1.1.2.3.B.1
DOE 6430.1A, 1300-3.5	I.3.2.2.3.C.1.a	3.8.2.1.2.B
DOE 6430.1A, 1300-3.5	I.3.2.2.3.C.1.a	3.8.2.1.2.C
DOE 6430.1A, 1655-99.8	I.3.3.2.B	3.4.5.5.1.D
DOE/RW-0214	I.3.5.3.2.C	3.4.2.6.1.C

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
DOE/RW-0214	I.3.5.3.2.C	3.4.2.6.1.E
DOE/RW-0214	I.3.5.3.2.C	3.4.2.6.1.J
DOE/RW-0333P	I.3.9	3.2.1.1.1.A
DOE/RW-0333P	I.3.4.3	3.2.1.1.3.3.A
DOE/RW-0333P	I.3.4.3	3.2.1.1.3.3.B
DOE/RW-0333P	I.3.4.2	3.4.5.3.1.M
DOE/RW-0333P	I.3.4.5	3.7.2.1.2.C
Executive Order 11988	I.3.3.11.A.u	3.3.1.Z
Executive Order 11988	I.3.3.11.A.u	3.4.4.1.J
Executive Order 11988	I.3.3.11.A.u	3.5.2.1.F
Executive Order 11988	I.3.3.11.A.u	3.5.4.1.E
Executive Order 11988	I.3.3.11.A.u	3.5.6.1.C
Executive Order 11988	I.3.3.11.A.u	3.5.10.1.D
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.1	3.3.1.Z
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.2	3.3.1.Z
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.1	3.4.3.1.C
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.1	3.4.4.1.J
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.2	3.4.4.1.J
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.1	3.5.2.1.F
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.2	3.5.2.1.F
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.2	3.5.4.1.E
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.1	3.5.4.1.E
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.2	3.5.6.1.C
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.1	3.5.6.1.C
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.1	3.5.10.1.D
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.2	3.5.10.1.D
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.2	3.7.2.2.1.B
Executive Order 11988, Section 2(b)	I.3.2.3.1.G.2	3.7.2.6.1.A
MGDS RD 3.2.5.2.3	I.3.2.2.3.D.1	3.2.1.1.3.2.C
MGDS RD 3.2.5.2.4.A	I.3.2.2.3.E.1	3.2.1.1.2.3.B.3
MGDS RD 3.2.5.2.4.A	I.3.2.2.3.E.1	3.2.1.1.2.3.B.4
MGDS RD 3.2.5.2.4.B	I.3.2.2.3.E.2	3.2.1.1.3.1.C
MGDS RD 3.2.5.2.9	I.3.2.2.3.D	3.2.1.1.2.3.C
MGDS RD 3.2.6.1.D	I.3.2.3.1.E	3.2.1.2.1.1.B
MGDS RD 3.3.6.7.C	I.3.3.6.6.C	3.4.2.1.2.L
MGDS RD 3.3.6.7.C	I.3.3.6.6.C	3.8.2.4.1.C
MGDS RD 3.5.1.1.1.A	I.3.5.1.A.1.a	3.2.1.1.2.3.D
MGDS RD 3.5.1.1.3	I.3.5.1.1	3.2.1.1.3.2.A
MGDS RD 3.5.1.4.A	I.3.5.1.2.A	3.2.1.1.2.3.H
MGDS RD 3.5.1.5	I.3.5.1.A.2	3.4.1.1.B

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
MGDS RD 3.5.3.2.A	I.3.5.3.2.A	3.4.2.6.1.L
MGDS RD 3.5.3.2.B	I.3.5.3.2.B	3.4.2.6.1.M
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.2.1.1.1.C.2
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.2.1.1.2.4.A
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.2.1.1.2.4.G
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.2.1.1.2.4.H
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.2.1.1.2.4.I
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.2.1.2.1.1.B
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.4.2.5.1.B
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.4.5.2.1.X
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.7.2.2.1.A
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.7.2.3.1.A
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.7.2.3.1.B
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.7.2.3.1.C
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.7.2.4.1.D
MGDS RD 3.7.1.3.B.3	I.3.3.12	3.7.2.6.1.C
MIL-STD-1472D Section 5.10	I.3.3.7.3	3.2.1.1.2.5.C
MIL-STD-1472D Section 5.12	I.3.3.7.4	3.2.1.1.2.5.D
MIL-STD-1472D Section 5.13.1	I.3.3.6.5.A	3.2.1.1.2.4.C
MIL-STD-1472D Section 5.13.1	I.3.3.6.5.A	3.6.4.2.1.G
MIL-STD-1472D Section 5.13.4	I.3.3.6.5.C	3.2.1.1.2.4.C
MIL-STD-1472D Section 5.13.4	I.3.3.6.5.C	3.2.1.1.2.4.D
MIL-STD-1472D Section 5.3.10	I.3.3.7.12	3.4.5.5.1.B
MIL-STD-1472D Section 5.3.10	I.3.3.7.12	3.4.5.5.1.C
MIL-STD-1472D Section 5.3.10	I.3.3.7.12	3.4.5.5.1.E
MIL-STD-1472D Section 5.3.10	I.3.3.7.12	3.4.5.5.1.H
MIL-STD-1472D Section 5.3.10	I.3.3.7.12	3.4.5.5.1.J
MIL-STD-1472D Section 5.6.3.2	I.3.3.7.2	3.2.1.1.2.5.B
MIL-STD-1472D, Section 5.8.1	I.3.2.1.1.2.A	3.4.2.1.2.A
MIL-STD-1472D, Section 5.8.1	I.3.2.1.1.2.A	3.4.2.5.1.H
MIL-STD-1472D, Section 5.8.1	I.3.2.1.1.2.A	3.4.2.6.1.I
MIL-STD-1472D, Section 5.8.1	I.3.2.1.1.2.A	3.4.5.1.2.A
MIL-STD-1472D, Section 5.8.1	I.3.2.1.1.2.A	3.8.2.5.1.F
MIL-STD-882B	I.3.2.2.2.A	3.2.1.1.2.1.C
MIL-STD-882B	I.3.2.2.2.A	3.2.1.1.2.1.C.1
MIL-STD-882B	I.3.2.2.2.A	3.2.1.1.2.1.C.2
MIL-STD-882B	I.3.2.2.2.A	3.2.1.1.2.1.C.3
NAC 444.750-840	I.3.3.11.A.v	3.4.5.4.1.H
NAC 444.750-840	I.3.3.11.A.v	3.4.5.4.1.K
NAC 445.070-4278	I.3.3.11.A.w	3.3.1.AA

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
NAC 445.070-4278	I.3.3.11.A.w	3.4.3.1.G
NAC 445.070-4278	I.3.3.11.A.w	3.4.5.2.1.AA
NAC 445.070-4278	I.3.3.11.A.w	3.4.5.4.1.H
NAC 445.070-4278	I.3.3.11.A.w	3.4.5.4.1.I
NAC 445.070-4278	I.3.3.11.A.w	3.4.5.6.1.F
NAC 445.070-4278	I.3.3.11.A.w	3.5.3.1.E
NRS 445.131-399	I.3.3.11.A.w	3.3.1.AA
NRS 445.131-399	I.3.3.11.A.w	3.4.3.1.G
NRS 445.131-399	I.3.3.11.A.w	3.4.5.2.1.AA
NRS 445.131-399	I.3.3.11.A.w	3.4.5.4.1.H
NRS 445.131-399	I.3.3.11.A.w	3.4.5.4.1.I
NRS 445.131-399	I.3.3.11.A.w	3.4.5.6.1.F
NRS 445.131-399	I.3.3.11.A.w	3.5.3.1.E
NRS 533.325	I.3.3.11.A.x	3.4.5.3.1.R
NUREG 0700, Section 6.1.5	I.3.2.1.1.1.A	3.2.1.1.2.6.A
NUREG 0700, Section 6.1.5	I.3.2.1.1.2.A	3.4.2.1.2.A
NUREG 0700, Section 6.1.5	I.3.2.1.1.3.A	3.4.2.1.2.A
NUREG 0700, Section 6.1.5	I.3.2.1.1.1.A	3.4.2.1.2.H
NUREG 0700, Section 6.1.5	I.3.2.1.1.2.A	3.4.2.5.1.H
NUREG 0700, Section 6.1.5	I.3.2.1.1.2.A	3.4.2.6.1.I
NUREG 0700, Section 6.1.5	I.3.2.1.1.2.A	3.4.5.1.2.A
NUREG 0700, Section 6.1.5	I.3.2.1.1.3.A	3.8.2.4.1.A
NUREG 0700, Section 6.1.5	I.3.2.1.1.3.A	3.8.2.4.1.B
NUREG 0700, Section 6.1.5	I.3.2.1.1.3.A	3.8.2.4.1.E
NUREG 0700, Section 6.1.5	I.3.2.1.1.2.A	3.8.2.5.1.F
NUREG-0700 Section 6.1	I.3.3.7.13	3.4.2.1.2.H
NUREG-0700 Section 6.1.4	I.3.3.6.4.A	3.4.2.7.1.A
NUREG-0700 Section 6.1.5.4.c	I.3.3.6.6.C	3.4.2.1.2.L
NUREG-0700 Section 6.1.5.4.c	I.3.3.6.6.C	3.8.2.4.1.C
NUREG-0700 Section 6.2 and 6.3	I.3.3.7.11	3.4.5.5.1.F
NUREG-0700 Section 6.2 and 6.3	I.3.3.7.11	3.4.5.5.1.I
NUREG-0700 Section 6.2 and 6.3	I.3.3.7.11	3.4.6.3.1.D
NUREG-0700 Section 6.2 and 6.3	I.3.3.7.11	3.4.6.3.1.E
NUREG-0700 Section 6.2 and 6.3	I.3.3.7.11	3.4.6.3.1.G
NUREG-0700 Section 6.2.1	I.3.3.7.12	3.4.5.5.1.B
NUREG-0700 Section 6.2.1	I.3.3.7.12	3.4.5.5.1.C
NUREG-0700 Section 6.2.1	I.3.3.7.12	3.4.5.5.1.E
NUREG-0700 Section 6.2.1	I.3.3.7.12	3.4.5.5.1.H
NUREG-0700 Section 6.2.1	I.3.3.7.12	3.4.5.5.1.J
NUREG-0700 Section 6.4	I.3.3.7.8	3.2.1.1.2.5.C

Table 6-1 Requirements Cross-Reference List (continued)

SOURCE	SD&TRD	ESFDR
NUREG-0700 Section 6.5	I.3.3.7.9	3.2.1.1.2.5.C
NUREG-0700 Section 6.6.1	I.3.3.7.7	3.2.1.1.2.8.A
NUREG-0700 Section 6.9	I.3.3.7.10	3.2.1.1.2.5.C
NWPA 113(c)(1)	I.3.3.11.B	3.4.6.3.1.F
NWPA 113(c)(1)	I.3.3.11.B	3.8.2.5.1.O
NWPA 113(c)(1)	I.3.3.11.B	3.8.2.8.1.D
UCRL 15910	I.3.2.3.1.E	3.2.1.2.1.1.B
UCRL 15910	I.3.2.3.1.C	3.2.1.2.1.1.C
UCRL 15910	I.3.2.3.1.C	3.2.1.2.1.1.C
UCRL 53526	I.3.2.3.1.C	3.2.1.2.1.1.C
UCRL 53526	I.3.2.3.1.C	3.2.1.2.1.1.C

APPENDIX A

SEISMIC DESIGN BASIS LOADS FOR THE EXPLORATORY STUDIES FACILITY

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APPENDIX A

SEISMIC DESIGN BASIS LOADS FOR THE EXPLORATORY STUDIES FACILITY

ESF SEISMIC DESIGN BASIS

The following requirements apply to ESF seismic design:

ESF Temporary Items

Surface

- A.1 Seismic design of ESF temporary surface facilities shall conform to requirements specified in the Uniform Building Code for UBC Zone 3.

[DERIVED]

Subsurface

- A.2 For the seismic design of temporary ESF subsurface facilities, the peak ground acceleration shall be 0.3 g at the earth's surface. This acceleration is consistent with Zone 3 of the Uniform Building Code.

[DERIVED]

- A.3 The attenuation factors in Table A-1 may be applied to determine subsurface ground motions. Table A-2 is not TBV for ESF temporary applications.

[DERIVED]

ESF Permanent Items

Subsurface

- A.4 For the seismic design of permanent ESF subsurface items, ground motions shall correspond to a hazard exceedance level of 5×10^{-4} designated in Table A-2.

[DERIVED]

- A.5 The attenuation factors in Table A-1 may be applied to determine subsurface ground motions. Table A-1 is TBV* for permanent applications.

[DERIVED]

Table A-1. Depth Reduction Factors to be Applied to Ground Motions at the Earth's Surface

Depth Interval (m)	Reduction Factors for Peak Horizontal Acceleration	Reduction Factors for Peak Vertical Acceleration	Reduction Factors for Peak Horizontal Velocity	Reduction Factors for Peak Vertical Velocity
< 100	1.00	1.00	1.00	1.00
100 - 200	0.60	0.70	0.70	0.80
200 - 400	0.50	0.60	0.60	0.70
> 400	0.50	0.50	0.55	0.60

[¹TBV*]Table A-2. Ground Motions² at the Earth's Surface for Design of ESF Permanent Subsurface Items

Hazard Exceedance Level (annual probability of being exceeded)	Mean Peak Horizontal ³ Acceleration (g)	Mean Peak Horizontal ³ Velocity (cm/sec)
5×10^{-4}	0.37	23

[TBV*]

Table A-3. Potential Repository Peak Accelerations for ESF Design

Surface ³	Subsurface ^{3,4}
0.75g	0.4g

[TBV*]

Notes:

¹TBV* applies to ESF permanent items TBV does not apply to ESF temporary items.²Ground motions designated here are consistent with performance category 3 as defined in DOE-STD-1020-94.³Vertical components of acceleration and velocity are designated as equal to the horizontal components.⁴Applicable for all subsurface depths.

APPENDIX B

**FACILITY DESIGN REQUIREMENTS FOR EXPLORATORY
STUDIES FACILITY TESTING**

APPENDIX B

FACILITY DESIGN REQUIREMENTS FOR EXPLORATORY
STUDIES FACILITY TESTING

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APPENDIX B

FACILITY DESIGN REQUIREMENTS FOR EXPLORATORY
STUDIES FACILITY TESTING

B.1 INTRODUCTION

This appendix presents the test-related, underground design requirements for the Exploratory Studies Facility (ESF). These ESF test-related requirements for facility design were previously incorporated into the Subsystems Design Requirements Document as Appendices B and C. This Appendix B contains Design Requirements that are consistent with the current ESF configuration, construction methods, and program. The Underground Testing Program covered in this appendix (see Table B-1) is a flowdown of activities identified in the *Site Characterization Plan* (SCP), DOE/RW-0199, the *Civilian Radioactive Waste Management Program Plan*, DOE/RW-0458, and in preliminary ESF test planning. The testing information, as provided, is deemed adequate to initiate ESF Title II Design. However, in many instances, detailed test-related design information will need to be prepared for individual design packages.

The format and content of this revision differs significantly from the previous (Rev 1; July, 1994). For example:

- A. Changes have been made so that common facility design criteria are consistent with the currently planned ESF testing program. However, traceability to the original list of SCP Activities, presented and discussed in the SCP, has been maintained.
- B. Only those requirements that directly affect the Common Facility design have been retained. Other requirements have been reserved for incorporation in Test Planning.
- C. Explicit, detailed requirements (e.g., alcove size) have either been removed or replaced by a range. Consistent with current practice, detailed requirements will be provided to the ESF Architect/Engineer(A/E) as Design and Test-Related Information for individual design packages.
- D. Each of the cited requirements is based on information from the Principal Investigators (PIs) responsible for conducting the individual test; this ensures that requirements are for the current program authorized by DOE.
- E. The requirements presentation format has been changed so that it is more consistent with the format used in the main body of this *Exploratory Studies Facility Design Requirements* (ESFDR) document.

Table B-1 ESF Tests and Reference Information

SCP Activity - Test Name	SCP (1988) Page Number	SCP Reference Number	WBS Element	Study Plan	Study Plan Name	Lead Organization	Appendix B Section
Chloride and Chlorine 36 Measurements of Percolation at Yucca Mountain	8.3.1.2-180	8.3.1.2.2.2.1	1.2.3.3.1.2.2	8.3.1.2.2.2	Water Movement Tests	LANL	B-3 (Note 1)
Matrix Hydrological Properties Testing	8.3.1.2-183	8.3.1.2.2.3.1	1.2.3.3.1.2.3	8.3.1.2.2.3	Characterization of Percolation in the Unsaturated Zone - Surface Based Study	USGS	B-3 (Note 1)
Intact Fracture Test in the ESF	8.3.1.2-238	8.3.1.2.2.4.1	1.2.3.3.1.2.4	8.3.1.2.2.4	Characterization of YM Percolation in the Unsaturated Zone - ESF Investigation	USGS	B-3 (Note 1)
Percolation Tests in the ESF	8.3.1.2-252	8.3.1.2.2.4.2	1.2.3.3.1.2.4	8.3.1.2.2.4	Characterization of YM Percolation in the Unsaturated Zone - ESF Investigation	USGS	B-4
Bulk Permeability Test in the ESF	8.3.1.2-271	8.3.1.2.2.4.3	1.2.3.3.1.2.4	8.3.1.2.2.4	Characterization of YM Percolation in the Unsaturated Zone - ESF Investigation	USGS	B-5
Radial Borehole Tests in the ESF	8.3.1.2-281	8.3.1.2.2.4.4	1.2.3.3.1.2.4	8.3.1.2.2.4	Characterization of YM Percolation in the Unsaturated Zone - ESF Investigation	USGS	B-6
Excavation Effects Test in the ESF	8.3.1.2-293	8.3.1.2.2.4.5	1.2.3.3.1.2.4	8.3.1.2.2.4	Characterization of YM Percolation in the Unsaturated Zone - ESF Investigation	USGS	B-7
Perched Water Testing in the ESF	8.3.1.2-300	8.3.1.2.2.4.7	1.2.3.3.1.2.4	8.3.1.2.2.4	Characterization of YM Percolation in the Unsaturated Zone - ESF Investigation	USGS	B-8
Hydrochemistry Tests in the ESF	8.3.1.2-304	8.3.1.2.2.4.8	1.2.3.3.1.2.4	8.3.1.2.2.4	Characterization of YM Percolation in the Unsaturated Zone - ESF Investigation	USGS	B-9
Hydrologic Properties of Major Faults in the ESF	8.3.1.2-316	8.3.1.2.2.4.10	1.2.3.3.1.2.4	8.3.1.2.2.4	Characterization of YM Percolation in the Unsaturated Zone - ESF Investigation	USGS	B-10
Diffusion Tests in the ESF	8.3.1.2-320	8.3.1.2.2.5.1	1.2.3.3.1.2.5	8.3.1.2.2.5	Diffusion Tests in the ESF	LANL	B-11
Petrologic Stratigraphy of the Topopah Spring Member	8.3.1.3-43	8.3.1.3.2.1.1	1.2.3.2.1.1.1	8.3.1.3.2.1	Mineralogy, Petrology, and Chemistry of Transport Pathways	LANL	B-3 (Note 1)
Mineral Distribution Between Host Rock and Accessible Environment	8.3.1.3-45	8.3.1.3.2.1.2	1.2.3.2.1.1.1	8.3.1.3.2.1	Mineralogy, Petrology, and Chemistry of Transport Pathways	LANL	B-3 (Note 1)
Fracture Mineralogy	8.3.1.3-47	8.3.1.3.2.1.3	1.2.3.2.1.1.1	8.3.1.3.2.1	Mineralogy, Petrology, and Chemistry of Transport Pathways	LANL	B-3 (Note 1)
History of Mineralogic and Geochemical Alteration at Yucca Mountain	8.3.1.3-49	8.3.1.3.2.2.1	1.2.3.2.1.1.2	8.3.1.3.2.2	History of Mineralogic and Geochemical Alteration of Yucca Mountain	LANL	B-3 (Note 1)
Biological Sorption and Transport	8.3.1.3-80	8.3.1.3.4.2	1.2.3.4.1.2.2	8.3.1.3.4.2	Biological Sorption and Transport	LANL	B-3 (Note 1)

Table B-1 ESF Tests and Reference Information (continued)

SCP Activity - Test Name	SCP (1988) Page Number	SCP Reference Number	WBS Element	Study Plan	Study Plan Name	Lead Organization	Appendix B Section
Field Scale Experiments to Study Radionuclide Transport at Yucca Mountain	8.3.1.3-127	8.3.1.3.7.2.2	1.2.3.4.1.5.2	8.3.1.3.7.2	Demonstrate Applicable Laboratory Data to Repository Transport Calculations	LANL	B-12
Underground Geologic Mapping	8.3.1.4-74	8.3.1.4.2.2.4	1.2.3.2.2.1.2	8.3.1.4.2.2	Characterization of Structural Features in the Site Area	USGS	B-13
Seismic Tomography/Vertical Seismic Profiling at the ESF	8.3.1.4-79	8.3.1.4.2.2.5	1.2.3.2.2.1.2	8.3.1.4.2.2	Characterization of Structural Features in the Site Area	USGS	B-14
Studies of Calcite and Opaline Silica Vein Deposits	8.3.1.5-110	8.3.1.5.2.1.5	1.2.3.6.2.2.1	8.3.1.5.2.1	Characterization of Yucca Mountain Quaternary Regional hydrology	USGS	B-3 (Note 1)
Geochemical Assessment of Yucca Mountain in Relation to the Potential for Mineralization	8.3.1.9-30	8.3.1.9.2.1.1	1.2.3.7.2.1	8.3.1.9.2.1	Natural Resource Assessments of Yucca Mountain, Nye County, Nevada.	USGS	B-3 (Note 1)
Laboratory Tests (Thermal and Mechanical) Using Samples from the ESF						SNL	B-3 (Note 1)
Density and Porosity Characterization	8.3.1.15-31	8.3.1.15.1.1.1	1.2.3.2.7.1.1	8.3.1.15.1.1	Laboratory Thermal Properties		B-3 (Note 1)
Volumetric Heat Capacity Characterization	8.3.1.15-34	8.3.1.15.1.1.2	1.2.3.2.7.1.1	8.3.1.15.1.1	Laboratory Thermal Properties		B-3 (Note 1)
Thermal Conductivity Characterization	8.3.1.15-36	8.3.1.15.1.1.3	1.2.3.2.7.1.1	8.3.1.15.1.1	Laboratory Thermal Properties		B-3 (Note 1)
Thermal Expansion Characterization	8.3.1.15-38	8.3.1.15.1.2.1	1.2.3.2.7.1.2	8.3.1.15.1.2	Laboratory Thermal Expansion Testing		B-3 (Note 1)
Compressive Mechanical Properties of Intact Rock at Baseline Experiment Conditions	8.3.1.15-40	8.3.1.15.1.3.1	1.2.3.2.7.1.3	8.3.1.15.1.3	Laboratory Determination of Mechanical Properties of Intact Rock		B-3 (Note 1)
Effects of Variable Environmental Conditions on Mechanical Properties	8.3.1.15-41	8.3.1.15.1.3.2	1.2.3.2.7.1.3	8.3.1.15.1.3	Laboratory Determination of Mechanical Properties of Intact Rock		B-3 (Note 1)
Mechanical Properties of Fractures at Baseline Experiment Conditions	8.3.1.15-43	8.3.1.15.1.4.1	1.2.3.2.7.1.4	8.3.1.15.1.4	Laboratory Determination of Mechanical Properties of Fractures		B-3 (Note 1)
Effects of Variable Environmental Conditions on Mechanical Properties of Fractures	8.3.1.15-44	8.3.1.15.1.4.2	1.2.3.2.7.1.4	8.3.1.15.1.4	Laboratory Determination of Mechanical Properties of Fractures		B-3 (Note 1)
Access Convergence Measurements	8.3.1.15-45	8.3.1.15.1.5.1	1.2.3.2.7.3.1	8.3.1.15.1.5	Excavation Investigations	SNL	B-15

Table B-1 ESF Tests and Reference Information (continued)

SCP Activity - Test Name	SCP (1988) Page Number	SCP Reference Number	WBS Element	Study Plan	Study Plan Name	Lead Organization	Appendix B Section
Demonstration Breakout Room	8.3.1.15-48	8.3.1.15.1.5.2	1.2.3.2.7.3.1	8.3.1.15.1.5	Excavation Investigations	SNL	B-16
Sequential Drift Mining	8.3.1.15-49	8.3.1.15.1.5.3	1.2.3.2.7.3.1	8.3.1.15.1.5	Excavation Investigations	SNL	B-17
Single Element Heater Test	Note 3	8.3.1.15.1.6.1	1.2.3.2.7.3.2	8.3.1.15.1.6	In Situ Thermomechanical Properties	SNL/ LLNL/LBL	B-18
Emplacement Drift Thermal Test	Note 3	8.3.1.15.1.6.5	1.2.3.2.7.3.2	8.3.1.15.1.6	In Situ Thermomechanical Properties	LLNL/ SNL/LBL	B-19
Engineered Barrier System Field Tests	8.3.4.2-57	8.3.4.2.4.4.1 8.3.4.2.4.4.2	1.2.3.12.4	8.3.4.2.4.4	Engineered Barrier System Field Tests	LLNL	B-20
Plate Loading Tests	8.3.1.15-65	8.3.1.15.1.7.1	1.2.3.2.7.3.3	8.3.1.15.1.7	In Situ Mechanical Properties	SNL	B-21
Rock Mass Strength Experiment	8.3.1.15-68	8.3.1.15.1.7.2	1.2.3.2.7.3.3	8.3.1.15.1.7	In Situ Mechanical Properties	SNL	B-22
Evaluation of Mining Methods	8.3.1.15-71	8.3.1.15.1.8.1	1.2.3.2.7.3.4	8.3.1.15.1.8	In Situ Design Verification	SNL	B-23
Monitoring of Ground Support Systems	8.3.1.15-72	8.3.1.15.1.8.2	1.2.3.2.7.3.4	8.3.1.15.1.8	In Situ Design Verification	SNL	B-24
Monitoring Drift Stability	8.3.1.15-73	8.3.1.15.1.8.3	1.2.3.2.7.3.4	8.3.1.15.1.8	In Situ Design Verification	SNL	B-25
Air Quality and Ventilation Experiment	8.3.1.15-74	8.3.1.15.1.8.4	1.2.3.2.7.3.4	8.3.1.15.1.8	In Situ Design Verification	SNL	B-26
Overcore Stress Experiments in the ESF	8.3.1.15-80	8.3.1.15.2.1.2	1.2.3.2.7.2.1	8.3.1.15.2.1	Characterization of the Site Ambient Stress Conditions	USGS	B-27
Development and Demonstration of Required Equipment	8.3.2.5-57	8.3.2.5.6		8.3.2.5.6	Development and Demonstration of Required Equipment	SNL	B-28 (Note 2)
In Situ Testing of Seal Components	8.3.3.2-41	8.3.3.2.2.3	1.2.3.13.2	8.3.3.2.2.3	In Situ Testing of Seal Components	SNL	B-29
Repository Horizon Rock Water Interactions	8.3.4.2-58	8.3.4.2.4.4.2	1.2.3.12.4	8.3.4.2.4.4	Engineered Barrier System Field Tests	LLNL	B-3 (Note 1)

Note 1: This test has been removed from the planning base. However, a subset of the generally defined ESF tests will be conducted in the Calico Hills unit.

Note 2: Development and Demonstration of Required Equipment is not currently planned

Note 3: This test is described in DOE/YMSCO-003 In Situ Thermal Testing Program Strategy

ESF test-related design requirements, contained herein, will be supplemented by the ESF Test Coordination Office (TCO) as necessary to support design development, using more detailed information from the Test Organizations and PIs. Supplements and revisions will be based on prioritized needs to support Title II Design phases as identified by the Assistant Manager for Scientific Programs and the Assistant Manager for Engineering and Field Operations. Revised ESF test-related design requirements will be submitted for inclusion in formal revisions of Appendix B of this ESFDR.

Testing related requirements are presented, for individual SCP activities, in Sections B.3 through B.29. Requirements that are common to a majority of the planned tests are presented in a summary section, Section B.2.

Each of the sub-sections describes the test and test-related requirements under three headings:

Definition of Test: A short description of the test that is compatible with the current program and the SCP.

Functional Requirements: Refers to the requirements for facility design and operational flexibility to perform the test.

Design Requirements: States general requirements with respect to test location, access, layout, excavation dimensions, Construction Contractor support, and utilities. As previously noted, detailed requirements in each of the above noted areas will be prepared by the ESF TCO during Test Planning and provided to the ESF A/E.

B.2 GENERAL, COMMON FACILITY DESIGN REQUIREMENTS FOR ESF TESTING

This section contains those design requirements that are generic to all, or a majority of the ESF tests. The remainder of the appendix contains common facility design requirements for each of the current program, ESF tests.

Design components addressed in this section include:

- Personnel;
- Laboratory, Office, and Storage Space;
- Utilities (electric power, water, and compressed air);
- Data Acquisition System (DAS);
- Drilling.

B.2.1 SCIENTIFIC PERSONNEL REQUIREMENTS FOR ESF TESTING**B.2.1.1 DESCRIPTION**

A testing integration study will be developed that defines the recommended planning and design assumptions for on-site scientific personnel requirements to support ESF testing. Initial estimates provided here were developed in 1988 (Los Alamos letter ESD-WX4-7/88-7) and will be refined as a part of the personnel integration study. The integration study will be completed during Title II design.

B.2.1.2 FUNCTIONAL REQUIREMENTS

Provide the system design and operational flexibility to accommodate ESF testing personnel requirements.

B.2.1.3 DESIGN REQUIREMENTS

- A. The ESF should be designed to accommodate an average scientific work force of 100 persons.

[DERIVED]

- B. Peak scientific personnel is estimated to be 120 people.

[DERIVED]

- C. Personnel estimates do not include:

- Drilling crews,
- Safety Personnel,
- Construction personnel,
- Visitors.

[DERIVED]

B.2.2 LABORATORY/OFFICE/STORAGE SPACE REQUIREMENTS**B.2.2.1 DESCRIPTION**

The Laboratory/Office/Storage Space Requirements for ESF Testing are specific for facilities or areas that are dedicated to testing. These spaces are located both above and below ground. Testing requirements for laboratory, office, test equipment assembly and calibration, repair, and storage areas are provided below. As the scientific program matures, additional requirements will be transmitted as revisions to this section.

B.2.2.2 FUNCTIONAL REQUIREMENTS

Provide adequate surface and underground laboratory, office, test equipment assembly and calibration, repair, and storage space to support the ESF testing activities.

B.2.2.3 DESIGN REQUIREMENTS

- A. All support facilities shall be located so that support can be provided to testing activities at all ESF access portals and underground test locations. If necessary, this may require some facility replication. If facilities are not replicated on each pad site, readily accessible, unimpeded transportation between sites shall be provided for.

[DERIVED]

- B. Provide the following Surface Test Support Facilities, as a minimum:

- (1) Office space for ESF TCO and PI personnel at the Field Operations Center and on the Portal Pad.

[DERIVED]

- (2) Test equipment assembly and calibration area at the Portal Pad.

[DERIVED]

- (3) Machine shop at the Portal Pad.

[DERIVED]

- C. Provide the following Underground Test Support Facilities, as a minimum:

- (1) A location shall be provided for short-term core storage. The location should be out of traffic areas and at least 3 m by 3 m by 2.4 m (10 ft x 10 ft x 8 ft). The temperature at the storage location shall be maintained between 2° and 18° C, except as accepted by the ESF TCO.

[DERIVED]

- (2) A securable, underground space of about 5 m by 6 m (15 ft x 20 ft) with a height of 2.5 m (8 ft) is required for storage of mapping equipment. If the North and South ramps are developed separately, a storage room is required in each one.

[DERIVED]

- (3) Secured storage in each alcove. The size of required storage facilities will be specified by the ESF TCO in consultation with the ESF A/E.

[DERIVED]

B.2.3 UTILITY REQUIREMENTS FOR ESF TESTING**B.2.3.1 DESCRIPTION**

- A. Electrical Power: Sections B.3 through B.29 and Table B-2 of this appendix provide electrical power requirements for each ESF test. If requirements are expected to exceed the designed standard power available at each underground test location (accesses and drifts), specific power design requirements for lighting, instrumentation, and heaters, data collection, or other test support are provided as design criteria in each test subsection. No consideration of construction-related or drilling electrical power requirements is included. If no special power requirements are anticipated for a specific test, a statement of adequacy for standard power supply is included. These statements are considered preliminary until the ESF A/E provides initial ESF electrical power availability and distribution information.

As ESF Title II design test planning proceeds, this section will be used to summarize electrical power requirements for ESF testing support at all locations in the facility.

- B. Water: Within the testing program, water will be required for flushing wet-cored boreholes, for cleaning rock surfaces, etc.
- C. Compressed Air: Compressed air will be required for flushing dry-drilled boreholes and for running air permeability and tracer tests.
- D. Communications: A communication system will be required to provide a contact between the ESF subsurface and both surface and off-site facilities.

B.2.3.2 FUNCTIONAL REQUIREMENTS

Provide the system design and operational flexibility to ensure adequate provision of utilities (electrical power, water, compressed air), ventilation, and communications to support all ESF test activities.

B.2.3.3 DESIGN REQUIREMENTS

- A. Electrical Power:

Provide surface and subsurface electrical power for ESF testing. Summarized requirements are contained in Table B-2.

[DERIVED]

- B. Water System:

- (1) Each test location shall have water provided as noted in Sections B.3 to B.29 and Table B-2.

[DERIVED]

- (2) The water supply for each test shall be provided to an access coupling and an isolation valve near each test location.

[DERIVED]

Table B-2 ESF Test-Related Utility Requirements

SCP Activity - Test Name	SCP Reference Number	Appendix B Section	Power	Lighting	Utilities and Services (Note 1)			
					Water	Compressed Air	Communications	Ventilation
Chloride and Chlorine 36 Measurements of Percolation at Yucca Mountain	8.3.1.2.2.2.1	B-3 (Note 1)	Standard	Standard	None	Standard	Standard	Standard
Matrix Hydrological Properties Testing	8.3.1.2.2.3.1	B-3 (Note 1)	Standard	Standard	Standard	Drilling	Standard	Standard
Intact Fracture Test in the ESF	8.3.1.2.2.4.1	B-3 (Note 1)	Standard	Test Area	Standard	Drilling	Standard	Standard
Percolation Tests in the ESF	8.3.1.2.2.4.2	B-4	Standard	Test Area	Test	Standard	Standard	Standard
Bulk Permeability Test in the ESF	8.3.1.2.2.4.3	B-5	Standard	Test Area	Standard	Drilling	Standard	Standard
Radial Borehole Tests in the ESF	8.3.1.2.2.4.4	B-6	Standard	Test Area	Test	Drilling	Standard	Standard
Excavation Effects Test in the ESF	8.3.1.2.2.4.5	B-7	Standard	Test Area	Standard	Drilling	Standard	Standard
Perched Water Testing in the ESF	8.3.1.2.2.4.7	B-8	Standard	Standard	None	Drilling	Standard	Standard
Hydrochemistry Tests in the ESF	8.3.1.2.2.4.8	B-9	Standard	Test Area	None	Drill/Test	Standard	Standard
Hydrologic Properties of Major Faults in the ESF	8.3.1.2.2.4.10	B-10	Standard	Test Area	None	Drill/Test	Standard	Standard
Diffusion Tests in the ESF	8.3.1.2.2.5.1	B-11	Standard	Test Area	Test	Drilling	Standard	Standard
Petrologic Stratigraphy of the Topopah Spring Member	8.3.1.3.2.1.1	B-3 (Note 1)	Standard	Standard	None	Standard	Standard	Standard
Mineral Distribution Between Host Rock and Accessible Environment	8.3.1.3.2.1.2	B-3 (Note 1)	Standard	Standard	None	Standard	Standard	Standard
Fracture Mineralogy	8.3.1.3.2.1.3	B-3 (Note 1)	Standard	Standard	None	Drilling	Standard	Standard
History of Mineralogic and Geochemical Alteration at Yucca Mountain	8.3.1.3.2.2.1	B-3 (Note 1)	Standard	Standard	None	Standard	Standard	Standard
Biological Sorption and Transport	8.3.1.3.4.2	B-3 (Note 1)	Standard	Test Area	None	Standard	Standard	Standard
Field Scale Experiments to Study Radionuclide Transport at Yucca Mountain	1.3.7.2.2	B-12	Standard	Test Area	Test	Drill/Test	Standard	Aux
Underground Geologic Mapping	8.3.1.4.2.2.4	B-13	Standard	Standard	Standard	Standard	Standard	Standard
Seismic Tomography/Vertical Seismic Profiling at the ESF	8.3.1.4.2.2.5	B-14	Standard	Standard	Standard	Drilling	Standard	Standard
Studies of Calcite and Opaline Silica Vein Deposits	8.3.1.5.2.1.5	B-3 (Note 1)						

Table B-2 ESF Test-Related Utility Requirements (continued)

SCP Activity - Test Name	SCP Reference Number	Appendix B Section	Utilities and Services (Note 1)					
			Power	Lighting	Water	Compressed Air	Communications	Ventilation
Geochemical Assessment of Yucca Mountain in Relation to the Potential for Mineralization	8.3.1.9.2.1.1	B-3 (Note 1)						
Laboratory Tests (Thermal and Mechanical) Using Samples from the ESF	0	B-3 (Note 1)	Standard	Standard	Standard	Standard	Standard	Standard
Density and Porosity Characterization	8.3.1.15.1.1.1	B-3 (Note 1)						
Volumetric Heat Capacity Characterization	8.3.1.15.1.1.2	B-3 (Note 1)						
Thermal Conductivity Characterization	8.3.1.15.1.1.3	B-3 (Note 1)						
Thermal Expansion Characterization	8.3.1.15.1.2.1	B-3 (Note 1)						
Compressive Mechanical Properties of Intact Rock at Baseline Experiment Conditions	8.3.1.15.1.3.1	B-3 (Note 1)						
Effects of Variable Environmental Conditions on Mechanical Properties	8.3.1.15.1.3.2	B-3 (Note 1)						
Mechanical Properties of Fractures at Baseline Experiment Conditions	8.3.1.15.1.4.1	B-3 (Note 1)						
Effects of Variable Environmental Conditions on Mechanical Properties of Fractures	8.3.1.15.1.4.2	B-3 (Note 1)						
Access Convergence Measurements	8.3.1.15.1.5.1	B-15	Std/UPS	Standard	Standard	Standard	Standard	Standard
Demonstration Breakout Room	8.3.1.15.1.5.2	B-16						
Sequential Drift Mining	8.3.1.15.1.5.3	B-17	Std/UPS	Test Area	Standard	Drilling	Standard	Controlled
Single Element Heater Test	8.3.1.15.1.6.2	B-18	Enhanced/UPS	Test Area	Standard	Drilling	Standard	Controlled
Emplacement Drift Thermal Test	8.3.1.15.1.6.5	B-19	Major	Test Area	Standard	Drilling	Standard	Controlled
Engineered Barrier System Field Tests	8.3.4.2-57	B-20	Major	Test Area	Standard	Drilling	Standard	Controlled
Plate Loading Tests	8.3.1.15.1.7.1	B-21	Std/UPS	Test Area	Standard	Drilling	Standard	Standard
Rock Mass Strength Experiment	8.3.1.15.1.7.2	B-22	Standard	Test Area	Standard	Drilling	Standard	Standard
Evaluation of Mining Methods	8.3.1.15.1.8.1	B-23	None	Standard	None	None	Standard	Standard
Monitoring of Ground Support Systems	8.3.1.15.1.8.2	B-24	Standard	Standard	Standard	None	Standard	Standard
Monitoring Drift Stability	8.3.1.15.1.8.3	B-25	Standard	Standard	Standard	Drilling	Standard	Standard

Table B-2 ESF Test-Related Utility Requirements (continued)

SCP Activity - Test Name	SCP Reference Number	Appendix B Section	Utilities and Services (Note 1)					
			Power	Lighting	Water	Compressed Air	Communications	Ventilation
Air Quality and Ventilation Experiment	8.3.1.15.1.8.4	B-26	Standard	Test Area	None	Drilling	Standard	Controlled
Overcore Stress Experiments in the ESF	8.3.1.15.2.1.2	B-27	Standard	Test Area	None	Drilling	Standard	Standard
Development and Demonstration of Required Equipment	8.3.2.5.6	B-28 (Note 2)						
In Situ Testing of Seal Components	8.3.3.2.2.3	B-29	Standard	Test Area	Standard	Drill/Test	Standard	Aux
Repository Horizon Rock Water Interactions	8.3.4.2.4.4.2	B-3 (Note 1)	Standard	Standard	None	Standard	Standard	Standard

Note 1: These tests will be performed under the ESF Consolidated Sampling Program.

Note 2: Development and Demonstration of Required Equipment is not currently planned

<u>Utility/Service</u>	<u>Level</u>	<u>Description</u>
Power -	Standard	Requires standard 110V electric power for small tools and lights
Power -	Enhanced	Requires standard plus either 220/240 VAC or 440/480 VAC service
Power -	Major	Activities with projected high power consumption at enhanced service, or higher voltages
Power -	UPS	Requires an uninterruptable power supply
Lighting Level -	Standard	Requires standard tunnel lighting
Lighting Level -	Test Area	Requires standard service plus temporary spot lighting
Lighting Level -	Flood-Lit	Requires permanently flood-lit test area using portable lights
Water -	Standard	Requires water tagged with a lithium bromide (LiBr) tracer
Water -	Test	Requires water tagged with a tracer to be specified by the ESF TCO or PI
Compressed Air -	Standard	Requires compressed air tagged with sulphur hexafluoride (SF6)
Compressed Air -	Drilling	Compressed air required for drilling (drill operation and cuttings removal)
Compressed Air -	Test	Compressed air required for Packer Inflation
Communications -	Standard	Standard ESF Communications (telephone)
Ventilation -	Standard	Standard ventilation service, including service to alcoves
Ventilation -	Aux	Auxiliary ventilation required
Ventilation -	Controlled	Requires special ventilation controls due to (1) experimental constraints, (2) need for restricted access to the test area

- (3) The constructor shall operate under an approved plan to minimize the use of water in construction-related drilling and shall track, record, and report all uses of water by application type. In addition to other program signatories, ESF TCO concurrence of this plan, and any plan revisions, is required.

[DERIVED]

- (4) All water used in or around the ESF for each activity shall be monitored, and appropriate quantity records shall be maintained. Methods of monitoring and recording water usage shall be developed by the ESF A/E and implemented by the Construction Contractor.

[DERIVED]

- (5) Water applied underground in dust suppression; blasthole drilling; in grout, mortar, concrete and shotcrete; wall washing (blowdown) prior to mapping; and other construction applications, shall be tagged with a universal tracer, Lithium bromide. The concentration of lithium bromide tracer in construction water should be 20 ppm (as bromide) with an acceptable tolerance of $\pm 10\%$.

[DERIVED]

C. Compressed Air:

- (1) Each test location shall have compressed air provided as noted in Sections B.3 through B.29 and Table B-2.

[DERIVED]

- (2) The compressed air supply for each test shall be provided to an access coupling and an isolation valve near each test location.

[DERIVED]

- (3) Except where explicitly waived by the ESF TCO, all compressed air used for construction shall be tagged with a universal gaseous tracer, sulfur hexafluoride. Exempted from this requirement is compressed air used in blasthole drilling, to power pneumatic tools, and in blowdown operations prior to geologic mapping.

[DERIVED]

- (4) Provision shall be made to prevent the introduction of liquid water from the compressed air supply into tests that are sensitive to water, such as Diffusion, Bulk Permeability, Repository Horizon Near-Field Hydrologic Properties, and Radial Boreholes.

[DERIVED]

D. Tracers:

The constructor will operate under an approved plan covering the use of tracers, fluids, and materials. In addition to other program signatories, ESF TCO concurrence of this plan, and any plan revisions, is required.

[DERIVED]

E. Communications:

- (1) Permanent intercom or telephone stations shall be provided in each of the major ESF test locations. Unless specifically considered in Section B.2, standard ESF communication system provisions, to be determined by the ESF A/E, are considered adequate.

[DERIVED]

- (2) Intercom and telephone systems cabling and equipment shall be designed such that no detectable electromagnetic signals are induced into the DAS equipment or any associated sensor.

[DERIVED]

- (3) Both telephone and intercom systems shall be powered from uninterruptible power supplies.

[DERIVED]

B.2.4 DATA ACQUISITION SYSTEM**B.2.4.1 DESCRIPTION**

This section of the ESFDR, Appendix B, defines design criteria for facilities, components, and construction contractor support required to support a DAS at the ESF. Additional requirements for the DAS are contained elsewhere in this ESFDR.

The DAS, as currently conceived, will consist of individual Data Collection Units co-located with each test requiring automatic data acquisition.

B.2.4.2 FUNCTIONAL REQUIREMENTS

Provide the system design and operational flexibility necessary to support the DAS.

B.2.4.3 DESIGN REQUIREMENTS

- A. A facility shall be provided at the surface for storage, maintenance, calibration, and assembly of DAS equipment. The development of detailed requirements shall be coordinated by the ESF TCO and provided to the ESF A/E.

[DERIVED]

- B. DAS facilities shall be placed as far away from any equipment likely to produce electromagnetic fields as is possible. Such equipment includes, but is not restricted to, power feeders, electrical rotating machinery, and other large electrical loads.

[DERIVED]

- C. Provide the necessary space in the underground facility to locate individual DAS stations. The required locations of DAS stations will be determined by the ESF TCO and provided to the ESF A/E as D&TRI.

[DERIVED]

- D. Provide an underground repair and spare parts storage facility centrally located within the ESF. The development of detailed requirements for this facility shall be coordinated by the ESF TCO and provided to the ESF A/E.

[DERIVED]

- E. Provide utilities (electric power) to individual DAS components.

[DERIVED]

B.2.5 DRILLING REQUIREMENTS FOR ESF TESTING

B.2.5.1 DESCRIPTION

Drilling requirements for this project encompass a wide range of borehole sizes, depths, and drilling methods. Table B-3 provides summary level drilling information for each of the tests described in Sections B.3 through B.29.

B.2.5.2 FUNCTIONAL REQUIREMENTS

Provide the system design and operational flexibility to ensure adequate provision of drilling to support all ESF test activities.

B.2.5.3 DESIGN REQUIREMENTS

- A. Test drilling related requirements shall be provided in Test Planning Documentation.

[DERIVED]

- B. Interim data, necessary for ESF design, shall be provided by the ESF TCO to the ESF A/E.

[DERIVED]

Table B-3 Summary Level Drilling Requirements

SCP Activity - Test Name	SCP Reference Number	Appendix B Section	Service Level	Drilling Support Requirements		
				Borehole Orientation	Drillhole Flushing Method	Number of Concurrent Drilling Operations
Chloride and Chlorine 36 Measurements of Percolation at Yucca Mountain	8.3.1.2.2.2.1	B-3 (Note 1)	None			
Matrix Hydrological Properties Testing	8.3.1.2.2.3.1	B-3 (Note 1)	None			
Intact Fracture Test in the ESF	8.3.1.2.2.4.1	B-3 (Note 1)	Special	Rib/Face	Any	1
Percolation Tests in the ESF	8.3.1.2.2.4.2	B-4	Standard	Rib/Floor	Air	1
Bulk Permeability Test in the ESF	8.3.1.2.2.4.3	B-5	Standard	Rib/Face	Air	1
Radial Borehole Tests in the ESF	8.3.1.2.2.4.4	B-6	Standard	Rib/Face	Air	1
Excavation Effects Test in the ESF	8.3.1.2.2.4.5	B-7	Standard	Rb / Rf / Fr	Any	2
Perched Water Testing in the ESF	8.3.1.2.2.4.7	B-8	Standard	Rb / Rf / Fr	Air	1
Hydrochemistry Tests in the ESF	8.3.1.2.2.4.8	B-9	Standard	Rb / Rf / Fr	Air	1
Hydrologic Properties of Major Faults in the ESF	8.3.1.2.2.4.10	B-10	Standard	Rib/Face	Air	1
Diffusion Tests in the ESF	8.3.1.2.2.5.1	B-11	Special	Rib/Face		1
Petrologic Stratigraphy of the Topopah Spring Member	8.3.1.3.2.1.1	B-3 (Note 1)	None			
Mineral Distribution Between Host Rock and Accessible Environment	8.3.1.3.2.1.2	B-3 (Note 1)	None			
Fracture Mineralogy	8.3.1.3.2.1.3	B-3 (Note 1)	None			
History of Mineralogic and Geochemical Alteration at Yucca Mountain	8.3.1.3.2.2.1	B-3 (Note 1)	None			
Biological Sorption and Transport	8.3.1.3.4.2	B-3 (Note 1)	Minor			

Table B-3 Summary Level Drilling Requirements (continued)

SCP Activity - Test Name	SCP Reference Number	Appendix B Section	Service Level	Drilling Support Requirements		
				Borehole Orientation	Drillhole Flushing Method	Number of Concurrent Drilling Operations
Field Scale Experiments to Study Radionuclide Transport at Yucca Mountain	8.3.1.3.7.2.2	B-12	Standard	Rb / Rf / Fr	Air	1
Underground Geologic Mapping	8.3.1.4.2.2.4	B-13	None			
Seismic Tomography/Vertical Seismic Profiling at the ESF	8.3.1.4.2.2.5	B-14	Standard	Rib/Face	Any	1
Studies of Calcite and Opaline Silica Vein Deposits	8.3.1.5.2.1.5	B-3 (Note 1)	None			
Geochemical Assessment of Yucca Mountain in Relation to the Potential for Mineralization	8.3.1.9.2.1.1	B-3 (Note 1)	None			
Laboratory Tests (Thermal and Mechanical) Using Samples from the ESF		B-3 (Note 1)	Note 3			
Density and Porosity Characterization	8.3.1.15.1.1.1	B-3 (Note 1)	Note 3			
Volumetric Heat Capacity Characterization	8.3.1.15.1.1.2	B-3 (Note 1)	Note 3			
Thermal Conductivity Characterization	8.3.1.15.1.1.3	B-3 (Note 1)	Note 3			
Thermal Expansion Characterization	8.3.1.15.1.2.1	B-3 (Note 1)	Note 3			
Compressive Mechanical Properties of Intact Rock at Baseline Experiment Conditions	8.3.1.15.1.3.1	B-3 (Note 1)	Note 3			
Effects of Variable Environmental Conditions on Mechanical Properties	8.3.1.15.1.3.2	B-3 (Note 1)	Note 3			
Mechanical Properties of Fractures at Baseline Experiment Conditions	8.3.1.15.1.4.1	B-3 (Note 1)	Note 3			

Table B-3 Summary Level Drilling Requirements (continued)

SCP Activity - Test Name	SCP Reference Number	Appendix B Section	Service Level	Drilling Support Requirements		
				Borehole Orientation	Drillhole Flushing Method	Number of Concurrent Drilling Operations
Effects of Variable Environmental Conditions on Mechanical Properties of Fractures	8.3.1.15.1.4.2	B-3 (Note 1)	Note 3			
Access Convergence Measurements	8.3.1.15.1.5.1	B-15	Standard	Rb / Rf / Fr	Any	1
Demonstration Breakout Room	8.3.1.15.1.5.2	B-16	Test Deferred			
Sequential Drift Mining	8.3.1.15.1.5.3	B-17	Standard	Rb / Rf / Fr	Air	2
Heater Experiment in TSW1	8.3.1.15.1.6.1	B-20	Standard	Rb / Rf / Fr	Air	1
Single Element Heater Test	8.3.1.15.1.6.1	B-18	Standard	Rb / Rf / Fr	Air	1
Emplacement Drift Thermal Test	8.3.1.15.1.6.5	B-19	Special	Rb / Rf / Fr	Air	2
Engineered Barrier System Field Tests	8.3.4.2.4.4.1 8.3.4.2.4.4.2	B-20	Special	Rb / Rf / Fr	Air	2
Plate Loading Tests	8.3.1.15.1.7.1	B-21	Standard	Rb / Rf / Fr	Any	1
Rock Mass Strength Experiment	8.3.1.15.1.7.2	B-22	Standard	Rb / Rf / Fr	Any	1
Evaluation of Mining Methods	8.3.1.15.1.8.1	B-23	None			
Monitoring of Ground Support Systems	8.3.1.15.1.8.2	B-24	Standard	Rb / Rf / Fr	Any	1
Monitoring Drift Stability	8.3.1.15.1.8.3	B-25	Standard	Rb / Rf / Fr	Any	1
Air Quality and Ventilation Experiment	8.3.1.15.1.8.4	B-26	None			
Overcore Stress Experiments in the ESF	8.3.1.15.2.1.2	B-27	Special	Rib/Face	Any	1
Development and Demonstration of Required Equipment	8.3.2.5.6	B-28 (Note 2)	Test Deferred			

Table B-3 Summary Level Drilling Requirements (continued)

SCP Activity - Test Name	SCP Reference Number	Appendix B Section	Service Level	Drilling Support Requirements		
				Borehole Orientation	Drillhole Flushing Method	Number of Concurrent Drilling Operations

Note 1: These tests will be performed under the ESF Consolidated Sampling Program.

Note 2: Development and Demonstration of Required Equipment is not currently planned

Note 3: Samples may also be taken from core retrieved as part of another test or test-related activity.

Drilling Support Requirements

Service Level - Special	Requires larger diameter or hole length greater than can be obtained using existing equipment.
Service Level - Standard	Requires HQ-sized holes using existing equipment, (e.g., Casagrande C5S; Longyear 38; Longyear 65).
Service Level - Minor	Requires the use of a jackleg or smaller hand held drills.
Service Level - None	Drilling support is not currently identified as being required for this test.
Orientation - Rb / Rf / Fr	Requires boreholes to be drilled at all orientations.
Orientation - Rib / Floor	Requires boreholes to be drilled in the rib and floor.
Orientation - Rib / Face	Requires boreholes to be drilled in the tunnel/alcove rib or face of alcove.
Orientation - Roof	Requires boreholes to be drilled in the tunnel/alcove roof (back).
Orientation - Floor	Requires boreholes to be drilled in the tunnel/alcove floor.
Drillhole Flushing Media - Air	Air must be used.
Drillhole Flushing Media - Water	Water must be used.
Drillhole Flushing Media - Any	Either air or water may be used.
Number of Drills - (1)	Estimated number of concurrently operated drill rigs required.