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Civilian Radioactive Waste Management System
Management and Operating Contractor

Controlled Design Assumptions Document

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Prepared for:

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Part 1

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July 1, 1998

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CONTROLLED DESIGN ASSUMPTIONS

ENGINEERING ORGANIZATION/TECHNICAL DISCIPLINE CONCURRENCE SHEET

Organization	Manager/ Reviewer	Signature	Date
Environmental Programs	E. W. McCann		7/1/98
Performance Assessment Operations	R. W. Andrews/ P. S. Hastings		1 July 98.
Project Engineering	V. A. Dulock/ H. N. Kalia		7-1-98
MGDS Licensing	K. L. Ashe/ D. R. Geiger	Dale Geiger	7/1/98
Repository Subsurface Design	K. Bhattacharyya/ R. L. Schreiner		7/1/98
Repository Surface Design	S. J. Meyers/ K. E. Schwartztrauber		7/1/98
Natural Environmental Program Operations	L. R. Hayes/ T. R. Scotese		7/1/98
MGDS Safety Assurance	D. Gwyn/ T. D. Dunn		7/1/98
MGDS System Analysis	M. D. Sellers		7-1-98
Waste Package Design	T. W. Doering		7-6-98
Waste Package Materials	D. Stahl		7/1/98
Radiological and Environmental Field Programs	L. D. Croft/ T. C. Bastian		7/1/98
Office of Quality Assurance	R. G. Peck/ P. V. Auer		7/1/98
Waste Acceptance and Transportation	J. R. Clark		7/2/98
Systems Engineering and Integration	R. C. Wagner/ G. A. Carruth		7/2/98

Note: The table on the following page shows the allocation of the engineering organizations/technical disciplines shown in Paragraph 5.2.D of procedure NLP-3-32 to current M&O organizations listed above.

CDA Document Concurrence List for Rev. 05

Previous Concurrence List		New Concurrence List for Rev. 05	
Engineering Organization/Technical Discipline	**Manager**	**Engineering Organization/Technical Discipline**	**Manager**
Environmental Impact/ Compliance	E. W. McCann	Environmental Programs	E. W. McCann
Performance Assessment	R. W. Andrews	Performance Assessment Operations	R. W. Andrews
Project Engineering	V. A. Dulock	Project Engineering	V. A. Dulock
Licensing	K. L. Ashe	MGDS Licensing	K. L. Ashe
Repository Design	K. Bhattacharyya	N/A	
Subsurface Design	D. G. McKenzie	Repository Subsurface Design	K .Bhattacharyya
Surface Design	S. J. Meyers	Repository Surface Design	S. J. Meyers
Scientific Program Operations	L. R. Hayes (L. Rickertsen reviewer)	Natural Environmental Program Operations	L. R. Hayes
System Safety Assurance	P. S. Hastings	MGDS Safety Assurance	D. Gwyn
Systems Analysis and Modeling	S. F. Saterlie	MGDS System Analysis	M. D. Sellers
Waste Package Development	H. A. Benton	Waste Package Design	T. W. Doering
Waste Package Materials	S. Stahl	Waste Package Materials	D. Stahl
Office of Quality Assurance	R. G. Peck	Office of Quality Assurance	R. G. Peck
None		Radiological/Environmental Field Programs*	L. D. Croft

Note: * Will be designated responsibility for TDS assumptions.

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ACRONYMS AND ABBREVIATIONS

ACD	Advanced Conceptual Design
ALARA	As Low As Reasonably Achievable
AML	Areal Mass Loading
ASTM	American Society of Testing and Materials
BCP	Baseline Change Proposal
BMP	Best Management Practices
BP	Big Rock Point (power plant)
BWR	Boiling Water Reactor
CCB	Change Control Board
CDA	Controlled Design Assumptions
CDB	Characteristics Data Base
CDR	Conceptual Design Report
CFR	Code of Federal Regulations
CMF	Cask Maintenance Facility
CRD	CRWMS Requirements Document
CRWMS	Civilian Radioactive Waste Management System
CSNF	Commercial Spent Nuclear Fuel
DC	Design Concept
DBE	Design Basis Event
DHLW	Defense High Level Waste
DI	Document Identifier
DIE	Determination of Importance Evaluation
DOE	Department of Energy
DOE/EM	DOE/Office of Environmental Management
DOE/RW	DOE/Office of Civilian Radioactive Waste Management
DPC	Dual Purpose Canister
DRD	Design Requirements Document
DSNF	DOE Spent Nuclear Fuel
EB	Engineered Barrier
EBDRD	Engineered Barrier Design Requirements Document
EBS	Engineered Barrier Segment
EEA	Emplacement Entry Area
EED	Equivalent Energy Density
EIS	Environmental Impact Statement
EL	Emplacement Locomotive
ESF	Exploratory Studies Facility
ESRP	Environment, Safety & Regional Programs
GROA	Geologic Repository Operations Area
HEPA	High-Efficiency Particulate Air
HH	High Heat
HLW	High-Level Waste
HVAC	Heating, Ventilation, and Air Conditioning
ICN	Interim Change Notice
IOC	Interoffice Correspondence

ACRONYMS AND ABBREVIATIONS (continued)

ISF	Interim Storage Facility
LA	License Application
LG	Large
LLW	Low-Level Waste
M&O	Management and Operating
MED	Medium
MGDS	Mined Geologic Disposal System
MGDS-RD	MGDS Requirements Document
MRS	Monitored Retrievable Storage
MPC	Multi-purpose Canister
MSHA	Federal Mine Safety and Health Administration
MTHM	Metric Tons Heavy Metal
MTU	Metric Tons of Uranium
NEPA	National Environmental Policy Act
NEPO	Natural Environment Program Operations
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NWPAA	Nuclear Waste Policy Act, As Amended
OFF	Oldest Fuel First
OSHA	Federal Occupational Safety and Health Administration
PRA	Probabilistic Risk Assessment
PWR	Pressurized Water Reactor
QA	Quality Assurance
RCA	Radiologically Controlled Area
RCRA	Resource Conservation and Recovery Act of 1976, as amended
RDRD	Repository Design Requirements Document
R/EFP	Radiological/Enviromental Field Programs
RFP	Request for Proposals
RIB	Reference Information Base
RSC	Regional Servicing Contractor
RW	Radioactive Waste
S	Surface
SAR	Safety Analysis Report
SCP	Site Characterization Plan
SE	System Engineering
SM	Small
SNF	Spent Nuclear Fuel
SRD	Site Requirements Document
SS	Subsurface
SSC	Structures, Systems, and Components
ST	South Texas Project (power plant)
TBD	To Be Determined
TBM	Tunnel Boring Machine
TBR	To Be Resolved

ACRONYMS AND ABBREVIATIONS (continued)

TBV	To Be Verified
TC	Transportation Cask
TD	Technical Data
TSLCC	Total System Life Cycle Cost
TSPA	Total-System Performance Assessment
UCF	Uncanistered Fuel
VA	Viability Assessment
WA	Waste Acceptance
WA&T	Waste Acceptance and Transportation
WHB	Waste Handling Building
WP	Waste Package
WVDP	West Valley Demonstration Project
YFF	Youngest Fuel First
YMP	Yucca Mountain Site Characterization Project
YMSCO	Yucca Mountain Site Characterization Office

SECTION 1

INTRODUCTION

1. INTRODUCTION

1.1 OBJECTIVE

The objective of the *Controlled Design Assumptions Document* (CDA) is to provide documentation and control of Mined Geologic Disposal System (MGDS) design assumptions in support of design and performance assessment in preparing for the Viability Assessment (VA), Suitability Report (SR), Environmental Impact Statement (EIS), and License Application (LA) milestones.

1.2 SCOPE

CDA document assumptions include conceptual and technical data assumptions, as well as tentative design requirements that are typically of interest or affect to the program (Civilian Radioactive Waste Management System [CRWMS]), project (MGDS), or to more than one element of the MGDS. The CDA supplements the current technical baseline documents of the MGDS until all assumptions and requirements are incorporated in the technical baseline. The document lists each assumption, identifies its rationale and design responsibility, and tracks its development status.

Several of the assumptions in this document have been intentionally specified to levels beyond those specified in sections of 10 CFR 60 to assure that the overall system performance objective for the geologic repository (10 CFR 60.112) will be met, with reasonable assurance.

1.3 BACKGROUND

The approach originally used in developing the Advanced Conceptual Design (ACD) was to develop multiple design concepts in parallel until sufficient scientific basis was available to support the selection of a single concept. The selection of a single concept was planned to occur at the completion of the ACD activities. Due to considerations such as limited resources, the changes in the program baseline, and the availability of increased scientific knowledge since publication of the *Site Characterization Plan Conceptual Design Report*, dated September 1987 (SCP-CDR) SNL 1987, Nevada Nuclear Waste Storage Investigations Project, a different process was necessary to help expedite repository/waste package design progress.

The process developed was referred to as the "focused" ACD approach. The essence of the process was based on the selection, in each design area, of a single primary design concept which was expected to meet the repository/waste package requirements. The selection of the primary concept was based on management decisions/assumptions which utilize the available technical data to support the decision. Each decision/assumption made that was not supported by sufficient technical data, generated a substantiation activity to validate the decision. Alternatives to major design features that are important to waste isolation were also considered as required by 10 CFR 60. The Focused ACD approach was based on the premise that meeting the requirements is adequate.

Following the conceptual design phase the purpose of the CDA has (beginning in Rev. 04) shifted to focus on facilitating the completion of the Phase 1 design for VA. In Revision 4, ICN 1, TDSS 023 was modified, Key Assumptions 074, 075, 076, and Technical Data Assumption 026 were added to the CDA, along with the corresponding adjustments to existing assumptions created by these

additions. Key Assumption 074 identifies the approach for dealing with the redistribution of moisture during the high thermal phase, Key Assumption 075 requires that seeping water that will enter the emplacement drift is not to contact the waste form for 10,000 years, and Key Assumption 076 requires multiple barriers to not have common modes of failure. Bounding water flux rates are specified in TDSS 026 while more details on the chemistry of the water were added to TDSS 023. In the original document issue, the U.S. Department of Energy (DOE) had the responsibility for identifying the key assumptions and determining the values or judgments to be used for the key assumptions. This responsibility has since been delegated to the CRWMS Management and Operating Contractor (M&O).

In Revision 4, ICN 2, the controlled design assumptions were updated for applicability to design concepts associated with a series of issues important to the VA milestone. Briefing and documentation of these "VA design issues", including status summaries, were provided in May 1997 (CRWMS 1997g). In Revision 4, ICN 2, a new Appendix C was added to the CDA Document to describe the reference and alternate design concepts associated with the individual VA design issues. The assumptions in Sections 3 through 10 of this CDA Document were updated to reflect the reference concepts for the various VA design issues. Appendix C identifies the assumptions within Sections 3 through 10 that are related to each VA design issue and whether they were changed or added in Revision 4, ICN 2.

The reference concepts for the VA design issues reflect the current design analysis and concepts for the MGDS. These design concepts are summarized in the *Reference Design Description for a Geologic Repository* (CRWMS M&O 1997v). The assumptions in Sections 3 through 10 of the CDA Document provide basis for this reference system design.

Appendix C also identifies assumptions related to the alternate concept(s) for each VA design issue. If the assumptions only apply to alternate concepts, they are not included in Sections 3 through 10. Appendix D was added in Revision 4, ICN 2 to contain these assumptions (designated by the prefix ALT) for alternate concepts.

Some alternate concepts may be carried only until scheduled analyses provide an appropriate decision basis. Others may be carried because of some uncertainty associated with the performance of the reference concept or because they are dependent on strategy that is yet to be resolved for another issue. In many cases, the evaluation of alternate concepts will be documented as alternatives for License Application purposes even if the reference concept is retained.

The decisions between reference and alternate concepts are generally subject to resolution through design analyses or systems analyses. The existence of an alternate concept does not imply that the design for the applicable alternate concept is being developed. The ALT assumptions associated with the alternate concepts are included in Appendix D to better understand the alternate concepts and the potential impacts that they would have on the reference system design assumptions. The ALT assumptions are not intended for any other use.

In Revision 4, ICN 3, a new Key assumption was added to provide the bounding dimensions and mass for Naval Spent Nuclear Fuel (SNF) canisters, and three Engineered Barrier Design

Requirements Document (EBDRD) assumptions were revised to reflect the corresponding impact on waste package and disposal container information.

In Revision 4, ICN 4, a new Key assumption was added to incorporate the assumed requirements for sealing requirements for the repository.

In Revision 5, a Key assumption was added to include plutonium disposition materials in the repository. Previous DCS assumptions related to ALARA (As Low as Reasonably Achievable) were modified to enhance their value and transferred to Key assumptions to recognize their applicability beyond surface facilities. Two DCSS assumptions were added to address diesel equipment restrictions and subsurface configuration for postclosure water drainage. A number of EBDRD and RDRD assumptions were added as a result of requirements traceability analysis. A series of TDS and TDSS assumptions were updated to reflect recent environmental monitoring data and to correct responsibility assignments. A few Key assumptions were revised to reflect recent work in support of Viability Assessment design and cost estimation. Notes of clarification were added to Key assumptions defining the baseline waste stream for design. Assumptions in most of the assumption categories were revised for varied technical updates and administrative changes. A few assumptions that had been validated by baselined design products or consolidated in other assumptions were withdrawn. A general updating of references was accomplished in Revision 5.

1.4 ASSUMPTIONS

Assumptions used in the preparation of each controlled design assumption are given in Sections II (Background) and III (Rationale) of each controlled design assumption Rationale Sheet. Assumptions listed in the documents referenced in Section 12 are considered in the assumptions themselves.

1.5 INTERFACES

The CDA document interfaces with the *Mined Geologic Disposal System Concept of Operations* (CRWMS M&O 1997p) document (see Section 1.7). The assumptions in the CDA document interface with the documents identified in Section 12 and in the controlled design assumptions.

1.6 QUALITY ASSURANCE

The Quality Assurance (QA) program is applicable to the CDA. The work associated with the CDA is identified in the QAP-2-0 activity evaluation entitled *QAP 2-0 Work Control Evaluation for Development of the Controlled Design Assumptions Document* (CRWMS M&O 1996j). The QAP-2-0 activity evaluation determined the activities to be subject to the requirements of the *Quality Assurance Requirements and Description* (QARD) (DOE 1998) controls. A QAP-2-3 classification analysis for all MGDS Systems, Structures, and Components (i.e., permanent items), including permanent items identified in the CDA Document, has been performed, and the MGDS *Q-List* has been updated (YMP 1997b). Determination of Importance Evaluation (DIE) in accordance with NLP-2-0, *Determination of Importance Evaluations,* are not applicable because this activity is not a field activity. No scientific or engineering software was used in the development of the CDA.

Due to the nature of this document, all data contained herein are of indeterminate quality. Requirements or other technical, quality affecting data using these assumptions as a basis prior to substantiation must clearly identify the data as unqualified/unconfirmed and reference this document as the source.

NLP-3-15, *To Be Verified (TBV) and To Be Determined (TBD) Monitoring System*, is not used to identify data of indeterminant quality in this document because the CDA is a conceptual document that does not support construction, fabrication, or procurement, and will not be used as part of a verified design package to be released to another organization for use in other design work.

1.7 SOURCES, REFERENCES, AND RELATED DOCUMENTS

The assumptions contained in this document are developed, based on, and are reflective of, the MGDS design process. The *Mined Geologic Disposal System Concept of Operations* (CRWMS M&O 1997p) is related to this document in the sense that some of the concepts of operations may have their bases in the assumptions of the CDA document.

Two special categories of controlled design assumptions (RDRD and EBDRD assumptions) assume modification or non-applicability of requirements contained in Revision 0, ICN-1 of the *Repository Design Requirements Document* (RDRD) (YMP 1994a) and *Engineered Barrier Design Requirements Document* (EBDRD) (YMP 1994b).

References that are used in developing the assumption rationales are contained in Section 12

1.8 ORGANIZATION

Section 2 describes the technical approach used to develop the controlled design assumptions. Section 3 lists all current assumptions to facilitate access and reference. Sections 3 through 10 contain the Assumption Rationale Sheets. Section 11 contains the conclusions, and Section 12 contains a list of references. Appendix A contains a log used to list all assumptions, including withdrawn assumptions, and document their status and responsible organizations. Appendix B contains the records of all withdrawn assumptions.

SECTION 2

CONTROLLED DESIGN ASSUMPTIONS TECHNICAL APPROACH

2. CONTROLLED DESIGN ASSUMPTIONS TECHNICAL APPROACH

This section describes the criteria for including design assumptions in this document and the process for developing and incorporating new assumptions, and updating or withdrawing existing assumptions.

2.1 ASSUMPTION CRITERIA

Each group within the Management and Operating Contractor (M&O) Mined Geologic Disposal System (MGDS) Development Organization provides assumptions for this document to facilitate the Viability Assessment (VA).

Assumptions are controlled and tracked if they meet any of the following criteria:

- The assumption is important to the overall program in terms of policy and decision making.
- The assumption affects and requires coordination of more than one project, organizational group, or external agency.
- The assumption affects a major design element of the project and is important to the project, the interfaces between segments, or affects waste isolation and containment.
- The assumption affects the project technical baseline documents.

2.2 ASSUMPTION TYPES

The assumptions are categorized as follows:

Key Assumptions

An important type of assumptions are identified as "Key" assumptions. The criteria for identifying an assumption as a key assumption are the first or second criteria in Section 2.1. A key assumption may also address a highly controversial issue. The first set of key assumptions was identified in the original issue of the CDA document by the Yucca Mountain Site Characterization Office (YMSCO) Repository, Waste Package Project Engineering and Systems Engineering staff. In the first revision of the document, control of key assumptions was transferred to the Management and Operating Contractor (M&O).

Design Requirement Document (DRD) Assumptions

Assumptions of this type, labeled EBDRD and RDRD, refer to requirements in the *Engineered Barrier Design Requirements Document* (EBDRD) (YMP 1994b) and the *Repository Design*

Requirements Document (RDRD) (YMP 1994a), respectively. Typically the DRD assumption in Section I of the Assumption Rationale Sheet will do one or more of the following:

- Remove a TBD or TBV contained in the original requirement
- State that the requirement is not applicable
- Replace the original DRD requirements with a new statement.

Technical Data (TD) Assumptions

Assumptions of this type include data selected from ranges of values specified in the *Reference Information Base* (RIB) (YMP 1995a) and elsewhere, as necessary, to support waste package and repository design.

Design Concept (DC) Assumptions

Assumptions of this type include identification of design concepts judgments and/or decisions made to move forward with the design. The design concept assumptions included in the document typically are those that have insufficient technical data to support a final decision on the design.

Identification

To identify the various assumptions, the abbreviation of their type is used in combination with a group of letters symbolizing their design responsibility. The groups of letters used are: S, for Surface; SS, for Subsurface; and WP, for Waste Package. The letters R and EB represent Repository and Engineered Barrier, respectively, and are used to identify Design Requirement Document assumptions. Using this identification system, the types of assumptions included in this document, as listed, are:

- KEY
- EBDRD
- RDRD
- DCS
- DCSS
- DCWP
- TDS
- TDSS

2.3 ASSUMPTION PROCESS

Values or judgments for the original set of key assumptions (contained in Rev. 00 of this CDA, approved in 1994) were developed by an Administrative Panel consisting of personnel from Yucca Mountain Site Characterization Project (YMP), Repository/Waste Package, Project Engineering, and Systems Engineering. The assumptions were based on opinions voiced at a key assumptions workshop held at the YMP. Participants in this workshop included technical specialists and programmatic representatives from YMSCO; Sandia National Laboratories; Lawrence Livermore National Laboratory; U.S. Geological Survey; Los Alamos National Laboratory; the Civilian Radioactive Waste Management System (CRWMS) Management and Operating Contractor (M&O); University of Nevada, Reno; and University of Nevada, Las Vegas. Values and/or judgments for the non-key assumptions were developed and concurred with by the M&O organizations participating in the waste package and/or repository ACD.

Figure 2-1 illustrates the process followed for generating, revising, and withdrawing controlled design assumptions in this revision. After establishing the need for an assumption, an Assumption Rationale Sheet is used for documenting it. In addition, the Assumption Status Log (Appendix A) is updated and is used to support documentation.

Assumption Rationale Sheets

Each new assumption made is documented on an Assumption Rationale Sheet. The rationale sheet contains a unique assumption identifier (refer to Section 2.2), a statement of the assumption, background relative to the assumption (in a DRD assumption this would include the original statement of the requirement), identification of the requesting organization, a statement of the intended use or need for the assumption, rationale for the assumption, and identification of the responsible M&O organization.

Assumption Withdrawal

The reason for withdrawing an assumption must be stated on the Assumption Rationale Sheet. Unless the assumption is no longer applicable, the withdrawal will be justified if the assumption is incorporated in a MGDS technical baseline document; and that fact must also be documented on the Assumption Rationale Sheet.

Assumptions that are withdrawn have a W in parentheses just after the assumption identifier and are placed in Appendix B. The date of the document revision is then recorded as the Withdrawal Date on the Assumption Rationale Sheet.

Assumption Status Log

The Assumption Status Log (Appendix A) lists all controlled assumptions (current and withdrawn), documents their revision status, and identifies the responsible organization.

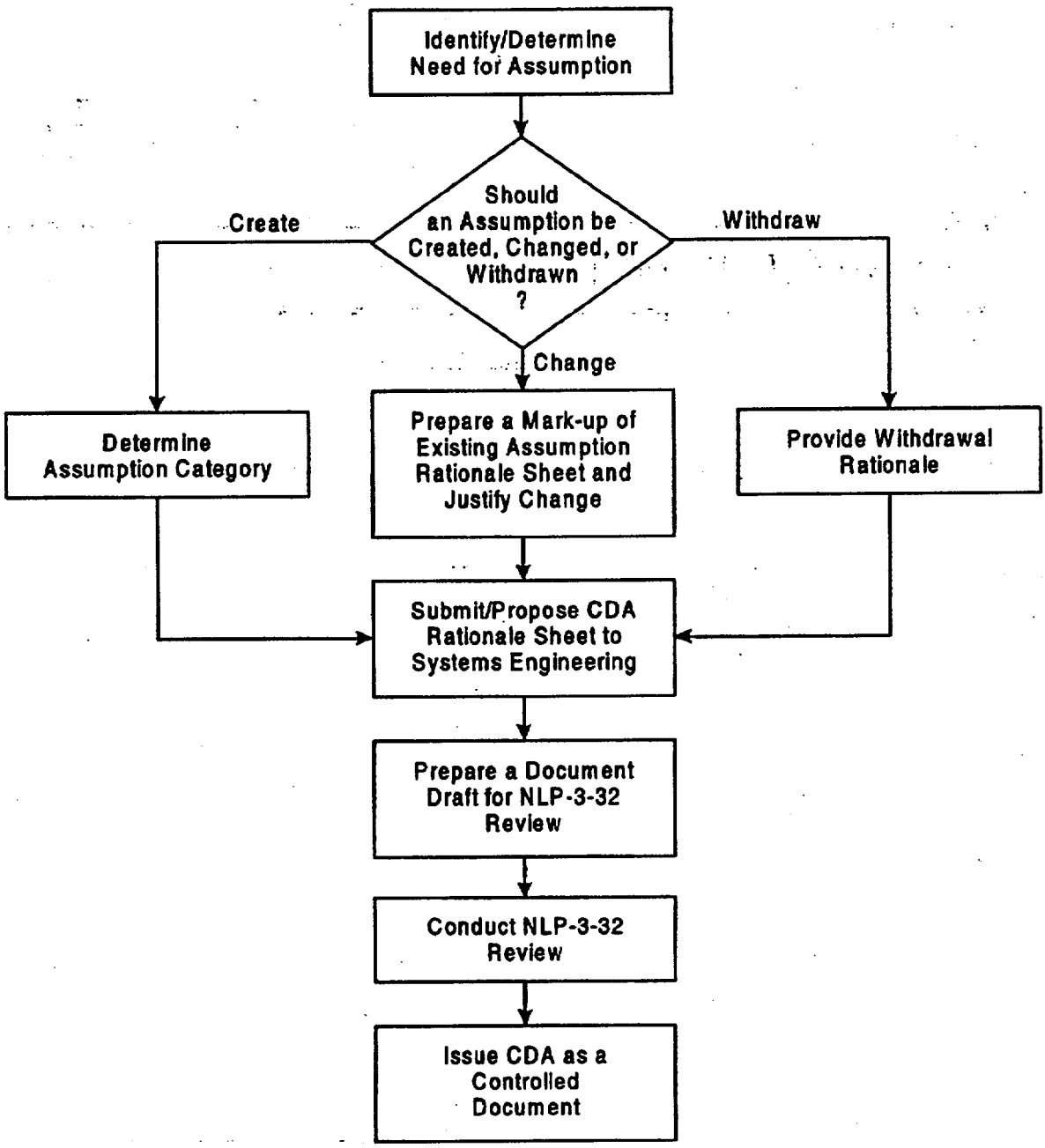

Figure 2-1. Process for Generating, Revising, or Withdrawing Assumptions

2.4 CDA REVISION

The Controlled Design Assumption (CDA) document is updated periodically as deemed necessary by its users. Review and distribution are conducted as required by QA procedures.

SECTION 3

KEY ASSUMPTIONS (KEY)

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 001 **Subject:** Cask Arrival Scenario

I. STATEMENT OF ASSUMPTION

The transportation cask arrival schedule at the Mined Geologic Disposal System (MGDS) is indicated in the following tables. Table 3-1 provides the nominal number of transportation casks, by year, arriving at the repository by legal weight trucks. These casks do not contain canisters. Table 3-2 provides the nominal number of transportation casks, by year, arriving at the repository by train. These casks also do not contain canisters. Table 3-3 provides the nominal number of casks arriving, by year, at the repository by train. These casks contain non-disposable canisters. Table 3-4 provides the nominal number of casks arriving, by year, at the repository. The high level waste (HLW) and DOE Spent Nuclear Fuel (SNF) will have been loaded in disposable canisters before shipment to the repository, as is indicated in Key Assumptions 002 and 005. As discussed in Key Assumption 005, a very small amount of the DOE SNF may be received uncanistered in casks if it can be handled and processed in the same facilities as the commercial SNF. This small quantity is not distinguished in the waste stream.

Exceptions to these tables must also be accommodated in order to create a design with sufficient flexibility to respond to present waste stream unknowns.

Exception 1: The total number of transportation casks received in any single year could reach 820.
Exception 2: The number of large disposable canisters containing commercial SNF received in any single year could reach 300.
Exception 3: Surges in commercial SNF shipments could reach 20% per month higher than the monthly average in the peak year for 4 consecutive months.

NOTE: The baseline waste stream reflected in the tables in Key Assumptions 001, 002, 003, and 004 was developed for design purposes, as indicated in the rationale below, and may differ from assumptions used to define expected operational conditions and establish related cost estimates.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, (X) Waste Package Development, or (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

The cask arrival scenario is necessary for sizing many elements of the MGDS system and for establishing average expected throughput rates.

Assumption Identifier: Key 001 (continued) **Subject:** Cask Arrival Scenario

III. RATIONALE

Rationale for assumption (source, author, date, and report title) or statement of reasoning behind engineering judgement:

Rationale is based on Waste Quantity, Mix and Throughput Study Report (CRWMS M&O 1997c). Table 3-1 is based on information contained in Table L-1 of that Throughput Study. Tables 3-2 and 3-3 were extracted from Table L-2 of the Throughput Study, and Table 3-4 was extracted from Table L-0. The Throughput Study compared a series of potential waste streams to identify the waste streams that are likely to provide reasonable upper bounds for design and selected the one that is most stressing to design as the baseline waste stream for design purposes.

The exceptions to the tables are included to reflect the other potential waste streams that dominated in other areas. The first exception is provided to reflect an alternative waste stream that had a larger number of maximum shipments received in a single year. It is extracted from the recommended design levels in Table 5-13 of the Throughput Study The second exception reflects the potential for the waste arriving at the repository in disposable canisters. Exception 3 is based on the approach proposed in Section 4.3.5 of the Throughput Study to conservatively estimate surges.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Key 001 Table 3-1. Baseline Commercial SNF Waste Stream - Truck Casks

Cask Name Capacity Fuel Type	Generic 9 BWR	Generic 7 BWR	Generic 4 PWR	Generic 3 PWR	High Heat 7 BWR	High Heat 3 PWR	Total
2010	13	0	19	0	0	0	32
2011	14	0	18	0	0	0	32
2012	34	0	15	0	0	0	49
2013	13	0	61	0	0	0	74
2014	12	0	67	14	0	2	95
2015	22	4	59	0	0	1	86
2016	16	0	53	0	0	48	117
2017	4	13	63	7	6	7	100
2018	13	35	31	11	1	23	114
2019	4	31	18	21	1	40	115
2020	25	0	31	36	3	14	109
2021	12	0	46	13	3	15	89
2022	25	0	44	36	2	3	110
2023	32	0	27	28	4	17	108
2024	27	0	28	15	2	21	93
2025	15	42	49	11	4	3	124
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
Total	281	125	629	192	26	194	1447

Controlled Design Assumption
Assumption Rationale Sheet

Key 001 Table 3-2. Baseline Commercial SNF Waste Stream - Rail Casks (uncanistered)

Cask Name Capacity Fuel Type	LG Gen 61 BWR	LG Gen 26 PWR	SM Gen 24 BWR	SM Gen 12 PWR	HH UCF 17 BWR	HH UCF 7 PWR	LG-ST 12 PWR	Total UCF Rail
2010	0	0	0	0	0	0	0	0
2011	10	16	35	10	0	0	0	71
2012	15	36	53	51	0	0	7	162
2013	17	58	81	77	0	0	14	247
2014	38	85	137	140	0	35	0	435
2015	36	90	109	142	1	24	17	419
2016	42	77	123	133	4	26	7	412
2017	29	86	100	115	3	43	14	390
2018	36	86	96	123	6	20	12	379
2019	30	78	74	93	1	32	13	321
2020	30	77	50	66	5	32	7	267
2021	24	64	33	74	7	11	8	221
2022	29	67	22	51	9	20	11	209
2023	22	67	29	32	7	31	8	196
2024	24	54	23	41	6	7	10	165
2025	16	52	14	39	5	10	9	145
2026	10	8	0	0	0	0	0	18
2027	3	34	0	0	0	0	0	37
2028	5	24	0	0	0	0	0	29
2029	3	14	0	0	0	0	0	17
2030	7	26	0	0	0	0	0	33
2031	3	40	0	0	0	0	0	43
2032	82	182	0	0	0	0	14	278
2033	58	109	0	0	0	0	3	170
Total	569	1430	979	1187	54	291	154	4664

Key 001 Table 3-3. Baseline Commercial SNF Waste Stream - Rail Casks (canistered)

Cask Name Capacity Fuel Type	LG Can. 61 BWR	LG Can. 24 PWR	MED Can. 44 BWR	MED Can. 21 PWR	SM Can. 24 BWR	SM Can. 12 PWR	LG Can. 22 BP	Total Canistered Rail
2010	5	9	4	7	0	0	0	25
2011	0	6	0	0	0	0	0	6
2012	0	2	0	0	0	0	0	2
2013	0	16	0	0	8	0	0	24
2014	0	5	0	0	4	0	1	10
2015	1	4	0	0	8	0	1	14
2016	0	7	0	0	10	4	1	22
2017	0	8	12	3	16	3	1	43
2018	2	5	3	4	24	4	6	48
2019	0	15	10	22	41	6	2	96
2020	6	22	23	26	38	8	0	123
2021	7	27	38	34	47	8	0	161
2022	2	25	23	47	68	12	0	177
2023	9	30	30	52	43	15	0	179
2024	9	39	43	56	40	12	0	199
2025	13	36	46	39	95	21	0	250
2026	33	81	52	70	143	31	1	411
2027	20	39	55	103	136	24	4	381
2028	26	54	59	100	88	19	1	347
2029	30	76	49	96	77	18	1	347
2030	51	76	21	94	64	11	2	319
2031	42	86	22	71	56	24	1	302
2032	0	3	0	0	0	0	3	6
2033	0	0	0	0	0	0	1	1
Total	256	671	490	824	1006	220	26	3493

Key 001

Table 3-4. Total Casks Arriving at the MGDS

	Cask Arrival					
Year	Truck	UCF Rail	DPC Rail	HLW	DSNF	Total
2010	32	0	25	0	1	58
2011	32	71	6	0	1	110
2012	49	162	2	0	3	216
2013	74	247	24	0	6	351
2014	95	435	10	0	8	548
2015	86	419	14	100	37	656
2016	117	412	22	100	45	696
2017	100	390	43	92	46	671
2018	114	379	48	92	59	692
2019	115	321	96	92	61	685
2020	109	267	123	92	62	653
2021	89	221	161	92	62	625
2022	110	209	177	92	48	636
2023	108	196	179	92	48	623
2024	93	165	199	92	53	602
2025	124	145	250	92	58	669
2026	0	18	411	92	57	578
2027	0	37	381	92	55	565
2028	0	29	347	92	55	523
2029	0	17	347	92	89	545
2030	0	33	319	92	95	539
2031	0	43	302	91	90	526
2032	0	278	6	42	101	427
2033	0	170	1	42	63	276
2034						0
2035						0
2036						0
2037						0
2038						0
2039						0
2040						0
2041						0
Total	1447	4664	3493	1663	1203	12470

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 002 **Subject:** Waste Form Arrival Scenario

I. STATEMENT OF ASSUMPTION

The assembly arrival schedule at the Mined Geologic Disposal System (MGDS) is indicated in the following tables. Table 3-5 provides the nominal number of assemblies, by year, arriving at the repository by legal weight trucks. These assemblies are not contained in canisters. Table 3-6 provides the nominal number of assemblies, by year, arriving at the repository by train. These assemblies also are not contained in canisters. Table 3-7 provides the nominal number of assemblies arriving, by year, at the repository by train. These assemblies are contained in non-disposable canisters. Table 3-8 provides the nominal number of commercial SNF assemblies (arriving in canisters or as bare assemblies) and high-level waste (HLW) and DOE SNF in disposable canisters arriving, by year, at the repository. As discussed in Key Assumption 005, a very small amount of the DOE SNF may be received uncanistered in casks if it can be handled and processed in the same facilities as the commercial SNF. This small quantity is not distinguished in the waste stream.

NOTE: The baseline waste stream reflected in the tables in Key Assumptions 001, 002, 003, and 004 was developed for design purposes, as indicated in the rationale below, and may differ from assumptions used to define expected operational conditions and establish related cost estimates.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, (X) Waste Package Development, or (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

The waste form arrival scenario is necessary for sizing many elements of the MGDS such as the surface waste handling facility.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Rationale is based on *Waste Quantity, Mix and Throughput Study Report* (CRWMS M&O 1997c). Table 3-5 is based on information contained in Table L-3 of that Throughput Study. Tables 3-6 and 3-7 are extracted from Table L-4 of the Throughput Study, and Table 3-8 is extracted from Tables L-0 and G-0. The Throughput Study compared a series of potential waste streams to identify the waste streams that are likely to provide reasonable upper bounds for design and selected the one that is most stressing to design as the baseline waste stream for design purposes.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 002 (continued) **Subject:** Waste Form Arrival Scenario

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:
Withdrawal Date:

Key 002 Table 3-5. Baseline Commercial SNF Waste Stream - Truck Assemblies

Cask Name Capacity Fuel Type	Generic 9 BWR	Generic 7 BWR	Generic 4 PWR	Generic 3 PWR	High Heat 7 BWR	High Heat 3 PWR	Total
2010	117	0	76	0	0	0	193
2011	126	0	72	0	0	0	198
2012	306	0	60	0	0	0	366
2013	117	0	244	0	0	0	361
2014	108	0	268	42	0	6	424
2015	198	28	236	0	0	3	465
2016	144	0	211	0	0	144	499
2017	36	91	252	21	42	21	463
2018	117	245	124	33	7	69	595
2019	36	217	72	63	7	120	515
2020	225	0	124	108	21	42	520
2021	108	0	184	39	21	45	397
2022	225	0	176	108	14	9	532
2023	288	0	108	84	28	51	559
2024	243	0	110	45	12	63	473
2025	134	292	196	33	25	9	689
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0
Total	2528	873	2513	576	177	582	7249

Controlled Design Assumption
Assumption Rationale Sheet

Key 002 Table 3-6. Baseline Commercial SNF Waste Stream - Rail Assemblies (uncanistered)

Cask Name Capacity Fuel Type	LG Gen 61 BWR	LG Gen 26 PWR	SM Gen 24 BWR	SM Gen 12 PWR	HH UCF 17 BWR	HH UCF 7 PWR	LG-ST 12 PWR	Total UCF Rail
2010	0	0	0	0	0	0	0	0
2011	610	416	840	120	0	0	0	1986
2012	915	936	1272	612	0	0	84	3819
2013	1037	1508	1944	924	0	0	168	5581
2014	2318	2210	3288	1680	0	245	0	9741
2015	2196	2340	2616	1704	17	168	192	9233
2016	2562	2002	2952	1596	68	182	84	9446
2017	1769	2236	2400	1380	51	301	168	8305
2018	2196	2236	2304	1476	102	140	144	8598
2019	1830	2002	1776	1116	17	224	156	7121
2020	1830	2002	1200	792	85	224	84	6217
2021	1464	1664	792	888	119	77	96	5100
2022	1769	1742	528	612	153	140	132	5076
2023	1342	1742	696	384	119	217	96	4596
2024	1464	1404	552	492	102	49	120	4183
2025	976	1352	336	468	85	70	108	3395
2026	610	208	0	0	0	0	0	818
2027	183	884	0	0	0	0	0	1067
2028	305	624	0	0	0	0	0	929
2029	183	364	0	0	0	0	0	547
2030	427	676	0	0	0	0	0	1103
2031	183	1040	0	0	0	0	0	1223
2032	5002	4732	0	0	0	0	168	9902
2033	3504	2834	0	0	0	0	28	6366
Total	34675	37154	23496	14244	918	2037	1828	114352

Key 002 Table 3-7. Baseline Commercial SNF Waste Stream - Rail Assemblies (canistered)

Cask Name Capacity Fuel Type	LG Can. 61 BWR	LG Can. 24 PWR	MED Can. 44 BWR	MED Can. 21 PWR	SM Can. 24 BWR	SM Can. 12 PWR	LG Can. 22 BP	Total Canistered Fuel
2010	305	216	176	147	0	0	0	844
2011	0	133	0	0	0	0	0	133
2012	0	48	0	0	0	0	0	48
2013	0	363	0	0	192	0	0	555
2014	0	120	0	0	96	0	22	238
2015	61	96	0	0	192	0	22	371
2016	0	168	0	0	222	48	22	460
2017	0	192	528	63	368	36	22	1209
2018	122	112	132	84	576	48	132	1206
2019	0	360	440	462	984	72	33	2351
2020	366	528	1012	546	912	96	0	3460
2021	427	648	1672	714	1128	96	0	4685
2022	122	600	1012	987	1622	144	0	4487
2023	549	720	1320	1087	1032	180	0	4888
2024	549	913	1863	1176	960	144	0	5605
2025	756	864	1988	819	2255	241	0	6923
2026	1920	1936	2288	1470	3432	364	22	11432
2027	1220	928	2420	2163	3251	288	88	10358
2028	1586	1294	2596	2100	2112	228	22	9938
2029	1830	1822	2156	2016	1848	216	22	9910
2030	-3109	1824	924	1974	1536	132	44	9543
2031	2562	2064	968	1491	1344	288	22	8739
2032	0	72	0	0	0	0	66	138
2033	0	0	0	0	0	0	22	22
Total	15484	16021	21495	17299	24062	2621	561	97543

Controlled Design Assumption
Assumption Rationale Sheet

Key 002 Table 3-8. Total Fuel Assemblies and HLW/DOE-SNF Canisters Arriving at the MGDS

Year	CSNF-Assemblies, HLW/DSNF-Canisters						
	Truck	UCF Rail	DPC Rail	HLW	DOE SNF Co-Disposal	DOE SNF Separate Disposal	Total
2010	193	0	844	0		1	1038
2011	198	1986	133	0		1	2318
2012	366	3819	48	0		3	4236
2013	361	5581	555	0		6	6503
2014	424	9741	238	0		8	10411
2015	465	9233	371	500	55	71	10695
2016	499	9446	460	500	55	104	11064
2017	463	8305	1209	460	100	49	10586
2018	595	8598	1206	460	84	134	11077
2019	515	7121	2351	460	84	100	10631
2020	520	6217	3460	460	84	101	10842
2021	397	5100	4685	460	84	101	10827
2022	532	5076	4487	460	84	41	10680
2023	559	4596	4888	460	84	41	10628
2024	473	4183	5605	460	84	61	10866
2025	689	3395	6923	460	84	81	11632
2026	0	818	11432	460	84	69	12863
2027	0	1067	10358	460	84	61	12030
2028	0	929	9938	460	84	61	11472
2029	0	547	9910	460	124	181	11222
2030	0	1103	9543	460	124	218	11448
2031	0	1223	8739	455	109	218	10744
2032	0	9902	138	210	99	230	10579
2033	0	6366	22	209	73	94	6764
Total	7249	114352	97543	8314	1,663	2,035	231156

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 003 **Subject:** Waste Package Emplacement Scenario

I. STATEMENT OF ASSUMPTION

The waste package emplacement scenario at the Mined Geologic Disposal System (MGDS) is as indicated in Table 3-9. This emplacement scenario is consistent with MGDS-RD Table 3-3, which shows a steady state emplacement rate of commercial spent nuclear fuel (SNF) of 3,000 MTU/year. The commercial SNF disposed of in this scenario totals 63,000 MTU. The high-level waste (HLW) and DOE SNF total approximately 7,000 MTU equivalents combined (see Key Assumption 005).

NOTE: The baseline waste stream reflected in the tables in Key Assumptions 001, 002, 003, and 004 was developed for design purposes, as indicated in the rationale below, and may differ from assumptions used to define expected operational conditions and establish related cost estimates.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, or (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

The waste package emplacement scenario is necessary for sizing many elements of the Mined Geologic Disposal System (MGDS) such as the underground facility.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Rationale is based on *Waste Quantity, Mix and Throughput Study* (CRWMS M&O 1997c). Table 3-9 is based on information contained in Tables L-5 and G-0 of that Throughput Study. The Throughput Study compared a series of potential waste streams to identify the waste streams that are likely to provide reasonable upper bounds for design and selected the one that is most stressing to design as the baseline waste stream for design purposes.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Key 003

Table 3-9. Baseline Combined Waste Stream - Waste Packages

Name Capacity Fuel Type K_{eff} Limit	LG-WP 44 BWR K<=1.0	LG-WP 44 BWR K<=1.37	SM-WP 24 BWR K<=1.54	ST-WP 12 PWR-ST K<=1.13	LG-WP 21 PWR K<=1.00	LG-WP 21 PWR K<=1.13	LG-WP 21 PWR K<=1.45	SM-WP 12 PWR K<=1.02	HLW/ DSNF Co- Disposal	DSNF Separate Disposal	Total
2010	3	11	0	0	3	17	1	2		1	38
2011	13	24	0	0	4	27	5	2		1	76
2012	20	38	0	7	19	56	0	9		3	152
2013	22	53	0	15	29	94	9	23		6	251
2014	37	96	0	0	45	150	7	30		8	373
2015	34	89	0	12	50	155	1	22	100	40	503
2016	41	96	0	8	57	131	3	32	100	56	524
2017	33	89	0	15	43	152	3	32	92	33	492
2018	49	86	0	12	52	133	4	31	92	65	524
2019	32	91	0	13	49	139	7	35	92	49	507
2020	35	95	0	8	51	138	5	36	92	50	510
2021	33	95	5	8	62	128	3	29	92	50	505
2022	36	79	15	11	61	131	3	38	92	31	499
2023	38	85	1	9	59	133	12	25	92	31	485
2024	43	84	8	10	63	118	15	26	92	36	495
2025	54	96	12	10	58	117	4	26	92	41	510
2026	12	176	2	0	77	94	20	0	92	35	508
2027	30	134	1	0	114	83	7	0	92	31	492
2028	17	135	1	0	92	109	2	0	92	31	479
2029	18	119	1	0	89	120	3	0	92	51	493
2030	28	111	2	0	88	129	5	0	92	56	513
2031	34	82	1	0	112	118	3	0	91	58	499
2032	31	85	0	14	105	118	7	0	42	71	473
2033	12	70	0	3	72	63	3	0	42	47	312
Total	707	2119	49	155	1454	2653	132	398	1663	883	10213

Partially-filled waste packages are rounded up at the end of each year of operations.
K_{eff} Limit is K_{eff} maximum, which is the upper limit of the acceptable criticality range. The ranges are defined in Table 2-8 of *Waste Quantity, Mix and Throughput Study Report*. The K_{eff} minimum limit of the range is zero for each waste package type except where there is more than one column. In those cases, the minimum limit is the maximum limit in the preceding column for that waste package type. e.g., the acceptable range is from 1.0 to 1.37 for the second LG-WP 44 BWR waste package.
Co-disposal waste packages with five HLW canisters and one DOE SNF canister.
Separate DOE SNF waste packages with varying numbers of canisters.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 004 **Subject:** Average Thermal SNF Characteristics

I. STATEMENT OF ASSUMPTION

The average commercial spent fuel characteristics upon receipt at the repository are:

25.9 years old with 39.56 GWd/MTU burnup and 3.69 wt.% enrichment (PWR).
27.2 years old with 32.24 GWd/MTU burnup and 3.00 wt.% enrichment (BWR).

Table 3-10 provides the average MTU/WP on a yearly basis. Table 3-11 provides the average heat output (kW)/WP.

NOTE: The baseline waste stream reflected in the tables in Key Assumptions 001, 002, 003, and 004 was developed for design purposes, as indicated in the rationale below, and may differ from assumptions used to define expected operational conditions and establish related cost estimates.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Rationale is based on *Waste Quantity, Mix and Throughput Study Report* (CRWMS M&O 1997c). The Throughput Study compared a series of potential waste streams to identify the waste streams that are likely to provide reasonable upper bounds for design and selected the one that is most stressing to design as the baseline waste stream for design purposes.

Tables 3-10 and 3-11 are based on information contained in Tables C-7 and C-8, respectively, of the Throughput Study. The average commercial spent fuel characteristics given above for PWR and BWR spent fuel for this baseline case are obtained from information in Table A-2 of that Throughput Study and reflect a youngest fuel first (YFF) scenario as follows: allocation rights to spent fuel pools and how much fuel to accept were calculated based on the order fuel was discharged (as per the *Acceptance Priority Ranking and Annual Capacity Report*) (DOE 1995e); SNF was selected from the pool in an order that first takes fuel that is 10 years old or older in YFF sequence, then fuel younger than 10 years old (down to 5 years old), then fuel from dry storage. This is not inconsistent with 10 CFR 961.11 Appendix E.B.3 which indicates that fuel with a minimum age of 5 years will be

Assumption Identifier: Key 004 (continued) **Subject:** Average Thermal SNF Characteristics

accepted. Shipping casks designed for 10 year old fuel would be derated for fuel less than 10 years old, thus requiring more cask loadings by the utility if the YFF criteria were not first applied to the fuel at least 10 years old in the respective pool.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Key 004

Table 3-10. Commercial SNF Baseline - Average MTU Per WP

Name Capacity Fuel Type K_{inf} Limit	LG-WP 44 BWR K<=1.00	LG-WP 44 BWR K<=1.37	SM-WP 24 BWR K<=1.54	ST-WP 12 PWR-ST K<=1.13	LG-WP 21 PWR K<=1.00	LG-WP 21 PWR K<=1.13	LG-WP 21 PWR K<=1.45	SM-WP 12 PWR K<=1.02	Average
2010	5.71	7.73	0	0	8.99	8.89	0.9	4.41	7.84
2011	7.18	7.69	0	0	9.02	8.78	8.89	4.03	8.05
2012	7.21	7.82	0	6.23	9.01	9.06	0	5.34	8.13
2013	7.38	7.75	0	6.13	9.15	9.02	8.65	5.32	8.08
2014	7.58	7.68	0	0	8.71	9.12	7.27	5.63	8.22
2015	7.57	7.79	0	6.46	8.96	9.02	2.54	5.24	8.24
2016	7.48	7.82	0	5.85	9.03	9.08	5.34	5.31	8.14
2017	7.6	7.9	0	6.35	9.06	9.08	8	5.45	8.22
2018	7.56	7.87	0	6.46	9.01	9.02	8.01	5.47	8.16
2019	7.43	8.07	0	6.33	9.04	9.1	7.72	5.44	8.21
2020	7.53	8.15	0	6.05	9	8.99	8.31	5.26	8.2
2021	7.71	8.11	3.5	6.46	8.99	9.06	7.01	5.35	8.23
2022	7.64	7.82	3.93	6.03	9.04	9.08	8.75	5.34	7.99
2023	7.73	7.94	0.52	6.46	9.03	9.01	8.85	5.2	8.27
2024	7.73	7.78	3.74	6.13	9.14	9.06	8.51	5.14	8.13
2025	7.54	7.73	3.84	6.26	8.83	9.08	8.84	5.08	7.96
2026	7.69	7.5	2.6	0	8.28	8.77	6.14	0	7.88
2027	7.76	7.53	0.12	0	8.68	8.78	7.2	0	8.16
2028	7.52	7.89	0.12	0	8.94	8.92	4.81	0	8.42
2029	7.68	7.96	1.03	0	9.02	9.01	5.96	0	8.54
2030	7.39	7.75	1.77	0	8.83	8.92	5.79	0	8.34
2031	7.53	7.78	0.6	0	9.04	8.94	7.52	0	8.53
2032	7.47	7.69	0	6.46	8.89	8.97	6.27	0	8.37
2033	7.15	7.81	0	5.02	8.92	8.91	6.63	0	8.39
Average	7.54	7.81	3.34	6.25	8.91	9.01	7.4	5.32	8.21

See footnote on $K_{infinity}$ in Table 3-9.

Key 004 Table 3-11. Commercial SNF Baseline - Average Initial Heat Per WP (kW/WP)

Name Capacity Fuel Type K_{inf} Limit	LG-WP 44 BWR K<=1.00	LG-WP 44 BWR K<=1.37	SM-WP 24 BWR K<=1.54	ST-WP 12 PWR-ST K<=1.13	LG-WP 21 PWR K<=1.00	LG-WP 21 PWR K<=1.13	LG-WP 21 PWR K<=1.45	SM-WP 12 PWR K<=1.02
2010	5.94	8.44	0.00	0.00	10.69	10.49	0.41	8.33
2011	13.15	10.25	0.00	0.00	13.93	10.89	3.03	8.38
2012	13.35	9.10	0.00	10.43	12.97	12.02	0.00	10.62
2013	12.99	9.26	0.00	9.84	13.16	11.06	2.96	10.91
2014	13.19	10.14	0.00	0.00	11.92	11.50	2.05	11.10
2015	12.35	8.84	0.00	9.80	12.43	11.33	0.99	10.93
2016	14.16	7.94	0.00	8.99	12.71	10.83	1.31	10.97
2017	12.83	7.64	0.00	11.17	11.97	11.22	1.65	10.66
2018	12.97	7.32	0.00	9.79	12.45	10.84	1.56	11.40
2019	13.62	6.36	0.00	8.94	12.50	10.19	2.52	11.14
2020	12.40	5.07	0.00	9.96	11.19	9.17	2.14	11.03
2021	12.30	5.71	1.18	11.49	10.69	9.58	2.01	11.45
2022	11.42	6.73	1.01	8.13	11.82	9.27	3.30	11.06
2023	11.61	6.18	0.13	8.97	11.89	9.69	4.65	10.88
2024	13.19	6.92	0.72	9.82	11.64	9.05	4.08	11.01
2025	12.70	7.01	0.85	8.44	12.30	9.99	3.42	10.68
2026	6.74	4.80	0.37	0.00	7.58	5.46	1.79	0.00
2027	7.13	4.59	0.02	0.00	8.04	6.27	2.57	0.00
2028	7.75	4.46	0.02	0.00	8.27	6.01	1.89	0.00
2029	8.21	4.24	0.16	0.00	8.42	6.16	1.93	0.00
2030	7.58	5.33	0.25	0.00	8.45	6.53	2.35	0.00
2031	8.01	6.09	0.08	0.00	9.02	6.77	2.84	0.00
2032	7.72	6.44	0.00	7.07	8.90	6.39	1.65	0.00
2033	7.49	6.28	0.00	4.69	9.12	6.00	1.96	0.00
Average	11.43	6.40	0.79	9.35	10.20	9.08	2.64	10.99

See footnote on $K_{infinity}$ in Table 3-9.

Average values, which were not shown in the *Waste Quantity, Mix, and Throughput Study Report*, were calculated as weighted averages of the values in the respective column using the waste package quantities from Table 3-9.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 005 **Subject:** HLW & DOE SNF

I. STATEMENT OF ASSUMPTION

The quantities of high-level waste (HLW) and U.S. Department of Energy (DOE) spent nuclear fuel (SNF) within the combined 7000 MTU equivalent to be disposed of in the repository are based on the direction and assumptions given in BCP-00-96-0005, *Implementation of the Program Approach* (DOE 1994b). The baseline change proposal (BCP) calls for the disposal at MGDS of 2333 MTHM of mostly canistered DOE SNF, replacing a similar amount out of the 7000 MTHM of high-level waste (HLW) previously planned for the repository. This leaves 4667 MTHM of canistered HLW to be disposed of in the repository.

All HLW and most DOE SNF will be received in disposable canisters. At the repository, these canisters will be packaged for disposal, and the waste packages emplaced in the subsurface facility. Many of the DOE SNF canisters will be co-disposed in waste packages with the HLW canisters, and the remaining DOE SNF canisters, including the Naval SNF canisters addressed in Key Assumption 086, will be disposed in separate waste packages. A small amount (approximately 50 MT) of DOE SNF may be received uncanistered if it meets the repository waste acceptance criteria and has acceptable characteristics so that it can be handled and processed in the same facilities as the commercial SNF.

Tables in Key Assumptions 001, 002, and 003 summarize the HLW and DOE SNF waste streams on a yearly basis. See Table 3-4 for the yearly streams of transportation cask arrivals. See Table 3-8 for the numbers of canisters of HLW and DOE SNF to be received each year. The DOE SNF canisters to be disposed of in separate waste packages are shown separately from those to be co-disposed in HLW waste packages. Table 3-9 shows the number of co-disposal waste packages with five HLW canisters and one DOE SNF canister and the number of separate-disposal waste packages containing varying numbers of DOE SNF canisters.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, or (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Design requirements specific to the DOE SNF needed for repository waste package design do not yet exist in the Mined Geologic Disposal System (MGDS) Design Requirements Documents (DRDs).

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 005 (continued) **Subject:** HLW & DOE SNF

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

BCP-00-96-0005 specifies that the total HLW and DOE SNF to be disposed at the repository will be two-thirds and one-third of 7000 MTU equivalent, respectively. (The HLW total is to include 640 MTU equivalent of West Valley Commercial HLW.)

The rationale for the HLW and DOE SNF waste stream is based on *Waste Quantity, Mix and Throughput Study Report* (CRWMS M&O 1997c). The supporting information for HLW and DOE SNF are contained in Appendix G of that Throughput Study.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 008 **Subject:** No Rod Consolidation

I. STATEMENT OF ASSUMPTION

Rod consolidation will not be performed at the Mined Geologic Disposal System (MGDS).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, (X) Waste Package Development, or (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Retracts a Conceptual Design Report (CDR) baseline performance objective and permits the design of waste package and Mined Geologic Disposal System (MGDS) design criteria to proceed.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- The concept of rod consolidation was based on the premise that it would cost less to develop, build, and operate the facilities and equipment necessary for consolidation than it would to buy, load, and emplace the larger number of waste packages required for intact fuel assemblies.
- Many studies have been conducted to evaluate the economic, operations, and schedule impacts related to rod consolidation.
- Study findings show that fuel disposal without rod consolidation reduces life cycle costs, shortens facility construction schedules, and offers additional operational advantages.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 009 **Subject:** Burnup Credit

I. STATEMENT OF ASSUMPTION

Will be able to take credit for Principal Isotope burnup credit in disposal criticality evaluations of commercial light water reactor spent nuclear fuel (SNF).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, or (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Establishes probable performance parameter, allowing focused design criteria options for waste package and Mined Geologic Disposal System (MGDS) design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Ongoing Technical Exchanges and Appendix 7 meetings with the NRC staff; results are encouraging.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package Development

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 011 **Subject:** Horizontal In-Drift Emplacement

I. STATEMENT OF ASSUMPTION

Waste packages will be emplaced in-drift in a horizontal mode. (See additional related assumption Key 066.)

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Establishes restrictive condition, which is essential for the development of focused Mined Geologic Disposal System (MGDS) design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Based on the current 21 and 12 PWR waste packages, the borehole emplacement option is impractical.
- Facilitates subsurface waste handling including emplacement operations, heat transfer of large waste packages, and leads to smaller emplacement drift sizes.
- Advantageous for long-term criticality control.

(This assumption is consistent with assumption RDRD 3.2.3.2.2.A.7)

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 013 **Subject:** No Human Entry in Emplacement Drifts Containing Waste Packages

I. STATEMENT OF ASSUMPTION

No human entry is planned in emplacement drifts while waste packages are present. The waste emplacement/retrieval equipment may use robotics and/or remote control features to perform operations and monitoring within the emplacement drifts. Under off-normal conditions, human entry will be considered if protection to the workers can be provided.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Establishes the need to investigate practical uses of robotics and remote control for subsurface activities and preclosure drift operations.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Repository Design Requirements Document (RDRD) (YMP 1994a): Geologic Repository Operations Area (GROA) shall to the extent practicable *achieve occupational doses* that are as low as reasonably achievable (ALARA). Under off-normal conditions, radiation exposures to workers should be within allowable limits.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 016 **Subject:** Retrievability Period

I. STATEMENT OF ASSUMPTION

The repository will be designed for a retrievability period of up to 100 years after initiation of emplacement.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Establishes the performance objective for life cycle and durability criteria to support the design of surface and subsurface facilities as well as to support concepts of retrieval of waste packages.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Required by *Implementation of the Program Approach* (DOE 1994b).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 017 **Subject:** Reasons for Retrieval

I. STATEMENT OF ASSUMPTION

Retrieval of emplaced waste may be performed for the following reasons:

- Failure in site, waste package, or some other system causing an unreasonable risk to public health and safety.
- The determination that recovery of valuable resources from the spent nuclear fuel is necessary.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Required by the *Nuclear Waste Policy Act, as Amended* (NWPAA) (DOE 1995b).

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Consistent with Program Approach assumptions.
- *Nuclear Waste Policy Act, as Amended* (NWPAA) (DOE 1995b).
- Retrievability System Study September 1994.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 019 **Subject:** Mass Loading Range

I. STATEMENT OF ASSUMPTION

Surface, subsurface and waste package designs will be based on a reference mass loading range of 19.8-24.7 kgU/m^2 (80-100 metric tons of uranium (MTU) per acre) or an Equivalent Energy Density (EED) producing similar thermal conditions. The areal mass loading (AML) value includes the metric tons of uranium from commercial and Naval spent nuclear fuel, but does not include the "equivalent metric tons of uranium" from low burnup DOE spent nuclear fuel or from (reprocessed) defense or commercial high level waste. The excluded equivalent MTU (which is nominally about 10% of the repository capacity) will be disposed of within the same footprint as the heat-producing waste accounted for in the AML value.

Other aspects of thermal management are addressed in Key Assumptions 067, 077, and 078.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Establishes a design range permitting Mined Geologic Disposal System (MGDS) and waste package design options to proceed with criteria to achieve these objectives.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- No final decision on design mass loading has been made because drift scale in situ test data are not yet available; the flexibility to accommodate higher or lower thermal loads is part of the thermal strategy.
- The reference mass loading range is consistent with current thermal strategy (CRWMS M&O 1995).
- The design mass loading will tend to the upper end of the reference range, unless constrained by other limits in this document or in requirements documents.

Assumption Identifier: Key 019 (continued) **Subject:** Mass Loading Range

- The *Thermal Loading Study of FY96* (CRWMS M&O 1996g) recommended limiting the mass loading to no more than 22.2 kgU/m^2 (90 MTU/acre). This limit was based on limiting the temperature of the average top of the zeolite layer (170 m below the repository horizon) to 90°C. The numerical relationship between AML and temperature at a particular depth has some degree of uncertainty. Since the zeolite protection requirement is specifically included in assumption DCSS 025 (independent of any uncertainty in the relationship between AML and temperature at depth), the reference AML is not changed in this section. However, the design must meet both requirements.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 022 **Subject:** Repository Horizon

I. STATEMENT OF ASSUMPTION

For the reference mass loading given in Key Assumption 019 the repository horizon will be located mainly in the TSw2 geologic unit within the primary area.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Clarifies incompatibility of low thermal loading and assumes a scenario permitting subsurface design criteria to proceed compatibly with Key Assumption 003.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Recent evaluations indicate the TSw1/TSw2 contact is not well defined and some rock within the presently defined TSw1 unit is suitable for the emplacement of SNF and HLW. Revised assumption provides more flexibility.
- Primary area is consistent with site characterization activities.
- Primary area is as defined in Mansure, A. J. and Ortiz, T. S., *Preliminary Evaluation of the Subsurface Area Available for a Potential Nuclear Waste Repository at Yucca Mountain* (SNL 1984). The primary area is not rigidly defined. Therefore, rigidly restricting the repository to an arbitrarily defined unit is not warranted. Modest crossing of the boundary between units should be allowed.

Assumption is consistent with the thermal strategy reference loading.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 023 **Subject:** Subsurface Fault Standoff

I. STATEMENT OF ASSUMPTION

To the extent practical, repository openings will be located to avoid Type 1 faults. For unavoidable Type 1 faults that intersect emplacement drifts, allow a 15 m standoff from the edge of the fault zone to the nearest waste package.

Avoidance is assumed to be adequate by using a 60 m offset from the main trace of a fault at the repository level. Exception: 120-m stand off is reflected on the west side of the Ghost Dance Fault because the fault had not been fully investigated as of Exploratory Studies Facility (ESF) design. In the current design, the ESF Topopah Spring Main drift coincides with the repository east service main.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Establishes design criteria permitting Repository layout to proceed consistent with these objectives.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

NUREG 1494, *Staff Technical Position on Consideration of Fault Displacement Hazards in Geologic Repository Design* (NRC 1994). Key Assumption 023 Rev. 01 is a combined version of Key Assumption 023 Rev. 00, Key Assumption 034 Rev. 00, and Key Assumption 035 Rev. 00.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 024 **Subject:** Site Generated Wastes

I. STATEMENT OF ASSUMPTION

Secondary site generated waste (low-level, hazardous, mixed, and municipal) will be transported to government-approved offsite facilities for disposal. Radioactive low-level waste (LLW) will be processed (including volume reduction) and packaged for shipment to off-Yucca Mountain-Site disposal, as designated in Key Assumption 082, and in compliance with the waste acceptance criteria for that disposal site. Used dual-purpose canisters (DPCs) will be prepared for off-site recycling. Hazardous and mixed wastes will be collected and packaged for transport to RCRA-approved off-site treatment, storage and disposal facility. This activity will be limited to packaging required for transportation and acceptance of the hazardous and mixed waste at the disposal facility. Measures will be taken to maintain separation of the hazardous and low-level wastes during HLW processing to preclude formation of mixed waste. Temporary accumulations of site-generated wastes will be accommodated onsite to facilitate treatment of low-level waste and packaging of all waste types prior to transport to designated facilities. Offsite disposal and recycling options are to be assessed.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
(X) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

- 10 CFR 60.132 states "Radioactive Waste Treatment Facilities shall be designed to process any radioactive wastes generated at the geologic repository operations area into a form suitable to permit safe disposal at the geologic repository operations area or to permit safe transportation and conversion to a form suitable for disposal at an alternative site in accordance with any regulations that are applicable."

Need for assumption (statement of intended use):

Clarifies the functional requirements and waste flows for the Waste Treatment facilities and Mined Geologic Disposal System (MGDS) site to be included in the License Application (LA) and Environmental Impact Statement (EIS).

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

A study of site-generated waste quantities and disposal options was completed in September 1997 and the report updated in February 1998 as *Site-generated Waste Disposal Options* (CRWMS M&O 1998a). It documented conclusions and rationale for selected options. Options for LLW disposal on-site and off-site were evaluated in that study. The availability of the LLW facility at the NTS, as addressed in Key Assumption 082, would provide a relatively low-cost alternative that is particularly convenient for

Assumption Identifier: Key 024 (continued) **Subject:** Site Generated Wastes

transportation. Options for DPC disposal were also investigated in the study, and it was concluded that DPCs should be assumed to be recyclable. Hazardous waste quantities were estimated to be too small to warrant permitting for treatment, storage and disposal. Mixed waste quantities comprise a small fraction of the hazardous wastes. Radioactive Waste (RW) policy excludes mixed waste from disposal at Mined Geologic Disposal System (MGDS) (June 22, 1995, Dreyfus' memorandum bounding NEPA analysis to non-RCRA spent nuclear fuel (SNF) and vitrified high-level waste [HLW]). Collection of municipal and construction wastes (nonradioactive, nonhazardous) in dumpsters for transport to State-permitted landfills is expected to provide environmentally-acceptable disposal at a reasonable cost.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering and Surface Design

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 030 **Subject:** Underground Rail Transport of Personnel and Supplies

I. STATEMENT OF ASSUMPTION

Rail will be used for transporting underground supplies and personnel to the extent practical.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Limits consideration of alternate subsurface transport method to permit focused underground design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Rail system is:

- Takes advantage of the rail system required to transport heavy waste packages.
- Well suited to in-drift emplacement mode.
- Ideal for supplying tunnel boring machine (TBM) operation and transportation of personnel.
- Repository subsurface gradient will allow use of rail system.
- Highly suitable for remote handled or automated operations.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 031 **Subject:** Waste Package Shielding

I. STATEMENT OF ASSUMPTION

A. Waste package containment barriers will provide sufficient shielding for protection of waste package materials from radiation enhanced corrosion.

B. Individual waste packages will not provide any additional shielding for personnel protection.

C. Additional shielding for personnel protection will be provided on the subsurface transporter and in surface and subsurface facilities.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):
Establishes coordinated criteria to permit waste package and Repository facilities design to proceed.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Cost, size, and weight of individually shielded waste packages may be excessive.
- Mined Geologic Disposal System (MGDS) will meet as low as reasonably achievable (ALARA) requirement, with more cost effective shielding options.
- Personnel radiation protection from individual waste packages will be provided through the use of:

  (1) remote handling equipment in the assembly and emplacement areas,
  (2) a shielded waste package transporter during emplacement operations, and
  (3) shielding and seals at the entrances to the emplacement drifts.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:
Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 039 **Subject:** Criticality Control Period

I. STATEMENT OF ASSUMPTION

The Criticality Control Period lasts to the end of the period of regulatory concern, which is currently undefined. It is presently assumed that the time of concern is greater than 10,000 years after closure.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Identifies the required period for criticality analysis.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

> The criticality control period is chosen to last to the end of the period of regulatory concern. This has generally been considered to be 10,000 years after closure of the repository.
>
> Assumption in accordance with 10 CFR 60.131(h). Note: On December 4, 1996 there was a change to 10 CFR 60; paragraph 10 CFR 60.131(b)(7) was renumbered 10 CFR 60.131(h).
>
> The interim postclosure standard (see Key 060) contains a 10,000 year time frame for controlling peak dose, but also states that time periods beyond 10,000 years must be considered.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 046 **Subject:** Backfill in Emplacement Drifts

I. STATEMENT OF ASSUMPTION

The repository design should not preclude the use of emplacement drift backfill at the end of the preclosure period. The specifications for the emplacement drift envelope to accommodate are: 1) level single layer backfill (quartz sand, crushed tuff, or other material of similar favorable thermohydrologic properties), and 2) waste packages should initially be covered with at least 0.6 meters of material.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Establishes a scenario which permits performance objectives and design criteria to be developed for the waste package and the Mined Geologic Disposal System (MGDS).

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

A *Waste Isolation Study* (CRWMS M&O 1997w) evaluated the effects of backfill on temperature and relative humidity of the waste package. This study concludes that backfill provided little or no performance benefit for flux of 6.2 mm/year. It did recommend that the ability to backfill be preserved, as it may be needed to support other barrier concepts, such as the survivability of a drip shield.

In light of the current repository performance margins and uncertainties, the underground repository layout should provide a sufficient envelope such that a reasonable backfill emplacement system could be designed and backfit at a later date. It is assumed that the emplaced backfill will not have to be compacted after placement. Further discussion of this conclusion can be found in the *Engineered Barrier System Performance Requirements Systems Study Report* (CRWMS M&O 1996d).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 047 **Subject:** Surface Facilities Location

I. STATEMENT OF ASSUMPTION

The proposed repository waste handling and administrative surface facilities will be located adjacent to the north portal. Flood considerations for locating surface facilities are included in Assumption TDS-008. Administrative facilities will be located east of the nuclear facilities.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Establishes probable general siting of facilities based on performance objectives to permit specific facility siting criteria to proceed.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Site Characterization Plan/Conceptual Design Report proposed the location of the central surface facilities at the entrance to the waste ramp portal.
- Northern Midway Valley is more likely to contain an area demonstrably free of late Quaternary surface faults.
- The Exploratory Studies Facility (ESF) alternatives study recommended relocation of the waste and tuff ramps portals based on Option 30 findings.
- The current technical baseline identifies a north and south portal location in accordance with the ESF enhanced configuration.
- The ESF is presently located at the entrance to the north portal.
- The south portal has a steeper ramp grade (2.62 percent) compared to the north portal ramp (2.15 percent).
- Planned site improvements for the ESF can be used for the proposed repository surface facilities.
- Prevailing winds were analyzed during Advanced Conceptual Design (ACD).

Assumption Identifier: Key 047 (continued) **Subject:** Surface Facilities Location

- Relative location of Administrative and Nuclear facilities considers prevailing winds in the event of an accidental hazardous release.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 053 **Subject:** Off-Normal Waste Handling

I. STATEMENT OF ASSUMPTION

The Mined Geologic Disposal System (MGDS) shall have the capability to handle canistered waste forms that require remedial processing. This includes remediation due to inability to load waste into a disposal container in the canistered configuration. Such off-normal handling includes opening the canister, removing the waste form, discarding the canister, and repacking the waste form in a disposal container. For Viability Assessment (VA) design purposes, this includes commercial SNF. Applicability for other waste forms will be assessed and resolved during License Application (LA) design.

II. BACKGROUND

Original Version
MGDSRD 3.2.3.2.3.1.1.L.
The Repository Segment shall have the capability to handle any abnormal multi-purpose canisters (MPCs) and other canistered waste forms that require remedial processing. Such processing may include opening the canister, transferring the waste form, adding filler material and resealing. [10CFR60.135(a)(1)] [CRD 3.7.4.2.D]

Requesting Management and Operating Contractor (M&O) organization:
(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Defines a probable functional requirement to permit continued development of the repository Waste Handling Building (WHB).

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This assumption complies with the *Mined Geologic Disposal System Requirements Document* (MGDS-RD) (DOE 1996c) requirements cited in the Background Section. The assumption pertains to disposable waste canisters that are otherwise intended not to be opened. The Referenced 10 CFR 60 and CRD sections are under "off-normal" headings. Therefore, this requirement applies to an off-normal occurrence. The requirement is not directly imposed by 10 CFR 60 or the CRD.

A separate, single operation cell will provide for the required remedial operations on an off-normal basis. This cell is proposed to prevent special operations from interfering with normal waste handling operations. The cell will need to be adaptable to multiple functional roles for one-time or low-volume events. Probable events and best remedial methodology will need to be investigated before operations

and equipment can be defined for this area. Programmatic guidance defines an approach where the addition of filler material to canistered waste, as a criticality remediation measure, may be unnecessary (IOC #VA.SE.GUR.8/95.016).

The implications and extent of applicability of a requirement on various DOE SNF, Naval SNF, and HLW are subject to differing interpretations that must be resolved during LA design to define the scope of impact on repository facilities.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 055 **Subject:** Retrieval Demonstration

I. STATEMENT OF ASSUMPTION

Proof of principle demonstrations of waste package retrieval will be conducted following license application.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, (X) Other (specify): Requirements, Systems Analysis and Modeling

Need for assumption (statement of intended use):

Provides input to test planning and scheduling.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Proof of principle required as a result of uncertainties associated with the performance of retrieval equipment in the underground environment.

Consistent with Program Approach assumptions.
Meets 10 CFR 60 and U.S. Department of Energy (DOE) requirements.

Proof of principle demonstration consistent with DOE position as stated in Appendix D of *Position of Retrievability for a Geologic Repository* (DOE 1985).

This assumption will be reexamined if a requirement to conduct retrieval demonstration prior to license application is established by DOE.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 057 **Subject:** Burnup or Thermal Measurements

I. STATEMENT OF ASSUMPTION

Repository waste handling baseline design will not have canistered spent nuclear fuel burnup or thermal measurement capability.

The burnup of every uncanistered commercial fuel assembly will need to be measured prior to emplacement in a waste package. The repository surface facility will have the capacity to perform a measurement verifying the burnup record for each fuel assembly. Fuel assemblies shipped in burnup credit transportation casks will have the necessary measurements prior to shipment to the repository, and no additional measurement will be required.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, (X) Waste Package Development, (X) Other (specify): Systems Engineering (Vienna)

Need for assumption (statement of intended use):

Waste Handling Building (WHB) Design

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Burnup measurements of spent nuclear fuel (SNF) in disposable waste canisters will be performed, at purchaser sites, if required for transportation. For assemblies received at the repository in disposable canisters any needed measurements would have to be made prior to loading the canister and the data provided with the canistered SNF.

Ongoing discussions with the Nuclear Regulatory Commission Staff indicate they will require a burnup measurement of some sort before burnup credit is allowed. Burnup measurement systems are addressed in Appendix B of *Topical Report on Actinide Only Burnup Credit for PWR Spent Nuclear Fuel Packages* (DOE 1997).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:
Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 058 **Subject:** Transportation Mode/Route Within Nevada

I. STATEMENT OF ASSUMPTION

Spent nuclear fuel (SNF) and high-level waste (HLW) arriving in Nevada on mainline rail lines, will be transported to the repository via rail. The five rail routes being considered are described in the *Rail Alignments Analysis*, BCBI00000-01717-0200-00002, Rev.00, July 1997 (CRWMS M&O 1997o). The five routes being considered are: Caliente route, Jean route, Carlin route, Valley Modified route, and Caliente/Chalk Mountain route.

Ultimate selection of a final route will be made under the NEPA process, since this decision has not been made. Program Cost Estimates will use an average cost of the five routes. Costs for design and construction of rail are contained in the Nevada Transportation Study Construction Cost Estimate, August, 1997, based on the rail alignment conceptual design prepared by Morrison Knudsen Corporation.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Engineering (Vienna)

Need for assumption (statement of intended use):

Provides basis for cost estimate.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The Primary Alignments for all five routes are considered to be the basis for cost estimating purposes of each alignment. Using the average of all five alignments is appropriate until a decision on a final route is made under the NEPA process.

The EIS will continue to evaluate heavy haul truck within the State of Nevada as an option in comparison to rail as indicated in the Notice of Intent (NOI). The EIS will provide the necessary analysis for decision makers to use to decide on mode and route. This decision will be documented under the NEPA process. Rail in Nevada is used as the assumption because it provides a reasonable basis for design that could be readily modified to heavy-haul if necessary.

Assumption Identifier: Key 058 (continued)

Subject: Transportation Mode/Route Within Nevada

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Transportation

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 059

Subject: MGDS Configuration Item Organization

I. STATEMENT OF ASSUMPTION

The configuration items of the Engineered Barrier Segment (EBS) and the configuration items groups of the repository (Surface and Subsurface) are organized as shown in Figure 3-1.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Configuration Management and Requirements Allocation.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The figure is based on Advanced Conceptual Design (ACD) development.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering (Requirements)

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

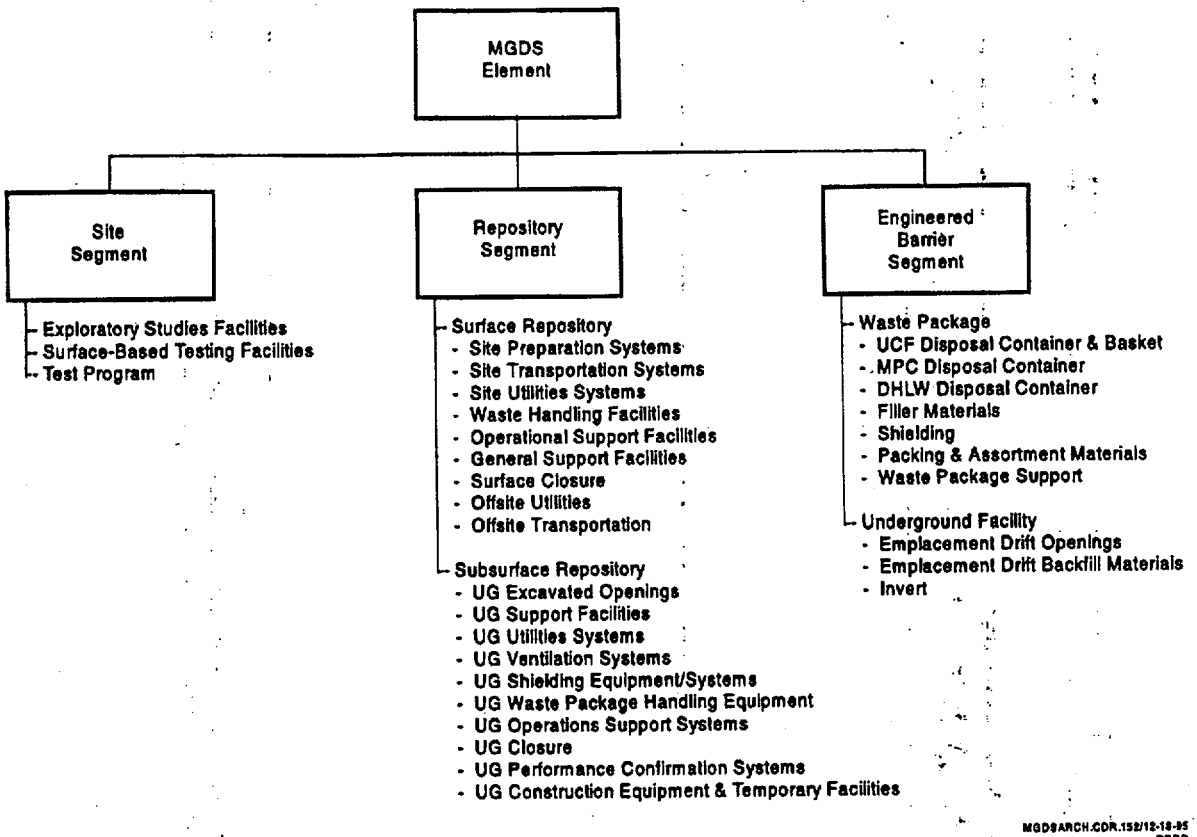

Figure 3-1. Mined Geologic Disposal System Configuration Item Organization

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 060 **Subject:** Interim Postclosure Performance Measure

I. STATEMENT OF ASSUMPTION

Until a new Environmental Protection Agency (EPA) standard is promulgated, the Yucca Mountain Site Characterization Office (YMSCO) will use the following interim performance measure and goal as a planning basis for evaluating the postclosure performance of the repository:

The interim system-level performance measure is a quantitative statement of the desired performance for the first 10,000 years after closure. It is followed by a system-level performance goal that recognizes there needs to be sufficient defense-in-depth in the repository's multiple barriers system to ensure that public safety is protected beyond 10,000 years. This is a serious system performance goal. It is qualitative because of increasing uncertainties beyond the first 10,000 years.

Performance Measure

The expected annual dose to an average individual in a critical group living 20 km from the repository should not exceed 25 mrem from all pathways and all radionuclides during the first 10,000 years after closure. (This dose limit is measured as Total Effective Dose Equivalent.)

Goal

Conduct analyses past 10,000 years to gain insight into longer-term system performance. For this period, the expected annual dose to an average individual in a critical group living 20 km from the repository should be below the 10,000 year performance measure.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Guidance is needed for a postclosure standard since 40 CFR 191 is no longer applicable to a repository at Yucca Mountain (per the Waste Isolation Plant Land and Withdrawal Act of 1992) and a new standard specific to Yucca Mountain (as required by the Energy Policy Act of 1992) has not yet been promulgated.

Assumption Identifier: Key 060 (continued) **Subject:** Interim Postclosure Performance Measure

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The interim postclosure performance measure and goal was established by YMSCO (YMP 1997) with the following rationale:

Consistent with the U.S. Nuclear Regulatory Commission (NRC) [Chairman Jackson's testimony to the Subcommittee on Energy and Power, U.S. House of Representatives, April 29, 1997 (Jackson 1997)], the DOE considers that 10,000 years is sufficient time to demonstrate waste isolation. The DOE supports the NRC in its position that an annual effective dose of 100 mrem to the average member of the population within the vicinity of Yucca Mountain protects public health and safety. To provide reasonable assurance and to be consistent with the NRC's regulations on decommissioning nuclear power reactors (61 FR 39278; 10 CFR Parts 2, 50, and 51), the DOE has invoked an interim performance measure so that it may move forward and demonstrate the safety case for a repository at Yucca Mountain.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 061

Subject: Performance Confirmation Requirements (1996)

I. STATEMENT OF ASSUMPTION

The following set of requirements is based on the FY 96 *Performance Confirmation Concept Study Report* (CRWMS M&O 1996e) and will be used as a basis for Mined Geologic Disposal System (MGDS) Performance Confirmation planning and design.

1. Repository design and operation shall provide facilities, access, instrumentation, recording, maintenance, and support for measuring/monitoring the performance confirmation parameters identified in Appendix D of the FY 96 *Performance Confirmation Concept Study Report* (CRWMS M&O 1996e).

2. The performance confirmation monitoring and measuring system shall have a maintainable service life of 125 years. (This includes 100 years plus the duration of initial construction plus the duration of final closure plus any time period during site characterization for which the system must be operable. This excludes the period of about 25 years to retrieve the waste if retrieval is required). Specific equipment and components shall have maintainable service lives dependent upon their identified function. These service lives are to be determined (TBD).

3. Planning of repository design and operations for performance confirmation test facilities and support shall consider the performance confirmation concepts identified in Section 5 of the *Performance Confirmation Concept Study Report* (CRWMS M&O 1996e) as a point of departure.

4. The performance confirmation system shall be planned to permit TBD percent availability of the system.

5. Test locations/environments, samples, and specimens, onsite and offsite, shall be representative of the Repository environments and design elements.

6. Performance confirmation staff, measurement and monitoring hardware and software, shall be available to support the variable demand for analysis, assessment, and periodic reporting throughout the Performance Confirmation Program.

7. Surface-based boreholes shall be provided for monitoring unsaturated and saturated zone hydrology and shall avoid underground excavations.

8. At least one alcove shall be provided for testing and monitoring a TBD fault zone prior to waste emplacement.

9. Monitoring of at least two percent of the thermal rock mass behavior (to be related to the number of emplacement drifts) shall be performed; a portion of the rock mass to be monitored should be near the first emplacement drifts to contain waste.

Assumption Identifier: Key 061 (continued)

Subject: Performance Confirmation Requirements (1996)

10. The performance confirmation monitoring and measuring system should make maximum use of automated equipment to collect, record, and analyze performance data.

11. The Repository Subsurface Facilities shall provide underground openings (drifts, alcoves, boreholes, and ancillary excavations), access, data acquisition, and test support to implement performance confirmation monitoring and test recommendations including interface and coordination with Site Investigation Testing, Repository Testing, Waste Package Testing, and Surface Support. These operations are to include, but are not to be limited to, capabilities for:

    a. Any ground support system (i.e., shotcrete or concrete) that covers the repository subsurface opening rock wall surface shall not be installed until after necessary rock mapping has been completed in drifts designated for mapping.

    b. A total of 500 samples of rock core shall be acquired following drift excavation in the emplacement drifts that are mapped as well as the non-emplacement drifts.

    c. Placement and recovery of material coupons or specimens in the emplacement drift or other underground locations shall be performed at least once every 10 years.

    d. Recovery of selected or malfunctioning waste packages shall be performed on a non-routine basis, as required.

    e. The design, excavation, and ground support of emplacement drifts shall permit installation of and access to test/monitoring instrumentation, and observation drift instrumentation, and provide access for remotely operated vehicles or mobile inspection platforms to obtain measurements.

    f. Excavation of at least one permanent observation drift above the repository horizon shall be developed in support of thermal monitoring.

    g. At least one alcove shall be prepared for underground monitoring of seismic activities.

    h. The air temperature, relative humidity, and gaseous radioactive emissions of all emplacement drifts shall be monitored in the drift ventilation system. (See Key Assumption 067.)

    i. The ventilation monitoring system shall be capable of identifying the specific drifts that are sources of gaseous radioactive emissions, if any, within TBD hours of detection of such emission.

    j. The provision and use of remotely operated vehicles or movable inspection platform for monitoring emplacement drift environments and effects shall be considered in support of

the following requirements:

- Personnel access into emplacement drifts shall not be permitted except for emergencies.

- Remote inspections of emplacement drifts at least once every ten years shall be performed to monitor rockfall, and visually inspect and thermally image waste packages.

k. Subsurface facilities operations shall have a program to inspect for groundwater inflow and, if detected, for measuring

- Groundwater inflow quantities,
- Temperature, and
- Chemical composition.

Measurements shall be made by:

- Direct measurement for all underground openings except emplacement drifts,

- Direct measurement during construction and prior to waste emplacement for emplacement drifts, and

- Indirect or remote measurement in emplacement drifts after waste emplacement.

l. Emplacement drift diameter changes shall be monitored periodically to track excavation convergence or instability. These measurements are required:

- In Permanent Observation Drifts, by measuring rock displacement.

- In selected drifts, by visual observation of rockfalls.

m. Alcoves or drifts shall be provided to support backfill performance and constructability experiments and tests, if backfill in emplacement drifts is required.

n. Alcoves shall be provided to support seal performance and constructability tests.

o. Subsurface Facilities shall provide facilities and test support as required by Site Investigation Thermal Testing to characterize and monitor thermal interaction effects while heating and while cooling and as required by Waste Package Testing for materials in situ tests.

12. The Repository Surface Facilities shall have the capability to support Performance Confirmation surface operations, equipment, and tests including, but not limited to:

    a. The capability to receive, handle, store, examine, test, and return to the underground waste packages, material coupons, and other specimens recovered from underground emplacement. This capability is to be exercised on a non-routine basis for malfunctioning radioactive waste packages, if any.

    b. Handling to include transferring and opening the disposal container and canistered and uncanistered waste forms, removing of samples, and repackaging, resealing, and decontaminating the disposal container.

    c. The capability for routine and non-routine non-destructive testing of sealed or resealed waste packages prior to emplacement or after recovery.

    d. The capability to receive, decontaminate, manage, temporarily store, and ship material coupons or specimens, retrieved from the emplacement drift, for offsite testing.

    e. The capability to receive, manage, temporarily store, and ship rock samples for offsite testing.

    f. The capability to transfer, automatically acquire, record, process, and communicate instrumentation data from surface and subsurface monitoring equipment and tests.

    g. The capability to support and protect continuous and periodic surface monitoring and tests operations.

    h. The facilities and equipment to support performance confirmation operations such as test monitoring and control, data processing, record management and communication, limited laboratory tests, analysis and evaluations.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
(X) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Performance confirmation requirements are needed for design and planning and do not yet exist in the Mined Geologic Disposal System (MGDS) design requirements documents.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 061 (continued)

Subject: Performance Confirmation Requirements (1996)

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The requirements were recommended in the *Performance Confirmation Concept Study Report* (CRWMS M&O 1996e). Some requirements have been clarified as a result of additional planning. The number of samples of rock core defined in requirement 11.b is estimated to provide the coverage needed to confirm the spatial variability of rock properties.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 063 **Subject:** Waste Package Destructive Testing

I. STATEMENT OF ASSUMPTION

Destructive testing of waste packages will be conducted if packages need to be recovered from the emplacement drift, on a contingency basis. Periodic or routine testing is not planned.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use): Needed to focus design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Assumption is based on the requirements recommended in the *Performance Confirmation Study Report* (CRWMS M&O 1996e) recommendation (see Key Assumption 061) and is stated here for emphasis.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 064 **Subject:** Seismic Design Criteria

I. STATEMENT OF ASSUMPTION

A. The seismic design of repository SSCs (structures, systems, and components) important to (radiological) safety (including surface facilities, subsurface facilities, and waste packages) shall be based on the methodology presented in Reference 1. Seismic design shall include design for vibratory ground motion and fault displacement.

B. Preliminary values corresponding to Frequency-Category-1 (mean annual exceedance probability of 0.001) and Frequency-Category-2 (mean annual exceedance probability of 0.0001) for the following parameters shall be based on Tables 1 & 3 and Appendix C from Reference 2.

- Peak acceleration (Table 1)
- Peak velocity (Table 1)
- Factors for reduction of ground motion with depth (Table 3)
- Response spectra (Appendix C)

REFERENCES:

Reference 1: *Preclosure Seismic Design Methodology for a Geologic Repository at Yucca Mountain*, Topical Report YMP/TR-003-NP, Rev. 2 (YMP 1997c).

Reference 2: *Seismic Design Inputs for the Exploratory Studies Facility at Yucca Mountain* (CRWMS M&O 1994a).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
(X) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Natural Environment Programs

Need for assumption (statement of intended use):

Criteria for seismic design are needed for SSC design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Reference 1 provides the approach to seismic design used for repository SSCs. Reference 2 lists parameters required for seismic design. These parameters were

Assumption Identifier: Key 064 (continued) **Subject:** Seismic Design Criteria

determined by a preliminary assessment of size specific hazards, and are considered appropriate for current Viability Assessment (VA) design.

- The methodology and values in the references will be used in anticipation that the topical report will ultimately be approved by the NRC.
- This assumption will be updated if these references are revised.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 065 **Subject:** Retrieval Design

I. STATEMENT OF ASSUMPTION

Mined Geologic Disposal System (MGDS) design for retrieval will be performed when, and if, retrieval of the waste packages is directed or required for a reason as defined in Key Assumption 017.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Design focus on handling operations.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Full scale retrieval of all waste packages that have been emplaced in the repository is considered to be unlikely. It would not be cost effective to design and construct facilities and equipment for an operation that is not expected to be required. However, for Viability Assessment (VA) it must be shown that MGDS design does not preclude retrieval and is compatible with the retrieval design concept.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 066 **Subject:** Gantry Emplacement and Pedestal Support

I. STATEMENT OF ASSUMPTION

Waste packages will be placed center in-drift, on pedestals, using gantry emplacement. (See related assumption Key 011).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, (X) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Affects emplacement drift size and emplacement method.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Placement of a waste package by a gantry is simple and accommodates retrieval. The waste package on a pedestal is most conducive to backfilling in emplacement drifts. Compared to railcar emplacement, there is substantial cost savings because only a few railcars are needed for gantry emplacement as opposed to needing one railcar for each waste package for railcar emplacement.

The gantry emplacement concept is reflected in drawing *Emplacement Gantry Interfaces, Emplacement Drift Plan & Elevations*, BCAF00000-01717-2700-85010.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 067 **Subject:** Emplacement Drift Ventilation

I. STATEMENT OF ASSUMPTION

Ventilation of each emplacement drift will be restricted after emplacement is completed in that drift. "Blast cooling" will be used if the drift must be cooled for maintenance or WP retrieval. Emplacement drift ventilation will be maintained at a low, controlled volume for monitoring purposes.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Affects design and operation of subsurface ventilation system.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Having a small, but steady flow of air through the emplacement drifts facilitates monitoring for airborne radionuclides
- Facilitates monitoring for health and safety
- Facilitates monitoring for performance confirmation
- Minimal ventilation after emplacement is consistent with the existing Advanced Conceptual Design.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 068 **Subject:** Use of North Ramp for Waste Transport

I. STATEMENT OF ASSUMPTION

The North Ramp will be used for waste transport.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Needed to focus Viability Assessment (VA) design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This assumption has been the basis for planning and design efforts for several years, and it has always been the favored location of waste package transport.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 069 **Subject:** Applicability of OSHA and MSHA

I. STATEMENT OF ASSUMPTION

The Federal Occupational Safety and Health Act (OSHA) (29USC651, et seq.) applies to all facilities and equipment.

The Federal Mine Safety and Health Act (MSHA) of 1977 (30USC801, et seq.) is a supplement to OSHA and applies only to subsurface facilities and equipment and to those mining-related surface facilities and equipment specifically addressed therein. There is no implication that the Mine Safety and Health Administration has any enforcement authority over construction or operations of the Mined Geologic Disposal System (MGDS).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Clarifies applicability of MSHA from 10 CFR 60.131(b)(9) which states:

"To the extent that DOE is not subject to the Federal Mine Safety and Health Act of 1977, as to the construction and operation of the geologic repository operations area, the design of the geologic repository operations area shall nevertheless include such provisions for worker protection as may be necessary to provide reasonable assurance that all structures, systems, and components important to safety can perform their intended functions. Any deviation from relevant design requirements in 30 CFR, Chapter I, Subchapters D, E, and N will give rise to a rebuttable presumption that this requirement has not been met."

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Adapted from MGDS-RD, paragraph 3.1.5.H.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 070 **Subject:** Excavated Opening Diameters

I. STATEMENT OF ASSUMPTION

The following diameters are assumed for underground openings.

Underground Opening	Diameter (m)
Shafts	6.1 (finished inside diameter)

Note: The diameters of ramps, access/service main, central exhaust main, emplacement drifts, and performance confirmation drifts have been baselined, as indicated in the rationale below.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, (X) Waste Package Development, or (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Needed to focus design for all affected parties.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Shaft diameters accommodate anticipated ventilation needs.
- The ramps and access/service main were excavated at 7.62 meter diameter as part of the ESF.
- Excavated diameters of ramps (7.62 m), access/service main (7.62 m), central exhaust main (7.62 m), and emplacement drifts (5.5 m) are provided on the *Typical Emplacement Drift and Ventilation Raise Sections, Elevations*, drawing BCAA00000-01717-2700-81035 (CRWMS M&O 1997s) which has been baselined.
- Excavated diameter of performance confirmation (observation) drifts (5.5 m) is provided on drawing BCAA00000-01717-2700-81034, *Performance Confirmation Facilities for VA Design Plan, Section* (CRWMS M&O 1997u), which has been baselined.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 071 **Subject:** Preclosure Controlled Area Boundary

I. STATEMENT OF ASSUMPTION

A preclosure controlled area boundary will be established at a distance at least 5 km in all directions from the Waste Handling Building (WHB) ventilation relase point and 5 km from the emplacement area ventilation exhaust shaft.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Incorporates radiological safety criteria from the U.S. Nuclear Regulatory Commission's (NRC's) December 1996 revision to 10 CFR 60 on design basis event (DBE) criteria and specifically the section 10 CFR 60.136 on the preclosure controlled area.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Preliminary DBE pilot analyses, as summarized in Draft PISA Chapter 7, "Radiological Safety Assessment of the Repository through Permanent Closure" (CRWMS M&O 1997), considered potential doses at distances of 0.1, 1, and 5 km. Of the three distances considered, preliminary analyses indicate that the 5 km distance from the WHB release point to the Preclosure Controlled Area boundary would be required to comply with the criteria of 10 CFR 60.136. This distance and the required radius from the emplacement area ventilation exhaust shaft must be verified in final DBE analyses scheduled for completion by the end of FY 1999.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface and Systems Engineering/Safety Assurance

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 073 **Subject:** No Filler Material

I. STATEMENT OF ASSUMPTION

The addition of filler material to spent nuclear fuel (SNF) arriving in disposable canisters is not required.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Needed for repository and waste package design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The project's position is not to choose the option of adding filler material to canisters which do not meet disposal requirements. Instead, the loaded canister will be opened, the SNF will be removed, the canister will be discarded, and the SNF will be repackaged in a new disposable container that meets disposal requirements. This modification of the project's approach is a result of the "MPC Policy Change" (BCP-00-96-0002, BCP REV 00).

This assumption complies with the intended interpretation of the MGDS RD 3.2.3.2.3.1.1.L requirement as found in Section 3.2.3.2.3.1.1.L of the Transportation SRD.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 074 **Subject:** Waste packages should not breach for 3,000 years

I. STATEMENT OF ASSUMPTION

As a goal, no more than 10 waste packages should breach within 3000 years after repository closure when exposed to the near-field environment based on TDSS 025 and TDSS 026 as modified by the engineered barrier system. Breaching of the waste package is defined as an opening through the wall of the waste package through which advective or diffusive transport of gas or radionuclides can occur.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify):
Program Chief Scientist

Need for assumption (statement of intended use):

Needed for repository and waste package design to reflect the potentially high, spatially variable, thermally mobilized water flux during the period of high thermal effects.

III. RATIONALE

This assumption is a goal which is based on current performance assessment calculations and may be withdrawn or modified as performance assessment calculations are updated. This assumption intends to restrict most of the waste packages from being breached during the thermal pulse period of 3,000 years (Reference) when exposed to the near-field environments based on TDSS 023 and TDSS 026 as modified by the Engineered Barrier System. This is expected to bounds the period of time that the boiling isotherm is at or beyond the edge of the drift.

Performance assessment results available in early 1997 indicated that, under conservative assumptions regarding characteristics of the site and an assumed percolation flux of 6.2 mm/year, the calculated dose rate ramps up steeply with a value on the order of 10 mrem/year at 10,000 years and a peak value on the order of 500 mrems/year at about 25,000 years. [These results reflect Total Effective Dose Equivalent for the average individual in the critical group defined for interim postclosure performance measurement in Attachment 1 to Enclosure 3 to FY 1997 Planning Guidance (YMP 1996b).] A higher percolation flux could result in a dose rate exceeding 500 mrems/year in less than 10,000 years. These calculations did not include the effect of an engineered water diversion system or more robust waste packages. Based on this information, the engineered barrier system should be designed to reduce the calculated peak dose rate by several orders of magnitude to achieve reasonable confidence that peak dose rates in 10,000 years will be less than expected standards. A design objective of a three-order of magnitude reduction is chosen here to provide an adequate margin of safety: that is, an engineered barrier system with all but 10 waste packages meeting this assumption will provide this margin of safety.

Assumption Identifier: Key 074 (continued) **Subject:** Waste packages should not breach for 3,000 years

Reference:

Wilder, D. 1996. *Near-Field and Altered Zone Environment Report, Volume II.* UCRL-LR-124998.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 075 **Subject:** Water should not contact waste form

I. STATEMENT OF ASSUMPTION

As a goal the Engineered Barrier System, when exposed to the environments based on assumptions TDSS 025 and TDSS 026, should prevent seeping water that is entering the emplacement drift from directly contacting the waste form at all but 10 waste form locations, for a period of at least 10,000 years after permanent closure of the repository.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify):
Program Chief Scientist

Need for assumption (statement of intended use):

Needed for repository and waste package design.

III. RATIONALE

This assumption is a goal which is based on current performance assessment calculations and may be withdrawn or modified as performance assessment calculations are updated. The intent of this assumption is to prevent the dissolution of the waste form and subsequent advective or diffusive transport of radionuclides to the natural barrier system, even if there are high incident seepage fluxes.

The duration of at least 10,000 years is in response to the interim postclosure performance measure (Key Assumption 060). If all the components of the engineered barrier system failed simultaneously after the 10,000 years, there would be little benefit from meeting this requirement with respect to contributing to the reduction of the peak dose released to the accessible environment. Therefore implied in this assumption is the fact that all portions of the engineered barrier system that prevent seeping water from contacting the waste form will not all fail at the same time after 10,000 years. The failures of those portions of the engineered barrier system are anticipated to follow a distribution function and will occur over a large number of years.

Performance assessment results available in early 1997 indicated that, under conservative assumptions regarding characteristics of the site and an assumed percolation flux of 6.2 mm/year, the calculated dose rate ramps up steeply with a value on the order of 10 mrem/year at 10,000 years and a peak value on the order of 500 mrems/year at about 25,000 years. [These results reflect Total Effective Dose Equivalent for the average individual in the critical group defined for interim postclosure performance measurement in Attachment 1 to Enclosure 3 to FY 1997 Planning Guidance (YMP 1996b).] A higher percolation flux could result in a dose rate exceeding 500 mrems/year in less than 10,000 years. These calculations did not include the effect of an engineered water diversion system or more robust waste packages. Based on this information, the engineered barrier system should be designed to reduce the calculated peak dose rate by several orders of magnitude to achieve reasonable confidence that peak dose rates in 10,000 years will be less than expected standards. A design objective of a three-order of

Assumption Identifier: Key 075 (continued) **Subject:** Water should not contact waste form

magnitude reduction is chosen here to provide an adequate margin of safety: that is, an engineered barrier system that protects the waste form in all but 10 waste packages will provide this margin of safety.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 076 **Subject:** Multiple barriers

I. STATEMENT OF ASSUMPTION

The Engineered Barrier System shall include multiple barriers to prevent seeping water which has entered the emplacement drift from contacting the waste form and these barriers are to be designed to preclude common mode failure. These multiple barriers can be any combination of diverse or redundant concepts.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Program Chief Scientist

Need for assumption (statement of intended use):

Needed for repository and waste package design for defense in depth against high incident flow of seeping water.

III. RATIONALE

This assumption is to provide "defense-in-depth" by requiring the design to incorporate a multiple barrier concept. These multiple barriers may work together or independently to prevent seeping water from contacting the waste form. The elimination of common mode failures is to ensure that a single failure mode will not result in the failure of multiple barriers such that the postclosure standards can no longer be met. Corrosion mechanisms such as general, pitting, and crevice, and stress corrosion cracking are considered to be separate failure modes.

For clarification, the following definitions apply to Key Assumption 076:

Redundant	Duplicate barriers with the same function and method of performance
Diverse	Separate barriers that meet the same function by different means
Independent	Separate barriers that are not dependent upon each other

IV. RESPONSIBILITIES AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface Design and Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 077 **Subject:** Waste Package and Drift Spacing

I. STATEMENT OF ASSUMPTION

Layout geometry will be similar to that in the Advanced Conceptual Design Report commonly termed "point load." Commercial spent nuclear fuel (SNF) waste packages (WPs) will be assigned area according to their individual mass content, while high level waste (HLW) and other low or no-heat WPs will be placed between commercial SNF WPs without accounting for their mass content. Drift spacing will be maximized within the constraints of providing WP spacing for specified mass per area and maintaining the ability to emplace the other WPs between the large commercial SNF WPs.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify):
Project Engineering

Need for assumption (statement of intended use):

Establishes emplacement layout geometry for thermal management permitting Mined Geologic Disposal System (MGDS) and waste package design to proceed.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

A point loading configuration is consistent with the existing Advanced Conceptual Design (CRWMS M&O 1996a). The mass per area for each WP is the ratio of the mass content of the WP and the area assigned to the WP. The area is a function of the drift spacing and the spacing between WPs. With the point loading concept the area allocated to each waste package is adjusted for its individual mass content to obtain the desired AML value. In determining the area for a given mass, the design is expected to increase the spacing between drifts to the extent practical and reduce the spacing between commercial WPs to the extent practical while retaining the ability to emplace other WPs between these commercial SNF WPs. This is the meaning of maximized drift spacing in the assumption, although it has been suggested that if WPs are pushed close enough together, they will radiate well into each other and result in a fall in temperature that would allow the WPs to be closer together (and hence, drifts further apart) for a given AML value.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 078 **Subject:** Waste Package Loading & Emplacement Order

I. STATEMENT OF ASSUMPTION

Waste will be placed in waste packages (WPs) in the approximate order in which received (within the limits specified elsewhere on initial heat output and criticality of SNF that can be loaded into each type of WP) and emplaced in the drifts in the order received from the surface facility. Less than ten (10) percent of the monthly throughput of SNF assemblies will be staged on the surface at the Repository before or after it is unloaded from casks to accommodate variances in operations throughput, and in waste form and disposal container compatibility.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Project Engineering

Need for assumption (statement of intended use):

Establishes part of thermal management strategy permitting Mined Geologic Disposal System (MGDS) and waste package design to proceed. There is currently no requirement for providing extensive surge (lag) storage to accommodate handling of the waste to support thermal management. The maximum lag storage capacity assumes it is not required to manage fuel assembly loading of the Disposal Containers, and the fuel assemblies will be received with thermal characteristics that are reasonably compatible with the emplacement strategy.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The heat and criticality characteristics of SNF that can be loaded in each WP type are defined in *Determination of Waste Package Design Configurations* (CRWMS 1997e) and were used in developing the commercial SNF waste stream presented in Key Assumptions 001, 002, 003, and 004. SNF characteristics within these limits will provide compliance with the fuel cladding temperature and criticality control requirements in assumptions DCWP 001 and EBDRD 3.7.1.3.A.

Minimal control of the sequencing of spent nuclear fuel assemblies into WPs, or of WPs into emplacement drifts, is consistent with the existing Advanced Conceptual Design. (CRWMS M&O 1996a) The limited control is achieved through a reasonable amount of lag storage so that SNF of compatible types and characteristics will be accumulated for loading individual disposal containers.

A reasonable portion of the assumed lag storage will also be required to accommodate the variances in cask and DC capacities, and for operational delays. It does not provide for surface cooling, early

receipt, or thermal blending. Such thermal management would require substantial capacity and related cost of lag storage of SNF assemblies, likely with an additional fuel staging pool. The assumption of limited lag storage is dependent on Key Assumption 084 that waste will be held at the source during extended off-normal outage at the repository.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 079 **Subject:** Disposal Criticality Analysis Methodology

I. STATEMENT OF ASSUMPTION

It is assumed that the disposal criticality analysis methodology as presented in the *Disposal Criticality Analysis Methodology Technical Report* (CRWMS M&O 1996n), with its use of Probabilistic Risk Assessment (PRA) and disposal burnup credit, will be accepted by the NRC for demonstrating that designs meet the disposal criticality control requirements. Key Assumption 081 addresses the ability to take credit for the presence of neutron absorber material for disposal criticality analyses.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Ongoing Technical Exchanges and Appendix 7 meetings with the NRC staff (e.g., February 5, 1997 and May 7, 1997); results encouraging.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package Development

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 080 **Subject:** Regional Servicing Contractor Interface

I. STATEMENT OF ASSUMPTION

Regional Servicing Contractors (RSCs), under contract to the DOE, will be responsible for arranging and providing waste acceptance and transportation services to deliver the commercial SNF to a Federal facility, which is the repository for the reference design case. This will include responsibility for providing, maintaining, and decontaminating the transportation casks in which the SNF will be received at the repository. The repository will not perform transportation cask maintenance and decontamination, except for the incidental maintenance and decontamination needed to return the casks to the RSC or ship the unloaded casks offsite to a Cask Maintenance Facility approved by the Nuclear Regulatory Commission or Agreement State.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Systems Engineering/Integration

Need for assumption (statement of intended use):

Interfaces need to be defined to focus MGDS design, particularly in the surface facility waste handling systems. Includes clarification that Cask Maintenance Facility is non-MGDS facility and not to be designed for the repository.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

A draft Request for Proposals (RFP) was released by DOE in November 1997 to solicit organizations interested in becoming RSCs. The expressed objective by DOE is to maximize use of private industry and reduce OCRWM involvement in the waste acceptance, storage and transportation of SNF. The final RFP will be used as the basis for developing an initial set of interface assumptions for inclusion in the CDA Document.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering/Integration

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 081 **Subject:** Neutron Absorbers

I. STATEMENT OF ASSUMPTION

Will be able to take credit for the presence of neutron absorber material in/from criticality control panels and rods made of long-term material for disposal criticality analyses.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Evaluations show some of the neutron absorber materials from long-term performance materials will be present over a long time. See Table 6-3 in Section 6.2.1 of *Disposal Criticality Analysis Methodology Technical Report* (CRWMS M&O 1996n) and Section 7.2.1 of *Second Waste Package Probabilistic Criticality Analysis: Generation and Evaluation of Internal Criticality Configurations* (CRWMS M&O 1996o).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package Development

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 082 **Subject:** LLW Disposal at NTS

I. STATEMENT OF ASSUMPTION

The DOE Nevada Test Site (NTS) LLW disposal facilities will be made available for MGDS generated LLW. This would be an off-Yucca Mountain Site compatible with Key Assumption 024. The volume of LLW to be shipped to the disposal facility will be minimized through appropriate means at the MGDS.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Systems Analysis and Modeling

Need for assumption (statement of intended use):

MGDS is currently not listed among LLW producers eligible for disposing LLW at NTS. Securing this listing must be accomplished.

Ensuring NTS availability is necessary because NTS and State of Nevada are currently in litigation regarding the NTS-wide EIS. It should be ensured that MGDS LLW waste is not affected.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

NTS LLW Site is an existing facility with known acceptance criteria and capacity to accommodate MGDS LLW. However, an agreement would have to be reached between YMSCO and the Nevada Operations Office before this assumption could be implemented, because the MGDS is currently not listed among LLW producers eligible for disposing LLW at NTS, as noted above in the Background.

Shipping LLW from MGDS to NTS will avoid transportation on public roads.

Justification for disposing of the waste at other than a nearby DOE facility would be needed to satisfy the intent of DOE Order 5820.2A.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Environment, Safety and Regional Programs

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 083 **Subject:** Mapping of Repository Subsurface Openings

I. STATEMENT OF ASSUMPTION

All non-emplacement drift repository subsurface facilities are to be mapped. The interval between mapped drifts, which may include emplacement drifts, will be no more than 200 - 300 meters. This equates to mapping every tenth emplacement drift assuming the subsurface layout and drift spacing in the current repository design.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Systems Analysis and Modeling

Need for assumption (statement of intended use):

The amount of mapping in the emplacement drifts will impact the emplacement drift ground support design. The specific amount of mapping to support performance confirmation data needs and to conform to construction records requirements are needed for design and planning and do not yet exist in the Mined Geologic Disposal System (MGDS) design requirements documents.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The mapping of non-emplacement drifts is expected to provide adequate information to develop adequate construction records and for many performance confirmation data needs, such as stratigraphy. The importance of faults in design, performance assessment and process modeling is uncertain.

For design, fault locations bound the volume of rock available for the potential repository within the Topopah Spring unit in horizontal direction, assuming a standoff of 120 m from the Ghost Dance fault and 60 m from other major faults; smaller faults with trace lengths of 200-300 meters exist on the surface and are expected to exist at the repository horizon but have not been considered.

For Performance Assessment and Process Modeling, the importance of faults for postclosure performance, including fluid flow and radionuclide transport, is not yet known; currently, only location and vertical offset of major faults are considered, but not their thermal-hydrological and radionuclide transport properties; postclosure importance will depend on the extent of lateral diversion of flow within hydrogeological units, being investigated now.

Assumption Identifier: Key 083 (continued)

Subject: Mapping of Repository Subsurface Openings

Due to this uncertainty, it is conservative to assume that smaller faults with trace lengths of 200-300 meters which are expected to exist at the repository horizon, such as they exist on the surface, should be mapped to determine their location and characteristics. If these small faults, which have a predominant north-south orientation, exist at the repository horizon, they would intersect emplacement drifts. In order to detect these faults, mapping every tenth drift (every 280 meters based on current spacing) should suffice.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Analysis

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 084 **Subject:** Hold Waste during Extended Off-normal Outage

I. STATEMENT OF ASSUMPTION

The waste will not be shipped from the waste sources (Purchasers of disposal services for commercial SNF and Producers of other waste forms) when the Repository cannot receive the waste due to an extended off-normal outage of more than two weeks. Depending on what part of the facility is out, a longer outage might be accommodated with on-site storage.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Clarify needs for storage facilities/capacities at the repository and identify subject for external interface resolution.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Risk of extended outage (e.g, by regulatory action) might preclude receipt of waste at the repository or any actions such as unloading casks. It would not be cost-effective to establish excessive storage capacity at the repository that would not be expected to be used. The duration of outage for which the repository could accommodate continuing waste receipts is based on the possibility that facilities to unload casks would not be available. It would increase if the pool and up-stream facilities are available.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 085 **Subject:** Waste Lifted Vertically

I. STATEMENT OF ASSUMPTION

The repository will only accept waste forms, casks, disposable canisters, and dual-purpose canisters that can be lifted and handled in a vertical orientation.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Focus of VA design effort and identification of subject for external interface resolution.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Provides an appropriate waste acceptance criterion and facilitates cost-effective design of waste handling facilities.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 086 **Subject:** Bounding Naval SNF Canister

I. STATEMENT OF ASSUMPTION

The largest canisters of Naval SNF accepted for disposal will not exceed the following dimensions and mass:

Overall Length:	5.385 m
Outside Diameter:	1.690 m
Mass:	44,452 kg

These disposable canisters are assumed to meet disposal requirements and therefore will not need to be opened at the repository. The corresponding waste package and disposal container information is located in the assumptions for EBDRD 3.7.1.J.1, EBDRD 3.7.1.J.2, and EBDRD 3.7.1.2.H.2.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

These bounding dimensions and mass will be used as a basis for the design and analysis of the large waste package for the disposal of Naval SNF.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgement:

A letter from Richard A. Guida (Guida 1997a), Naval Propulsion Program, to Russell Dyer, YMSCO, October 29, 1997, identified the following values (which have been converted to metric units in the assumption) as the maximum expected parameters for the external dimensions and weight of Naval SNF canisters:

Length -	212 inches
Diameter -	66.5 inches
Loaded weight - 49 tons	

This was provided to update information in a February 14, 1997 Department of the Navy letter, Richard A. Guida (Guida 1997b) to Wesley Barnes, YMSCO, dated February 14, 1997)

Assumption Identifier: Key 086 (continued) **Subject:** Bounding Naval SNF Canister

The addition of Naval SNF canisters to the waste forms to be disposed represents an increase in the bounding conditions for the length and mass of waste packages. It is not considered to be a viability issue, as such, but an impact assessment needs to be performed to determine the actual impacts on repository design for VA.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 087 **Subject:** Sealing Requirements

I. STATEMENT OF ASSUMPTION

Shafts, ramps, and exploratory boreholes, at the potential Yucca Mountain, Nevada nuclear waste repository, will be permanently sealed upon closure of the repository. The seals system for shafts, ramps, and exploratory boreholes will be designed to meet the following requirements:

1. All boreholes that come within a vertical distance 100 m above the repository horizon or that are deeper in depth and are within an area bounded by a distance of 400 m from the repository emplacement perimeter shall be sealed.

2. Based on the current projection of 7 boreholes that meet the above criteria, all of these boreholes shall be sealed to achieve an effective seal conductivity of between 10^{-4} and 10^{-3} cm/s. If the number of boreholes changes, the effective seal conductivity range will be scaled by the ratio of the total cross-sectional area of the 7 boreholes divided by the total cross-sectional area of the actual boreholes.

3. Shafts and ramps shall be sealed to limit water flow through all shafts and ramps to less than or equal an amount that is between 3,500 to 35,000 m^3/yr. An effective seal conductivity of 10^{-6} cm/s will restrict the combined flow in two shafts and two ramps to 3,500 m^3/yr, while an effective conductivity of 10^{-5} cm/s will restrict flow to 35,000 m^3/yr. Additionally, design margin storage for water equal to the amount of flow through all shafts and ramps after sealing (3,500 to 35,000 m^3/yr) shall be added above and beyond the amount planned to accommodate the potential annual infiltration to the repository.

4. The seal system shall be designed to operate in rock temperatures between 13 to 90°C, pH values between 4.5 to 10.5, and the annual anticipated water infiltration (currently projected to be between 5 to 30 mm/yr).

5. The design life of the seals system shall be 1,000 years.

6. The geohydrologic behavior of the mountain and the rock mass quality at different locations shall be considered in selecting locations for the placement of seals to minimize the inflow of water from existing or potential future perched water zones.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): System Analysis.

Need for assumption (statement of intended use):

The sealing subsystem is part of the Yucca Mountain Waste Isolation System. Sealing is defined as the permanent closure of the shafts, ramps, and exploratory boreholes. Sealing includes those components

that would reduce potential inflows above the repository, or that would divert flow near the repository horizon to allow vertical infiltration to below the repository. Sealing of such features as emplacement drifts within the repository perimeter is not considered in the above criteria.

The regulatory basis for sealing is contained in 10 CFR 60 and Nevada State regulations. Quantitative subsystem release requirements are established in 10 CFR 60.113 while 10 CFR 60.134 provides qualitative requirements to not have preferential pathways that would compromise the geologic repository's ability to meet the performance objectives. Without seals, preferential pathways would exist. The assumption provides assumed requirements for the components of the sealing system. The Nevada Administrative Code also requires sealing of boreholes of abandoned geothermal or injection wells in NAC 534A.490 (NAC 1985) and abandoned water wells in NAC 534A.150 (NAC 1977).

III. RATIONALE

The rationale is based on the *Repository Seals Requirements Study* (CRWMS M&O 1997i) which was conducted to evaluate the need for seals and develop sealing requirements. This systems analysis study was conducted, developed, and reviewed using procedure QAP-3-5. The sealing requirements address the primary waterflow and airflow requirements and in this way are related directly to the regulatory basis for seals.

The repository seals assessment (CRWMS M&O 1997i) concluded that sealing of shafts, ramps, and exploratory boreholes would be required for some potential anticipated water flows. Sealing of these shafts, ramps, and exploratory boreholes will be necessary to minimize the impact of preferential pathways on waste isolation. Allowable water and airflow goals for sealing were developed to avoid compromising the repository's waste isolation ability.

The evaluations concluded that all boreholes which were within a certain distance of the potential repository horizon need to be sealed. The estimates for how well the sealing needs to be done were based on the total cross-sectional area of the boreholes. Currently, there are seven boreholes drilled or planned to be drilled that meet the distance criteria specified above. If this were to change, then the seal flow criteria would need to be modified according to the increase or decrease in cross-sectional area of the boreholes.

Shafts and ramps providing access to the repository must be sealed also. In this case a range of water flow through the seals would be allowed, but it must be coupled to a provision for a design margin on the storage of water equal to the amount allowed through the seal. This provides for a flexible design in that less water storage needs to be constructed if the seal is made less permeable (lower flow allowed), and conversely, a more permeable, less restrictive seal could be used if more design margin water storage is allowed. The design needs some basic water storage volume for the water that could enter the repository, from any source (seals or host rock), and have to be temporarily stored (so that it did not reach the waste packages) until it would drain through the rock. Based on the primary area of the repository and an estimated infiltration rate of 30 mm/yr, a conservative estimate for the amount of basic water storage needed (without considering the amount needed to accommodate the flow through

the seals) would be 14,000 m^3. This is conservative in that it assumes that the entire amount of water in a year enters at once and then drains. Since the unsaturated zone is free draining, it will be unlikely that this amount of volume will actually be needed for water storage. Nevertheless, this volume can readily be facilitated by existing repository design.

The sealing of the shafts, ramps, and exploratory boreholes insure that these do not provide preferential pathways to air flow as well as water flow. Analyses (CRWMS M&O 1997i) were done showing that if the shafts, ramps, and exploratory boreholes were sealed to the criteria needed to limit the water flow then the airflow through these would be less than one percent of the airflow that would occur through the entire rock mass encompassed by the potential repository area. This amount is sufficiently small to not be considered a preferential pathway for airflow and thus there was no additional criteria placed on the seals for airflow.

The seal system will need to withstand a range of conditions throughout its life span. Temperatures of the rock will go through a range of values. Based on early work (Fernandez, et. al. 1987), seals are not well adapted to exceeding the boiling point of water and this needs to be considered in the placement of the seals. Some of the rock near the repository horizon will exceed the boiling point, and seals should not be placed in those locations. The seal will also need to withstand a wide range of pH conditions based on the variability of groundwater chemistry indicated in assumption TDSS 025.

Placement of seals in shafts, ramps, and exploratory boreholes will likely be required at more than a single point in each shaft, ramp, or borehole. This may be due to the fact that the purpose of the seal is not only to seal the pathway from water coming in from outside the mountain but also from perched water that may exist in the mountain or may form as a consequence of thermohydrologic changes. Where the shaft, ramp, or borehole intersects features in the rock that could lead to an influx of water, seals will be needed directly below those features. The geohydrology of the rock and the rock quality need to be examined to identify the locations where existing or potentially future occurrences of perched water may exist.

The seals and the repository layout, including the subsurface water storage, operate together to provide defense in depth to keep water away from the waste form. Decay heat tends to dry out the rock and push water away from the waste packages. As the heat decreases below the water's boiling point, water will return, which begins to occur around 1000 years after emplacement. The required lifetime of the seals should be no less than this, but should not necessarily be any more stringent than what will occur in the mountain. Therefore, a decision was made to place a 1000-year minimum lifetime on the seals.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: System Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 088 **Subject:** Plutonium Disposition Materials

I. STATEMENT OF ASSUMPTION

Mixed Oxide (MOX) SNF which initially contained 33 MT of weapons-grade plutonium and immobilized plutonium (IP) waste forms containing 17 MT of plutonium are to be disposed of at the MGDS between 2010 and 2032. The MGDS design will have the flexibility to handle this mix of waste forms or an option to handle all 50 MT as immobilized plutonium.

- MOX SNF assemblies will be received in forms similar to commercial PWR/BWR SNF, replacing an equivalent number of commercial SNF assemblies in the baseline waste stream for the repository.

- IP will be received in directly disposable canisters that can be co-disposed in waste packages with HLW canisters.

NOTE: The inclusion of the plutonium disposition materials will modify the waste stream tables provided in Key Assumptions 001, 002, 003, and 004 to some extent. However, as indicated in this assumption, the handling of the plutonium disposition materials will be similar to that for the wastes that are replaced in the waste stream.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): System Engineering, Project Engineering

Need for assumption (statement of intended use):

The forms in which plutonium are to be received at the repository need to be defined to ensure that the repository design can handle the plutonium to be disposed in the MGDS as directed in the approval of baseline change proposal BCP-00-98-0001, "Incorporate Plutonium Disposition Materials in the CRWMS Baseline" by the Program Baseline Change Control Board Chairman on December 19, 1997. (DOE 1997c)

III. RATIONALE

Section 14 of BCP-00-98-0001 (DOE 1997c) indicates that the DOE Office of Fissile Materials Disposition has determined that approximately a 2/3: 1/3 "split" between MOX SNF and IP (about 33MT:17MT) is a reasonable assumption, and it was used as the basis for determining impacts in the BCP. However, it was indicated that the final allocation has not been established, and that the DOE Office of Fissile Materials Disposition reserved the option to immobilize all 50 MT.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 088 (continued) **Subject:** Plutonium Disposition Materials

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: System Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 089 **Subject:** Occupational Exposure Limits

I. STATEMENT OF ASSUMPTION

Facilities that contain radioactive materials will be designed such that individual occupational radiation doses will be as low as reasonably achievable (ALARA) and should be less than 500 millirem per year Total Effective Dose Equivalent during Category 1 design basis events (including normal operations). Cost-benefit analyses will be conducted in accordance with the criterion in Key Assumption 090 to assess the applicability of this design dose limit.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Radiological/Environmental Field Programs

Need for assumption (statement of intended use):

This assumption provides the design dose limit for occupational dose and is the basis for calculations involving radiological safety.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The assumption is in conformance to the U.S. Department of Energy (DOE) Radiological Control Manual (DOE 1992), the Nevada (NV)/Yucca Mountain Site Characterization Project (YMP) Radiological Control Manual (DOE 1994a), and 10 CFR 20.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Radiological/Environmental Field Programs and Safety Assurance

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 090 **Subject:** ALARA Studies

I. STATEMENT OF ASSUMPTION

The Design of MGDS systems, facilities, and processes will be developed and modified using an ALARA evaluation process that includes mandatory dose reduction measures be added to the point where further reductions would cost more than $2,000 (in 1995 dollars) per person-rem averted over the life of the facility until closure.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Radiological/Environmental Field Programs

Need for assumption (statement of intended use):

ALARA is a requirement that is established to ensure that radiological safety is adhered to in the design and operation of nuclear facilities.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The requirement for ALARA in design is contained in 10 CFR 20.1101(b), which states: "The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)." Guidance on the ALARA process is contained in several regulatory guides such as 8.8, 8.10, and 8.37 (NRC 1978, NRC 1975, and NRC 1993), and implemented in the MGDS design process by Mined Geologic Disposal System Design ALARA Program (CRWMS M&O 1995s).

Cost benefit guidance is given in NUREG-1530, *Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy* (NRC 1995), which states in section 8: "...the NRC proposes that $2,000 per person-rem be used for routine emission, accidental releases, and 10 CFR 20 ALARA programs."

Assumption Identifier: Key 090 (continued) **Subject:** ALARA Studies

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Radiological/Environmental Field Programs and Safety Assurance

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 091 **Subject:** ALARA Trigger Point

I. STATEMENT OF ASSUMPTION

The ALARA design process will be applied to all systems, facilities, and processes where the projected annual collective dose for the discrete process is greater than 1 person-rem Total Effective Dose Equivalent .

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Radiological/Environmental Field Programs

Need for assumption (statement of intended use):

ALARA is a requirement that is established to ensure that radiological safety is adhered to in the design and operation of nuclear facilities.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The requirement for ALARA in design is contained in 10 CFR 20.1101(b), which states: "The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)." Guidance on the ALARA process is contained in several regulatory guides such as 8.8, 8.10, and 8.37 (NRC 1978, NRC 1975, and NRC 1993), and implemented in the MGDS design process by *Mined Geologic Disposal System Design ALARA Program* (CRWMS M&O 1995s).

Guidance is given in National Council on Radiation Protection and Measurements (NCRP) Report No. 120, *Dose Control at Nuclear Power Plants* (NCRP 1994), in section 6.5.1 which states: "A graded approach to ALARA reviews can help to ensure that jobs receive appropriate attention with respect to radiological and dose control techniques. The graded approach utilizes criteria such as estimated collective dose to gauge the degree of the radiological hazard. The greater the degree of hazard, the greater the amount of planning and review needed. An initial rough estimate of the collective dose can be made which defines the level of review." Even though this relates to operational programs, it applies to the design process. Appendix C recommends a graded approach in ALARA reviews of radiation work. The recommendation is that an annual collective dose, for a discrete process, of 1 person-rem trigger the ALARA review process. This level is also used in the nuclear industry as a graded approach ALARA review trigger point.

Assumption Identifier: Key 091 (continued) **Subject:** ALARA Trigger Point

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Radiological/Environmental Field Programs and Safety Assurance

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: Key 092 **Subject:** Commercial SNF Receipts

I. STATEMENT OF ASSUMPTION

The commercial SNF receipts in the first year (2010) will be increased by 100 MTU to a total of 400 MTU, with a corresponding reduction of 100 MTU in the twenty-fourth (last) year's receipts to 1,800 MTU. These adjustment in receipts are in relation to the commercial SNF receipt schedule in Table 3-3 of the *Mined Geologic Disposal System Requirements Document*, DOE/RW-0404, Rev. 2, DCN 2 (DOE 1996c). The adjustment will not impact the total quantity of commercial SNF received nor the annual receipt rate during full operations at the repository.

NOTE: The change in the quantity of commercial SNF received in 2010 will modify the waste stream tables provided in Key Assumptions 001, 002, 003, and 004 to a small extent. However, with the total quantity and full-operations receipt rate unchanged, the design levels in the baseline waste stream do not substantially change.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Reflect the latest planning by DOE.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The increase from 300 MTU to 400 MTU of commercial SNF for receipt in 2010 has been effected by the OCRWM Program Change Control Board in Rev. 4 of the *Civilian Radioactive Waste Management System Requirements Document*, DOE/RW-0406 (DOE 1998b) which retains the total of 63,000 MTU of commercial SNF for disposal in the repository. The corresponding reduction of 100 MTU in the last year (2033) of receipts results in the retention of the 63,000 MTU total.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

SECTION 4

ENGINEERED BARRIER DESIGN REQUIREMENTS DOCUMENT ASSUMPTIONS (EBDRD)

NOTE: Assumptions in this section refer to requirements in the *Engineered Barrier Design Requirements Document* (EBDRD) (YMP 1994b). As indicated in Section 2.2, the assumption, typically, will do one or more of the following:

- Remove a TBD or TBV contained in the original requirement
- State that the requirement is considered to be not applicable
- Replace the original requirement with a new statement

The original version of the corresponding requirement as contained in the EBDRD is reproduced in the Background section of the assumption rationale sheet.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.1.2.C

Subject: Preclosure Radiation Exposures and Releases of Radioactive Material

I. STATEMENT OF ASSUMPTION

C. The Engineered Barrier Segment, together with the Repository Segment, shall be designed so that until permanent closure has been completed, radiation exposures, radiation levels, and releases of radioactive materials to unrestricted areas will be maintained within the limits specified in 10 CFR 20 and applicable environmental standards for radioactivity established by the EPA.

II. BACKGROUND

Original Version

EBDRD 3.2.1.2 EMPLACEMENT MODE REQUIREMENTS

C. The Engineered Barrier Segment, together with the Repository Segment, shall be designed so that until permanent closure has been completed, radiation exposures, radiation levels, and releases of radioactive materials to unrestricted areas will at all times be maintained within the limits specified in 10 CFR 20 and applicable environmental standards for radioactivity established by the EPA, as listed in Section 3.2.2.

[MGDS-RD 3.2.1.3.K][10 CFR 60.111(a)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Need for assumption (statement of intended use):

Update to reflect the current version of 10 CFR 60.

III. RATIONALE

Rationale for assumption (source author, date and report title) or statement of reasoning behind engineering judgment.

The NRC revised 10 CFR 60.111(a) in a final rule issued December 4, 1996 (Federal Register Vol. 61, No. 234, pages 64257-64270) by deleting "at all times" to clarify that the requirement does not apply to radiation exposures, levels, and releases from Category 2 design basis events.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.1.4.B **Subject:** Retrievability Period

I. STATEMENT OF ASSUMPTION

The period of emplaced waste retrievability stated in the corresponding EBDRD requirement will be extended as indicated in Key Assumption 016.

II. BACKGROUND

Original Version

EBDRD 3.2.1.4 RETRIEVAL MODE REQUIREMENTS

B. The waste packages shall be designed to preserve the option of waste retrieval throughout the period during which wastes are being emplaced and, thereafter until the completion of a performance confirmation program and NRC review of the information obtained from such a program. To satisfy this objective, the geologic repository shall be designed so that any or all of the emplaced waste could be retrieved on a reasonable schedule starting at any time up to 50 years after waste emplacement operations are initiated, unless a different time period is approved or specified by the NRC. 10 CFR 60.111(b)(3) gives guidance for developing the schedule. [MGDS-RD 3.2.1.5.B][10 CFR 60.111(b)(1)]]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Need for assumption (statement of intended use):

Key Assumption 016 requires that the emplaced waste be retrievable for up to 100 years after initiation of waste emplacement operations. It is necessary to acknowledge that this extends the required period of retrievability in EBDRD 3.2.1.4.B.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

See Key Assumption 016.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.1.6.B

Subject: Cumulative Releases of Radionuclides for 10,000 Years

I. STATEMENT OF ASSUMPTION

This corresponding EBDRD requirement is considered to be not applicable. See Key Assumption 060.

II. BACKGROUND

Original Version

EBDRD 3.2.1.6 POST-CLOSURE MODE REQUIREMENTS

B. The Engineered Barrier Segment shall be designed so that the Engineered Barrier Segment together with the Repository Segment, provides a reasonable expectation (TBD), based upon performance assessments, that the cumulative releases of radionuclides to the accessible environment for 10,000 years after disposal from all significant processes and events that may affect the disposal system shall have a likelihood of less than one chance in 10 of exceeding the quantities calculated according to Table 1 of Appendix A of 40 CFR 191. In addition, it shall have a likelihood of less than one chance in 1,000 of exceeding ten times the quantities calculated according to Table 1 of Appendix A of 40 CFR 191 (TBR).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Since 40 CFR 191 is no longer applicable to a repository at Yucca Mountain, Key Assumption 060 establishes an interim postclosure performance measure and goal that are to be used as the planning basis for evaluating the postclosure performance of the repository until a new Environmental Protection Agency standard is promulgated.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

See Key Assumption 060. 40 CFR 191 has been remanded.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.2.3 **Subject:** Public Protection

I. STATEMENT OF ASSUMPTION

The corresponding EBDRD requirements are considered to be not applicable. The public protection requirements are to be met by repository design and operations. See requirement 3.2.2.2 in the *Repository Design Requirements Document* (RDRD).

II. BACKGROUND

Original Version

EBDRD 3.2.2.3 PUBLIC PROTECTION

A. The Engineered Barrier Segment, together with the Repository Segment, shall be designed to operate so that the total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contribution from the facility's disposal of radioactive material into sanitary sewerage in accordance with 10 CFR 20.2003. However, the facility may apply for prior NRC authorization to operate up to an annual dose limit for an individual member of the public of 0.5 rem (5 mSv) in accordance with 10 CFR 20.1301(c).

[Derived][10 CFR 20.1301(a),(c)]

B If members of the public have access to controlled areas, the limits for members of the public shall continue to be applicable to those individuals.

[Derived][10 CFR 20.1301(b)]

C. The Engineered Barrier Segment, together with the Repository Segment, shall be designed to operate so that the dose in any unrestricted area from external sources does not exceed 0.002 rem (0.02 mSv) in any one hour.

[Derived][10 CFR 20130(a)(2)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Need for assumption (statement of intended use):

To clarify that the public protection requirements represent a repository operations issue.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.2.3 (continued) **Subject:** Public Protection

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The corresponding public protection requirements from 10 CFR 20.1301 relate to operations and are to be met by repository design and operations.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.3.1.A.2

Subject: Annual Dose Equivalent to Member of the Public

I. STATEMENT OF ASSUMPTION

This corresponding EBDRD requirement is considered to be not applicable. See Key Assumption 060.

II. BACKGROUND

Original Version

EBDRD 3.2.3.1.A

2. The disposal system shall be designed so that the Engineered Barrier Segment, together with the Repository Segment and the geologic setting, provides a reasonable expectation that for 1,000 years after disposal, undisturbed performance of the disposal system shall not cause the annual dose equivalent from the disposal system to any member of the public in the accessible environment to exceed 25 millirems (TBR) to the whole body or 75 millirems (TBR) to any critical organ. All potential pathways (associated with undisturbed performance) from the disposal system to people shall be considered, including the assumption that individuals consume 2 liters per day of drinking water from any significant source of groundwater outside of the controlled area.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Need for assumption (statement of intended use):

Since 40 CFR 191 is no longer applicable to a repository at Yucca Mountain, Key Assumption 060 establishes an interim postclosure performance measure and goal that are to be used as the planning basis for evaluating the postclosure performance of the repository until a new Environmental Protection Agency standard is promulgated.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

See Key Assumption 060. 40 CFR 191 has been remanded.

Assumption Identifier: EBDRD 3.2.3.1.A.2 (continued)

Subject: Annual Dose Equivalent to Member of the Public

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.3.1.A.3

Subject: Radionuclide Concentrations in Groundwater and Annual Dose

I. STATEMENT OF ASSUMPTION

This corresponding EBDRD requirement is considered to be not applicable. See Key Assumption 060.

II. BACKGROUND

Original Version

EBDRD 3.2.3.1.A

3. The Engineered Barrier Segment shall be designed so that the Engineered Barrier Segment together with the Repository Segment and the geologic setting provides a reasonable expectation, that for 1,000 years after disposal, undisturbed performance of the disposal system shall not cause the radionuclide concentrations averaged over any year in water withdrawn from any portion of a special source of groundwater, if one exists, to exceed:

a. 5 picocuries per liter of radium-226 and radium-228 (TBR)

b. 15 picocuries per liter of alpha-emitting radionuclides (including radium-226 and radium-228 but excluding radon) (TBR)

c. an annual dose equivalent to the total body or any internal organ greater than 4 millirems (TBR) per year if an individual consumed 2 liters per day of drinking water from such a source of groundwater. These dose equivalencies would be from combined concentrations of radionuclides that emit beta or gamma radiation.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Need for assumption (statement of intended use):

Since 40 CFR 191 is no longer applicable to a repository at Yucca Mountain, Key Assumption 060 establishes an interim postclosure performance measure and goal that are to be used as the planning basis for evaluating the postclosure performance of the repository until a new Environmental Protection Agency standard is promulgated.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Assumption Identifier: EBDRD 3.2.3.1.A.3 (continued) **Subject:** Radionuclide Concentrations in Groundwater and Annual Dose

See Key Assumption 060. 40 CFR 191 has been remanded.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.3.1.A.4

Subject: Increase in Radionuclide Concentrations in Groundwater

I. STATEMENT OF ASSUMPTION

This corresponding EBDRD requirement is considered to be not applicable. See Key Assumptions 060 and 74.

II. BACKGROUND

Original Version

EBDRD 3.2.3.1.A

4. If any of the average annual radionuclide concentrations existing in a special source of groundwater, if one exists, before construction of the Engineered Barrier Segment already exceed the limits in 3.2.3.1.A.3, the Engineered Barrier Segment shall be designed so that the Engineered Barrier Segment together with the Repository Segment and the geologic setting provides a reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the concentrations in water withdrawn from that special source of groundwater by more than the limits established in section 3.2.3.1.A.3.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Since 40 CFR 191 is no longer applicable to a repository at Yucca Mountain, Key Assumption 060 establishes an interim postclosure performance measure and goal that are to be used as the planning basis for evaluating the postclosure performance of the repository until a new Environmental Protection Agency standard is promulgated.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

See Key Assumption 060. 40 CFR 191 has been remanded.

Assumption Identifier: EBDRD 3.2.3.1.A.4 (continued)

Subject: Increase in Radionuclide Concentrations in Groundwater

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.3.3.A.13

Subject: Lining and Grouting Material Selection

I. STATEMENT OF ASSUMPTION

Lining and grouting materials may be used in repository construction if it has been shown that their use does not adversely impact waste isolation nor interface with required testing activities. They will be evaluated for chemical reactions that may adversely impact waste isolation.

II. BACKGROUND

Original Version

EBDRD 3.2.3.3.A.13

13. To the extent practicable, lining and grouting material selection (if used) will consider material chemistry and take into account potential chemical interactions with groundwater that could affect waste package corrosion and radionuclide solubility.

[Derived]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

Lining and grouting materials will be used during the construction of the Exploratory Studies Facility (ESF) and repository.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The Tracers, Fluids, and Materials Plan requires impact analyses be performed to determine if any adverse impacts to waste isolation will result from their use.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.3.4.C.1.g **Subject:** SNF Weight

I. STATEMENT OF ASSUMPTION

Waste Acceptance (WA) will provide standard spent nuclear fuel (SNF) meeting the following criteria:

1. Spent fuel waste form will be the high-level radioactive waste and any encapsulating or stabilizing matrix, such as cladding that is associated with spent fuel.

   g. Mass: Up to 882.2 kg for South Texas PWR fuel, 773.4 kg for PWR fuel other than South Texas, and 328.4 kg for BWR fuel.

[Derived]

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

The heaviest spent nuclear fuel (SNF) assembly is needed to size all subsystems within the subsystems of Transport Waste, Store Waste, and Dispose Waste, which must move the accumulated masses.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

According to the Design Analysis titled *Waste Container Cavity Size Determination* (DI: BBAA00000-01717-0200-00026 REV 00) (CRWMS M&O 1997r) the masses of the largest fuel assemblies for South Texas, PWR fuel assemblies excluding South Texas, and BWR fuel assemblies are 882.2 kg, 773.4 kg, and 328.4 kg, respectively.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.3.4.C.4

Subject: Commercial SNF Radionuclide Inventory/ Isotopic Concentrations

I. STATEMENT OF ASSUMPTION

Estimation of SNF radionuclide inventories for planning purposes and scoping analyses will be based upon the Characteristics Data Base.

Calculation of isotopic concentrations for design activities supporting licensing will be based on the SCALE code system where appropriate to provide improved data for purposes such as disposal criticality design. The Unified Data Base, which is to be issued by updating and expanding the Characteristics Data Base, will provide a source of all radiological data for other design activities in support of licensing (e.g., for facility shielding design).

II. BACKGROUND

Original Version
EBDRD 3.2.3.4.C

Waste Acceptance (WA) will provide standard spent nuclear fuel (SNF) meeting the following criteria:

4. Estimated inventory of radionuclides will be To Be Determined (TBD). [Derived]

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, (X) Waste Package Development, (X) Other (specify): Systems Analysis and Modeling

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The Characteristics Data Base (CDB) is a family of six controlled microcomputer data bases, developed from the information provided in/for a series of reports prepared by Oak Ridge National Laboratory (ORNL) for the U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM). The radionuclide and isotopic information in the CDB was generated by the ORIGEN2 code. A series of ORIGEN2 results were entered into the database, with an interpolations program providing results for cases between the specific characteristics in the ORIGEN2 cases. The CDB is a fast, easy to use scoping tool which

provides approximate estimates. It is currently being updated and expanded and soon will be re-issued as the Unified Data Base by the CRWMS M&O Technical Data Management organization.

The SCALE code system is a modular code system for performing standardized computer analyses for licensing evaluations. The SCALE code system was developed for the Nuclear Regulatory Commission (NRC) and has been accepted for licensing evaluations in the past. The use of the SCALE code system is consistent with the other current DOE licensing efforts with the NRC (namely the Topical Report on Actinide-Only Burnup Credit for PWR Spent Nuclear Fuel Packages). Waste Package Development has provided this rationale for the statement on the SCALE code.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.3.4.C.5 **Subject:** SNF Shipped Dose Rate Limits

I. STATEMENT OF ASSUMPTION

The corresponding Engineered Barrier Design Requirements Document (EBDRD) requirement is considered to be not applicable.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Original Version
EBDRD 3.2.3.4.C.5

C. Waste Acceptance (WA) will provide standard spent nuclear fuel (SNF) meeting the following criteria:

5. Dose rate at shipment will be up (To Be Determined [TBD]). [Derived]

Need for assumption (statement of intended use):

Waste acceptance at the Mined Geologic Disposal System (MGDS); operational, health and safety considerations.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Currently, no surface dose rate limits are specified for disposable waste canisters in the Waste Acceptance (WA) Site Requirements Document (SRD). Until the limits are specified , this EBDRD requirement is assumed to be deleted.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.4.5 **Subject:** Shielding

I. STATEMENT OF ASSUMPTION

3.2.4.5 SHIELDING

Shielding criteria shall be as defined in Key Assumption 031.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Analysis and Modeling

Original Version
EBDRD 3.2.4.5 SHIELDING

Allocation of shielding requirements to the waste package, if required, is To Be Determined (TBD).

Need for assumption (statement of intended use):

Needed to satisfy waste package design, surface facilities design, health and safety, subsurface operations, and postclosure performance evaluations.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- Consistency with Key Assumption 031.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.4.6.A

Subject: EBS Design Objective for Design Basis Event

I. STATEMENT OF ASSUMPTION

A. An Engineered Barrier Segment (EBS) design objective shall be to ensure that conservatively estimated consequences of Category 1 and Category 2 design basis events, as defined in 10 CFR 60.2, are limited in accordance with requirements contained in 10 CFR 60

II. BACKGROUND

Original Version
EBDRD 3.2.4.6 DESIGN BASIS EVENTS

A. An Engineered Barrier Segment (EBS) design objective shall be to ensure that conservatively estimated consequences of normal operations and credible accidents are limited in accordance with requirements contained in U.S. Department of Energy (DOE) Order 6430.1A, Section 1300-1.4, Guidance on Limiting Exposure of the Public. Events to be considered based on site function and licensing requirements are To Be Determined (TBD).
[MGDS-RD 3.2.4.6.A][DOE Order 6430.1A, 1324-2.1]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): System Engineering/Safety Assurance.

Need for assumption (statement of intended use):

Reflect the appropriate regulatory authority for design basis events.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The original requirement statement implied an all-inclusive list of possible events should be attached to the requirement itself. The development of credible design basis events will be captured in the Safety Analysis Report.

The analysis of design basis events and the establishment of related design criteria are subject to NRC regulatory authority and are governed by the requirements of 10 CFR 60.

Assumption Identifier: EBDRD 3.2.4.6.A (continued)

Subject: EBS Design Objective for Design Basis Event

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: System Engineering/Safety Assurance

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.5.1.2.B.1 **Subject:** EBS Reliability

I. STATEMENT OF ASSUMPTION

B. Reliability of the Engineered Barrier Segment (EBS) shall be as follows:

1. Waste Package - The probability of failure (breach) of an individual waste package during the preclosure phase should be demonstrated to be less than 10^{-6} per year based on credible hazards.

II. BACKGROUND

Original Version:
EBDRD 3.2.5.1.2

B. Reliability of the Engineered Barrier Segment (EBS) shall be as follows:

1. Waste Package (To Be Determined [TBD])

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Statistical events leading to preclosure waste package failure (which are required here to be less than 10^{-6} per year) include weld defects with a significant probability of nondetection, of 25 mm or greater. Typical credible hazards include seismic events (vibratory ground motion and fault rupture) and rock falls. Typical noncredible hazards include a major explosion due to sabotage or flooding due to climate change.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering /Specialty Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.2.5.4 **Subject:** EBS Maintainable Preclosure Service Life

I. STATEMENT OF ASSUMPTION

Engineered Barrier Segment (EBS) structures, systems, and components shall be designed for a maintainable preclosure service life of at least 150 years following first emplacement of waste. [MGDS-RD 3.2.5.4.B][CRD 3.2.5.4]

II. BACKGROUND

Original Version
EBDRD 3.2.5.4 SERVICE LIFE
Engineered Barrier Segment (EBS) structures, system, and components shall be designed for a maintainable preclosure service life of at least To Be Determined (TBD) years or the period of time authorized by the license granted by the Nuclear Regulatory Commission (NRC) in accordance with the provisions of 10 CFR 60.3.
[MGDS-RD 3.2.5.4.B][CRD 3.2.5.4]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Requirements

Need for assumption (statement of intended use):

Needed by the Design Organizations for input to the Engineered Barrier Segment (EBS) structures, system, and preclosure components relative to a specified maintainable service life; including retrievability.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The Key Assumption: "The Repository will be designed (proof of principle) for a retrievability period of up to 100 years after initiation of emplacement" was developed at a Key Assumption Workshop held in Las Vegas, Nevada on May 4, 1994 (Letter W. B. Simecka to L. D. Foust, AMEFO:PDS-3545).

The 150-year period is rounded up from a 144-year period that is based on a 100-year retrievability period, plus 10 years retrieval preparation, plus 24 years to perform retrieval, plus 10 years to close the repository.

DCSS-028 addresses drift maintenance.

Assumption Identifier: EBDRD 3.2.5.4 (continued) **Subject:** EBS Maintainable Preclosure Service Life

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.3.3.B

Subject: Information on Label for Equipment and Parts

I. STATEMENT OF ASSUMPTION

Resolution of To Be Determined (TBD) with corresponding Engineered Barrier Design Requirements Document (EBDRD) requirement not required for Viability Assessment (VA).

II. BACKGROUND

Original Version
EBDRD 3.3.3.B INFORMATION ON LABEL FOR EQUIPMENT AND PARTS

The label shall indicate clearly and concisely the function and purpose of the item being labeled. The information provided on the label shall be To Be Determined (TBD). Unnecessary information (e.g., information used only for manufacturing purposes) must not be included. Hierarchial labeling should be used to facilitate component location on control panels, if used.
[MGDS-RD 3.3.3.B][DOE Order 6430.1A, 1300-12.4.11]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This requirement is at a level of detail below that to be addressed during Viability Assessment (VA).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.D **Subject:** EBS Minimum Performance

I. STATEMENT OF ASSUMPTION

D. The Engineered Barrier Segment (EBS) shall be designed, assuming anticipated processes and events, so that containment of radioactive material within the waste packages will be substantially complete for 3000 years (with less than 10 waste packages failing within 3000 years after permanent closure of the geologic repository).
[MGDS-RD 3.7.3.2.C][10 CFR 60.113(a)(1)(ii)(A)]

II. BACKGROUND

Original Version
EBDRD 3.7

D. The Engineered Barrier Segment (EBS) shall be designed, assuming anticipated processes and events, so that containment of radioactive material within the waste packages will be substantially complete (To Be Determined [TBD]) for a period to be determined by the Nuclear Regulatory Commission (NRC), but not less than 300 years nor more than 1,000 years (To Be Resolved [TBR]) after permanent closure of the geologic repository. Nuclear Regulatory Commission (NRC) Staff Position 60-001 indicates that this is a minimum performance requirement, and that credit can be taken in Engineered Barrier Segment (EBS) and overall repository system performance assessments for containment, provided by design, in excess of 1000 years.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

Needed to satisfy waste package and subsurface design and establish postclosure performance measurements.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This interpretation of EBDRD 3.7.D is consistent with 99.9 percent of the waste packages not being breached for 3000 years from Key Assumption 074.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.D (continued) **Subject:** EBS Minimum Performance

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.G.1

Subject: Emplacement Borehole Wall Temperature

I. STATEMENT OF ASSUMPTION

The corresponding Engineered Barrier Design Requirements Document (EBDRD) requirement is considered to be not applicable.

II. BACKGROUND

Original Version
EBDRD 3.7

G. To limit the predicted thermal and thermomechanical response of the host rock and surrounding strata and groundwater system, the Engineered Barrier Segment (EBS) configuration and loading shall:

1. Limit borehole wall temperature (if a borehole is used) to 275° C (To Be Verified [TBV]).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Analysis and Modeling

Need for assumption (statement of intended use):

Performance measure.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The Site Characterization Plan (SCP) (Table 8.3.2.2-4) list the value tentative thermal goal. Needed confidence in the value was judged high in the Site Characterization Plan (SCP). Subsequent work which took into account multi-purpose canisters (MPCs) found this goal was unnecessary ("Site Characterization Plan Thermal Goals Reevaluation," DI B00000000-01717-5705-0005 Rev. 00). The reevaluation notes that as long as the large waste package centerline temperature is less than 350° C and the 1-m rock temperature is less than 200° C, the borehole wall rock surface temperature goal is not needed. (See assumptions DCWP 001 and DCSS 023.)

Assumption Identifier: EBDRD 3.7.G.1 (continued) **Subject:** Emplacement Borehole Wall Temperature

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Analysis and Modeling

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.G.2

Subject: Vertical Borehole Rock Mass and In-Drift Wall Temperatures

I. STATEMENT OF ASSUMPTION

G. To limit the thermal and thermomechanical response of the host rock and surrounding strata and groundwater system, the Engineered Barrier Segment (EBS) configuration and loading shall:

2. Keep emplacement drift wall temperatures <200° C. (See Assumption DCSS.023.)

II. BACKGROUND

Original Version
EBDRD 3.7

G. To limit the predicted thermal and thermomechanical response of the host rock and surrounding strata and groundwater system, the Engineered Barrier Segment (EBS) configuration and loading shall:

2. Limit the maximum temperature 1 m into the rock to 200° C (To Be Verified [TBV]).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

Performance measure.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This emplacement drift wall temperature limit reflects the recommendation of the *Site Characterization Plan Thermal Goals Reevaluation*, DI B00000000-01717-5705-00005 Rev. 00 (CRWMS M&O 1993a).

Emplacement drift wall temperature limit of 200° C is consistent with current thermal strategy and a disposal canister maximum surface temperature of 225° C.

Thermal Loading Study for FY 1996, DI: B00000000-01717-5705-00044 REV 01 (CRWMS M&O 1996g), recommended retention of the 200° C limit.

Assumption Identifier: EBDRD 3.7.G.2 (continued) **Subject:** Vertical Borehole Rock Mass and In-Drift Wall Temperatures

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Analysis and Modeling

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.G.3 **Subject:** TSw3 Temperature Limit

I. STATEMENT OF ASSUMPTION

The corresponding EBDRD requirement is considered to be not applicable. (See assumption DCSS 025.)

II. BACKGROUND

Original Version
EBDRD 3.7

G. To limit the predicted thermal and thermomechanical response of the host rock and surrounding strata and groundwater system, the Engineered Barrier Segment (EBS) configuration and loading shall:

3. Limit the TSw3 (vitrophyre tuff) maximum temperature to 115° C (To Be Verified [TBV]).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Analysis and Modeling

Need for assumption (statement of intended use):

Performance measure.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The Site Characterization Plan (SCP) established this temperature goal on TSw3 in an effort to protect the zeolites from mineralogic changes that could decrease their ability to retard radionuclide transport. Recent core measurements have found that the zeolitized layer is well below the TSw2/3 interface. Thus, there appears to be no reason for maintaining this goal. Reference: *Thermal Loading Study for FY96* (CRWMS M&O 1996g).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization:
Systems Analysis and Modeling

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.G.4 **Subject:** Ground Surface Temperature Rise Limit

I. STATEMENT OF ASSUMPTION

G. To limit the thermal and thermomechanical response of the host rock and surrounding strata and groundwater system, the Engineered Barrier Segment (EBS) configuration and loading shall:

4. Limit the change in temperature at 45 cm below the soil surface to 2° C above what the established naturally occurring pre-emplacement average annual ground surface temperature is within the footprint of the MGDS. (The MGDS footprint is defined as that area directly above emplaced waste packages and extending 500 m horizontally beyond the edge of emplaced packages.) [This is to limit ecological impact at the surface.]

II. BACKGROUND

Original Version
EBDRD 3.7

G. To limit the predicted thermal and thermomechanical response of the host rock and surrounding strata and groundwater system, the Engineered Barrier Segment (EBS) configuration and loading shall:

4. Limit the maximum ground surface temperature change in the vicinity of the repository to 6° C.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

Performance measure.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The Site Characterization Plan (SCP) (Table 8.3.2.2-4) lists 6° C as the tentative thermal goal. Needed confidence in the value is judged to be low. The thermal goal was reevaluated and in 1991 presented to the Nuclear Waste Technical Review Board by K. Ostler. His work indicated that a maximum temperature increase of 2° C at the surface would be a more conservative goal and would have minimum impact on the ecology. His work was summarized in the 1993 Site Characterization Plan (SCP) thermal goals reevaluation ("Site Characterization Plan Thermal Goals Reevaluation," DI B00000000-01717-5705-00005 Rev. 00).

Assumption Identifier: EBDRD 3.7.G.4 (continued) **Subject:** Ground Surface Temperature Rise Limit

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization:
Systems Analysis and Modeling

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.G.5

Subject: Drift Temperature Limit for Borehole Emplacement

I. STATEMENT OF ASSUMPTION

The corresponding Engineered Barrier Design Requirements Document (EBDRD) requirement is considered to be not applicable.

II. BACKGROUND

Original Version
EBDRD 3.7

G. To limit the predicted thermal and thermomechanical response of the host rock and surrounding strata and groundwater system, the Engineered Barrier Segment (EBS) configuration and loading shall:

5. Limit the emplacement drift maximum temperature to 100° C (To Be Verified [TBV]).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

Performance measure

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Requirement is based upon outdated emplacement method and thermal strategy.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization:
Systems Analysis and Modeling

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.G.6 **Subject:** Access Drift Temperature Limit

I. STATEMENT OF ASSUMPTION

The corresponding EBDRD requirement is considered to be not applicable. See Assumption DCSS 023.

II. BACKGROUND

Original Version
EBDRD 3.7

G. To limit the predicted thermal and thermomechanical response of the host rock and surrounding strata and groundwater system, the Engineered Barrier Segment (EBS) configuration and loading shall:

6. Limit the access drift wall rock maximum temperature to 50° C (To Be Verified [TBV]) during preclosure.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

Performance measure.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The access drift temperature limit of 50°C is an operational limit that is now assumed in DCSS 023.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization:
Systems Analysis and Modeling

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.I

Subject: Waste Package Substantially Complete Containment

I. STATEMENT OF ASSUMPTION

Containment of radioactive material within all but 10 waste packages shall be substantially complete for at least 3000 years after permanent closure of the geologic repository (i.e., fewer than 10 waste packages shall be breached within the first 3000 years after permanent closure of the geologic repository).

II. BACKGROUND

Original Version

Containment of radioactive material within the waste package shall be substantially complete (To Be Determined [TBD]) for a period of years (To Be Determined [TBD]) after permanent closure of the geologic repository.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This assumption derives directly from Key Assumption 074.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.J.1 **Subject:** Waste Package External Dimensions

I. STATEMENT OF ASSUMPTION

The nominal external dimensions of the waste packages for a) commercial SNF that is repackaged, or b) uncanistered commercial SNF, shall be within the following ranges:

Outer Diameter: 1.250 m < OD < 1.700 m
Outer Length: 5.250 m < OL < 5.900 m

The nominal external dimensions of the waste packages for a) HLW, or b) HLW co-disposed with DOE SNF shall be within the following ranges:

Outer Diameter: 1.750 m < OD < 2.000 m
Outer Length: 3.700 m < OL < 5.400 m

The nominal external dimensions of the waste packages for canistered commercial SNF shall be within the following ranges:

Outer Diameter: 1.510 m < OD < 1.960 m
Outer Length: 5.250 m < OL < 5.850 m

The nominal external dimensions of the waste packages for canistered Naval SNF shall be within the following ranges:

Outer Diameter: 1.890 m < OD < 2.000 m
Outer Length: 5.500 m < OL < 6.200 m

II. BACKGROUND

Original Version
EBDRD 3.7.1.J.1 (WP)

The waste package shall meet the following criteria:

1. External dimensions shall be To Be Determined (TBD), with a tolerance of To Be Determined (TBD).
   [Derived]

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.J.1 (continued) **Subject:** Waste Package External Dimensions

Need for assumption (statement of intended use):

For Transporter Design, Surface Facility Design, and to allow for dimensional tolerancing on preliminary waste package reference designs.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Commercial SNF that is repackaged or uncanistered commercial SNF: Based on preliminary dimensions for the 21 PWR UCF WP (with thermal shunts) and the 12 PWR UCF WP for South Texas Fuel. These preliminary bounding dimensions do not include possible added length for disposal of control rod assemblies with the fuel.

HLW or HLW co-disposed with DOE SNF: Based on preliminary dimensions for a 4 HLW disposal container and a 5 DHLW/DOE SNF disposal container to hold standard and long HLW canisters. The minimum diameter is based on the 4 HLW disposal container, and the maximum outer diameter is based on the 5 HLW/DOE SNF co-disposal container. The reference disposal container length for standard HLW canisters is 3.790 m. The maximum outer length of 5.400 m is based on the 15 ft (4.57 m) HLW canister proposed by Hanford.

Canistered commercial SNF: Based on preliminary disposal container dimensions for disposal of the Westinghouse MPC designs (24 BWR and 44 BWR) including margin for tolerancing.

Canistered Naval SNF: Based on preliminary disposal container dimensions for disposal of two sizes of Naval SNF canisters including margin for tolerancing. Dimensions for the larger container are determined from the bounding dimensions of the Naval SNF canisters defined in Key Assumption 086. Dimensions for the smaller disposal container are determined from the dimensions for the smaller Naval SNF canister defined in a letter from Richard A. Guida, (Guida 1997b) Navy Nuclear Propulsion Program, to Wesley Barnes, YMSCO, February 14, 1997.

The addition of Naval SNF canisters to the waste forms to be disposed represents an increase in the bounding conditions for the length and mass of waste packages. It is not considered to be a viability issue, as such, but an impact assessment needs to be performed to determine the actual impacts on repository design for VA.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.J.2 **Subject:** Waste Package Maximum Mass

I. STATEMENT OF ASSUMPTION

The waste package mass shall not exceed 83,000 kg.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
(X) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Original Version
EBDRD 3.7.1.J.2 WEIGHT LIMIT FOR WASTE PACKAGE

The waste package shall meet the following criteria:

Weight shall not exceed to be determined.

Need for assumption (statement of intended use):

Surface and Subsurface facility designs are partially based on the mass of the waste package.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The mass of the waste package to dispose of the large Naval SNF canister is the largest waste package mass and is estimated to be between 82,000 kg and 83,000 kg. The bounding dimensions and mass of this large Naval SNF canister are defined in Key Assumption 086, and the upper limit on dimensions of the waste package to dispose of the canister are provided in assumption EBDRD 3.7.1.J.1.

The addition of Naval SNF canisters to the waste forms to be disposed represents an increase in the bounding conditions for the length and mass of waste packages. It is not considered to be a viability issue, as such, but an impact assessment needs to be performed to determine the actual impacts on repository design for VA.

The waste package design concepts are not finalized. Dimensional changes and therefore mass changes will occur as the design effort continues.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.J.3 **Subject:** Waste Package Surface Finish

I. STATEMENT OF ASSUMPTION

The corresponding Engineered Barrier Design Requirements Document (EBDRD) requirement is considered to be not applicable.

II. BACKGROUND

Original Version
EBDRD 3.7.1.J

The waste package shall meet the following criteria:

3. Surface finish shall be To Be Determined (TBD).

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Final design of the waste package will need to have a specified surface finish for handling, radionuclide control, and for thermal and corrosive performance.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Design activities during the Viability Assessment (VA) phase will not be impacted by a specified surface finish. The surface finish requirement will be developed during the License Application Design phase.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.1.F **Subject:** Waste Package Drop Tolerance

I. STATEMENT OF ASSUMPTION

The waste package, after being sealed, shall be capable of withstanding a 2-m drop onto a flat, essentially unyielding surface without breaching.

II. BACKGROUND

Original Version
EBDRD 3.7.1.1 SPENT NUCLEAR FUEL (SNF) AND HIGH-LEVEL WASTE (HLW) THAT IS EMPLACED IN THE UNDERGROUND FACILITY SHALL MEET THE FOLLOWING CRITERIA:

F. The canistered waste form shall be capable of withstanding a drop of To Be Determined (TBD) onto a flat, essentially unyielding surface without breaching.

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, (X) Other (specify): Developed

Need for assumption (statement of intended use):

This assumption will impact the height to which the surface and subsurface facilities can lift the waste package during handling. The design of the waste package will be directly affected since, in general, the higher the package is lifted, the bigger the package will need to be in order to ensure package integrity after a drop.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Reason for verbiage change: Spent nuclear fuel (SNF) and high-level waste (HLW) may be received in disposable canisters. A package is given credit for long-term performance.

Engineering experience in the design of storage and transportation casks. The 2 m will be verified during the design efforts.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.2.A

Subject: Waste Package Handling and Transportation Loads

I. STATEMENT OF ASSUMPTION

The disposal container shall have the mechanical integrity to sustain a static load at least equal to its own weight during routine handling and transport within the repository operations area.

II. BACKGROUND

Original Version
EBDRD 3.7.1.2.A

The container shall contain the radioactive waste materials during all normal handling and emplacement operations and in the event of accidents or other dynamic effects, contribute to limiting dispersal of the waste. The container shall also have the mechanical integrity to sustain routine handling and transportation loads (to be determined).

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

This assumption is needed to support the design of the surface and subsurface handling equipment. The load limit will be imposed on the container.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Routine handling and transportation procedures involve the weight of the waste package. Maximum load values will change as design progresses.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.2.B

Subject: Container Substantially Complete Containment

I. STATEMENT OF ASSUMPTION

B. The container shall contribute to the waste package such that containment of the enclosed radionuclides is substantially complete for 3000 years (with less than 10 waste packages failing within 3000 years after permanent closure of the geologic repository). Appropriate credit will be taken for SNF cladding in retarding the release of radionuclides based on analysis of cladding damage in the repository.
[MGDS-RD 3.7.3.2.C][10 CFR 60.113(a)(1)(ii)(A)]

II. BACKGROUND

Original Version
EBDRD 3.7.1.2 WASTE CONTAINER REQUIREMENTS

B. The container shall contribute to the waste package such that containment of the enclosed radionuclides is substantially complete (To Be Determined [TBD]) during the containment period of not less than 300 to 1,000 years (To Be Resolved [TBR]) after permanent closure of the geologic repository.
[MGDS-RD 3.7.3.2.C][10 CFR 60.113(a)(1)(ii)(A)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, (X) Other (specify):
Systems Engineering

Need for assumption (statement of intended use):

Substantially complete containment is the primary purpose of having an engineered barrier.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This assumption derives directly from the goal in Key Assumption 074. Performance assessment does not use the goal as an assumed result, but models what system performance would be achieved based on a base case design scenario and alternative scenarios reflecting design modifications.

Assumption Identifier: EBDRD 3.7.1.2.B (continued) **Subject:** Container Substantially Complete Containment

In its June 4, 1998 meeting, the Level 3 CCB directed that the CDA be modified to indicate that credit will be taken for cladding. The nuclear industry has done research on zirconium since the early 1950s and found it to be highly corrosion resistant. Performance assessment modeling by the M&O has considered credit for cladding in retarding the release of radionuclides. After excluding certain cladding from any credit, it has modeled the exposed surface area of fuel resulting from damages to cladding (incuding perforations, mechanical failures from rockfalls, and localized corrosion) after the failure of the disposal container.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.2.C

Subject: Controlled Release During Period of Isolation

I. STATEMENT OF ASSUMPTION

The container shall contribute to controlling the release rate of radionuclides during the period of isolation. See Key Assumption 074.

II. BACKGROUND

Original Version
EBDRD 3.7.1.2

C. The container shall contribute (To Be Determined [TBD]) to controlling the release of radionuclides during the period of isolation.

[Derived][10 CFR 60.135(a)(1)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Regulation 10 CFR 60.13(a)(ii)(A) requires substantially complete containment for a period up to 1,000 years after repository closure. Key Assumption 074 provides a goal for the maximum number of waste packages to be breached within 3000 years after repository closure.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.2.D

Subject: Container to Limit Liquid Water Contact

I. STATEMENT OF ASSUMPTION

D. The intent of this requirement is now addressed in Key Assumption 075.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Analysis and Modeling

Original Version
EBDRD 3.7.1.2

D. The container shall be designed to limit the amount of liquid water (To Be Determined [TBD]) allowed to contact the enclosed waste form.
[Derived]

Need for assumption (statement of intended use):

Waste Package Design; Performance Assessment.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Water is being required to be kept off of the waste form, as per Key Assumption 075.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Analysis and Modeling

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.2.E **Subject:** Container Information Label

I. STATEMENT OF ASSUMPTION

Resolution of To Be Determined (TBD) in the corresponding Engineered Barrier Design Requirements Document (EBDRD) requirement not required for Viability Assessment.

II. BACKGROUND

Original Version
EBDRD 3.7.1.2.E INFORMATION ON LABEL

The container shall provide a means of unique identification, which shall be a label documenting the process history of the container's contents and shall be attached to the body and lid of the container. The information on the label shall be To Be Determined (TBD).

[MGDS-RD 3.7.3.3.F][10 CFR 60.135(b)(4)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This requirement is at a level of detail below that to be addressed during Viability Assessment.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.2.H.2

Subject: Disposal Container Maximum Mass

I. STATEMENT OF ASSUMPTION

The waste package disposal container shall meet the following criteria:

Mass of empty disposal container (including top lids) shall not exceed 38,000 kg.

II. BACKGROUND

Original Version
EBDRD 3.7.1.2.H THE CONTAINER SHALL MEET THE FOLLOWING CRITERIA:

The maximum weight shall be To Be Determined (TBD).

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Surface and subsurface facility designs are partially based on the mass of the waste package.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The mass represents the tare mass (container mass: barriers and lids only) of the disposal container to dispose of the large Naval SNF canister for which bounding dimensions and mass are given in Key Assumption 086. The above mass value bounds the preliminary estimation of the mass of the large Naval SNF canister disposal container.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.2.H.3 **Subject:** Disposal Container External Dimensions

I. STATEMENT OF ASSUMPTION

The dimensions of the disposal containers for commercial SNF, HLW, DOE SNF, and Naval SNF are assumed identical to those of the waste packages and will be within the dimension ranges given in Assumption EBDRD 3.7.1.J.1.

II. BACKGROUND

Original Version
EBDRD 3.7.1.2.H THE CONTAINER SHALL BE DESIGNED TO MEET THE FOLLOWING CRITERIA:

3. The envelope shall be To Be Determined (TBD).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, (-) Other (specify):

Need for assumption (statement of intended use):

Surface and Subsurface facility designs are partially based on the size of the waste package. The waste package and any container used must be compatible.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

At this time no packing material is assumed external to the container; therefore, the container and waste package external dimensions are the same by definition. There will, however, be minor variations in dimensions due to temperature change and weld distortion.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.3.A **Subject:** Criticality Control Requirement

I. STATEMENT OF ASSUMPTION

Preclosure:
The internal structure shall provide separation of the waste forms such that nuclear criticality shall not be possible unless at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety.

The calculated effective multiplication factor (k_{eff}) must be sufficiently below unity to show at least a five percent margin after the allowance for the bias in the method of calculation and the uncertainty in the experiments used to validate the method of calculation.

Postclosure:
The Engineered Barrier System shall be designed such that the probability and consequences of nuclear criticality provide reasonable assurances that the performance objective of 10CFR60.112 is met.

II. BACKGROUND

Original Version
EBDRD 3.7.1.3.A

The calculated effective multiplication factor (k_{eff}) must be sufficiently below unity to show at least a five percent margin after allowance for the bias in the method of calculation and the calculation uncertainty in the experiments used to validate the method of calculation (To Be Determined [TBD]). [MGDS-RD 3.2.2.6.A][10 CFR 60.131(b)(7)]]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

(NOTE: It is suggested that the EBDRD Section 3.7.1.3.A be rephrased to follow 10 CFR 60.131(h). On December 4, 1996 there was a change to 10 CFR 60; paragraph 10 CFR 60.131(b)(7) was renumbered 10 CFR 60.131(h).

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.3.A (continued) **Subject:** Criticality Control Requirement

The preclosure assumption is based directly on 10CFR 60.131(h). The postclosure assumption is based on wording for a new postclosure criticality regulation proposed by U.S. Department of Energy (DOE) to Nuclear Regulatory Commission (NRC). The NRC has indicated recognition that a new postclosure rule is needed.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor Organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.1.3.D

Subject: Waste Package Internal Structure Loads

I. STATEMENT OF ASSUMPTION

For Viability Assessment (VA), the loads imposed on the internal structure are similar to the waste package loads.

- Static load on the waste package due to its own weight during handling and transportation.
- Withstand a drop of 2 m.

II. BACKGROUND

Original Version
EBDRD 3.7.1.3.D The internal structure shall be capable of withstanding handling, emplacement, and retrieval loads.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

For Viability Assessment (VA), the internal container structure will be evaluated using the same loads as the container barriers. If different loading scenarios are generated, additional loading conditions will be developed.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.2.B **Subject:** Backfill Permeability

I. STATEMENT OF ASSUMPTION

BACKFILL PERMEABILITY (if emplacement drift backfill is used).

The requirements for backfill placed in emplacement drifts are:.

B. The backfill permeability shall not have an adverse effect on the long-term performance of the waste package.

II. BACKGROUND

Original Version
EBDRD 3.7.2.B BACKFILL PERMEABILITY

The requirements for backfill placed in other underground openings in the repository are addressed in the Repository Design Requirements Document.

B. The backfill shall have a permeability of To Be Determined (TBD).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Wording consistent with wording of Section 3.7.2.A and 3.7.2.C.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: EBDRD 3.7.3 **Subject:** Emplacement Hardware Requirements

I. STATEMENT OF ASSUMPTION

The emplacement hardware is used to support and protect the emplaced waste packages. Examples of emplacement hardware are a pedestal under the waste package for the in-drift emplacement concept and a carriage and rail system for the horizontal opening concept. Emplacement hardware does not include ground support hardware, which is part of the Repository Segment. Emplacement hardware requirements will be added during Advanced Conceptual Design (ACD) and Viability Assessment (VA).

II. BACKGROUND

Original Version
EBDRD 3.7.3 EMPLACEMENT HARDWARE REQUIREMENTS

The emplacement hardware requirements (To Be Determined [TBD]) are for hardware used to support and protect the emplaced waste packages. Examples of emplacement hardware are a pedestal under the waste package for the in-drift emplacement concept and a carriage and rail system for the horizontal opening concept. Emplacement hardware does not include ground support hardware, which is part of the Repository Segment. Emplacement hardware requirements will be added during and after ACD.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling/Requirements

Need for assumption (statement of intended use):

Removal of the "TBD" from the statement does not impact waste package or subsurface design at this time. Performance requirements will have to be developed for the emplacement hardware architecture identified during ACD and VA and added to Section 3.7.3 of the Engineered Barrier Design Requirements Document (EBDRD).

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Performance requirements cannot be allocated to emplacement hardware until that hardware is identified during ACD and VA.

Assumption Identifier: EBDRD 3.7.3 (continued)

Subject: Emplacement Hardware Requirements

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Waste Package

Document(s) Supporting Withdrawal of Assumption:

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SECTION 5

REPOSITORY DESIGN REQUIREMENTS DOCUMENT ASSUMPTIONS (RDRD)

NOTE: Assumptions in this section refer to requirements in the *Repository Design Requirements Document* (RDRD) (YMP 1994a). As indicated in Section 2.2, the assumption, typically, will do one or more of the following:

- Remove a TBD or TBV contained in the original requirement
- State that the requirement is considered to be not applicable
- Replace the original requirement with a new statement

The original version of the corresponding requirement as contained in the RDRD is reproduced in the Background section of the assumption rationale sheet.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.1.2.B **Subject:** Waste Receiving Schedule

I. STATEMENT OF ASSUMPTION

The corresponding RDRD requirement is considered to be not applicable. Design of Waste Handling Operations are presently based on tables in Key Assumptions 001, 002, and 003, which reflect the baseline waste stream developed in the *Waste Quantity, Mix and Throughput Study Report* (CRWMS 1997c) based on the waste receipt schedule in Table 3-1 of the *Civilian Radiactive Waste Management System Requirements Document*, Rev. 3 (DOE 1996b) and Table 3-3 of the *Mined Geologic Disposal System Requirements Document*, Rev. 2, DCN 2 (DOE 1996c). Key Assumption 092 increases the quantity of commercial SNF received in the first year to 400 MTU, and Key Assumption 088 identifies plutonium disposition materials to be included in the waste receipts.

II. BACKGROUND

Original Version
RDRD 3.2.1.2

B. The repository shall be capable of receiving waste according to the schedule shown in Table 3.3 of this document.
[MGDS RD 3.2.1.3.J][CRD 3.7.4.2.G]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

The waste receiving schedule is necessary for sizing all elements of the Mined Geologic Disposal System (MGDS) and for establishing the average expected throughput rates.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

See Key Assumptions 001, 002, 003, 088, and 092.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.1.2.B (continued) **Subject:** Waste Receiving Schedule

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Analysis

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.1.2.C

Subject: Preclosure Radiation Exposures and Releases of Radioactive Material

I. STATEMENT OF ASSUMPTION

C. The GROA shall be designed so that until permanent closure has been completed, radiation exposures, radiation levels, and releases of radioactive materials to unrestricted areas will be maintained within the limits specified in 10 CFR 20 and applicable environmental standards for radioactivity established by the EPA.

II. BACKGROUND

Original Version

RDRD 3.2.1.1 EMPLACEMENT MODE REQUIREMENTS

C. The GROA shall be designed so that until permanent closure has been completed, radiation exposures, radiation levels, and releases of radioactive materials to unrestricted areas will at all times be maintained within the limits specified in 10 CFR 20 and applicable environmental standards for radioactivity established by the EPA, as listed in Section 3.2.2.

[MGDS-RD 3.2.1.3.K][10 CFR 60.111(a)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Update to reflect the current version of 10 CFR 60.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The NRC revised 10 CFR 60.111(a) in a final rule issued December 4, 1996 (Federal Register Vol. 61, No. 234, pages 64257-64270) by deleting "at all times" to clarify that the requirement does not apply to radiation exposures, levels, and releases from Category 2 basis events.

Assumption Identifier: RDRD 3.2.1.2.C (continued) **Subject:** Preclosure Radiation Exposures and Releases of Radioactive Material

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.1.4.B **Subject:** Retrievability Period

I. STATEMENT OF ASSUMPTION

The period of emplaced waste retrievability stated in the corresponding RDRD requirement will be extended as indicated in Key Assumption 016.

II. BACKGROUND

Original Version

RDRD 3.2.1.4 RETRIEVAL MODE REQUIREMENTS

B. The GROA shall be designed to preserve the option of waste retrieval throughout the period during which wastes are being emplaced and, thereafter until the completion of a performance confirmation program and NRC review of the information obtained from such a program. To satisfy this objective, the geologic repository shall be designed so that any or all of the emplaced waste could be retrieved on a reasonable schedule starting at any time up to 50 years after waste emplacement operations are initiated, unless a different time period is approved or specified by the NRC. 10 CFR 60.111(b)(3) gives guidance for developing the schedule.

[MGDS-RD 3.2.1.5.B][10 CFR 60.111(b)(1)]]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Key Assumption 016 requires that the emplaced waste be retrievable for up to 100 years after initiation of waste emplacement operations. It is necessary to acknowledge that this extends the required period of retrievability in RDRD 3.2.1.4.B.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

See Key Assumption 016.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.1.6.C

Subject: Disposal System Postclosure Performance (40 CFR 191)

I. STATEMENT OF ASSUMPTION

The corresponding Repository Design Requirements Document (RDRD) requirement is considered to be not applicable. See Key Assumption 060.

II. BACKGROUND

Original Version
RDRD 3.2.1.6

C. The disposal system shall be designed to provide a reasonable expectation, based on performance assessments, that the cumulative releases of radionuclides to the accessible environment for 10,000 years after disposal from all significant processes and events that may affect the disposal system shall have a likelihood of less than one chance in 10 of exceeding the quantities calculated according to Table A-1 of Appendix A of 40 CFR 191; and have a likelihood of less than one chance in 1,000 of exceeding 10 times the quantities calculated according to Table A-1 of Appendix A of 40 CFR 191 (TBR).
[MGDS-RD 3.2.1.7.C][40 CFR 191.13(a)(TBR)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

Since 40 CFR 191 is no longer applicable to a repository at Yucca Mountain, Key Assumption 060 establishes an interim preclosure performance measure and goal that are to be used as the planning basis for evaluating the postclosure performance of the repository until a new Environmental Protection Agency standard is promulgated.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

See Key Assumption 060. 40 CFR 191 has been remanded.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.2.1.E

Subject: Annual Dose Equivalent to Member of the Public

I. STATEMENT OF ASSUMPTION

This corresponding RDRD requirement is considered to be not applicable. See Key Assumption 060.

II. BACKGROUND

Original Version

RDRD 3.2.2.1 GENERAL REQUIREMENTS

E. The disposal system shall be designed to meet the individual protection requirements specified by 40 CFR 191.15 [TBR].

[MGDS-RD 3.2.2.1.G][40 CFR 191.15 [TBR]]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

Since 40 CFR 191 is no longer applicable to a repository at Yucca Mountain, Key Assumption 060 establishes an interim postclosure performance measure and goal that are to be used as the planning basis for evaluating the postclosure performance of the repository until a new Environmental Protection Agency standard is promulgated.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

See Key Assumption 060. 40 CFR 191 has been remanded.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.2.2.A

Subject: Dose Limit to Public from Repository Operations

I. STATEMENT OF ASSUMPTION

A. Repository facilities shall be designed to operate so that the total effective dose equivalent to individual members of the public from Category 1 design basis events in the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contribution from the facility's disposal of radioactive material into sanitary sewerage in accordance with 10 CFR 20.2003. However, the facility may apply for prior NRC authorization to operate up to an annual dose limit for an individual member of the public of 0.5 rem (5 mSv) in accordance with 10 CFR 20.1301(c).

II. BACKGROUND

Original Version

EBDRD 3.2.2.3 PUBLIC PROTECTION

A. Repository facilities shall be designed to operate so that the total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contribution from the facility's disposal of radioactive materials into sanitary sewerage in accordance with 10 CFR 20.2003. However, the facility may apply for prior NRC authorization to operate up to an annual dose limit for an individual member of the public of 0.5 rem (5 mSv) in accordance with 10 CFR 20.1301(c).

[MGDS-RD 3.2.2.3.A][10 CFR 20.1301(a),(c)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify: Systems Engineering

Need for assumption (statement of intended use):

Update to reflect the applicability to Category 1 design basis events. Regulation 10 CFR 60.136 is applicable to Category 2 design basis events.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The NRC added a regulation on preclosure controlled area (10 CFR 60.136) to 10 CFR 60 in a final rule issued December 4, 1996 (Federal Register Vol. 61, No. 234, pages 64257-64270). It provides, for Category 2 design basis events, a dose limit to individuals on or beyond the boundary of the preclosure controlled area. Releases resulting from Category 1 design basis events would not be

Assumption Identifier: RDRD 3.2.2.2.A (continued) **Subject:** Dose Limit to Public from Repository Operations

permitted to cause doses exceeding the limits of 10 CFR 20. This applicability to Category 1 events is reflected in the assumption.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.2.2.C

Subject: Dose Limit to Public in Unrestricted Areas

I. STATEMENT OF ASSUMPTION

C. Repository facilities shall be designed to operate so that the dose in any unrestricted area from external sources does not exceed 0.002 rem (0.02 mSv) in any one hour for Category 1 design basis events.

II. BACKGROUND

Original Version

EBDRD 3.2.2.3 PUBLIC PROTECTION

C. Repository facilities shall be designed to operate so that the dose in any unrestricted area from external sources does not exceed 0.002 rem (0.02 mSv) in any one hour.

[MGDS-RD 3.2.2.3.B][10 CFR 20130(a)(2)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): System Engineering

Need for assumption (statement of intended use):

Update to reflect the applicability to Category 1 design basis events. Regulation 10 CFR 60.136 is applicable to Category 2 design basis events.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The NRC added a regulation on preclosure controlled area (10 CFR 60.136) to CFR 60 in a final rule issued December 4, 1996 (Federal Register Vol. 61, No. 234, pages 64257-64270). It provides, for Category 2 design basis events, a dose limit to individuals on or beyond the boundary of the preclosure controlled area. Releases resulting from Category 1 design basis events would not be permitted to cause doses exceeding the limits of 10 CFR 20. This applicability to Category 1 events is reflected in the assumption.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: System Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.1.3.B

Subject: Cask Inspection and Decontamination

I. STATEMENT OF ASSUMPTION

Cask inspection, decontamination, and repair responsibilities implied in the corresponding RDRD requirement are limited as indicated by Key Assumption 080.

II. BACKGROUND

Original Version

RDRD 3.2.3.1.3 REPOSITORY SEGMENT - TRANSPORTATION INTERFACE

B. The Repository Segment is responsible for inspecting and decontamination the cask using Transportation procedures. The Repository Segment also performs minor cask repairs using materials and instructions provided by Transportation.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

A cask maintenance facility is no longer planned at the repository as it was when the corresponding RDRD requirement was established.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Cask maintenance will be a responsibility of the Regional Service Contractor, thus limiting the capabilities to be provided at the repository. See Key Assumption 080.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.1.3.I **Subject:** Cask Cleaning

I. STATEMENT OF ASSUMPTION

Cask cleaning responsibilities implied in the corresponding RDRD requirement are limited as indicated by Key Assumption 080.

II. BACKGROUND

Original Version

RDRD 3.2.3.1.3 REPOSITORY SEGMENT - TRANSPORTATION INTERFACE

I. The Repository Segment shall have the facilities to clean the interiors of unloaded casks to satisfy the requirements of Transportation and any existing agreements for cleanliness with the waste purchasers/producers or the MRS.

[MGDS-RD 3.2.3.2.3.G]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Engineering

Need for assumption (statement of intended use):

A cask maintenance facility is no longer planned at the repository as it was when the corresponding RDRD requirement was established.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Cask maintenance will be a responsibility of the Regional Service Contractor, thus limiting the capabilities to be provided at the repository. See Key Assumption 080.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.2.2.A.7 **Subject:** Emplacement Concept

I. STATEMENT OF ASSUMPTION

The Repository Segment shall accommodate horizontal, in-drift emplacement of waste packages.

II. BACKGROUND

Original Version
RDRD 3.2.3.2.2.A.7

7. The Repository Segment shall accommodate the emplacement concept (To Be Determined [TBD]) selected during Advanced Conceptual Design (ACD).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The selection of this emplacement method is based on the Advanced Conceptual Design (ACD) efforts. (This assumption is consistent with assumption Key 011.)

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.2.2.A.11a **Subject:** Repository Design to Limit Waste Form - Water Contact

I. STATEMENT OF ASSUMPTION

a) The repository shall be designed so that a combination of characteristics will support the engineered barrier system to prevent the seeping water from coming into contact with the waste form in all but 10 waste form locations for a period of at least 10,000 years.

II. BACKGROUND

Original Version
RDRD 3.2.3.2.2.A.11

a) The repository layout shall be designed so that a combination of characteristics will assist in keeping liquid water from contacting the waste packages for the first 300 to 1000 (to be verified) years after closure.
[Derived]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

The requirement is needed for general repository design and to set initial standards for postclosure performance.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This interpretation is in support of Key Assumption 075.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.2.2.A.11.b

Subject: Layout to Ensure Waste Form Design Limit Temperatures Not Exceeded

I. STATEMENT OF ASSUMPTION

This corresponding RDRD requirement is considered to be not applicable. See Assumption DCWP 001 for design limit temperature for the waste form and Key Assumption 019 for the repository mass loading for thermal management.

II. BACKGROUND

Original Version

RDRD 3.2.3.2.2.A.11
The underground facility shall be designed based on the requirement that, assuming anticipated processes and events, containment of radioactive material within the waste packages will be substantially complete for a period TBD by the NRC, but not less than 300 years nor more than 1,000 years after permanent closure of the geologic repository.

b) The layout shall also ensure that the design limit temperatures [TBD] for waste forms are not exceeded.

[Derived][MGDS-RD 3.7.3.2.C][10 CFR 60.113(a)(1)(ii)(A)]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Engineering

Need for assumption (statement of intended use):

Clarification that requirements are covered in other assumptions.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Assumption DCWP 001 addresses the design limit temperature for the waste form, and assumption EBDRD 3.7.1.I provides the requirement for substantially-complete containment of radioactive material within the waste packages. Key Assumption 019 defines the mass loading range per unit area that is to be used for thermal management with the resultant impact on the layout for the emplacement of waste packages.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.2.2.A.11.b (continued)

Subject: Layout to Ensure Waste Form Design Limit Temperatures Not Exceeded

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.4.B **Subject:** Non-Potable Water

I. STATEMENT OF ASSUMPTION

B. Non-potable water. The Repository Segment will connect with the exiting Nevada Test Site (NTS) water supply system.

II. BACKGROUND

Original Version
RDRD 3.2.3.4.B

NON-POTABLE WATER (3 PARTS)

B. Non-potable water. The Repository Segment interfaces with the To Be Determined (TBD) water supply system. The Mined Geologic Disposal System (MGDS) requires To Be Determined (TBD) gallon(s) per day at To Be Determined (TBD) psi.

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Need to identify water system source.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Use existing water supply system.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.4.D **Subject:** Telephone Communications

I. STATEMENT OF ASSUMPTION

D. Telephone communications. The Repository Segment shall connect to the existing Nevada Test Site (NTS) telephone system.

II. BACKGROUND

Original Version
RDRD 3.2.3.4.D

D. Telephone communications. The Repository Segment interfaces with the NTS switched telephone system at To Be Determined (TBD). The Mined Geologic Disposal System (MGDS) requires:

1. TBD Federal Telecommunication System (FTS) lines with TBD quality.
2. TBD commercial long distance lines with TBD quality.
3. TBD lines to the local NTS exchange with TBD quality.
4. TBD private lines.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

The requirement as stated in the Repository Design Requirements Document (RDRD) assumes a level of detail that far exceeds what is needed for Viability Assessment (VA). It also ignores existing agreements between Yucca Mountain Site Characterization Office (YMSCO) and NTS with regards to communications.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

U.S. Department of Energy (DOE) NTS Standard Operating Procedure Chapter 5301, Telecommunications, defines the responsibilities and interfaces for all aspects of telecommunications at the NTS. Repository Design Requirements Document (RDRD) Requirement 3.2.3.4.D is consistent with current policy. See the following:

YMP-FOI-5301, Field Telecommunications
NTS-SOP-5301, Telecommunications
NTS-SOP-5302, Telecommunications--Radio Utilization Program

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.2.3.4.D (continued) **Subject:** Telephone Communications

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.1.C **Subject:** Special Sources of Groundwater

I. STATEMENT OF ASSUMPTION

The corresponding Repository Design Requirements Document (RDRD) requirement is considered to be not applicable. See Key Assumption 060.

II. BACKGROUND

Original Version
RDRD 3.7.1 GROUNDWATER

C. Groundwater. If any of the average annual radionuclide concentrations existing in a special source of groundwater (if one exists) before construction of the disposal system already exceed the limits in 40 CFR 191.16(a), the disposal system shall be designed to provide a reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the disposal system shall not increase the existing average annual radionuclide concentrations in water withdrawn from the special source of groundwater by more than the limits established in 40 CFR 191.16(a) (TBR).
[MGDS-RD 3.7.2.2.C][40 CFR 191.16(b) (TBR)]

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Groundwater protection will adhere to interim standards stated in Key Assumption 060.

There are no special sources of groundwater at Yucca Mountain, as defined in 40 CFR 191.12(0); therefore, the requirements of 40 CFR 191.16 do not impact Yucca Mountain. In addition, 40 CFR 191 has been remanded. See Key Assumption 060.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization:
Systems Engineering /Site Investigation

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.3.5.A.1 **Subject:** General Underground Lighting

I. STATEMENT OF ASSUMPTION

General lighting for underground shall meet OSHA and MSHA codes. See Key Assumption 069 with regard to the applicablity of OSHA and MSHA.

II. BACKGROUND

RDRD 3.7.3.5.A

UNDERGROUND GENERAL LIGHTING

1. General lighting for underground shall be at least To Be Determined ft-candles in the mains.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Analysis and Modeling

Need for assumption (statement of intended use):

Design to address adequate lighting for underground workings.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Setting numerical limits for underground lighting should not be in the Repository Design Requirements Document (RDRD). Those limits are established in the building codes that govern underground construction, as well as MSHA and OSHA requirements.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.3.5.A.2 **Subject:** Underground Service Facilities Lighting

I. STATEMENT OF ASSUMPTION

General lighting for underground service facilities not related to waste handling or security shall meet OSHA and MSHA codes. See Key Assumption 069 with regard to the applicability of OSHA and MSHA.

II. BACKGROUND

Original Version
RDRD 3.7.3.5.A UNDERGROUND GENERAL LIGHTING

2. In the service facilities not related to waste handling or security, lighting shall be at least To Be Determined ft-candles.
   [Derived]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, (X) Other (specify): Systems Analysis and Modeling

Need for assumption (statement of intended use):

Design to address adequate lighting for underground workings.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Setting numerical limits for underground lighting should not be in the Repository Design Requirements Document (RDRD). Those limits are established in the building codes that govern underground construction, as well as MSHA and OSHA requirements.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.3.9.E **Subject:** Site-Generated Hazardous Waste

I. STATEMENT OF ASSUMPTION

E. Hazardous waste will be collected and packaged onsite for transport to an offsite Resource Conservation and Recovery Act of 1976 (RCRA) approved treatment, storage, and disposal facility.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Original Version:
RDRD 3.7.3.9 SITE-GENERATED WASTE TREATMENT

E. Nonradioactive hazardous waste disposal facilities shall have sufficient capacity to process the quantities of hazardous waste anticipated throughout the operation of the repository (To Be Determined [TBD]). Nonradioactive hazardous waste disposal facilities shall comply with U.S. Department of Energy (DOE) Orders 5480.3 and 5480.4.
[Derived][DOE Order 5480.3; 5480.4]

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This assumption is needed to document the requirement to provide compliance with appropriate U.S. Department of Energy (DOE) requirements involving the handling of nonradioactive hazardous wastes. The quantities of this waste will be determined during the course of the Viability Assessment (VA). See related Key Assumption 024.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.4.1.A.2 **Subject:** Storage Capacity for Waste Receipts

I. STATEMENT OF ASSUMPTION

The corresponding Repository Design Requirements Document (RDRD) requirement is considered to be not applicable.

II. BACKGROUND

Original Version
RDRD 3.7.4.1.A STORAGE CAPACITY FOR WASTE RECEIPTS

2. Waste handling facilities shall provide a temporary storage capacity equivalent to To Be Determined (TBD) waste receipts.

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Requirement for surface facility holding or buffer areas will determine the capacity of waste handling facility or other facility storage requirements. No need for requirement.

See Rationale for Assumption RDRD 3.7.4.1.A.3

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.4.1.A.3 **Subject:** Waste Handling Holding Areas

I. STATEMENT OF ASSUMPTION

3. Waste handling facilities shall have buffer or holding areas at certain steps spread out within these operations. These areas will have sufficient capacity that in the event of an unplanned stoppage, operations may be completed to a reasonable safety shut down condition. This includes the receipt of in-transit casks, emptying casks, filling and sealing disposal containers, and decontaminating and emptying cask dispatch.
[10CFR60.132(a)] [Derived.]

II. BACKGROUND

Original Version
RDRD 3.7.4.1 WASTE HANDLING REQUIREMENTS

A. Waste Handling

3. Storage facilities shall have the capability to store the waste as received from offsite, as well as the prepared waste packages onsite (To Be Determined [TBD]).
[Derived]

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

The need is to ensure safe completion of operations.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The term "storage" has many connotations on this project. Capacity to receive unlimited offsite waste has significant design impact, which cannot be necessarily met at this time. Until other criteria is established to limit this capacity, this assumption defines the limit as that waste which is in processing or in transit to reduce the need to reverse an operation as a result of a stoppage anywhere in the Mined Geologic Disposal System (MGDS).

"Buffer" capacity is needed to provide "surge" in the process activities and to maintain steady process flow in the overall system. Because the Nuclear Waste Policy Act (NWPA) does not permit extensive, long-term interim storage at the repository, this assumption interprets any reference to storage in surface facilities as a short-term holding area for steady process flow and for safe, unplanned stoppages. These holding areas are not to be used for waste form or waste package aging, or for storage of retrieved waste packages. Holding area capacities will be determined by design process flow simulations.

Assumption Identifier: RDRD 3.7.4.1.A.3 (continued) **Subject:** Waste Handling Holding Areas

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.5.A **Subject:** Shaft Conveyances

I. STATEMENT OF ASSUMPTION

The corresponding Repository Design Requirements Document (RDRD) requirement is considered to be not applicable.

II. BACKGROUND

Original Version
RDRD 3.7.5 Repository Underground Requirements

A. Shaft Conveyances. Shaft conveyences; if used for handling radioactive waste, shall meet the following requirements:

1. Hoists important to safety shall be designed to preclude cage free-fall.
[MGDS-RD 3.7.2.6.A.1] [10 CFR 60.131(b)(10)(i)]

2. Hoists important to safety shall be designed with a reliable cage location system.
[MGDS-RD 3.7.2.6.A.2][10 CFR 60.131(b)(10)(ii)]

3. Loading the unloading systems for hoists important to safety shall be designed with a reliable system of interlocks that will fail safely upon malfunction.
[MGDS-RD 3.7.2.6.A.3][10 CFR 60.131(b)(10)(iii)]

4. Hoists important to safety shall be designed to include two independent indicators to indicate when waste packages are in place and ready for transfer.
[MGDS-RD 3.7.2.6.A.4][10 CFR 60.131(b)(10)(iv)]

5. The size and weight limits of the hoisting system in the men-and-materials [TBV] shaft for materials handling shall be [TBD].
[Derived]

6. The hoist shall satisfy all local, state, and federal regulations pertaining to safety, including those applicable to Title 8, Chapter 4, Subchapter 20 of the CAC.
[DOE Order 5480.4]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

The requirements do not apply to the design concept for the repository.

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.5.A (continued) **Subject:** Shaft Conveyances

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Shaft conveyances are not to be used for handling radioactive waste. The waste is to be transported between surface and subsurface via ramp.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.5.B.6 **Subject:** Underground Air Supply

I. STATEMENT OF ASSUMPTION

Supply and exhaust adequate quantities of air to and from underground working areas such that operator safety, health, and productivity requirements are maintained.

II. BACKGROUND

Original Version
RDRD 3.7.5.B

6. Supply and exhaust adequate quantities of air (To Be Determined [TBD]) to and from underground working areas such that operator safety, health and productivity requirements are maintained. [Derived]

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects ventilation design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The requirement as stated is valid without the To Be Determined (TBD). The air quantity is architecture and operations dependent and does not belong in the Repository Design Requirements Document (RDRD).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3:7.5.N.1 **Subject:** Waste Ramp Air Flow

I. STATEMENT OF ASSUMPTION

The corresponding Repository Design Requirements Document (RDRD) requirement is considered to be not applicable.

II. BACKGROUND

Original Version
RDRD 3.7.5.N SHAFT AIRFLOW

1. The waste ramp shall permit flow of intake ventilation air for the emplacement area, which, when combined with the airflow in the shafts, is adequate for emplacement operations (To Be Verified [TBV]).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( )Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Sets requirements for shaft, ramp, and ventilation design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Remove Design Specific requirement that presupposes the routes for providing ventilation air. Assumes there will be shafts and they will be used for air intake. Assumes the waste ramp will be used to supply air to the emplacement areas. This is inappropriate.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.5.N.2 **Subject:** Tuff Ramp Air Flow

I. STATEMENT OF ASSUMPTION

The corresponding Repository Design Requirements Document (RDRD) requirement is considered to be not applicable.

II. BACKGROUND

Original Version
RDRD 3.7.5.N TUFF RAMP AIRFLOW

2. The tuff ramp shall permit flow of ventilation airflow capacity adequate to meet the return air requirements of the development area during the construction and operation periods (To Be Verified [TBV]).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects architecture.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

It is architecture and function dependent.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.5.N.5 **Subject:** Shaft Size

I. STATEMENT OF ASSUMPTION

If shafts are used, the shaft size shall be determined by the size of the conveyances needed to move materials, personnel, and equipment underground; the volume of ventilation flow needed; and the space required for utility lines.

II. BACKGROUND

Original Version
RDRD 3.7.5.N SHAFTS (SIZE REQUIREMENTS)

5. If shafts are used, the shaft size shall be determined by the size of the conveyances needed to move materials, personnel, and equipment underground; the volume of ventilation flow needed; and the space required for utility lines (To Be Determined [TBD]).

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects shaft design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The requirement as stated is valid without the To Be Determined (TBD). The requirement gives the criteria for determining the shaft size; it need not also give the shaft size or the areas required for the items used to determine the shaft size. These will be determined during design and are architecture and operations dependent.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: RDRD 3.7.5.O.2 **Subject:** Men-and-Materials Shaft Usage

I. STATEMENT OF ASSUMPTION

The corresponding Repository Design Requirements Document (RDRD) requirement is considered to be not applicable.

II. BACKGROUND

Original Version
RDRD 3.7.5.O MEN-AND-MATERIALS SHAFT

2. The service main shall be adequate to handle the transport of development personnel, supplies, utility lines, and machinery to the men-and-materials shaft (To Be Verified [TBV]), to the service facilities for the development area, and to the development area.

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects repository architecture.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Requirement assumes there will be a men-and-materials shaft and a service main. Both of these are architecture-dependent and should not be specified in the Repository Design Requirements Document (RDRD).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date: