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Postclosure Modeling and Analyses Design Parameters

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10. Remarks

Revision 01 Originator responsibilities: R. L. Keller selected direct inputs to the report and developed the results presented in Section 6 of the report. R. H. Spencer Jr. selected other references cited and prepared the balance of the report. The following individuals were contributors to the development of this report: M. Anderson, D. Darling, T. Ehrhorn, T. McCormick, D. Mecham, R. Rajagopal, D. Rhodes, R. Saunders, J. Schmitt, J. Steinhoff, S. Su, D. Tang, E. Thomas, J. Tutterrow, M. Woods, and R. Zimmerman. N. Brown checked the check copy (draft 1a), the back-check copy (draft 1b), and the back-check comment resolution copy (draft 1c) prior to departing BSC. R.W. Andrews completed the final check.

Revision 02 Originator responsibilities: R.H. Spencer Jr. revised the report. R.L Keller contributed to revising the report, including with regard to resolving comments and incorporating comment resolutions.

Change History

11. Revision No.	12. Description of Change
00	Original issue.
01	Complete revision to incorporate parameters from updated analysis and model reports and to develop derived design requirements. Removes statement concerning stainless-steel-clad fuel in response to Condition Report 4534. Establishes an interface constraint for the maximum temperature for the HLW glass canisters in response to Condition Report 8254. The waste package surface temperature constraint has been clarified in response to Condition Report 8374. Corrected the stress corrosion cracking threshold value in response to Condition Report 9844. Provides technical basis for the drift wall temperature limit of 200 degrees C in response to Condition Report 7969. Implements decision proposal TMRB-2006-021.

BSC	**TECHNICAL REPORT SIGNATURE PAGE/ CHANGE HISTORY** *Complete only applicable items.*	1. QA: QA 2. Total Pages: 80

Change History (continued)

11. Revision No.	12. Description of Change
02	Revised to incorporate changes to Table 1 authorized by TMRB decision proposals TMRB-2007-049 (delete Parameter 09-02, modify parameter 01-18, add parameters 01-20, -21, -22, and 03-16 d) [removal of oxide film], and update bases of Parameter 06-02), TMRB-2007-061 (clarify Parameter 05-02), TMRB-2007-062 (add Parameter 02-03 d) [dust mitigation]), and TMRB-2007-066 (revise parameters 01-14 and 04-04, add Parameters 03-26 and 06-06, and delete Parameters 03-25 and 07-05, -06, and –17). Revised wording of Parameter 03-12 to add constraint for the number of plates used in fabricating the waste package Alloy-22 outer corrosion barrier, as stated in the cited basis and authorized in TMRB-2005-024. Revised wording of Parameters 03-14, 04-08, 07-09, 07-12, and 07-14 to delete specific process constraints that are covered by invoking standard nuclear industry practices. Noted that compliance with Parameters 06-03 and 07-08 is only demonstrated in postclosure analyses. Revised Parameter 07-10 to address the difference between inspections for full penetration welds and fillet welds. Deleted manual shielded metal-arc welding as an acceptable welding technique from Parameter 07-11. Clarified parameters 01-17, 03-04, 03-05, 04-07, and 05-01, and strengthened parameter 09-03 in response to review comments. Removed proposed ranges/tolerances from Parameters 01-10 and 01-13 and added Section 7 to address proposed parameter ranges. Incorporated ACN 03 to REV 01. Updated references and made other editorial clarifications.

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TABLES

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ACRONYMS

10 CFR	Title 10 Code of Federal Regulations
AMRs	analysis and model reports
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BSC	Bechtel SAIC Co., LLC
BWR	boiling water reactor
CSNF	commercial spent nuclear fuel
DEMs	discipline engineering managers
DHLW	defense high level waste
DIRS	document input reference system
DOE	U.S. Department of Energy
DSC	drip shield connector
DSNF	defense-related spent nuclear fuel
EBS	engineered barrier system
EG RAO	Engineering Requirements Area Owner
ET	eddy current examination/testing
FEPs	features, events and processes
GMAW	gas metal arc weld
GTAW	gas tungsten arc weld
GWd/MTU	gigawatt days per metric ton of uranium
HLW	high-level radioactive waste
IDD	interface definition document
IED	information exchange document
ITWI	important to waste isolation
LA	license application
LaBS	lanthanum borosilicate
MCO	multicanister overpack
MIC	microbially influenced corrosion
MOX	mixed oxide fuel
MT	metric ton
NSNF	naval spent nuclear fuel

ACRONYMS (Continued)

PT	liquid penetrant testing
PWR	pressurized water reactor
QA	quality assurance
RAO	requirements area owner
RHH	repository host horizon
RT	radiographic examination/testing
SCC	stress corrosion cracking
SNF	spent nuclear fuel
SSCs	structures, systems, and components
SZ	saturated zone
TAD	transport, aging, and disposal
TFMs	tracers, fluids, and materials
TMRB	Technical Management Review Board
TSPA	Total System Performance Assessment
U-235	Uranium-235
UNS	Unified Numbering System
UT	ultrasonic examination/testing
UZ	unsaturated zone
VT	visual examination/testing
wt%	weight-percent
YMP	Yucca Mountain Project

1. PURPOSE AND INTENDED USE

1.1 PURPOSE

The purpose of this report is to:

- Establish as controlled internal design constraints for repository structures, systems, and components (SSCs) the specific functions that are estimated to affect performance assessment results and the specific values or ranges of values chosen for controlling parameters as reference bounds for design.

- Identify as controlled interface parameters those other functions and parameters that are relied upon to define and control the interface between design of the repository and postclosure performance assessment of the repository.

The controlled internal design constraints established in this report are derived from statements in postclosure analyses that credit functions as modeled in those analyses to specific design features and their controlling parameters. This includes statements that credit design features and their controlling parameters to conclude that a feature, event, or process is very unlikely or that it would not significantly affect performance assessment results.

The controlled interface parameters identified in this report are other design parameters (i.e., they are not controlling parameters) that have been cited as inputs to postclosure models and analyses. These parameters are characteristics of engineered barrier system SSCs that must be accounted for in models and analyses, but that are not currently estimated to be critical to performance assessment results. (This is the case because these parameter values are driven by design decisions or by design inputs other than waste isolation functions.) Values or ranges of values of these parameters were generally determined during conceptual or preliminary design as design outputs. Thus the identification of these parameters as internal design constraints or design inputs is inappropriate. However, the integrity of performance assessment models and analyses and the integrity of subsequent design process outputs depend on these parameters remaining stable at their established values or ranges of values. Their identification as controlled interface parameters will ensure consistency between the repository as designed and constructed and the repository as modeled in the assessment of postclosure performance. It is understood that controlled interface parameter values and ranges simply reflect the as-designed, as-analyzed condition. Interface control parameter values and ranges may be changed or expanded to accommodate design evolution and any necessary changes with sufficient additional analyses and agreement from both Bechtel SAIC Co., LLC (BSC) and the Office of Civilian Radioactive Waste Management Lead Laboratory for Repository Systems (hereinafter "Lead Laboratory").

To achieve its purpose, this report presents the design parameters used as input in postclosure models, analyses, and supporting calculations and, based on the usage of each parameter, either establishes the parameter's value or range of values as a controlled internal design constraint or identifies the interface control mechanism for the parameter (or parameter set). The design parameters and their associated controlled internal design constraints or interface control mechanisms are presented in Section 6 of this report.

1.2 STATUS IN DOCUMENT HIERARCHY

This report is an interface definition document as defined in CC-PRO-2001, *Technical Interface Control,* and is designated a Level 4 technical baseline document, as described in EG-PRO-3DP-G04B-00005, *Configuration Management*. The Technical Management Review Board (TMRB) is the change control authority for this report.

1.3 INTENDED USE

Both the controlled internal design constraints and the controlled interface parameters presented in this report are internal constraints. Accordingly, this report is to be managed within the requirements management system as an internal-constraints document in accordance with RQ-PRO-2000, *Managing Internal Constraints.* This report will be allocated to the Engineering Requirements Area Owner (EG RAO).

Controlled internal design constraints presented in this report are to be implemented during the design process by the EG RAO (as the design authority) in accordance with EG-PRO-3DP-G04B-00005 or, where appropriate, allocated to another RAO for implementation. Implementation of controlled internal design constraints during the design process will involve allocation of the internal constraints to systems or facilities, the selection and application of appropriate codes and standards, and the translation of internal constraints into design through the hierarchy of design media as discussed in EG-PRO-3DP-G03B-00001, *Design Process.*

It is important to note that the design authority's responsibility is limited to implementing the controlled internal design constraints such that compliance can be demonstrated (with the use of performance confirmation data as necessary) only up to the time of repository closure. The responsibility for demonstrating any future postclosure state with respect to compliance with internal design constraints rests with the Lead Laboratory. Further, the Lead Laboratory retains responsibility for demonstrating how and to what extent compliance with the internal design constraints contributes to barrier capability.

Interface control parameters presented in this report are to be controlled during the design process by the EG RAO in accordance with EG-PRO-3DP-G04B-00005, Section 3. Any changes that affect the interface control parameters are to be classified as Level 4 changes and thus will require TMRB authorization prior to implementation. Note that TMRB authorization ensures that both BSC and the Lead Laboratory agree that the need for the change justifies accepting the impacts associated with the change.

It should be noted that some of the design parameters identified in this report have been and will continue to be used in postclosure calculations and analyses but, at present, have no foreseeable application to design, construction, or operations. Such parameters are included in this report for completeness and for consistency between postclosure analyses and design, should the parameters be applied to design at some future time, and are identified as "information only." The EG RAO may treat such parameters as information in the internal constraints allocation process.

Also, it is recognized that certain of the parameters presented in this report are based on the state of knowledge as of this writing. Ongoing testing, postclosure modeling and analysis, and design evolution may establish new, reduced or expanded ranges of values of these parameters. Where the term 'nominal' is used, future efforts may define a range of values. (Proposed tolerances and ranges for selected parameters are presented in Section 7 of this report.) But until such time as these new values are established, the parameter values as currently defined remain in effect. Also, in some cases the current state of knowledge is so limited that the controlled internal design constraint, as presently defined, does not establish a sufficient basis for compliance with the internal constraint. Such internal constraints are to be allocated as applicable and implemented to the extent practical, with demonstration of compliance deferred until such time as a basis for compliance is established.

Controlled internal design constraints presented in this report are referenceable as internal design constraints within BSC and the Lead Laboratory. Controlled interface parameter values presented in this report are referenceable as direct input (but not as internal design constraints) within both BSC and the Lead Laboratory. Other information in this report is not intended for use as direct input, but this report may be useful in identifying or confirming the appropriate sources for such information.

1.4 LIMITATIONS ON USE

This report is not intended for use during construction, procurement, or fabrication.

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2. SCOPE AND METHODOLOGY

2.1 BACKGROUND

The Monitored Geologic Repository at Yucca Mountain is being developed as the nation's first repository for disposal of high-level nuclear waste. The postclosure function of the repository is to isolate the waste from the public and the accessible environment. Multiple barriers consisting of natural barriers and an engineered barrier system (EBS) will perform the waste isolation function to meet the postclosure performance objectives established in 10 CFR 63.113 [DIRS 180319]. In accordance with 10 CFR 63.114 [DIRS 180319], postclosure performance of the repository will be demonstrated in a performance assessment.

The design of the EBS SSCs is a primary input to the analysis and model reports (AMRs) that support postclosure performance assessment of the repository. The design of EBS SSCs is defined by the design parameters, or attributes, associated with them. The term "design parameters" in this context includes functions and performance requirements allocated to SSCs through the design process, as well as the attributes of SSCs that are developed during design (e.g., dimensions; weight; materials; fabrication and quality-control processes; operating characteristics).

2.2 IDENTIFICATION OF DESIGN PARAMETERS

This report identifies the repository design parameters that have been used as direct inputs in AMRs or other scientific documents that support the postclosure performance assessment. A review of active Lead-Laboratory-owned documents was performed to identify the design parameters, using either of two different methods. The first method of identification was to review the screening decisions for each of the features, events, and processes (FEPs) that were considered for potential inclusion in the performance assessment. The second method of identification was to review the AMRs (and supporting calculations) in which conceptual models of the included FEPs were developed and documented.

2.2.1 Review of FEPs Screening Decisions

The final results of the FEP screening analyses are documented in a set of ten FEP analysis reports (collectively referred to as FEPs AMRs) (*Development of the Total System Performance Assessment-License Application Features, Events, and Processes,* BSC 2005 [DIRS 173800], Section 2.4.1). Each FEP is screened as either "included" in or "excluded" from postclosure performance assessment. For each included FEP, the AMR in which the FEP is addressed includes a disposition discussion that describes how the FEP is to be modeled in the performance assessment. For each excluded FEP, the AMR includes a screening argument for excluding the FEP from the performance assessment. (A FEP may be excluded based on low consequence or low probability, per criteria given at 10 CFR 63.342 [DIRS 180319], or by regulation per other provisions of 10 CFR 63, e.g., 10 CFR 63.305 (b) [DIRS 180319]).

A listing of all FEPs was prepared to document the review of FEP screening decisions. The appropriate discipline engineering managers (DEMs) from the Nuclear & Radiological, Civil/ Structural/Architectural, Systems Engineering, Thermal/Structural Analysis, and Mining disciplines were assigned to review the screening decisions[1] for a given FEP. These assignments were based on the relevance of each discipline to the particular characteristics of each FEP. Most of the DEMs assigned additional discipline engineers to support the review of their assigned FEPs. (The reviewers are identified as contributors to this report on the signature page.)

Instructions for the review, listings of assigned FEPs, and the relevant screening decisions were provided to reviewers. Each reviewer first identified all statements in the FEP screening decisions in which features of the engineered barrier system and its components are mentioned. These statements were incorporated into the listing of FEPs as "applicable quotes" from the AMRs.

Next, the applicable quotes were reviewed to determine if a quote implied an internal constraint and if additional action was needed to identify or clarify an internal constraint. If a quote implied an internal constraint, an internal constraint statement was derived from the quote. If the derived internal constraint did not specify a bounding value or a range of values for a parameter, actions necessary to refine the internal constraint statement were noted. Derived internal constraints and actions were documented in the listing of FEPs.

The results of the screening decision reviews were then compiled. Questions or issues were noted and resolved with the reviewers and selected derived internal constraints and actions were then further refined. The compiled results were then redistributed to all reviewers for their concurrence.

2.2.2 Review of other Models, Analyses, and other Supporting Documents

The [BSC] Lead Laboratory Technical Interface Manager (a coauthor of this report) reviewed the other postclosure documents owned by the Lead Laboratory for the use of design parameters. The tabulation of inputs, the reference listing, and the Document Input Reference System (DIRS) Report for each document were reviewed to identify design parameters used as direct input. These data were compiled and DIRS Document and Input Status Links reports for information exchange documents (IEDs) were then used to crosscheck the results of the review of Lead Laboratory documents. Each use of a design parameter was then reviewed by referring to the specific statements in which the input was used.

Each design parameter use was then correlated to the appropriate derived internal constraint(s) that had been developed from the review of FEPs screening decisions. If a statement that used a design parameter implied a new, previously unrecognized internal constraint, a new derived internal constraint was developed. Also, where so noted, derived internal constraint parameter values were developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

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[1] A substantial number of FEPs are addressed in more than one FEP AMR. The decision to include or exclude such a FEP is the same in all AMRs in which it is addressed. However, each individual screening decision addresses the particular characteristics of the FEP that are relevant to the topical area of that particular AMR. Therefore all FEP screening decisions were reviewed.

The results of these reviews were then compiled. The derived internal constraints were then categorized as internal design constraints or interface control parameters based on their relationship to excluded FEPs and to functions that are estimated to affect performance assessment results. Representative analyses from the FEPs AMRs and other AMRs were then selected as the postclosure bases for each derived internal constraint. Work-in-process records of the activities described in this section are available on compact disc within the Records Information Management System under Accession No. MOL.20070711.0514. Final results are presented in Section 6.

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3. QUALITY ASSURANCE

The preparation, review, approval, and control of this document are in accordance with PA-PRO-0313, *Technical Reports*, and CC-PRO-2001, *Technical Interface Control,* and its review is also in accordance with PA-PRO-0601, *Document Review*. This report is an interface definition document as defined in CC-PRO-2001. As such, it is subject to the approval of the Engineering Manager, who is responsible for implementing the derived internal constraints presented herein in the design of the repository. This technical report is not associated with scientific investigation activities and is not required to have a technical work plan prepared in accordance with LP-2.29Q-BSC, *Planning for Science Activities*. This report contains information that will be used to design and analyze items that may be important to waste isolation. Therefore, this document is subject to the requirements of QA-DIR-10, *Quality Management Directive*, Sections 2.1.C.1.1.a.i and 17.E, and is designated as QA: QA.

This document is controlled as a Level 4 technical baseline document. This document was developed consistent with guidance given in CC-DIR-10, *Configuration Management Program.* The TMRB (the Level 4 change control authority) authorized this revision of this document in accordance with CC-PRO-1001, *Technical Management Review Board Operations*. Documents that are not part of the repository technical baseline (e.g., feasibility studies, sensitivity studies, tolerance development, etc.) may use parameters contrary to those found within this document. However, prior to incorporation within the technical baseline, such parameters must be reconciled with this document through an approved TMRB decision proposal.

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4. USE OF SOFTWARE

No software requiring qualification in accordance with IT-PRO-0011, *Software Management* was used in the development of this report. Microsoft Excel was used to document work-in-process; however, its use was limited to the word processing capabilities of Excel (no computations performed). Therefore its use is not subject to the controls established in PA-PRO-0313.

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5. INPUTS AND ASSUMPTIONS

5.1 INPUTS

Several document types were inputs to this report and were used to identify the design parameters that are relevant to the postclosure performance assessment. These inputs (parameters and their sources) are documented in the appropriate tables in Section 6. As previously discussed in Section 2, input sources include the features, events, and processes (FEP) screening decisions taken from the FEPs AMRs, the development of conceptual models for included FEPs taken from other AMRs, other supporting calculations, and information exchange documents.

5.2 ASSUMPTIONS

There are no assumptions made in this report. However, the bases of parameters presented in this report may have relied on assumptions that are described in the cited references.

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6. POSTCLOSURE DESIGN PARAMETERS

The conclusions reached from the reviews of design parameter usage in postclosure models, analyses, and supporting documents are presented in Table 1. The results are grouped into the following categories based on the engineered system(s) and/or feature(s) to which each derived internal constraint applies:

1. Subsurface Facilities
2. Engineered Barrier System (EBS) In-Drift Configuration
3. Waste Package
4. Waste Form and Transport, Aging, and Disposal (TAD) Canister
5. Emplacement and Retrieval
6. Subsurface Ventilation
7. Drip Shield
8. Emplacement Pallet
9. Closure

Each row of the table includes one unique derived internal constraint. Within each category, rows are numbered sequentially for identification. Controlled interface parameters are identified as such, and the mechanism (e.g., the IED) for controlling the value or ranges of values for the interface parameter is identified. Parameters that have no applicability to design (i.e., that are only informative regarding the bases for postclosure analyses) are identified as "Information Only." Some derived internal constraints apply to multiple categories and are repeated for each category to which they apply. The key uses of the design parameters that are controlled by an internal constraint are listed adjacent to the internal constraint in the Postclosure Basis column. Taken together, these uses constitute the bases of the internal constraint. Parameters with a limited basis that are subject to future refinement are identified by inclusion of appropriate clarifying statements in the Postclosure Basis column.

Common acronyms used in Table 1 are defined in the list of acronyms contained in the front matter of this report. Less-common acronyms are also defined where used in the table.

Table 1. Postclosure Design Parameters

No.	Parameter	Derived Internal Constraint	Postclosure Basis
SUBSURFACE FACILITIES			
01-01	Repository Geographic and Geologic Location [Controlled Interface Parameters]	The interface control mechanisms for the location of the subsurface facilities of the repository within the footprint of emplacement area boundary and the repository host horizon (RHH) within the lithostratigraphic detail are the Subsurface Facilities Layout Geographical Data IED(s) and Geotechnical and Thermal Parameters IEDs.	Representative analyses: • FEP 2.2.08.01.0A – Chemical characteristics of groundwater in the SZ (BSC 2005 [DIRS 174190], Section 6.2.25); • FEP 2.2.08.12.0A – Chemistry of water flowing into the drift (BSC 2005 [DIRS 174191], Section 6.2.32); Current control mechanism: • *IED Subsurface Facilities Layout Geographical Data* (BSC 2007 [DIRS 179927]). • *IED Geotechnical and Thermal Parameters* (BSC 2007 [DIRS 179928])

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-02	Repository Layout [Controlled Interface Parameters]	The interface control mechanism for the general layout and configuration of the subsurface facilities, including shafts, portals, ramps, mains, emplacement drifts, observation drifts, and other subsurface features, and waste package nominal endpoint coordinates, elevations, and available drift lengths is the Subsurface Facilities Layout Geographical Data IED(s).	Representative analyses: • FEP 1.2.04.03.0A – Igneous intrusion into repository (BSC 2005 [DIRS 173981], Section 6.2.2.2); • FEP 1.2.06.00.0A – Hydrothermal activity (BSC 2005 [DIRS 174191], Section 6.8.2); • FEP 2.1.14.19.0A – In-package criticality resulting from a seismic event (degraded configurations) (BSC 2004 [DIRS 168556], Section 6.8.6); • FEP 2.1.14.16.0A – In-package criticality (degraded configurations) (BSC 2004 [DIRS 168556], Section 6.8.2); • FEP 2.1.13.02.0A – Radiation damage in EBS (BSC 2004 [DIRS 170020], Section 6.2.38); • FEP 2.1.13.02.0A – Radiation damage in EBS (BSC 2005 [DIRS 175014], Section 6.2.82); • *Drift Degradation Analysis,* Section 6.2 (BSC 2004 [DIRS 166107]); • FEP 1.5.01.01.0A – Meteorite impact (BSC 2004 [DIRS 170021], Section 6.2.4.5). Current control mechanism: • *IED Subsurface Facilities Layout Geographical Data* (BSC 2007 [DIRS 179927]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-03	Repository Geologic Location [Controlled Interface Parameters]	The interface control mechanism for the repository areas, emplacement area by geologic unit, fault intersection coordinates, and borehole locations is the Subsurface Facilities Geological Data IED.	Representative analyses: • FEP 2.2.06.03.0A – Seismic activity alters perched water zones (BSC 2005 [DIRS 174191], Section 6.8.8); • FEP 1.1.01.01.0A – Open site investigation boreholes (BSC 2005 [DIRS 174191], Section 6.3.1); • FEP1.2.02.03.0A – Fault displacement damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.2); • FEP 2.1.14.15.0A – In-package criticality (intact configuration) (BSC 2004 [DIRS 168556], Section 6.8.1); • FEP 2.1.14.18.0A – In-package criticality resulting from a seismic event (intact configuration) (BSC 2004 [DIRS 168556], Section 6.8.5); • FEP 2.1.14.19.0A – In-package criticality resulting from a seismic event (degraded configurations) (BSC 2004 [DIRS 168556], Section 6.8.6); • FEP 2.1.14.20.0A – Near-field criticality resulting from a seismic event (BSC 2004 [DIRS 168556], Section 6.8.7); • FEP 2.1.14.21.0A – In-package criticality resulting from rock fall (intact configuration) (BSC 2004 [DIRS 168556], Section 6.8.9); • FEP 2.1.14.22.0A – In-package criticality resulting from rock fall (degraded configuration) (BSC 2004 [DIRS 168556], Section 6.8.10); • FEP 2.1.14.23.0A – Near-field criticality resulting from rock fall (BSC 2004 [DIRS 168556], Section 6.8.11); • FEP 2.1.14.24.0A – In-package criticality resulting from an Igneous event (intact configuration) (BSC 2004 [DIRS 168556], Section 6.8.13);

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-03 (Continued)	Repository Geologic Location [Controlled Interface Parameters]		• FEP 2.1.14.25.0A – In-package criticality resulting from an Igneous event (degraded configuration) (BSC 2004 [DIRS 168556], Section 6.8.14); • FEP 2.1.14.26.0A – Near-field criticality resulting from an Igneous event (BSC 2004 [DIRS 168556], Section 6.8.15); • FEP 2.2.14.10.0A – Far-field criticality resulting from a seismic event (BSC 2004 [DIRS 168556], Section 6.8.8); • FEP 2.2.14.11.0A – Far-field criticality resulting from rock fall (BSC 2004 [DIRS 168556], Section 6.8.12); • FEP 2.2.14.12.0A – Far-field criticality resulting from an igneous event (BSC 2004 [DIRS 168556], Section 6.8.16). Current control mechanism: • *IED Subsurface Facilities Geological Data* (BSC 2007 [DIRS 182926]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-04	Repository Elevation – Standoff from Water Table	The base of the emplacement drifts shall be located at least 120 m above the maximum elevation of the present-day water table. Note: Based on its current location, the maximum elevation of the present-day water table beneath the emplacement area is ~850 m above sea level. Thus the minimum elevation of the base of the emplacement drifts shall be 970 m above sea level.	Representative analyses: • FEP 2.1.08.01.0B – Effects of rapid influx into the repository (BSC 2005 [DIRS 175014], Section 6.2.33); • FEP 2.1.08.09.0A – Saturated Flow in the EBS (BSC 2005 [DIRS 175014], Section 6.2.40); • FEP 1.1.02.00.0A – Chemical effects of excavation and construction in EBS (BSC 2005 [DIRS 175014], Section 6.2.1); • FEP 2.1.07.04.0A – Hydrostatic pressure on Waste Package (BSC 2005 [DIRS 175014], Section 6.2.30); • FEP 2.1.07.04.0B – Hydrostatic pressure on Drip Shield (BSC 2005 [DIRS 175014], Section 6.2.31); • FEP 2.1.08.12.0A – Induced hydrologic changes in invert (BSC 2005 [DIRS 175014], Section 6.2.42); • *Underground Layout Configuration* (BSC 2003 [DIRS 165572], Section 7.1.1).
01-05	Repository Standoff from Quaternary Fault	The emplacement drifts shall be located a minimum of 60 m from a Quaternary fault with potential for significant displacement.	Representative analysis: • FEP 1.2.02.03.0A – Fault displacement damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.2).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-06	Repository Elevation – Overburden Thickness	The overburden thickness (i.e., the distance from the top of each emplacement drift to the topographic surface) shall be a minimum of 200 m.	Representative analyses: • FEP 1.2.02.03.0A – Fault displacement damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.2); • FEP 1.2.04.05.0A – Magma or pyroclastic base surge transports waste (BSC 2005 [DIRS 173981], Section 6.2.2.6); • FEP 1.4.11.00.0A – Explosions and crashes (Human Activities) (BSC 2004 [DIRS 170021], Section 6.2.3.9); • FEP 1.5.01.01.0A – Meteorite impact (BSC 2004 [DIRS 170021], Section 6.2.4.5); • FEP 2.3.09.01.0A – Animal burrowing/intrusion (BSC 2005 [DIRS 174107], Section 6.2.23).
01-07	Repository Standoff from Perched Water	The emplacement drifts shall be located a minimum of 30 m from the top of the Tptpv2 (Topopah Spring Tuff Crystal-poor Vitric Zone) because perched water may occur at the base of the Topopah Spring Tuff Unit.	Representative analysis: • FEP 2.2.06.03.0A – Seismic activity alters perched water zones (BSC 2005 [DIRS 174191], Section 6.8.8). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-08	Orientation of Emplacement Drifts	The emplacement drifts will be nominally parallel. The design azimuth shall be the same for all emplacement drifts, and shall be within a range of 70° to 80°.	Representative analyses: • *Drift Degradation Analysis*, Section 6.3.1.1 (BSC 2004 [DIRS 166107]); • *Number of Waste Packages Hit by Igneous Events*, Section 4.1 (SNL 2007 [DIRS 177432]); • *TBV-361 Resolution Analysis: Emplacement Drift Orientation* (CRWMS M&O 1999 [DIRS 115042] Section 7). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
01-09	Excavation Methods	The repository ramps, access mains, exhaust mains, and emplacement drifts shall be constructed by tunnel boring machines (TBM). The starter tunnel to support each unique TBM advance shall be excavated by blasting or mechanical excavation methods.	Representative analyses: • FEP 1.1.02.00.0A – Chemical effects of excavation and construction in EBS (BSC 2005 [DIRS 175014], Section 6.2.1); • FEP 1.1.02.00.0B – Mechanical effects of excavation and construction in EBS (BSC 2005 [DIRS 175014], Section 6.2.2).
01-10	Emplacement Drift Configuration	The emplacement drift excavations shall be circular in cross section with a nominal diameter of 5.5 m.	Representative analyses: • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 174995], Section 6.2.22); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 175014], Section 6.2.28); • FEP 2.2.06.04.0A – Effects of subsidence (BSC 2005 [DIRS 174191], Section 6.5.4); • *Drift Degradation Analysis*, Section 6.3.1.1(BSC 2004 [DIRS 166107]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-11	Emplacement Drift Gradient	The grade of the emplacement drift shall be nominally horizontal so that overall water drainage is directly into the rock to prevent water accumulation.	Representative analysis: • FEP 2.1.08.12.0A – Induced hydrologic changes in invert (BSC 2005 [DIRS 175014], Section 6.2.42).
01-12	Non-Emplacement Opening Gradient	The repository non-emplacement openings shall provide a repository grade so overall water drainage and accumulation is away from emplacement areas.	Representative analysis: • FEP 2.1.08.12.0A – Induced hydrologic changes in invert (BSC 2005 [DIRS 175014], Section 6.2.42).
01-13	Emplacement Drift Spacing	The subsurface facility shall be designed to locate the emplacement drifts nominally 81 m apart to prevent thermal interaction between adjacent drifts and to allow drainage of thermally mobilized water within the rock pillars to percolate past the drifts.	Representative analyses: • FEP 2.2.10.01.0A – Repository-induced thermal effects on flow in the UZ (BSC 2005 [DIRS 174191], Section 6.9.9).
01-14	Verification of Design Rock Properties	The emplacement openings shall provide for post-excavation investigations of each drift that will be conducted under the Performance Confirmation Program. The objective of post-excavation investigations is to verify that host rock properties are bounded by the rock properties described within the in situ observations and model assumptions used in postclosure analyses. Post-excavation investigations will include geologic mapping to confirm that fracture geometric variability and initial rock properties are within the model input parameter range used in rockfall calculations.	Representative analyses: • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 174995], Section 6.2.22); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 175014], Section 6.2.28).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-15	Design of Ground Support System [Controlled Interface Parameters]	The interface control mechanisms for the design and materials used for ground support are the Subsurface Facilities Ground Support Configuration and Subsurface Facilities Committed Materials IEDs.	Representative analyses: • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 174995], Section 6.2.22); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 175014], Section 6.2.28); • FEP 2.1.06.01.0A – Chemical effects of rock reinforcement and cementitious materials in EBS (BSC 2005 [DIRS 175014], Section 6.2.18); • FEP 2.1.07.02.0A – Drift collapse (BSC 2005 [DIRS 175014], Section 6.2.29); • FEP 2.1.11.03.0A – Exothermic reactions in the EBS (BSC 2004 [DIRS 170020], Section 6.2.32); • FEP 2.1.11.03.0A – Exothermic reactions in the EBS (BSC 2005 [DIRS 175014], Section 6.2.68); • FEP 2.2.08.03.0B – Geotechnical interactions and evolution in the UZ (BSC 2005 [DIRS 174191], Section 6.9.7). Current control mechanism: • *IED Subsurface Facilities Ground Support Configuration* (BSC 2007 [DIRS 182927]). • *IED Subsurface Facilities Committed Materials* (BSC 2007 [DIRS 180940]).
01-16	Air Circulation through Ground Support	The permanent ground support shall be perforated to allow air circulation between the host rock and the in-drift environment.	Representative analysis: • FEP 2.1.06.04.0A – Flow through rock reinforcement materials in EBS (BSC 2005 [DIRS 175014], Section 6.2.20).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-17	Emplacement Drift Ground Support	The unfailed emplacement drift ground support system shall prevent raveling or rockfall during preclosure in the emplacement drifts that could induce residual tensile stresses in the waste package above 257 MPa. In the event the ground support system fails, the waste packages that have come into contact with fallen rock or ground support materials shall be inspected for surface damage and remediated as required prior to closure.	Representative analyses: • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 174995], Section 6.2.22); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 175014], Section 6.2.28). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
01-18	Unheated Drift Length	As boundary conditions for the thermo-hydrologic model in the postclosure, in the event that access main and exhaust main drifts are backfilled, areas at both ends of the emplaced waste will be free of backfill. The two areas will each be a minimum of 15 m long and their combined length will total a minimum of 75 m. Note: Emplacement areas will not be backfilled (see Parameter 05-04).	Representative analyses: • FEP 2.1.08.04.0A – Condensation forms on roofs of drifts (drift-scale cold traps) (BSC 2005 [DIRS 175014], Section 6.2.35); • FEP 2.1.08.04.0B – Condensation forms at repository edges (repository-scale cold traps) (BSC 2005 [DIRS 175014], Section 6.2.36); • *In-Drift Natural Convection and Condensation*, Section 6.3.3.1 (SNL 2007 [DIRS 181648]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
01-19	Flood Protection	The portal and shaft collar locations shall be situated such that they can be protected from water inflow as a result of the probable maximum flood.	Representative analyses: • FEP 1.1.02.01.0A – Site flooding (during construction and operation) (BSC 2005 [DIRS 174191], Section 6.3.3); • FEP 1.1.04.01.0A – Incomplete closure (BSC 2005 [DIRS 174191], Section 6.3.4); • FEP 2.1.05.02.0A – Radionuclide transport through seals (BSC 2005 [DIRS 174191], Section 6.3.7).
01-20	Repository Standoff from Paintbrush Nonwelded Hydrogeologic Unit	The minimum distance between the top of each emplacement drift and the base of the Paintbrush nonwelded hydrogeologic unit shall be 100 m.	Representative analyses: • FEP 2.2.10.05.0A – Thermo-mechanical stresses alter characteristics of rocks above and below the repository (BSC 2005 [DIRS 174191], Section 6.9.12); • *Mountain-Scale Coupled Processes (TH/THC/THM) Models,* Sections 6.3.1 and 6.3.1.1 (BSC 2005 [DIRS 174101]).
01-21	Minimum Thickness of the Paintbrush Nonwelded Hydrogeologic Unit above the Repository	The minimum thickness of the Paintbrush nonwelded hydrogeologic unit above the repository shall be 10 m.	Representative analyses: • FEP 2.2.07.05.0A – Flow in the UZ from episodic infiltration (BSC 2005 [DIRS 174191], Section 6.4.5).
01-22	Repository Standoff from Calico Hills Nonwelded Hydrogeologic Unit	The minimum distance between the base of each emplacement drift and the top of the Calico Hills nonwelded hydrogeologic unit shall be 60 m.	Representative analyses: • FEP 2.2.10.14.0A – Mineralogic dehydration reactions (BSC 2005 [DIRS 174191], Section 6.9.16); • *Mountain-Scale Coupled Processes (TH/THC/THM) Models,* Sections 6.3.1 and 6.3.1.1 (BSC 2005 [DIRS 174101]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
EBS IN-DRIFT CONFIGURATION			
02-01	As-Emplaced Waste Configuration [Controlled Interface Parameters]	The interface control mechanism for the emplaced waste packages shall be the Emplacement Drift Configuration and Environment IED.	Representative analyses: • FEP 1.2.03.02.0A – Seismic ground motion damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.3); • FEP 2.1.09.09.0A – Electrochemical effects in EBS (BSC 2005 [DIRS 174995], Section 6.2.26); • FEP 2.1.09.09.0A – Electrochemical effects in EBS (BSC 2004 [DIRS 170019], Section 6.2.20); • FEP 2.1.06.05.0B – Mechanical degradation of invert (BSC 2005 [DIRS 175014], Section 6.2.22). Current control mechanism: • *IED Emplacement Drift Configuration and Environment* (BSC 2007 [DIRS 180412]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
02-02	As-Emplaced Waste Package-Drip Shield Configuration [Controlled Interface Parameters]	The interface control mechanism for the minimum distance from top-of-waste-package to interior-height-of-drip-shield is the Emplacement Drift Configuration and Environment IED(s).	Representative analyses: • FEP 1.2.03.02.0A – Seismic ground motion damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.3); • FEP 1.2.03.02.0B – Seismic-induced rockfall damages EBS components (BSC 2005 [DIRS 175014], Section 6.2.9); • FEP 2.1.03.07.0B – Mechanical impact on drip shield (BSC 2005 [DIRS 174995], Section 6.2.14); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 174995], Section 6.2.22); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 175014], Section 6.2.28). Current control mechanism: • *IED Emplacement Drift Configuration and Environment* (BSC 2007 [DIRS 180412]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
02-03	Committed Materials [Controlled Interface Parameters – Item e) only]	During construction of the emplacement drifts, and operation and closure of the repository, administrative controls will be imposed to prevent impact on waste isolation from materials used, lost, or left in the repository. These controls will be supported by technical evaluation. The following constraints will be imposed on the administrative control of TFMs, construction materials and committed materials: a) All material not technically evaluated and determined acceptable prior to the permanent closure of the repository will be removed from subsurface facilities prior to permanent closure. b) Committed materials that are proposed to remain in the underground repository following permanent closure period will be technically evaluated and determined acceptable prior to use. c) Administrative controls will include accounting and inspection, as appropriate to confirm that controls on the approved TFM quantities and compositions are met. d) Concrete dust generation shall be kept to a minimum through the use of surface coatings and / or the use of dust suppression and ventilation control during concrete installation and / or removal.	Representative analyses: • FEP 1.1.02.00.0A – Chemical effects of excavation and construction in EBS (BSC 2005 [DIRS 175014], Section 6.2.1); • FEP 1.1.02.03.0A – Undesirable materials left (BSC 2005 [DIRS 175014], Section 6.2.4); • FEP 2.1.06.01.0A – Chemical effects of rock reinforcement and cementitious materials in EBS (BSC 2005 [DIRS 175014], Section 6.2.18); • FEP 2.1.09.01.0A – Chemical characteristics of water in drifts (BSC 2005 [DIRS 175014], Section 6.2.45); • FEP 1.1.03.01.0B – Error in backfill emplacement (BSC 2005 [DIRS 175014], Section 6.2.6); • FEP 2.1.04.01.0A – Flow in the backfill (BSC 2005 [DIRS 175014], Section 6.2.12); • FEP 2.1.04.02.0A – Chemical properties and evolution of backfill (BSC 2005 [DIRS 175014], Section 6.2.13); • FEP 2.1.04.03.0A – Erosion or dissolution of backfill (BSC 2005 [DIRS 175014], Section 6.2.14); • FEP 2.1.04.04.0A – Thermal-mechanical effects of backfill (BSC 2005 [DIRS 175014], Section 6.2.15); • FEP 2.2.01.01.0B – Chemical effects of excavation and construction in the near-field (BSC 2005 [DIRS 174191], Section 6.9.2); • FEP 2.2.01.02.0B – Chemical changes in the near-field from backfill (BSC 2005 [DIRS 175014], Section 6.2.85); • FEP 2.2.08.03.0B – Geotechnical interactions and evolution in the UZ (BSC 2005 [DIRS 174191], Section 6.9.7) • FEP 2.1.09.28.0A - Localized Corrosion on Waste Package Outer Surface due to Deliquescence (BSC 2005 [DIRS 174995] Section 6.2.18); • *Analysis of Dust Deliquescence for FEP Screening* (SNL 2007 [DIRS 181267]), Addendum 1, Section 6.1.3[a].

No.	Parameter	Derived Internal Constraint	Postclosure Basis
02-03 (continued)	Committed Materials [Controlled Interface Parameters – Item e) only]	e) Various IED(s) list materials which are intended to be present in the repository at closure, and which have been found to be acceptable by analysis. All tracers, fluids, and materials (TFMs) that may be used during construction, operation, or closure, will be controlled. An historical summarization of TFM quantities that have been approved for use is listed in the TFM IDD(s).	Current control mechanisms: • *IED Subsurface Facilities Ground Support Committed Materials* (BSC 2007 [DIRS 180940]); • *IED Emplacement Drift Invert* (BSC 2007 [DIRS 182746]); • *IED Interlocking Drip Shield* (BSC 2007 [DIRS 180444]); • *IED Emplacement Pallet* (BSC 2007 [DIRS 180445]); • *IED Waste Package Configuration* (BSC 2007 [DIRS 182928]).
02-04	Invert and EBS Components in Situ Stress and Thermal Response	The invert and EBS components shall be designed to accommodate at least a 10 mm displacement to account for potential in situ stress and thermal response.	Representative analyses: • FEP 2.1.06.05.0B – Mechanical degradation of invert (BSC 2005 [DIRS 175014], Section 6.2.22); • FEP 2.1.09.03.0C – Volume increase of corrosion products impacts other EBS components (BSC 2005 [DIRS 175014], Section 6.2.47); • FEP 2.1.11.07.0A – Thermal expansion/stress of in-drift EBS components (BSC 2005 [DIRS 175014], Section 6.2.69); • FEP 2.1.11.07.0A – Thermal expansion/stress of in-drift EBS components (BSC 2005 [DIRS 174995], Section 6.2.29). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
02-05	EBS In-Drift Materials Interactions	EBS materials shall be inert relative to each other so that physical contact between EBS materials minimizes dissimilar material interaction mechanisms. The waste package outer corrosion barrier shall not contact EBS components other than the Alloy 22 support surfaces of the pallet.	Representative analyses: • FEP 2.1.03.04.0A – Hydride cracking of waste packages (BSC 2005 [DIRS 174995], Section 6.2.8); • FEP 2.1.03.04.0B – Hydride cracking of drip shields (BSC 2005 [DIRS 174995], Section 6.2.9); • FEP 2.1.06.07.0A – Chemical effects at EBS component interfaces (BSC 2005 [DIRS 175014], Section 6.2.26);
02-06	EBS Material Interactions – Copper	For the as-emplaced configuration, the drip shields and waste packages shall not contact any copper that may be present in other EBS components such as parts of the emplacement vehicle rail system. The total mass of elemental copper per meter of emplacement drift shall be less than 5.0 kg/m.	Representative analyses: • FEP 2.1.03.09.0A – Copper corrosion in EBS (BSC 2005 [DIRS 174995], Section 6.2.17); Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
02-07	Emplacement Drift Invert Function	The emplacement drift invert (ballast) shall provide a nominally level surface that supports the drip shield, waste package, and waste package emplacement pallet for static loads and that limits degradation associated with ground motion (but excluding faulting displacements) after closure of the repository.	Representative analysis: • FEP 2.1.06.05.0B – Mechanical degradation of invert (BSC 2005 [DIRS 175014], Section 6.2.22). Note: The portion of this derived internal constraint statement regarding limiting degradation has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
02-08	Invert Materials [Controlled Interface Parameters – Item a) only]	a) The interface control mechanism for the components and materials used in the invert and for the gradation and placement of the invert ballast material is the Emplacement Drift Invert IED(s). b) The invert material will be carbon steel and crushed tuff. The crushed tuff shall have properties consistent with the repository host rock excavated by mechanical means.	Representative analyses: • FEP 2.1.06.05.0B – Mechanical degradation of invert (BSC 2005 [DIRS 175014], Section 6.2.22); • FEP 2.1.08.05.0A – Flow through invert (BSC 2005 [DIRS 175014], Section 6.2.37). Current control mechanism: • *IED Emplacement Drift Invert* (BSC 2007 [DIRS 182746]).
02-09	[Deleted]		
02-10	Emplacement Drift Invert Configuration [Controlled Interface Parameters]	The interface control mechanism for the general configuration, plan, and details of the emplacement drift invert is the Emplacement Drift Invert IED.	Representative analyses: • *Drift-Scale THC Seepage Model*, Section 4.1.10 (SNL 2007 [DIRS 177404]); • *Seismic Consequence Abstraction*, Table 4-1 (SNL 2007 [DIRS 176828]); • *Drift-Scale Coupled Processes (DST and TH Seepage) Models*, Section 4.1.4 (BSC 2005 [DIRS 172232]); • *Multiscale Thermohydrologic Model*, Addendum 1, Section 4.1[a] (SNL 2007 [DIRS 181383]); • FEP 2.1.06.05.0B – Mechanical degradation of invert (BSC 2005 [DIRS 175014], Section 6.2.22); • FEP 2.1.09.03.0C – Volume increase of corrosion products impacts other EBS components (BSC 2005 [DIRS 175014], Section 6.2.47). Current control mechanism: • *IED Emplacement Drift Invert* (BSC 2007 [DIRS 182746]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
WASTE PACKAGE			
03-01	Waste Package Dimensions and Component Masses [Controlled Interface Parameters]	The interface control mechanism for the waste package dimensions and component masses is the Waste Package Configuration IED.	Representative analyses: • *Seismic Consequence Abstraction*, Table 4-1 (SNL 2007 [DIRS 176828]); • *EBS Radionuclide Transport Abstraction*, Section 4.1.3 (SNL 2007 [DIRS 177407]). Current control mechanisms: • *IED Waste Package Configuration* (BSC 2007 [DIRS 182928]);
03-02	Waste Package Quantities [Controlled Interface Parameters]	The interface control mechanism for the waste packages in the LA-design inventory, including quantities, dimensions, materials, and characteristics, is the Waste Package Configuration IED(s).	Representative analyses: • FEP 2.1.08.12.0A – Induced hydrologic changes in invert (BSC 2005 [DIRS 175014] Section 6.2.42); • FEP 2.1.08.14.0A – Condensation on underside of Drip Shield (BSC 2005 [DIRS 175014] Section 6.2.43); • FEP 2.1.11.03.0A – Exothermic reactions in the EBS (BSC 2005 [DIRS 175014] Section 6.2.68); • FEP 2.1.02.25.0B – Naval SNF cladding (BSC 2004 [DIRS 170019] Section 6.2.15). Current control mechanism: • *IED Waste Package Configuration* (BSC 2007 [DIRS 182928]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-03	Waste Package Outer Barrier Material and Thickness	The waste package outer barrier shall be comprised of Alloy 22 with a minimum thickness of 25 mm for codisposal, naval, and TAD waste packages. Note: See Parameter 03-19, Waste Package Outer Barrier Material Specifications for Alloy 22 material composition.	Representative analyses: • FEP 2.1.08.15.0A – Consolidation of EBS components (BSC 2005 [DIRS 175014], Section 6.2.44); • FEP 2.1.12.03.0A – Gas generation (H_2) from waste package corrosion (BSC 2005 [DIRS 175014], Section 6.2.76); • *General Corrosion and Localized Corrosion of Waste Package Outer Barrier* (SNL 2007 [DIRS 178519] Section 6.4.2).; Note: With respect to minimum thickness, this derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation. This derived internal constraint does not establish a minimum thickness internal constraint for future waste package designs.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-04	Waste Package Radial Gap	The difference between the waste package inner vessel outer diameter and the outer corrosion barrier inner diameter shall be a minimum of 2 mm and a maximum of 10 mm for the as fabricated package.	Representative analyses: • FEP 2.1.03.07.0A – Mechanical impact on waste package (BSC 2005 [DIRS 174995], Section 6.2.13); • FEP 2.1.09.03.0B – Volume increase of corrosion products impacts waste package (BSC 2005 [DIRS 174995], Section 6.2.25); • FEP 2.1.11.07.0A – Thermal expansion/stress of in-drift EBS components (BSC 2005 [DIRS 175014], Section 6.2.69); • FEP 2.1.11.07.0A – Thermal expansion/stress of in-drift EBS components (BSC 2005 [DIRS 174995], Section 6.2.29). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
03-05	Waste Package Longitudinal Gap	The difference between the inner vessel overall length and the outer corrosion barrier cavity length, from the top surface of the interface ring to the bottom surface of the top lid, shall be a minimum of 30 mm.	Representative analyses: • FEP 2.1.11.07.0A – Thermal expansion/stress of in-drift EBS components (BSC 2005 [DIRS 175014], Section 6.2.69); • FEP 2.1.11.07.0A – Thermal expansion/stress of in-drift EBS components (BSC 2005 [DIRS 174995], Section 6.2.29). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-06	Waste Package Internal Pressurization	The waste package shall be designed to accommodate internal pressurization of the waste package including effects of a high temperature of 350 °C and fuel rod gas release.	Representative analysis: • FEP 2.1.03.07.0A – Mechanical impact on waste package (BSC 2005 [DIRS 174995], Section 6.2.13).
03-07	Waste Package Corrosion Allowance [Information Only]	For postclosure mechanical calculations and analysis, a corrosion allowance of at least 2 mm per side shall be accounted for on exposed waste package surfaces. Calculations will be performed using mechanical properties at 150 °C or greater.	Representative analyses: • FEP 2.1.03.01.0A – General corrosion of waste packages (BSC 2005 [DIRS 174995], Section 6.2.2). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
03-08	Seismic Design of Waste Package [Controlled Interface Parameters]	The interface control mechanism for the seismic design spectra, time histories, and ground accelerations for the subsurface facilities is the Seismic Data IED.	Representative analyses: • FEP 1.2.03.02.0A – Seismic ground motion damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.3). Current control mechanism: • *IED Seismic Data* (BSC 2007 [DIRS 179278]).
03-09	Waste Package Worst-Case Dose Rate	The waste package containing the TAD canister with 21 PWR fuel assemblies shall represent the worst-case dose rate (80 GWd/MTU burnup, 5% U-235 enrichment and 5 years decay).	Representative analyses: • FEP 2.1.13.02.0A – Radiation damage in EBS (BSC 2004 [DIRS 170020], Section 6.2.38); • FEP 2.1.13.02.0A – Radiation damage in EBS (BSC 2005 [DIRS 175014], Section 6.2.82).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-10	Waste Package Design Basis Bounding Dose Rate [Controlled Interface Parameters]	The interface control mechanism for the design basis bounding dose rate calculations for waste packages and representative neutron flux is the Waste Package Radiation Characteristics IED.	Representative analysis: • FEP 2.1.13.01.0A – Radiolysis (BSC 2005 [DIRS 175014], Section 6.2.81). Current control mechanism: • *IED Waste Package Radiation Characteristics* (BSC 2006 [DIRS 180503]).
03-11	Waste Package Decay Heat [Controlled Interface Parameters]	The interface control mechanisms for the postclosure design basis waste package decay heat are the Waste Package Decay Heat Generation IEDs.	Representative analyses: • FEP 2.1.11.03.0A – Exothermic reactions in the EBS (BSC 2004 [DIRS 170020], Section 6.2.32); • FEP 2.1.11.03.0A – Exothermic reactions in the EBS (BSC 2005 [DIRS 175014], Section 6.2.68). Current control mechanisms: • *IED Waste Package Decay Heat Generation – TSPA Modeling Basis* (BSC 2007 [DIRS 183016]); • *IED Waste Package Decay Heat Generation Design Basis and Thermal Information* (BSC 2007 [DIRS 180449]).
03-12	Waste Package Fabrication	The waste package outer corrosion barrier cylinder shall be fabricated from no more than 3 sections with longitudinal welds offset. The waste package will be inspected and evaluated per applicable criteria, e.g., Parameter 03-18, at the fabricator location and upon receipt at the repository location.	Representative analysis: • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-13	Waste Package Fabrication Weld Inspections	The waste package outer corrosion barrier fabrication welds shall be nondestructively examined by means of radiographic examination (RT) and ultrasonic testing (UT) for flaws equal to or greater than 1/16 inch. Outer corrosion barrier fabrication welds shall also be examined using liquid penetrant per the applicable specification.	Representative analysis: • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15). • *Analysis of Mechanisms for Early Waste Package/Drip Shield Failure* (SNL 2007 [DIRS 178765], Section 6.2.1). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
03-14	Waste Package Welding Materials	The waste package fabrication welds shall be conducted in accordance with standard nuclear industry requirements.	Representative analysis: • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15).
03-15	Waste Package Fabrication Welding Flaws	The welding techniques for the fabrication welds shall be constrained to GMAW (gas metal arc welding) except for short-circuiting mode, and automated GTAW (gas tungsten arc welding) for Alloy 22 (UNS N06022) material, limited to <45 kJ/in. Welding flaws 1/16 inch and greater will be repaired for the outer corrosion barrier in accordance with written procedures that have been accepted by the design organization prior to their usage.	Representative analyses: • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15); • FEP 2.1.03.02.0A – Stress corrosion cracking (SCC) of waste packages (BSC 2005 [DIRS 174995], Section 6.2.4). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-16	Waste Package Annealing	a) After fabrication and before inserting the inner vessel, the waste package outer corrosion barrier shall be solution annealed and quenched. b) The minimum time for solution annealing will be 20 minutes at 2,050 °F (1,121 °C) +50 °F (28 °C) / -0 °F (0 °C). c) The waste package shall be quenched at a rate greater than 275 °F (153 °C) per minute to below 700 °F (371 °C). d) The annealing-induced oxide film shall be removed by means of electrochemical polishing or grit blasting. e) After solution annealing and quenching, the waste package surface temperature will be kept below 300 °C to eliminate postclosure issues (i.e., phase stability), except for short-term exposure (closure-weld, etc.).	Representative analyses: • FEP 2.1.03.02.0A – Stress corrosion cracking (SCC) of waste packages (BSC 2005 [DIRS 174995], Section 6.2.4); • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15), • *General Corrosion and Localized Corrosion of Waste Package Outer Barrier* (SNL 2007 [DIRS 178519] Section 6.4.4.4). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-17	Waste Package Closure	a) The Alloy 22 outer lid will be sealed utilizing the gas tungsten arc weld (GTAW) process, limited to <45 kJ/in. The weld mass shall be less than 0.104 lb/in (18.5 g/cm) of weld. b) The Alloy 22 outer lid weld will be nondestructively examined using VT, ET, and UT. Flaws greater than 1/16 inch (1.6 mm) shall be repaired. c) The Alloy 22 outer lid weld will be stress mitigated using low-plasticity burnishing to a compressive depth of at least 3 mm. d) Process control to ensure there has been adequate stress mitigation on the welds will be performed. Following the stress mitigation, the final closure weld will be reexamined using VT, ET, and UT.	Representative analyses: • FEP 2.1.03.02.0A – Stress corrosion cracking (SCC) of waste packages (BSC 2005 [DIRS 174995], Section 6.2.4); • *Weld Flaw Evaluation and Nondestructive Examination Process Comparison Results for High-Level Radioactive Waste Package Manufacturing Program* (Smith 2003 [DIRS 163114], Section 2.2.3.1). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
03-18	Waste Package Surface Marring Prior to Emplacement	The waste package shall be certified as suitable for emplacement by process control and/or inspection to ensure surface marring is acceptable per derived internal constraint. The surface marring constraints are: The damage to the waste package corrosion barrier that displaces material (i.e. scratches) shall be limited to 1/16 inch (1.6 mm) in depth. Modifications to the waste package corrosion barrier that deform the surface, but do not remove material (i.e. dents), shall not leave residual tensile stresses greater than 257 MPa.	Representative analysis: • FEP 2.1.03.07.0A – Mechanical impact on waste package (BSC 2005 [DIRS 174995], Section 6.2.13). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-19	Waste Package Outer Barrier Material Specifications	The waste package Alloy 22 will be manufactured to ASTM B575-99a [DIRS 147465] with the additional more restrictive, elemental and chemical composition allowable specifications: (a) Cr = 20.0 to 21.4%, (b) Mo = 12.5 to 13.5%, (c) W = 2.5 to 3.0%, and (d) Fe = 2.0 to 4.5%.	Representative analyses: • FEP 2.1.11.06.0A – Thermal sensitization of waste packages (BSC 2005 [DIRS 174995], Section 6.2.27); • *Aging and Phase Stability of Waste Package Outer Barrier*, Section 8.1 and 8.2 (BSC 2004 [DIRS 171924]). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation. The values used in the Aging and Phase Stability AMR are based upon experimental values. Using Alloy 22 with lower alloying element concentrations is acceptable because it is less likely that alloying elements would precipitate. Higher concentrations may be supportable in the future, but are not currently analyzed.
03-20	Materials Contacting the Waste Package	After fabrication final cleaning, the waste package shall be prepared for shipment. Materials or objects contacting the waste package outer surfaces during transportation, loading, and emplacement will be evaluated to ensure that any physical degradation and contamination are within allowable limits.	Representative analysis: • FEP 2.1.03.01.0A – General corrosion of waste packages (BSC 2005 [DIRS 174995], Section 6.2.2). • *General Corrosion and Localized Corrosion of Waste Package Outer Barrier* (SNL 2007 [DIRS 178519], Section 5.1)

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-21	Waste Package Handling	The waste package shall be handled in a controlled manner during fabrication, handling, transport, storage, emplacement, installation, operation, and closure activities to minimize damage; surface contamination; and exposure to adverse substances.	Representative analyses: • FEP 2.1.03.01.0A – General corrosion of waste packages (BSC 2005 [DIRS 174995], Section 6.2.2); • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15); • *General Corrosion and Localized Corrosion of Waste Package Outer Barrier* (SNL 2007 [DIRS 178519], Section 5.1)
03-22	Waste Package Handling and Emplacement	Waste package handling and emplacement activities shall be monitored through equipment with resolution capable of detecting waste package damage. An operator and an independent checker shall perform the operations. Records demonstrating compliance shall be maintained.	Representative analysis: • FEP 1.1.03.01.0A – Error in waste emplacement (BSC 2005 [DIRS 174995], Section 6.2.1).
03-23	Waste Package Surface Finish	The waste package surface finish shall be specified to be at least 125 roughness as defined in ASME B46.1 [DIRS 166013].	Representative analyses: • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-24	Waste Package Surface Damage Prior to Closure	The emplacement drift ground support system shall be inspected prior to drip shield installation. Waste packages that have come in contact with fallen rock or ground support materials will be inspected to ensure the damage to the waste package corrosion barrier that displace material (i.e. scratches), shall be limited to 1.6 mm (1/16 in) in depth. Modifications to the waste package corrosion barrier that deform the surface, but do not remove material (i.e. dents), shall not leave residual tensile stresses greater than 257 MPa.	Representative analyses: • FEP 2.1.03.07.0A – Mechanical impact on waste package (BSC 2005 [DIRS 174995], Section 6.2.13); • FEP 2.1.03.08.0A – Early failure of waste packages (BSC 2005 [DIRS 174995], Section 6.2.15); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 174995], Section 6.2.22); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 175014], Section 6.2.28). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation. The postclosure analyses do not specify or reference an allowable quantity of surface damage or a maximum acceptable size of a dent or scratch. Until such time, the derived internal constraint for scratches is based upon the maximum allowable weld flaws in the fabrication specification, which is defined in *Analysis of Mechanisms for Early Waste Package/Drip Shield Failure* (SNL 2007 [DIRS 178765], Section 6.3.1.2). These criteria are the basis for excluding base metal flaws from further consideration in early waste package failure mechanisms in TSPA (SNL 2007 [DIRS 178765], Section 6.3.6).
03-25	[Deleted.]		

No.	Parameter	Derived Internal Constraint	Postclosure Basis
03-26	Waste Package Moisture Removal and Inerting	All waste packages shall be vacuum dried and backfilled with helium in a manner consistent with that described in *Standard Review Plan for Dry Cask Storage Systems* (NUREG 1536) (NRC 1997 [DIRS 101903]), Section 8.V.1.	• FEP 2.1.03.06.0A – Internal corrosion of waste packages prior to breach (BSC 2005 [DIRS 174995], Section 6.2.12).
WASTE FORM & TAD CANISTER			
04-01	Loading of Waste Forms	To minimize waste form damage, waste package and TAD canister-loading activities shall be performed and monitored in accordance with industry standard practices including an operator and an independent checker. Records demonstrating compliance shall be maintained.	Representative analysis: • FEP 1.1.03.01.0A – Error in waste emplacement (BSC 2005 [DIRS 174995], Section 6.2.1).
04-02	Handling of Bare SNF	Bare SNF shall be handled in a standard industry fashion to limit damage and prevent unzipping of fuel rod cladding.	Representative analysis: • FEP 2.1.09.03.0A – Volume increase of corrosion products impacts cladding (BSC 2004 [DIRS 170019], Section 6.2.19).
04-03	Waste Form CSNF Fuel Rod Maximum Burnup Limit	The CSNF fuel rod or assembly maximum burnup shall be less than 80 GWd/MTU (this is bounded by the PWR burnup).	Representative analyses: • FEP 2.1.02.20.0A – Internal pressurization of cladding (BSC 2004 [DIRS 170019], Section 6.2.10); • FEP 2.1.02.21.0A – Stress corrosion cracking (SCC) of cladding (BSC 2004 [DIRS 170019], Section 6.2.11).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
04-04	Waste Form Moisture Removal and Inerting	All TAD canisters shall be vacuum dried and backfilled with helium in a manner consistent with that described in *Standard Review Plan for Dry Cask Storage Systems* (NUREG 1536) (NRC 1997 [DIRS 101903]), Section 8.V.1.	Representative analyses: • FEP 2.1.02.11.0A – Degradation of cladding from waterlogged rods (BSC 2004 [DIRS 170019], Section 6.2.1); • FEP 2.1.03.06.0A – Internal corrosion of waste packages prior to breach (BSC 2005 [DIRS 174995], Section 6.2.12). Note: This internal constraint is reflected in *Preliminary Transportation, Aging and Disposal Canister System Performance Specification* (DOE 2006 [DIRS 179349], Section 3.1.6). Note that these FEP analyses are being revised to be consistent with the TAD canister specification.
04-05	Cladding Temperature Limit – Waste Form	The maximum temperature of the CSNF cladding upon emplacement shall not exceed 350 °C (to prevent damage from creep or hydride reorientation).	Representative analyses: • FEP 2.1.02.19.0A – Creep rupture of cladding (BSC 2004 [DIRS 170019], Section 6.2.9); • FEP 2.1.02.21.0A – Stress corrosion cracking (SCC) of cladding (BSC 2004 [DIRS 170019], Section 6.2.11); • FEP 2.1.02.22.0A – Hydride cracking of cladding (BSC 2004 [DIRS 170019], Section 6.2.12); • FEP 2.1.02.26.0A – Diffusion-controlled cavity growth in cladding (BSC 2004 [DIRS 170019], Section 6.2.16). Note: Derived internal constraint may change if CSNF cladding performance is not included in performance assessment.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
04-06	Maximum Temperature of HLW Glass Canisters – Waste Form	The maximum HLW glass temperature shall be less than 400 °C.	Representative analyses: • FEP 2.1.02.03.0A – HLW glass degradation (Alteration, Dissolution, and Radionuclide Release) (BSC 2004 [DIRS 170020], Section 6.2.7); • FEP 2.1.02.06.0A – HLW Glass Recrystallization (BSC 2004 [DIRS 170020], Section 6.2.10); • *Defense HLW Glass Degradation Model* (BSC 2004 [DIRS 169988, Section 7.5]).
04-07	Waste Package Capacities	Waste package capacities shall be as follows: a) <u>TAD-Bearing Waste Package:</u> 1 CSNF TAD canister. b) <u>Naval Waste Packages:</u> 1 NSNF canister. c) <u>2-MCO/2-DHLW Waste Package:</u> 2 N-Reactor MCOs and 2 HLW glass canisters (short loading allowed). d) <u>5-HLW/DOE SNF Co-disposal Waste Packages:</u> <u>Either:</u> 5 HLW glass canisters (including no more than 1 LaBS glass canister) and 1 DSNF canister in the center position (short loading allowed), <u>Or:</u> 1 24-inch DSNF canister and 4 HLW canisters (center position empty and no LaBS glass canisters) (short loading allowed).	Representative analyses: • FEP 2.1.01.02.0A – Interactions between co-located waste (BSC 2004 [DIRS 170020], Section 6.2.2); • FEP 2.1.01.02.0B – Interactions between co-disposed waste (BSC 2004 [DIRS 170020], Section 6.2.3); • *MOX Spent Nuclear Fuel and LaBS Glass for TSPA-LA*, Section 6 (SNL 2007 [DIRS 177422]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
04-08	Handling of Waste Forms	Waste form handling operations shall be performed in a standard industry fashion to limit damage. An operator and an independent checker shall perform the operations. Records demonstrating compliance shall be maintained.	Representative analyses: • FEP 2.1.02.11.0A – Degradation of cladding from waterlogged rods; (BSC 2004 [DIRS 170019], Section 6.2.1) • FEP 2.1.02.12.0A – Degradation of cladding prior to disposal (BSC 2004 [DIRS 170019], Section 6.2.2).
04-09	Waste Package & TAD Canister Excluded Materials	Materials that have not been previously analyzed and included in the Waste Package Configuration IEDs shall not be placed in the waste package, or in the TAD canister that will be placed into the waste package.	Representative analyses: • FEP 2.1.02.14.0A – Microbially influenced corrosion (MIC) of cladding (BSC 2004 [DIRS 170019], Section 6.2.4); • FEP 2.1.02.19.0A – Creep rupture of cladding (BSC 2004 [DIRS 170019], Section 6.2.9); • FEP 2.1.09.02.0A – Chemical Interaction with Corrosion Products (BSC 2005 [DIRS 175014], Section 6.2.46); • FEP 2.1.02.02.0A – CSNF Degradation (Alteration, Dissolution, and Radionuclide Release) (BSC 2004 [DIRS 170020], Section 6.2.6). Current control mechanism: • *IED Waste Package Configuration* (BSC 2007 [DIRS 182928]). Note: The TAD canister internal constraint is reflected in *Preliminary Transportation, Aging and Disposal Canister System Performance Specification* (DOE 2006 [DIRS 179349], Section 3.1.8).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
EMPLACEMENT & RETRIEVAL			
05-01	Waste Package Handling and Emplacement	Waste package handling and emplacement activities shall be monitored through appropriate equipment. An operator and an independent inspector shall verify proper waste package installation. Records demonstrating compliance shall be maintained.	Representative analysis: • FEP 1.1.03.01.0A – Error in waste emplacement (BSC 2005 [DIRS 174995], Section 6.2.1).
05-02	Waste Package Spacing	Adjacent waste packages in a given emplacement drift shall be emplaced 0.1 m (nominal) apart, from the top surface of the upper sleeve of one waste package to the bottom surface of the lower sleeve of the adjacent waste package.	Representative analyses: • FEP 1.1.02.02.0A – Preclosure ventilation (BSC 2005 [DIRS 174191], Section 6.2.1); • FEP 1.1.03.01.0A – Error in waste emplacement (BSC 2005 [DIRS 174995], Section 6.2.1); • *Drift Scale THM Model*, Section 6.3 (BSC 2004 [DIRS 169864]); • *In-Drift Natural Convection and Condensation,* Addendum 1, Section 4.1[a] (SNL 2007 [DIRS 181648]).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
05-03	Waste Package Thermal Limits	The waste package emplacement shall be within an envelope such that the emplacement of waste packages does not exceed the other relevant thermal limits of mid-pillar temperature, drift wall temperature, waste package temperature, and cladding temperature. In addition, the local-average line-load (over any 7 waste package segment) in the emplaced repository will not exceed 2.0 kW/m, and no waste package shall exceed thermal output of 18 kW. Finally, the calculated Thermal Energy Density of any seven adjacent as-emplaced waste packages shall not exceed 96°C at the mid-pillar calculated using mean host-rock thermal properties and representative saturation levels for wet and dry conditions, as described in the Geotechnical and Thermal Parameters IED(s).	Representative analyses: • FEP 1.1.03.01.0A – Error in waste emplacement (BSC 2005 [DIRS 174995], Section 6.2.1); • FEP 1.1.02.02.0A – Preclosure ventilation (BSC 2005 [DIRS 174191], Section 6.2.1); • FEP 2.1.01.04.0A – Repository-scale spatial heterogeneity of emplaced waste (BSC 2004 [DIRS 170021], Section 6.2.1.7); • FEP 2.1.08.03.0A – Repository dry-out due to waste heat (BSC 2005 [DIRS 175014], Section 6.2.34); • *Drift Scale THM Model*, Section 4.1.1.3 and Table 6.3-1 (BSC 2004 [DIRS 169864]); • *Multiscale Thermohydrologic Model*, Addendum 1, Section 4.1[a] SNL 2007 [DIRS 181383]). Current control mechanism: • IED Geotechnical and Thermal Parameters (BSC 2005 [DIRS 174829], Entire). • IED Geotechnical and Thermal Parameters II (BSC 2007 [DIRS 178277], Entire). • IED Geotechnical and Thermal Parameters III (BSC 2007 [DIRS 178796], Entire). • IED Geotechnical and Thermal Parameters IV (BSC 2007 [DIRS 179808], Entire). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
05-04	No Backfill in Emplacement Drifts	Engineered backfill shall not be present in the space between the drip shield and the drift wall.	Representative analyses: • FEP 2.1.04.01.0A – Flow in the backfill (BSC 2005 [DIRS 175014], Section 6.2.12); • FEP 2.1.04.02.0A – Chemical properties and evolution of backfill (BSC 2005 [DIRS 175014], Section 6.2.13); • FEP 2.1.04.03.0A – Erosion or dissolution of backfill (BSC 2005 [DIRS 175014], Section 6.2.14); • FEP 2.1.04.04.0A – Thermal-mechanical effects of backfill (BSC 2005 [DIRS 175014], Section 6.2.15); • FEP 2.1.04.05.0A – Thermal-mechanical properties and evolution of backfill (BSC 2005 [DIRS 175014], Section 6.2.16).
SUBSURFACE VENTILATION			
06-01	Duration of Ventilation Period	The duration of the ventilation period shall be a minimum of 50 years after final emplacement.	Representative analyses: • FEP 1.1.02.02.0A – Preclosure ventilation (BSC 2005 [DIRS 174191], Section 6.2.1); • *Ventilation Model and Analysis Report*, Sections 4.1.10 and 6.4.1.1 (BSC 2004 [DIRS 169862]); • *Multiscale Thermohydrologic Model*, Addendum 1, Section 4.1[a] (SNL 2007 [DIRS 181383]).
06-02	Drift Wall Temperature	The maximum preclosure emplacement drift wall temperature shall not exceed 200 °C to avoid possible adverse conditions (e.g. mineralogical transitions, rock weakening etc.)	Representative analyses: • FEP 1.1.02.02.0A – Preclosure ventilation (BSC 2005 [DIRS 174191], Section 6.2.1); • FEP 2.1.11.01.0A – Heat generation in EBS (BSC 2005 [DIRS 175014], Section 6.2.66); • FEP 2.2.10.13.0A – Repository-induced thermal effects on flow in the SZ (BSC 2005 [DIRS 174190], Section 6.2.40).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
06-03	Waste Package Temperature Limit	The waste package surface temperature shall be kept below 300 °C for the first 500 years and below 200 °C for the next 9,500 years to eliminate postclosure issues (i.e. phase stability). Note: Compliance with this constraint after repository permanent closure is demonstrated in postclosure analyses (only). Parameters 05-03, 06-01, and 06-06 support compliance with this constraint during both the preclosure and postclosure periods.	Representative analyses: • FEP 2.1.11.06.0A – Thermal sensitization of waste packages (BSC 2005 [DIRS 174995], Section 6.2.27); • *Aging and Phase Stability of Waste Package Outer Barrier*, Section 8 (BSC 2004 [DIRS 171924]).
06-04	Cladding Temperature Limit – Ventilation	The maximum temperature of the CSNF cladding upon emplacement shall not exceed 350 °C (to prevent damage from creep or hydride reorientation).	Representative analyses: • FEP 2.1.02.19.0A – Creep rupture of cladding (BSC 2004 [DIRS 170019], Section 6.2.9); • FEP 2.1.02.21.0A – Stress corrosion cracking (SCC) of cladding (BSC 2004 [DIRS 170019], Section 6.2.11); • FEP 2.1.02.22.0A – Hydride cracking of cladding (BSC 2004 [DIRS 170019], Section 6.2.12); • FEP 2.1.02.26.0A – Diffusion-controlled cavity growth in cladding (BSC 2004 [DIRS 170019], Section 6.2.16). Note: Derived internal constraint may change if CSNF cladding performance is not included in performance assessment.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
06-05	Maximum Temperature of HLW Glass Canisters – Ventilation	The maximum HLW glass temperature shall be less than 400 °C.	Representative analyses: • FEP 2.1.02.03.0A – HLW glass degradation (Alteration, Dissolution, and Radionuclide Release) (BSC 2004 [DIRS 170020], Section 6.2.7); • FEP 2.1.02.06.0A – HLW Glass Recrystallization (BSC 2004 [DIRS 170020], Section 6.2.10); • *Defense HLW Glass Degradation Model* (BSC 2004 [DIRS 169988], Section 7.5).
06-06	Average Airflow Rate for Preclosure Ventilation of Emplacement Drifts	During the preclosure phase, the nominal inlet airflow rate per emplacement drift shall be 15 m^3/sec. The range of airflow rate in a given drift shall be 15 m^3/sec ± 2 m^3/sec, based on integrated ventilation efficiency and drift length.	• FEP 1.1.02.02.0A – Preclosure ventilation (BSC 2005 [DIRS 175014], Section 6.2.3); • FEP 1.1.02.00.0A – Chemical effects of excavation and construction in EBS (BSC 200* [DIRS 175014], Section 6.2.1); • FEP 2.1.11.01.0A – Heat generation in EBS (BSC 2005 [DIRS 175014], Section 6.2.66); • FEP 2.2.10.13.0A – Repository-induced thermal effects on flow in the SZ (BSC 2005 [DIRS 174190], Section 6.2.40); • *Ventilation Model and Analysis Report*, Sections 6.11 and 8.1 (BSC 2004 [DIRS 169862]). Note: The postclosure thermal condition is partially dependent on the heat removal by preclosure ventilation. The thermal condition at the end of the preclosure ventilation is used as initial condition for postclosure models.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
DRIP SHIELD			
07-01	Drip Shield Design [Controlled Interface Parameters]	The interface control mechanism for the drip shields dimensions and characteristics is the Interlocking Drip Shield IED.	Representative analyses: • FEP 2.1.03.10.0B – Advection of liquids and solids through cracks in the Drip Shield (BSC 2005 [DIRS 175014], Section 6.2.64); • FEP 2.1.06.07.0A – Chemical effects at EBS component interfaces (BSC 2005 [DIRS 175014], Section 6.2.26); • FEP 2.1.06.07.0B – Mechanical effects at EBS component interfaces (BSC 2005 [DIRS 175014], Section 6.2.27); • FEP 2.1.12.08.0A – Gas explosions in EBS (BSC 2005 [DIRS 175014], Section 6.2.80). Current control mechanism: • *IED Interlocking Drip Shield* (BSC 2007 [DIRS 180444]).
07-02	Drip Shield Design and Installation	The drip shield shall be designed to interlock and overlap in a manner that prevents a liquid drip path from above the drip shield to the waste package. The drip shield handling and emplacement activities shall be monitored through appropriate equipment. An operator and an independent inspector shall verify proper drip shield installation. Records demonstrating compliance shall be maintained.	Representative analyses: • FEP 1.1.03.01.0A – Error in waste emplacement (BSC 2005 [DIRS 174995], Section 6.2.1); • FEP 2.1.06.06.0A – Effects of drip shield on flow (BSC 2005 [DIRS 175014], Section 6.2.25); • FEP 2.1.07.06.0A – Floor buckling (BSC 2005 [DIRS 175014], Section 6.2.32).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
07-03	Drip Shield Corrosion Allowance [Information Only]	For mechanical calculations and analysis, a corrosion allowance of at least 1mm per side shall be accounted for on all drip shield surfaces. Calculations will be performed using mechanical properties at 150 °C or greater.	Representative analyses: • FEP 1.2.03.02.0A – Seismic ground motion damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.3); • FEP 2.1.03.01.0B – General corrosion of drip shields (BSC 2005 [DIRS 174995], Section 6.2.3).
07-04	Drip Shield Materials and Thicknesses	The drip shield shall be constructed of Titanium Grade 7, with a minimum thickness of 15 mm. The drip shield structural material shall be manufactured of Titanium Grade 29.	Representative analyses: • FEP 1.2.03.02.0B – Seismic-induced rockfall damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.4); • FEP 2.1.03.01.0B – General corrosion of drip shields (BSC 2005 [DIRS 174995], Section 6.2.3).
07-05	[Deleted.]		
07-06	[Deleted.]		
07-07	EBS Drip Shield / Emplacement Drift Invert Materials Interactions	Alloy 22 bases shall be attached to the drip shield to preclude titanium contact with the invert (including transport equipment rails).	Representative analyses: • FEP 2.1.03.04.0B – Hydride cracking of drip shields (BSC 2005 [DIRS 174995], Section 6.2.9); • FEP 2.1.06.07.0A – Chemical effects at EBS component interfaces (BSC 2005 [DIRS 175014], Section 6.2.26).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
07-08	Drip Shield Seismic Performance [Controlled Interface Parameters]	The interface control mechanism for the drip shield design is the Interlocking Drip Shield IED such that during a seismic event it resists separation through failure of the DSC Connector Guides, the DSC Left/Right Support Beams, and the Left/Right Support Beam Connectors. Note: Compliance with the postclosure performance aspects of the drip shield within this constraint is demonstrated in postclosure analyses (only).	Representative analysis: • *Seismic Consequence Abstraction,* Section 6.7.3 (SNL 2007 [DIRS 176828]). Current control mechanism: • *IED Interlocking Drip Shield* (BSC 2007 [DIRS 180444]). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
07-09	Drip Shield Fabrication	The drip shield shall be fabricated in accordance with standard nuclear industry practices, including material control, welding, weld flaw detection and repair and heat treatment.	Representative analysis: • FEP 2.1.03.08.0B – Early failure of drip shields (BSC 2005 [DIRS 174995], Section 6.2.16).
07-10	Drip Shield Fabrication Weld Inspections	The drip shield full penetration fabrication welds shall be nondestructively examined by visual (VT), liquid penetrant (PT), and ultrasonic testing (UT), for flaws. Fillet welds shall be inspected by means of PT and VT for flaws. All flaws larger than code standards shall be repaired.	Representative analysis: • FEP 2.1.03.08.0B – Early failure of drip shields (BSC 2005 [DIRS 174995], Section 6.2.16). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.

No.	Parameter	Derived Internal Constraint	Postclosure Basis
07-11	Drip Shield Fabrication Welding Flaws	The welding techniques for the fabrication welds shall be constrained to GMAW (gas metal arc welding) except for short-circuiting mode, and automated GTAW (gas tungsten arc welding). Welding flaws will be repaired in accordance with written procedures that have been accepted by the design organization prior to their usage.	Representative analyses: • FEP 2.1.03.08.0B – Early failure of drip shields (BSC 2005 [DIRS 174995], Section 6.2.16); • FEP 2.1.03.04.0B – Hydride cracking of drip shields (BSC 2005 [DIRS 174995], Section 6.2.9); • *Hydrogen-Induced Cracking of the Drip Shield* (SNL 2007 [DIRS 181339], Section 6). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
07-12	Drip Shield Fabrication Weld Materials	All drip-shield welding shall be conducted in accordance with standard nuclear industry practices. For Ti-7 (Titanium Grade 7) to Ti-7 welds, Ti-7 weld filler material shall be used. For Ti-29 (Titanium Grade 29) to Ti-29 welds, Ti-29 shall be used. For Ti-7 to Ti-29 welds Ti-28 weld filler shall be used.	Representative analyses: • FEP 2.1.03.08.0B – Early failure of drip shields (BSC 2005 [DIRS 174995], Section 6.2.16); • FEP 2.1.03.02.0B – Stress corrosion cracking (SCC) of drip shields (BSC 2005 [DIRS 174995], Section 6.2.5); • FEP 2.1.03.04.0B – Hydride cracking of drip shields (BSC 2005 [DIRS 174995], Section 6.2.9); *Hydrogen-Induced Cracking of the Drip Shield* (SNL 2007 [DIRS 181339], Section 6).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
07-13	Drip Shield Heat Treatment	After fabrication the drip shield assembly and lifting feature assemblies shall be stress-relieved. After completion of all required work except for the final machining, the drip shield assembly and lifting feature assemblies shall be furnace heated for stress relief at 1100 °F +/- 50 °F for a minimum of 2 hours. To prevent pickup of hydrogen, a slightly oxidizing atmosphere shall be used; air-cooling is allowed.	Representative analyses: • FEP 2.1.03.08.0B – Early failure of drip shields (BSC 2005 [DIRS 174995], Section 6.2.16); • FEP 2.1.03.02.0B – Stress corrosion cracking (SCC) of drip shields (BSC 2005 [DIRS 174995], Section 6.2.5); • FEP 2.1.03.04.0B – Hydride cracking of drip shields (BSC 2005 [DIRS 174995], Section 6.2.9); • *Hydrogen-Induced Cracking of the Drip Shield* (SNL 2007 [DIRS 181339], Section 6). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
07-14	Drip Shield Handling	a) The drip shield shall be handled in accordance with standard nuclear industry practices to minimize damage, surface contamination, exposure to adverse substances, and impacts. b) Drip shield installation shall be controlled and monitored through appropriate equipment to minimize possible waste package/drip shield damage and/or misinstallation. Installation shall include the use of equipment with an alarm, an operator, and an independent checker. Records demonstrating compliance shall be maintained.	Representative analyses: • FEP 2.1.03.07.0A – Mechanical impact on waste package (BSC 2005 [DIRS 174995], Section 6.2.13); • FEP 2.1.03.08.0B – Early failure of drip shields (BSC 2005 [DIRS 174995], Section 6.2.16).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
07-15	Drip Shield Thermal Expansion Constraint	To account for volume increase of corrosion products the drip shield shall not be constrained laterally or longitudinally, or rigidly mounted to the invert. Drip shield connectors shall be designed to allow thermal expansion without binding to 300 °C.	Representative analysis: • FEP 2.1.11.07.0A – Thermal expansion/stress of in-drift EBS components (BSC 2005 [DIRS 175014], Section 6.2.69).
07-16	As-emplaced Waste Configuration – Waste Package/Drip Shield Clearance [Controlled Interface Parameters]	The interface control mechanism for the minimum distance from top-of-waste-package to interior-height-of-drip-shield is the Emplacement Drift Configuration and Environment IED(s).	Representative analyses: • FEP 1.2.03.02.0A – Seismic ground motion damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.3); • FEP 1.2.03.02.0B – Seismic-induced rockfall damages EBS components (BSC 2005 [DIRS 175014], Section 6.2.9); • FEP 2.1.03.07.0B – Mechanical impact on drip shield (BSC 2005 [DIRS 174995], Section 6.2.14); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 174995], Section 6.2.22); • FEP 2.1.07.01.0A – Rockfall (BSC 2005 [DIRS 175014], Section 6.2.28). Current control mechanism: • *IED Emplacement Drift Configuration and Environment* (BSC 2007 [DIRS 180412]).
07-17	[Deleted.]		

No.	Parameter	Derived Internal Constraint	Postclosure Basis
EMPLACEMENT PALLET			
08-01	Emplacement Pallet Design [Controlled Interface Parameters]	The interface control mechanism for the emplacement pallet dimensions and characteristics is the Emplacement Pallet IED.	Representative analyses: • FEP 2.1.06.05.0A – Mechanical degradation of emplacement pallet (BSC 2005 [DIRS 175014], Section 6.2.21); • FEP 2.1.06.05.0C – Chemical degradation of emplacement pallet (BSC 2005 [DIRS 175014], Section 6.2.23); • FEP 2.1.06.07.0B – Mechanical effects at EBS component interfaces (BSC 2005 [DIRS 175014], Section 6.2.27). Current control mechanism: • *IED Emplacement Pallet* (BSC 2007 [DIRS 180445]).
08-02	Emplacement Pallet Function	For the design static load, the emplacement pallet shall maintain the waste package emplacement nominal position for at least 300 years, and maintain a nominally horizontal waste package emplacement for 10,000 years.	Representative analyses: • FEP 2.1.06.05.0A – Mechanical degradation of emplacement pallet (BSC 2005 [DIRS 175014], Section 6.2.21); • FEP 2.1.06.05.0C – Chemical degradation of emplacement pallet (BSC 2005 [DIRS 175014], Section 6.2.23); • FEP 2.1.06.07.0B – Mechanical effects at EBS component interfaces (BSC 2005 [DIRS 175014], Section 6.2.27).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
08-03	Emplacement Pallet Fabrication and Corrosion Allowance [Controlled Interface Parameters – Item a) only] [Information Only _Items d), e) and f) only]	a) The interface control mechanism for the emplacement pallet material properties is the Emplacement Pallet IED b) The emplacement pallet shall be fabricated of Alloy 22 plates and square stainless steel tubes c) The contacts between the waste package and emplacement pallet shall be Alloy 22. d) The corrosion allowance for the Alloy 22 components shall be at least 2 mm. e) The corrosion allowance for the stainless steel components shall be at least 2 mm. f) The mechanical properties at 150° C or higher shall be used for postclosure analysis.	Representative analyses: • FEP 1.2.03.02.0A – Seismic ground motion damages EBS components (BSC 2005 [DIRS 173981], Section 6.2.1.3); • FEP 2.1.06.05.0A – Mechanical degradation of emplacement pallet (BSC 2005 [DIRS 175014], Section 6.2.21); • FEP 2.1.06.05.0C – Chemical degradation of emplacement pallet (BSC 2005 [DIRS 175014], Section 6.2.23). Current control mechanism: • *IED Emplacement Pallet* (BSC 2007 [DIRS 180445]).
08-04	EBS Materials Interactions – Emplacement Pallet Function	EBS materials shall be inert relative to each other so that physical contact between EBS materials minimizes dissimilar material interaction mechanisms. The Emplacement Pallet shall be designed such that, for the nominal scenario (e.g. not seismic or igneous), the waste package outer corrosion barrier shall not contact EBS components other than the Alloy 22 support surfaces of the pallet.	Representative analyses: • FEP 2.1.03.04.0A – Hydride cracking of waste packages (BSC 2005 [DIRS 174995], Section 6.2.8); • FEP 2.1.03.04.0B – Hydride cracking of drip shields (BSC 2005 [DIRS 174995], Section 6.2.9); • FEP 2.1.06.07.0A – Chemical effects at EBS component interfaces (BSC 2005 [DIRS 175014], Section 6.2.26).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
08-05	Waste Package and Emplacement Pallet Static Stresses	For the nominal scenario emplacement configuration, the tensile stresses imposed on the alloy 22 components of both the waste package and the emplacement pallet shall be less than 257 MPa (the approximate stress corrosion cracking threshold for alloy 22).	Representative analysis: • FEP 2.1.03.02.0A – Stress Corrosion Cracking (SCC) of waste packages (BSC 2005 [DIRS 174995], Section 6.2.4). Note: This derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
CLOSURE			
09-01	Closure of Shafts and Ramps	Closure of the shafts shall include backfilling for the entire depth of the opening. Closure of ramps shall include backfilling along the entire length of the opening.	Representative analysis: • FEP 2.1.05.01.0A – Flow through seals (access ramps and ventilation shafts) (BSC 2005 [DIRS 174191], Section 6.3.6); • FEP 2.3.09.01.0A – Animal burrowing/intrusion (BSC 2005 [DIRS 174107], Section 6.2.23). Note: With regard to backfilling of ramps, this derived internal constraint statement has been developed as an agreed upon engineering-scientific interface constraint to address non-specific FEP discussions in a manner that can be incorporated into technical designs and verified through their implementation.
09-02	[Deleted]		
09-03	Closure of Boreholes	Site investigation boreholes within or near the footprint of the repository block will be backfilled with material compatible with the host rock and plugged.	Representative analysis: • FEP 1.1.01.01.0A – Open site investigation boreholes (BSC 2005 [DIRS 174191], Section 6.3.1).

No.	Parameter	Derived Internal Constraint	Postclosure Basis
09-04	Reclamation of Lands Disturbed by Repository	Lands disturbed by the repository shall be reclaimed following the *Reclamation Implementation Plan* (YMP 2001 [DIRS 154386], Section 1) as established in *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002 [155970], Sections 2.1.2.4, 4.1.3.2, 4.1.3.3, and 4.1.4.4) to ensure that there are no preclosure disturbances that will impact postclosure performance.	Representative analyses: • FEP 1.2.07.01.0A – Erosion/denudation (BSC 2005 [DIRS 174191], Section 6.5.1); • FEP 1.2.07.02.0A – Deposition (BSC 2005 [DIRS 174191], Section 6.5.2); • FEP 2.3.11.02.0A – Surface Runoff and Flooding (BSC 2005 [DIRS 174191], Section 6.2.39); • FEP 2.3.11.03.0A – Infiltration and Recharge (BSC 2005 [DIRS 174191], Section 6.2.40).

7. PROPOSED RANGES FOR SELECTED PARAMETERS

As was noted previously, ongoing testing, postclosure modeling and analysis, and design evolution may establish ranges of values for controlling parameters. Selected controlling parameters, their current values, and their proposed ranges are presented in Table 2. Ranges for controlling parameters will be incorporated into Table 1 (via revision of this document) after they have been confirmed in future postclosure analyses. Note that controlling parameter ranges are not equivalent to construction tolerances. Rather, a parameter range establishes the bounds within which design may specify a parameter value and appropriate tolerances.

Table 2. Proposed Ranges of Values for Selected Parameters

No.	Parameter	Controlling Parameter and Current Value	Proposed Range
01-10	Emplacement Drift Configuration	Emplacement Drift Diameter: 5.5 m nominal	5.0 m to 6.0 m
01-13	Emplacement Drift Spacing	Emplacement Drift Spacing: 81 m nominal	76 m to 86 m
03-17	Waste Package Closure	Closure Weld Mass[2]: Less than 0.104 lb/in (18.5 g/cm)	Less than 30 g/cm

[2] This parameter will be expressed as Closure Weld Preparation Geometry and Weld Width in future revisions of this document.

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8. INPUTS AND REFERENCES

8.1 DOCUMENTS CITED

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