U.S. Department of Energy
Office of Civilian Radioactive Waste Management

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Overview of License Application Update

Presented to:
U.S. Nuclear Regulatory Commission

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Rockville, Maryland

Presentation Outline

- Primary Sources of LA Changes
- Structure of Initial LA Update
- Summary of LA Update Content
- Nature of LA Changes
- Changes to Primary Reference Documents

Primary Sources of LA Changes

- **Design/Analysis Evolution**
- **Corrective Action Program**
- **Responses to NRC Requests for Additional Information (RAIs)**

Structure of Initial LA Update

- **LA changes were submitted as revisions to the original LA with no changes in format**
  - **General Information (GI)**
  - **Safety Analysis Report (SAR)**
  - **Classified Information submitted separately - Naval Nuclear Propulsion Program (NNPP) Technical Support Document**

Summary of LA Update Content

- **Enclosures to transmittal letter (contents of shipping box):**
  1. Yucca Mountain Repository License Application, Revision 1, with revised sections clearly identified as Revision 1 (the docket number was added to Revision 0 sections) – DVD and paper copy
  2. Revised primary reference documents to the LA, affecting 36 of the original 196 references (included for information and not part of the LA) – CD
  3. Listing of electronic files provided on DVDs/CDs – paper and electronic format
  4. Tables (2) summarizing all changes made in the first LA update – paper copy
  5. The individual pages affected by changes since the June 3, 2008, original submittal – paper copy (some pages are marked as “Official Use Only” and are withheld from public release)

Summary of LA Update Content (Continued)

- **Changes Included in the LA Update**
  - LA changes approved by DOE from Revision 0
- **LA Pages/Sections Affected**
  - 356 pages revised
  - 40 sections updated to Revision 1
- **Identification of Changes**
  - Text and tables – specific changes indicated by change bar in right margin on each page
  - Figures – change bar in right margin of page shows replacement of the figure (specific change within figure not marked)

Summary of LA Update Content (Continued)

- **Change Summary Tables**

  Two tables provided with update

  - **Table 1, Change Summary by LA Page Number – states specific change on each revised page and refers to an LA Change Number when appropriate**
  - **Table 2, Change Summary by LA Change Number – provides a brief summary for each of the (60) LA Changes**

Table 1 - LA Revision 1 Update – Change Summary by LA Page Number			
LA Section	**LA Page Number**	**LA Subsection Revised**	**Description of Change**
GI-1	1-5	1.1.2.1	Deleted “Details of” and changed “are” to “is”.
	1-16, 1-17	1.2.2	Changed “transfer canisters, transportation casks, and aging overpacks” to “transfer canisters from transportation casks, shielded transfer casks, and aging overpacks”.
	1-22	1.4.2	Deleted “Additionally, Table 1-1 contains cross references to the appropriate SAR sections that summarize the listed materials”.
	1-22	1.5	Updated reference citation.
	1-25	Table 1-1	Deleted the last column of the table.
	1-35	Figure 1-7	Updated Repository Operations Summary Timeline figure to reflect revised project schedule milestones. [See LA change number 32]
GI-2	2-9	Figure 2-1 (Sheet 1 of 3)	Updated High-Level Project Schedule figure to reflect revised project schedule milestones. Deleted last page of former schedule. Corrected aging pad area identifiers consistent with LA text. Deleted “CCCF – Central Control Center Facility” and “EL – elevation” and added “HEPA – high-efficiency particulate air” and “IFC – issue for construction” in the note. [See LA change number 32]
	2-11	Figure 2-1 (Sheet 2 of 3)	Updated High-Level Project Schedule figure to reflect revised project schedule milestones. Deleted last page of former schedule. Corrected aging pad area identifiers consistent with LA text. Deleted “CRCF – Canister Receipt and Closure Facility” and added “CCCF – Central Control Center Facility”, IHF – Initial Handling Facility”, and “RF – Receipt Facility” in the note. [See LA change number 32]
	2-13	Figure 2-1 (Sheet 3 of 3)	Updated High-Level Project Schedule figure to reflect revised project schedule milestones. Deleted last page of former schedule. Corrected aging pad area identifiers consistent with LA text. Deleted “IHF – Initial Handling Facility” and “WHF – Wet Handling Facility” in the note. [See LA change number 32]
GI-5	5-25	5.1.6.4	Updated reference citation.
	5-48	5.2.2.3.1	Updated reference citation.
	5-64	5.2.3.2.2	Changed “Section 6.5.6” to “Section 6.5.7”.
	5-98, 5-106, 5-107	5.3	Updated reference citations.
	5-153	Figure 5-33	Deleted “Paintbrush Canyon” from middle Structural Blocks labels (top of page).
	5-155	Figure 5-35	Changed “Gold Mountains” to “Gold Mountain” for acronym “GOM”.
SAR 1.1	1.1-25	1.1.2.3	Changed “is projected to the expected first year of operation of the repository” to “was projected to the expected first year of operation of the repository in 2017” and changed “radioactive waste handling operations” to “radioactive waste handling operations in 2067” (first change bar). Deleted "which is" (second change bar). [See LA change number 32]
	1.1-25	1.1.2.3	Added a new last sentence to the end of the paragraph (third change bar). [See LA change number 32]
	1.1-26	1.1.3.1	Changed “are” to “were” (first change bar). Added two new sentences to the end of the paragraph (second change bar).
	1.1-27	1.1.3.1	Deleted reference to Quality Management Directive and moved reference to LA Section 5.1 (QARD) from the list to the lead-in paragraph. Clarified duration of meteorological monitoring program.
	1.1-28	1.1.3.1	Changed “do” to “did” (first change bar) and added “in” (last change bar). Changed “measurements made at each site are included” to “measurements that were made at each site during the period from 1994 through 2006” (second change bar).

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	LA Sections Revised	Description of Change	LA Change Type**
1	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect a revision to a Canister Receipt and Closure Facility (CRCF) Seismic Input Ground Motions calculation. This revision corrected editorial errors in the calculation. The results presented in the LA were not impacted by this revision.	updated reference
2	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect revisions to Initial Handling Facility (IHF) mass properties and damping calculations correcting a multiplier error for an equipment dead load. The results presented in the LA were not impacted by this revision.	updated reference
3	SAR 1.1.5.3 SAR Table 1.1-65 SAR Figure 1.1-73	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors. The results presented in the LA were not impacted by this revision.	editorial
4	GI-2 Figure 2-1	This LA change corrected surface aging pad area identifiers on the High-Level Project Schedule figure to be consistent with similar information presented elsewhere in the LA. The schedule itself was revised under LA Change Number 32 and included the correct identifiers.	clarification/ correction
5	SAR 1.3.2.1 SAR 1.3.2.3 SAR 1.3.3.5 SAR Table 1.3.3-5 SAR Table 1.3.3-6	This LA change clarified information associated with the Transport and Emplacement Vehicle (TEV) equipment descriptions and operational steps, and corrected the safety category classification of seismic motion switches to reflect that they are not important to safety (non-ITS). The LA change did not affect the nuclear safety design bases of the TEV.	clarification/ correction
6	SAR 2.2 SAR 2.3.6 SAR 2.3.7	This LA change clarified the cross reference tables and subheadings that map the Safety Analysis Report (SAR) subsections to the NUREG-1804 Acceptance Criteria. The LA change improved the accuracy of the mapping information presented in the LA.	editorial
7	SAR Table 2.4-12	This LA change corrected a typographical error.	editorial
8	GI-5 Figure 5-33 GI-5 Figure 5-35 SAR Figure 2.2-16 SAR Figure 2.3.4-21	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors.	editorial
9	SAR 2.3.8.5	This LA change deleted an incorrect statement describing an illustrative example comparing breakthrough curves for 12 colloidal species. Specifically, the following statement was deleted: "In this illustrative example, each species is modeled as a simple decaying species, with no daughter products tracked."	clarification/ correction
10	SAR Figure 1.4.3-1	This LA change reflected a revision to a Site Fire Water Distribution Piping and Instrumentation diagram implementing an additional underground yard fire water mains connection to the fire water riser valve room in the Initial Handling Facility (IHF). The additional yard firewater mains connection to IHF valve riser room #3 had not been originally shown in the source drawing. The LA change did not affect the nuclear safety design bases of the fire protection system.	design/ analysis evolution
11	SAR Figure 1.2.3-23 SAR Figure 1.2.4-36 SAR Figure 1.2.4-37 SAR Figure 1.2.5-22 SAR Figure 1.2.5-41	This LA change reflected revisions to crane hoist logic diagrams for several handling facilities to correct inconsistencies in terminology and equipment identification numbers. The LA change did not affect the nuclear safety design bases of the crane hoists.	clarification/ correction
12	SAR 1.5.1.4.2	This LA change corrected the number of naval spent nuclear fuel (SNF) types for which thermal analyses were presented in the Naval Nuclear Propulsion Program (NNPP) Technical Support Document (TSD). Specifically, the number of SNF types was changed from four to two.	clarification/ correction

Nature of LA Changes

- **Editorial**
- **Updated Reference**
- **Clarification/Correction**
- **Design/Analysis Evolution**

Editorial Changes

- Revisions to correct typographical and grammatical errors or to maintain consistency within the LA and its supporting documents
- 11 changes in update
- Examples

Editorial Changes

EXAMPLE 1

LA Change Number 8

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
1	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect a revision to a Canister Receipt and Closure Facility (CRCF) Seismic Input Ground Motions calculation. This revision corrected editorial errors in the calculation. The results presented in the LA were not impacted by this revision.	updated reference
2	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect revisions to Initial Handling Facility (IHF) mass properties and damping calculations correcting a multiplier error for an equipment dead load. The results presented in the LA were not impacted by this revision.	updated reference
3	SAR 1.1.5.3 SAR Table 1.1-65 SAR Figure 1.1-73	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors. The results presented in the LA were not impacted by this revision.	editorial
4	GI-2 Figure 2-1	This LA change corrected surface aging pad area identifiers on the High-Level Project Schedule figure to be consistent with similar information presented elsewhere in the LA. The schedule itself was revised under LA Change Number 32 and included the correct identifiers.	clarification/ correction
5	SAR 1.3.2.1 SAR 1.3.2.3 SAR 1.3.3.5 SAR Table 1.3.3-5 SAR Table 1.3.3-6	This LA change clarified information associated with the Transport and Emplacement Vehicle (TEV) equipment descriptions and operational steps, and corrected the safety category classification of seismic motion switches to reflect that they are not important to safety (non-ITS). The LA change did not affect the nuclear safety design bases of the TEV.	clarification/ correction
6	SAR 2.2 SAR 2.3.6 SAR 2.3.7	This LA change clarified the cross reference tables and subheadings that map the Safety Analysis Report (SAR) subsections to the NUREG-1804 Acceptance Criteria. The LA change improved the accuracy of the mapping information presented in the LA.	editorial
7	SAR Table 2.4-12	This LA change corrected a typographical error.	editorial
8	GI-5 Figure 5-33 GI-5 Figure 5-35 SAR Figure 2.2-16 SAR Figure 2.3.4-21	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors.	editorial
9	SAR 2.3.8.5	This LA change deleted an incorrect statement describing an illustrative example comparing breakthrough curves for 12 colloidal species. Specifically, the following statement was deleted: "In this illustrative example, each species is modeled as a simple decaying species, with no daughter products tracked."	clarification/ correction
10	SAR Figure 1.4.3-1	This LA change reflected a revision to a Site Fire Water Distribution Piping and Instrumentation diagram implementing an additional underground yard fire water mains connection to the fire water riser valve room in the Initial Handling Facility (IHF). The additional yard firewater mains connection to IHF valve riser room #3 had not been originally shown in the source drawing. The LA change did not affect the nuclear safety design bases of the fire protection system.	design/ analysis evolution
11	SAR Figure 1.2.3-23 SAR Figure 1.2.4-36 SAR Figure 1.2.4-37 SAR Figure 1.2.5-22 SAR Figure 1.2.5-41	This LA change reflected revisions to crane hoist logic diagrams for several handling facilities to correct inconsistencies in terminology and equipment identification numbers. The LA change did not affect the nuclear safety design bases of the crane hoists.	clarification/ correction
12	SAR 1.5.1.4.2	This LA change corrected the number of naval spent nuclear fuel (SNF) types for which thermal analyses were presented in the Naval Nuclear Propulsion Program (NNPP) Technical Support Document (TSD). Specifically, the number of SNF types was changed from four to two.	clarification/ correction

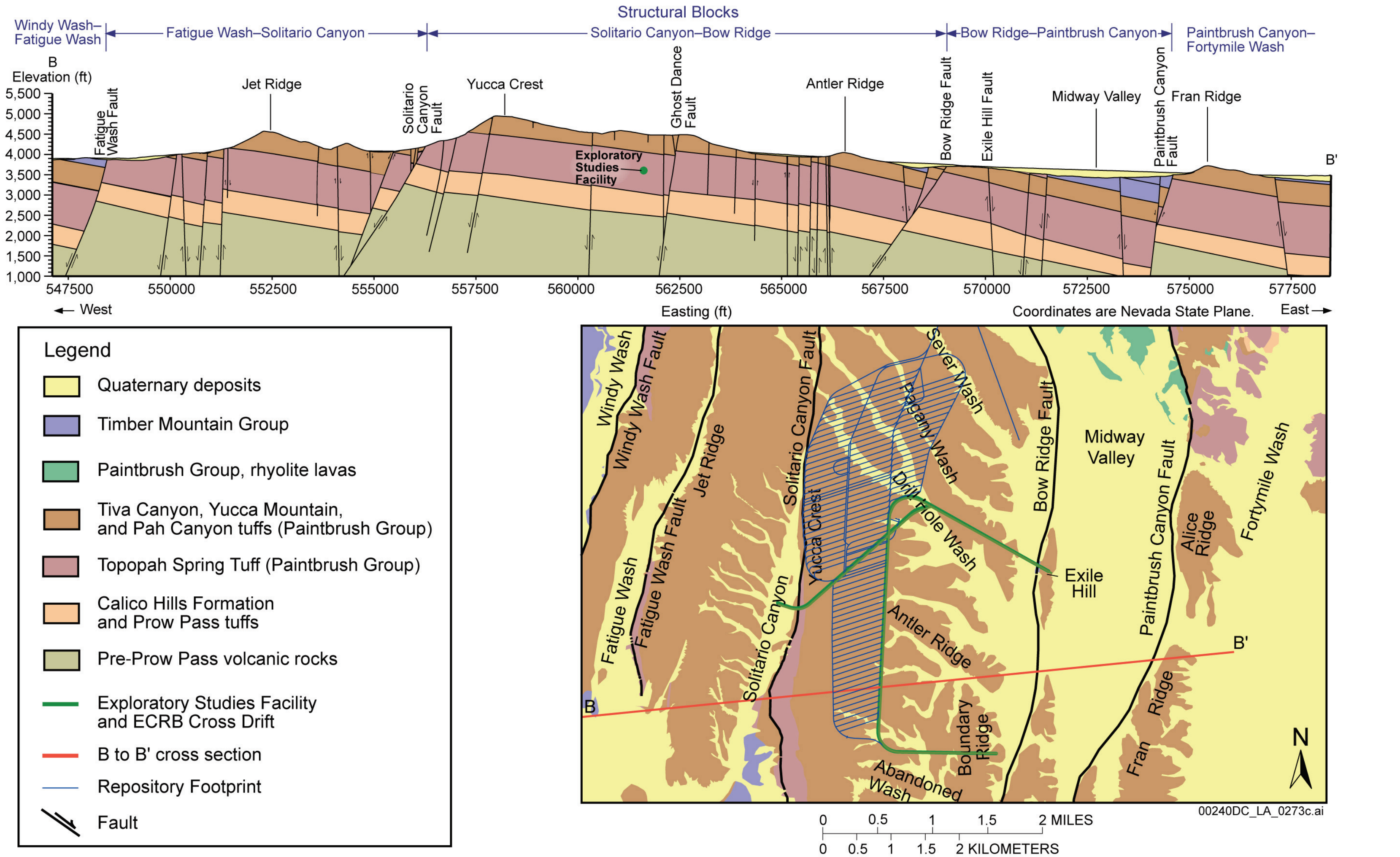


Figure 5-33. Approximate East–West Geologic Section across Yucca Mountain Site Area (top) along Line of Cross Section in Plan View (bottom)

Source: Day et al. 1998, cross section B-B′; Potter et al. 2002, plan view.

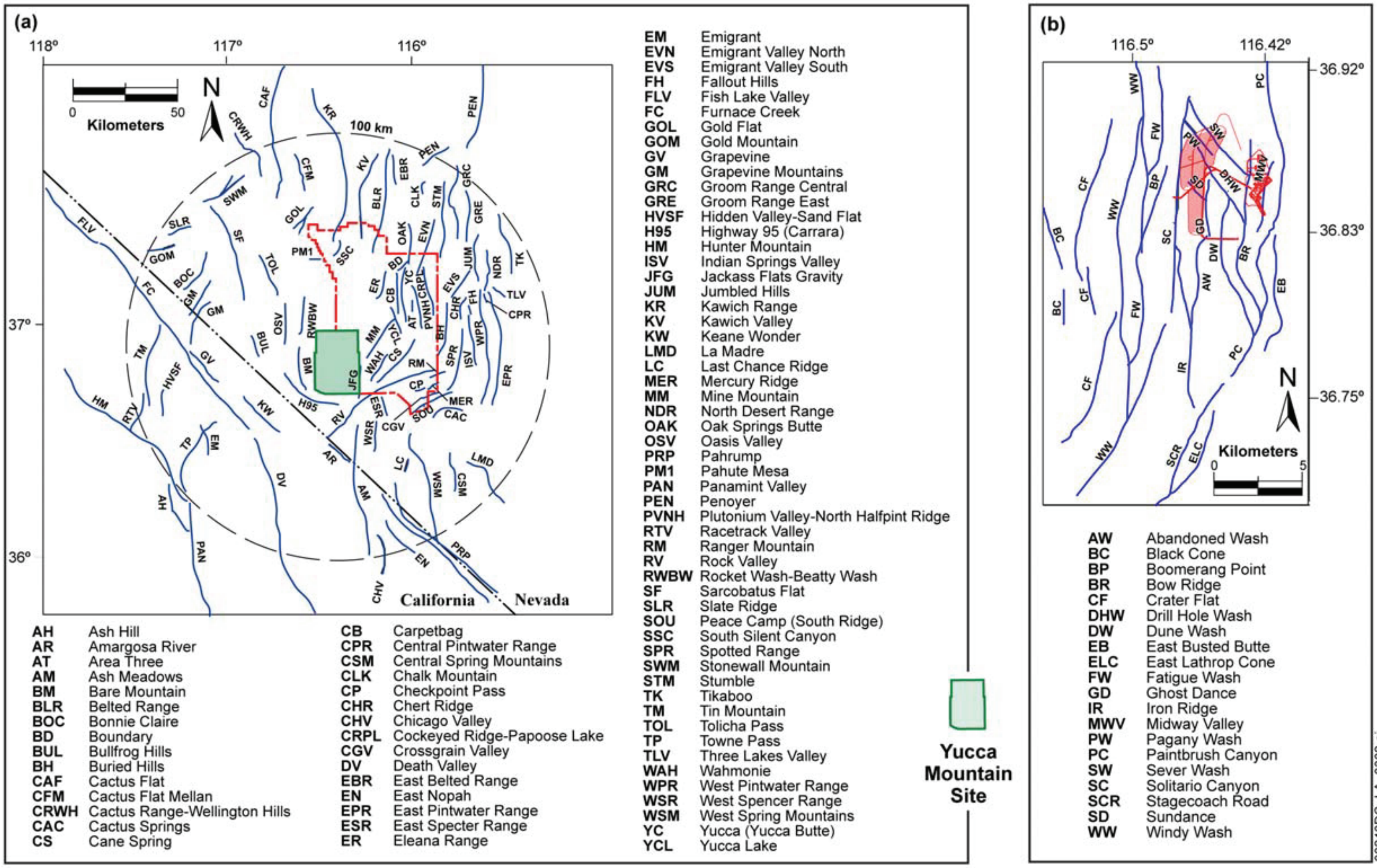


Figure 5-35. Known or Suspected Quaternary Faults and Other Notable Faults in the Yucca Mountain Region

NOTE: (a) Known or suspected Quaternary faults within 100 km of Yucca Mountain. (b) Detail of (a) showing known or suspected faults near Yucca Mountain. Note that the geologic repository operations area is shown for illustration purposes only.

Source: BSC 2004a, Figure 4-23.

Editorial Changes

EXAMPLE 2

LA Change Number 29

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
24	SAR 1.2.4.4.2 SAR Figures 1.2.4-101, -102 1.2.4-103, -105 1.2.4-106, -107 1.2.4-108, -109 1.2.4-110, -111 SAR Figures 1.2.5-84, -85 1.2.5-88, -89 1.2.5-90, -91 SAR 1.2.8.3.1.2 SAR Figure 1.2.8-29 SAR Figure 1.2.8-34	This LA change reflected revisions to (18) logic diagrams and ventilation and instrumentation diagrams for several facilities to present the automatic signals for heating, ventilation, and air conditioning (HVAC) equipment. The change added an important to safety (ITS) interlock for automatic starting of standby fans upon an operating fan trip. The change was implemented to ensure availability of high-efficiency particulate air (HEPA) filtration of facility exhausts. The LA change updated design details without affecting the nuclear safety design bases and the procedural safety controls presented in the LA.	design/ analysis evolution
25	SAR Figure 1.2.3-2 SAR Figure 1.2.3-14 [OUO] Appendix A Figure A-1 Figure A-13	This LA change reflected revisions to Initial Handling Facility (IHF) general arrangement drawings. A Motor Control Center (MCC) and Load Center (LC) were resized and reconfigured, electrical equipment quantities and locations were changed, and air compressors were relocated. The drawings were revised to make them consistent with the IHF electrical space requirements calculation (for revised electrical quantities) and the general purpose and instrument air calculation (relocation of air compressors). The LA change updated design details without affecting the nuclear safety design bases of the IHF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
26	SAR Figure 1.2.5-2 SAR Figure 1.2.5-4 [OUO] Appendix A Figure A-39 Figure A-41	This LA change reflected revisions to Wet Handling Facility (WHF) general arrangement drawings. Air compressors, electrical equipment, and doorways were relocated, and an electrical lighting panel was added. The drawings were revised to make them consistent with the WHF electrical space requirements calculation (for revised electrical quantities) and the general purpose and instrument air calculation (relocation of air compressors). The LA change updated design details without affecting the nuclear safety design bases of the WHF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
27	SAR 1.3.1.1 SAR Table 1.9-8	This LA change corrected the criterion for naval waste package standoff distance from a mapped fault, and updated the referenced source document. Specifically, the phrase "mapped faults with vertical displacements greater than 6.5 ft (2 m)" was changed to "any mapped fault which is determined to have a cumulative offset of at least 6.6 ft (2 m)".	clarification/ correction
28	SAR Table 1.3.4-3 SAR Figure 1.3.4-15	This LA change corrected drip shield dimensions to be consistent with the source drawing. Changes due to rounding and unit conversion in the SAR Table were also included. The LA changes did not affect the nuclear safety design bases for the drip shields.	clarification/ correction
29	SAR Table 1.3.6-3	This LA change corrected a structure, system, and component (SSC) name in an LA table.	editorial
30	SAR 1.6.3.4.3	This LA change corrected the placement of a reference citation within a paragraph to make it consistent with the information presented in the source document.	editorial

Table 1.3.6-3. Summary of Conformance of Subsurface Facility Design to Postclosure Control Parameters—Repository Closure (Continued)

Structure, System and Component	Postclosure Control Parameter		Relevant to ITWI	Design Criteria/Configuration	Postclosure Procedural Safety Control
	Parameter Number and Title	Values, Ranges of Values or Constraints			
Subsurface Facility - Closure	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.	No	NA (Background information: Closure of boreholes will be performed with material compatible with the host rock. DOE will determine at the time of borehole closure if regulations apply to borehole closure. Timing of closure of boreholes will be determined on a case-by-case basis because some boreholes will continue to be used during the emplacement and postemplacement phases (i.e., seismic instrumentation boreholes). Where applicable, some boreholes will be closed and plugged prior to excavation of the emplacement drifts to minimize impacts on the excavation. If this timing is not possible for some boreholes, closure may be postponed until after excavation or even until closure of the repository.)	Procedures will be developed for the purpose of controlling the closure of boreholes and for tracking closure activities. These procedures will require that site investigation boreholes within or near the footprint of the repository block will be backfilled with material compatible with the host rock and plugged.

Updated Reference Changes

- Updates to reference citations in the LA to maintain consistency with the latest version of a supporting document with no other changes to the content of the LA
- 10 changes in update
- Example

Updated Reference Changes

EXAMPLE

LA Change Number 2

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	LA Sections Revised	Description of Change	LA Change Type**
1	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect a revision to a Canister Receipt and Closure Facility (CRCF) Seismic Input Ground Motions calculation. This revision corrected editorial errors in the calculation. The results presented in the LA were not impacted by this revision.	updated reference
2	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect revisions to Initial Handling Facility (IHF) mass properties and damping calculations correcting a multiplier error for an equipment dead load. The results presented in the LA were not impacted by this revision.	updated reference
3	SAR 1.1.5.3 SAR Table 1.1-65 SAR Figure 1.1-73	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors. The results presented in the LA were not impacted by this revision.	editorial
4	GI-2 Figure 2-1	This LA change corrected surface aging pad area identifiers on the High-Level Project Schedule figure to be consistent with similar information presented elsewhere in the LA. The schedule itself was revised under LA Change Number 32 and included the correct identifiers.	clarification/ correction
5	SAR 1.3.2.1 SAR 1.3.2.3 SAR 1.3.3.5 SAR Table 1.3.3-5 SAR Table 1.3.3-6	This LA change clarified information associated with the Transport and Emplacement Vehicle (TEV) equipment descriptions and operational steps, and corrected the safety category classification of seismic motion switches to reflect that they are not important to safety (non-ITS). The LA change did not affect the nuclear safety design bases of the TEV.	clarification/ correction
6	SAR 2.2 SAR 2.3.6 SAR 2.3.7	This LA change clarified the cross reference tables and subheadings that map the Safety Analysis Report (SAR) subsections to the NUREG-1804 Acceptance Criteria. The LA change improved the accuracy of the mapping information presented in the LA.	editorial
7	SAR Table 2.4-12	This LA change corrected a typographical error.	editorial
8	GI-5 Figure 5-33 GI-5 Figure 5-35 SAR Figure 2.2-16 SAR Figure 2.3.4-21	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors.	editorial
9	SAR 2.3.8.5	This LA change deleted an incorrect statement describing an illustrative example comparing breakthrough curves for 12 colloidal species. Specifically, the following statement was deleted: "In this illustrative example, each species is modeled as a simple decaying species, with no daughter products tracked."	clarification/ correction
10	SAR Figure 1.4.3-1	This LA change reflected a revision to a Site Fire Water Distribution Piping and Instrumentation diagram implementing an additional underground yard fire water mains connection to the fire water riser valve room in the Initial Handling Facility (IHF). The additional yard firewater mains connection to IHF valve riser room #3 had not been originally shown in the source drawing. The LA change did not affect the nuclear safety design bases of the fire protection system.	design/ analysis evolution
11	SAR Figure 1.2.3-23 SAR Figure 1.2.4-36 SAR Figure 1.2.4-37 SAR Figure 1.2.5-22 SAR Figure 1.2.5-41	This LA change reflected revisions to crane hoist logic diagrams for several handling facilities to correct inconsistencies in terminology and equipment identification numbers. The LA change did not affect the nuclear safety design bases of the crane hoists.	clarification/ correction
12	SAR 1.5.1.4.2	This LA change corrected the number of naval spent nuclear fuel (SNF) types for which thermal analyses were presented in the Naval Nuclear Propulsion Program (NNPP) Technical Support Document (TSD). Specifically, the number of SNF types was changed from four to two.	clarification/ correction

diaphragm. The rigid basemat is connected to the ground by soil springs. Figures 1.2.2-14 through 1.2.2-16 illustrate the lumped-mass, multiple-stick models used in the analysis of the CRCF, RF, and WHF structures and foundations (BSC 2007j, Section 7.3). Figure 1.2.2-17 shows how stick elements and rigid links are used in a typical reinforced concrete shear wall seismic model.

For these concrete structures, soil-structure interactions are represented using soil springs and dashpots for horizontal and vertical translation, rocking, and torsion effects using the impedance method in accordance with ASCE 4-98, *Seismic Analysis of Safety-Related Nuclear Structures and Commentary*, Section 3.3.4.

Seismic demand forces and appropriate static load demand forces are combined using defined load cases to determine critical load combinations for design of primary structural members. Structural members are designed according to code requirements as specified in Section 1.2.2.1.8.

The WHF pool is evaluated for sloshing of water due to a seismic event. This analysis determined water pressures imposed on the pool walls and the amount of freeboard required to prevent spilling of pool water on the WHF pool area floor.

Code capacities, based on concrete member dimensions, and number and spacing of steel reinforcing bars are determined and compared to the demand conditions to ensure adequate code compliance for the primary structural members of reinforced concrete shear walls, floor and roof slabs, and the building mat foundation. Similarly, structural steel member properties and demand stress conditions are determined and compared to the code allowable capacities to ensure adequate code compliance for the primary steel members.

In addition to the ITS concrete structure, the CRCF, RF, and WHF each include an ITS structural steel vestibule for the transportation casks. The WHF also includes an ITS structural steel vestibule for the site transporter. Each vestibule is analyzed using a three-dimensional finite element model of the steel frame structure with a fixed base. The vestibule model is separate from the concrete model. There is a seismic separation joint between the concrete structure and the structural steel vestibule.

The structural steel vestibule models for the seismic analyses are developed and analyzed using the finite element program SAP 2000. The seismic forces and moments determined by the analyses of the seismic ground motions are combined with the nonseismic forces and moments to compute the demand loads and stresses in the structural elements. Conformance with governing design code requirements is then verified by ensuring that the code capacities exceed the demand conditions.

1.2.2.1.6.3.2.4 Structural Model for IHF and Aging Pads

The analysis of the IHF utilizes a three-dimensional finite element model of the steel frame structure and both the inner and outer concrete waste package handling substructures without soil springs and dashpots (fixed base analysis) (Figure 1.2.2-18). The IHF exterior loadout area is separated from the main structure through the use of a seismic separation joint running from the foundation slab to the roof (BSC 2008; BSC 2008g; BSC 2007l; BSC 2008h).

BSC 2008d. *CRCF Soils Springs—2007 Strain Compatible Soil Properties*. 060-SYC-CR00-00700-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080229.0002.

BSC 2008e. *Wet Handling Facility Soil Spring Constants and Damping Values - 2007 Soil Data.* 050-SYC-WH00-00700-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080229.0004.

BSC 2008f. *Receipt Facility Soil Springs and Damping by New Soil Data*. 200-SYC-RF00-00900-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080229.0001.

BSC 2008g. *Initial Handling Facility (IHF) Soil Springs and Damping*. 51A-SYC-IH00-00500-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080617.0007.

BSC 2008h. *IHF Steel Structure Seismic Analysis and Steel Member Design.* 51A-SSC-IH00-00600-00B. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.200080219.0006.

BSC 2008i. *CRCF Seismic Analysis – 2007 Seismic Input Ground Motions*. 060-SYC-CR00-00800-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080616.0015.

BSC 2008. *Initial Handling Facility (IHF) Mass Properties*. 51A-SYC-IH00-00400-000-00B. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080616.0016.

Burchsted, C.A.; Kahn, J.E.; and Fuller, A.B. 1976. *Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application*. ERDA 76-21. Oak Ridge, Tennessee: Oak Ridge National Laboratory. ACC: NNA.19901127.0194.

DOE (U.S. Department of Energy) 2003. *Nuclear Air Cleaning Handbook*. DOE-HDBK-1169-2003. Washington, D.C.: U.S. Department of Energy. ACC: MOL.20060105.0204.

DOE 2007. *Preclosure Seismic Design and Performance Demonstration Methodology for a Geologic Repository at Yucca Mountain Topical Report*. YMP/TR-003-NP, Rev. 5. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: DOC.20070625.0013.

DOE 2008. *High-Level Radioactive Waste and U.S. Department of Energy and Naval Spent Nuclear Fuel to the Civilian Radioactive Waste Management System. Volume 1 of Integrated Interface Control Document*. DOE/RW-0511, Rev. 4, ICN 1. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: DOC.20080821.0001.

Clarification/Correction Changes

- Clarifications or corrections to descriptions in the LA that are more than just typographical, but do not change design bases or safety analyses
- 21 changes in update
- Examples

Clarification/Correction Changes

EXAMPLE 1

LA Change Number 5

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
1	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect a revision to a Canister Receipt and Closure Facility (CRCF) Seismic Input Ground Motions calculation. This revision corrected editorial errors in the calculation. The results presented in the LA were not impacted by this revision.	updated reference
2	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect revisions to Initial Handling Facility (IHF) mass properties and damping calculations correcting a multiplier error for an equipment dead load. The results presented in the LA were not impacted by this revision.	updated reference
3	SAR 1.1.5.3 SAR Table 1.1-65 SAR Figure 1.1-73	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors. The results presented in the LA were not impacted by this revision.	editorial
4	GI-2 Figure 2-1	This LA change corrected surface aging pad area identifiers on the High-Level Project Schedule figure to be consistent with similar information presented elsewhere in the LA. The schedule itself was revised under LA Change Number 32 and included the correct identifiers.	clarification/ correction
5	SAR 1.3.2.1 SAR 1.3.2.3 SAR 1.3.3.5 SAR Table 1.3.3-5 SAR Table 1.3.3-6	This LA change clarified information associated with the Transport and Emplacement Vehicle (TEV) equipment descriptions and operational steps, and corrected the safety category classification of seismic motion switches to reflect that they are not important to safety (non-ITS). The LA change did not affect the nuclear safety design bases of the TEV.	clarification/ correction
6	SAR 2.2 SAR 2.3.6 SAR 2.3.7	This LA change clarified the cross reference tables and subheadings that map the Safety Analysis Report (SAR) subsections to the NUREG-1804 Acceptance Criteria. The LA change improved the accuracy of the mapping information presented in the LA.	editorial
7	SAR Table 2.4-12	This LA change corrected a typographical error.	editorial
8	GI-5 Figure 5-33 GI-5 Figure 5-35 SAR Figure 2.2-16 SAR Figure 2.3.4-21	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors.	editorial
9	SAR 2.3.8.5	This LA change deleted an incorrect statement describing an illustrative example comparing breakthrough curves for 12 colloidal species. Specifically, the following statement was deleted: "In this illustrative example, each species is modeled as a simple decaying species, with no daughter products tracked."	clarification/ correction
10	SAR Figure 1.4.3-1	This LA change reflected a revision to a Site Fire Water Distribution Piping and Instrumentation diagram implementing an additional underground yard fire water mains connection to the fire water riser valve room in the Initial Handling Facility (IHF). The additional yard firewater mains connection to IHF valve riser room #3 had not been originally shown in the source drawing. The LA change did not affect the nuclear safety design bases of the fire protection system.	design/ analysis evolution
11	SAR Figure 1.2.3-23 SAR Figure 1.2.4-36 SAR Figure 1.2.4-37 SAR Figure 1.2.5-22 SAR Figure 1.2.5-41	This LA change reflected revisions to crane hoist logic diagrams for several handling facilities to correct inconsistencies in terminology and equipment identification numbers. The LA change did not affect the nuclear safety design bases of the crane hoists.	clarification/ correction
12	SAR 1.5.1.4.2	This LA change corrected the number of naval spent nuclear fuel (SNF) types for which thermal analyses were presented in the Naval Nuclear Propulsion Program (NNPP) Technical Support Document (TSD). Specifically, the number of SNF types was changed from four to two.	clarification/ correction

Criticality Safety—Prior to repository closure, subsurface nuclear criticality safety is assured by the commercial SNF and U.S. Department of Energy (DOE) SNF canisters and waste package designs (Sections 1.5.1 and 1.5.2). The canisters and waste package designs provide a barrier to moderators in the subsurface during preclosure. As described in Section 1.14, the waste package contents are expected to remain subcritical at all times. Prior to waste package failure during the postclosure period, the waste package provides an additional barrier to criticality by excluding moderators. The intact waste package fabricated and loaded as designed is subcritical under fully flooded conditions (SNL 2008a, Section 6). The commercial SNF and DOE SNF canisters also provide a combination of fissile material limits, geometry control, and fixed neutron-absorber materials, as needed.

The subsurface facility and mechanical handling SSCs are designed to handle only sealed waste packages. Sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases cannot lead to event sequences that result in a nuclear criticality (Section 1.14).

Mechanical Handling Equipment—Subsurface SSCs used to lift, handle, transport, or emplace waste packages incorporate design features to minimize the potential for drops, collisions, and other types of mechanical impacts to waste packages. The TEV incorporates design features to ensure a high degree of reliability with a low likelihood of failure. These include redundant or diverse design features for load-bearing components and braking processes. In addition to a travel route that is defined by the arrangement of the crane rails, the travel path of the TEV within the subsurface facility is controlled to minimize the potential for collisions. Design features incorporated into the TEV to prevent collisions include a non-ITS collision prevention system and physical stops. More information regarding the design features of the TEV is presented in Section 1.3.3.5.1.

Classification of SSCs—Repository subsurface SSCs are functionally classified based on their ITS and ITWI attributes.

Subsurface ITS SSCs are those SSCs whose function is (Section 1.9.1):

- To provide reasonable assurance that waste packages can be received, handled, emplaced, and retrieved without exceeding the requirements of 10 CFR 63.111(b)(1) for normal operations and Category 1 event sequences.
- To prevent or mitigate Category 2 event sequences that could result in radiological exposures exceeding the values specified in 10 CFR 63.111(b)(2) to any individual located on or beyond any point on the boundary of the site.

SSCs that contribute significantly to the performance of any of the three barriers (Upper Natural Barrier, EBS, and Lower Natural Barrier), are classified as ITWI. Section 2.1 identifies those SSCs associated with the natural and engineered barriers whose function is to provide reasonable expectation that spent nuclear fuel (SNF) and high-level radioactive waste can be disposed in conformance with the requirements of 10 CFR 63.113(b) and (c) as ITWI. The methodology for classification of ITWI SSCs is described in *Postclosure Nuclear Safety Design Bases* (SNL 2008b), and the parameters needing controls (procedural or configuration management) to satisfy heaviest and largest waste package with its emplacement pallet (BSC 2008b, Section 3.2.1.35). Although the TEV is based on proven and commercially available technology, project-specific functions and performance requirements are such that this SSC represents a first-of-a-kind application of existing technology. Design features for the project-specific equipment designs that are part of the TEV are advanced through a process that evaluates codes and standards and identifies supplemental requirements to address nonstandard design areas. This design development process is described in Section 1.3.2.7. Design functions and features for the TEV and its SSCs that are classified as ITS are described in the following section and in Sections 1.3.3.5 and 1.3.4.8 (BSC 2008b, Sections 3.1, 3.2, and 3.3). Operational processes for the TEV are discussed in Section 1.3.3.5.2.

The primary purpose of the TEV is to transport and emplace waste packages in a manner that prevents a waste package breach. A secondary purpose for the TEV is for use in waste package retrieval as discussed in Section 1.11. The TEV primary objective is accomplished by establishing design requirements that identify performance levels that must be met by TEV design features and operational controls to limit or prevent the effects of potential event sequences that could lead to a waste package breach during transport. Information used to define design requirements that address potential event sequences is based on hazards analyses and event sequence evaluations performed through the preclosure safety analyses process. This information is provided in Sections 1.6 and 1.7. Design criteria that support development of the TEV, together with the design bases, are presented in Table 1.3.3-5.

The design requirements for the TEV that address the nuclear safety design bases are presented in the following discussion with design solutions for implementing the requirements.

1.3.2.3.1 Nuclear Safety Design Basis Requirements

The preclosure safety analyses credit the TEV with performing ITS functions and meeting the performance criteria listed in Section 1.9. The TEV design requirements have been established to ensure performance of the identified ITS functions as defined in the nuclear safety design bases developed for the preclosure safety analysis. Two preclosure procedural safety controls (PSC-10 and PSC-25) have been identified for the waste package transportation and emplacement system (Table 1.9-10).

The following discussion addresses the nuclear safety design bases requirements applicable to the TEV and summarizes the design approach for satisfying each requirement. More information regarding the nuclear safety design bases and the preclosure safety analyses is presented in Sections 1.6, 1.7, 1.8 and 1.9.

Runaway—The probability of runaway of a TEV that can result in a potential breach of a waste package shall be less than or equal to 2.0×10^{-9} per transport (Section 1.9; Table 1.3.3-5, HE.SS.01).

The TEV SSCs that address this requirement include high-torque drive motors with high-ratio gearboxes, driveshafts, wheels, an integral disc brake in each drive motor, and rail brakes (BSC 2008c, Section 5.1). As recommended by ASME NOG-1-2004 (Section 5333.1) for a crane load of 50 to 99 tons, the speed of the TEV will not exceed a design-rated load "fast" speed of 150 ft/min

Table 1.3.3-6. Design Requirements and Implementation Descriptions for the Transport and Emplacement Vehicles

Structure, System, or Subsystem	Component or Function	Performance Parameter	Design Requirements	Design Implementation Descriptions
Design, Environmental and Operational Requirements				
Waste Package Transportation/ Emplacement System: Transport and Emplacement Vehicle (TEV)	TEV—Position and range sensors	Prevent collisions	Collision Prevention—The system shall prevent collision with equipment and other objects such as emplacement access doors, surface nuclear facility shield doors, another TEV or large rocks.	The TEV meets this requirement through the use of forward and reverse range sensing devices, forward and reverse range switches, drive motor integral disc brakes, and rail brakes. To prevent collision, the forward and reverse range sensing devices detect objects within the path of the TEV. Upon detecting an object, a signal is sent through the forward or reverse range switches to the drive motor integral disc brakes and rail brakes. The forward and reverse range switches are effective whenever the front shield doors are closed. However, the forward and reverse range sensing switches are bypassed when in the surface nuclear facility loadout rooms or emplacement drifts for loading or unloading a waste package. These sensors and switches detect the presence of an object such as another piece of equipment, another TEV, or a closed emplacement access door that may be in the path of the TEV and stop the TEV before a collision can occur (BSC 2008c, Section 3.2.1.28).
	TEV—Power distribution system	Eliminate movement of a TEV during a seismic event	Power Removed During Seismic Event—Power to the TEV shall be removed after a seismic event.	In the electrical power system, seismic motion switches are provided to sense motion. If this motion is sensed, the switches disconnect the electrical power to the TEV third rail. Removal of power results in automatic setting of the TEV brakes and cessation of other TEV operations (BSC 2008c, Section 3.2.2.10).
	TEV—Drive and control system	Maintain control of equipment in weather	Extreme Wind—While on the surface the TEV shall be designed to function in an extreme straight wind (90 mph).	Although this requirement is non-ITS, it credits components that are ITS. Drive motors and gearboxes will be sized and selected for an operating speed of 150 feet per minute (1.7 mph) during a 90-mph head wind. Stopping capability of the TEV will be sized to account for a 90-mph tail wind. The TEV low profile will reduce vehicle instability in a 90-mph cross wind (BSC 2008c, Section 3.2.1.2).

Clarification/Correction Changes

EXAMPLE 2

LA Change Number 12

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
1	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect a revision to a Canister Receipt and Closure Facility (CRCF) Seismic Input Ground Motions calculation. This revision corrected editorial errors in the calculation. The results presented in the LA were not impacted by this revision.	updated reference
2	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect revisions to Initial Handling Facility (IHF) mass properties and damping calculations correcting a multiplier error for an equipment dead load. The results presented in the LA were not impacted by this revision.	updated reference
3	SAR 1.1.5.3 SAR Table 1.1-65 SAR Figure 1.1-73	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors. The results presented in the LA were not impacted by this revision.	editorial
4	GI-2 Figure 2-1	This LA change corrected surface aging pad area identifiers on the High-Level Project Schedule figure to be consistent with similar information presented elsewhere in the LA. The schedule itself was revised under LA Change Number 32 and included the correct identifiers.	clarification/ correction
5	SAR 1.3.2.1 SAR 1.3.2.3 SAR 1.3.3.5 SAR Table 1.3.3-5 SAR Table 1.3.3-6	This LA change clarified information associated with the Transport and Emplacement Vehicle (TEV) equipment descriptions and operational steps, and corrected the safety category classification of seismic motion switches to reflect that they are not important to safety (non-ITS). The LA change did not affect the nuclear safety design bases of the TEV.	clarification/ correction
6	SAR 2.2 SAR 2.3.6 SAR 2.3.7	This LA change clarified the cross reference tables and subheadings that map the Safety Analysis Report (SAR) subsections to the NUREG-1804 Acceptance Criteria. The LA change improved the accuracy of the mapping information presented in the LA.	editorial
7	SAR Table 2.4-12	This LA change corrected a typographical error.	editorial
8	GI-5 Figure 5-33 GI-5 Figure 5-35 SAR Figure 2.2-16 SAR Figure 2.3.4-21	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors.	editorial
9	SAR 2.3.8.5	This LA change deleted an incorrect statement describing an illustrative example comparing breakthrough curves for 12 colloidal species. Specifically, the following statement was deleted: "In this illustrative example, each species is modeled as a simple decaying species, with no daughter products tracked."	clarification/ correction
10	SAR Figure 1.4.3-1	This LA change reflected a revision to a Site Fire Water Distribution Piping and Instrumentation diagram implementing an additional underground yard fire water mains connection to the fire water riser valve room in the Initial Handling Facility (IHF). The additional yard firewater mains connection to IHF valve riser room #3 had not been originally shown in the source drawing. The LA change did not affect the nuclear safety design bases of the fire protection system.	design/ analysis evolution
11	SAR Figure 1.2.3-23 SAR Figure 1.2.4-36 SAR Figure 1.2.4-37 SAR Figure 1.2.5-22 SAR Figure 1.2.5-41	This LA change reflected revisions to crane hoist logic diagrams for several handling facilities to correct inconsistencies in terminology and equipment identification numbers. The LA change did not affect the nuclear safety design bases of the crane hoists.	clarification/ correction
12	SAR 1.5.1.4.2	This LA change corrected the number of naval spent nuclear fuel (SNF) types for which thermal analyses were presented in the Naval Nuclear Propulsion Program (NNPP) Technical Support Document (TSD). Specifically, the number of SNF types was changed from four to two.	clarification/ correction

Control Rod Retention Hardware:

- Fabrication to Naval Nuclear Propulsion Program procurement specification requirements since *1998 ASME Boiler and Pressure Vessel Code*, Section III, Division 1, Subsections NF and NG do not address zirconium alloys.

1.5.1.4.2 Thermal Characteristics of Naval SNF

Naval fuel assemblies are composed of materials that keep temperatures low enough to maintain integrity of the cladding. The heat transfer characteristics of Zircaloy and hafnium are provided in Section 1.5.1.4 of the Naval Nuclear Propulsion Program Technical Support Document. The thermal properties of Stainless Steel Type 316/316L and Alloy 22 are provided in *2004 ASME Boiler and Pressure Vessel Code* (ASME 2004, Section II) and Hastelloy C-22 Alloy (Haynes International 2002, p. 13), respectively. Standard properties for air are used in both preclosure and postclosure thermal calculations.

The decay heat in naval SNF originates from fission product and actinide decay, and decreases exponentially over time based on the effective decay constant for the particular radionuclides. The decay heat load for the loaded naval SNF canister is calculated by Naval Nuclear Propulsion Program codes using *American National Standard for Decay Heat Power in Light Water Reactors* (ANSI/ANS-5.1-1994) for exponential fits of decay heat with time, or by converting the activities for the radionuclide inventory in the naval SNF canister to a heat generation rate. The decay heat powers from contributing radionuclides are calculated and summed using ORIGEN-S or other codes developed by the Naval Nuclear Propulsion Program. The codes sum the decay heat powers from contributing radionuclides to calculate the decay heat load.

The thermal power for naval SNF canisters containing two naval SNF types at five years after reactor shutdown is given in Section 1.5.1.4 of the Naval Nuclear Propulsion Program Technical Support Document.

1.5.1.4.3 Nuclear Characteristics of Naval SNF

The actual radionuclide inventory varies depending on naval SNF type, naval SNF canister size, naval SNF basket design, and packaging method. In addition, within each naval SNF type, there are variations related to operational history and time after shutdown. As a result, a radionuclide inventory for a representative naval SNF canister is developed for use in the postclosure radionuclide release source term analysis.

The radionuclide inventory for a representative naval SNF canister is developed based on detailed core depletion calculations. The radionuclide inventory accounts for fission products, actinides, Zircaloy cladding, hafnium control rods, activated structural components, and crud. Additional description of the methodology used to create a radionuclide inventory for a representative naval SNF canister is provided in Section 1.5.1.4 of the Naval Nuclear Propulsion Program Technical Support Document.

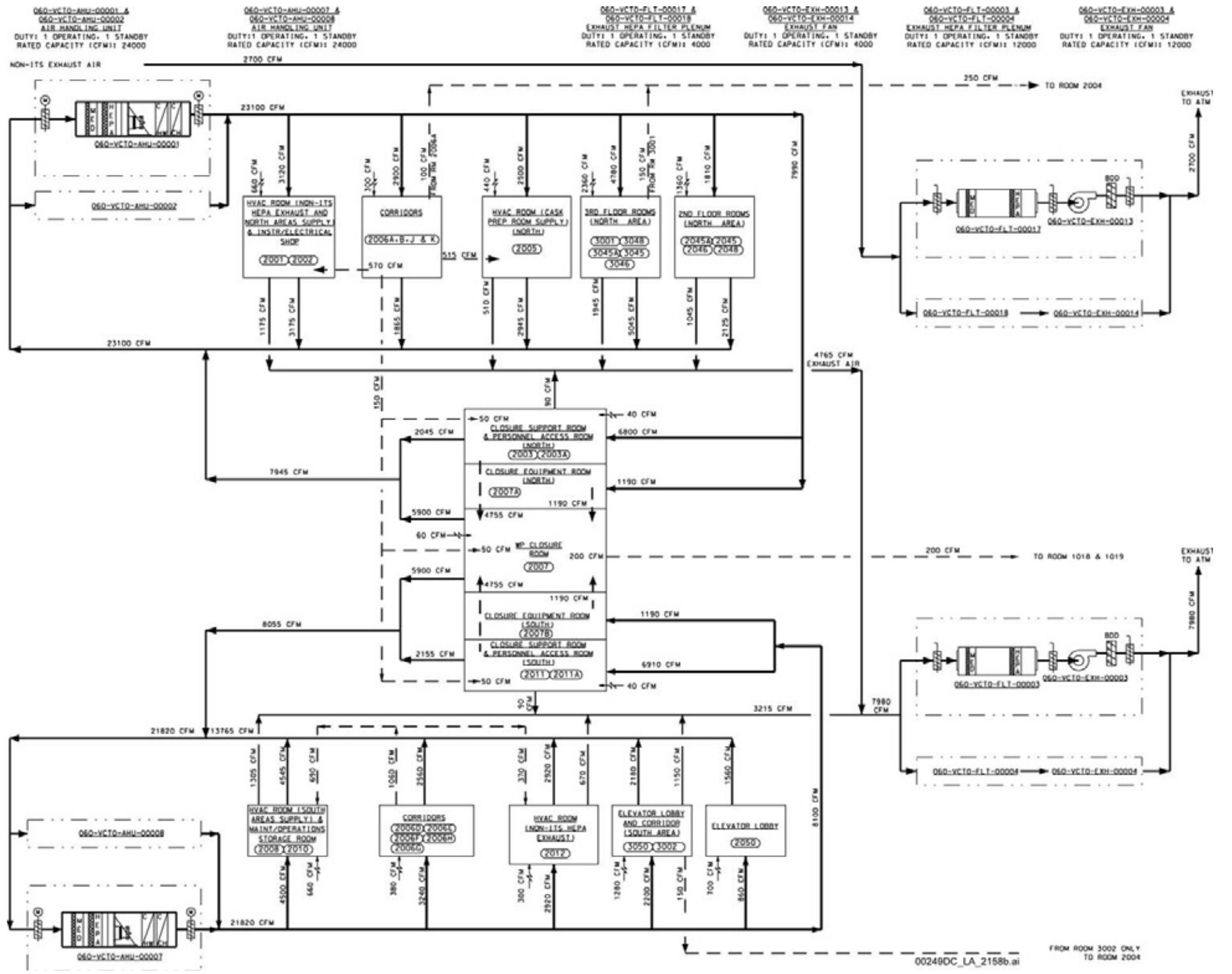
Depletion codes developed by the Naval Nuclear Propulsion Program, in conjunction with the publicly available ORIGEN-S computer program, solve for the change in radionuclide inventories

Clarification/Correction Changes

EXAMPLE 3

LA Change Number 51

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
51	SAR Figure 1.2.4-113	This LA change reflected a revision to a ventilation and instrumentation drawing for the Canister Receipt and Closure Facility (CRCF) exhaust discharge ventilation ductwork arrangement to atmosphere. The first and second floor exhausts discharge independently to the atmosphere instead of through a common exhaust. The LA change did not affect the nuclear safety design bases of the CRCF tertiary confinement exhaust and heating, ventilation, and air conditioning (HVAC) supply subsystem, which is not important to safety (non-ITS).	clarification/ correction
52	SAR 1.5.1.5 SAR 2.2.3 SAR 2.3.7.14	This LA change was a reference change only to reflect a revision to the Monitored Geologic Repository Systems Requirements Document. The analyses and conclusions presented in the LA were not impacted by this revision.	updated reference
53	SAR 1.2 SAR 1.3 SAR 1.4 SAR 1.9	This LA change was a reference citation change only to reflect a revision to the Basis of Design for the TAD Canister-Based Repository Design Concept (BOD) document incorporating clarifications and updates to design details. The analyses and conclusions presented in the LA were not impacted by this revision.	updated reference
59	SAR 1.8.7 SAR Table 1.8-3	This LA change revised three radionuclide inventories for Pressurized Water Reactor (PWR) representative spent nuclear fuel. Based on expert judgment, it was concluded that these changes were not likely to impact the values presented in the LA. Table 7 of the calculation was revised. The only impact on the LA was to correct the tabulated PWR inventories for the three affected radionuclides in SAR Table 1.8-3.	clarification/ correction
61	SAR 2.4.2 SAR Table 2.4-8 SAR Figure 2.4-8	This LA change improved the discussion of the Total System Performance Assessment (TSPA) model validation (e.g., added clarifying information). The TSPA model and associated calculations were not impacted.	clarification/ correction
62	SAR 2.2.1.4.1.3.2.2 SAR Table 2.2-8 SAR 2.3.5.3.3.3 SAR 2.3.5.5 SAR Figure 2.3.5-47 SAR Figure 2.3.5-55 SAR 2.3.6.4.4.1 SAR 2.4.2.3	This LA change incorporated a note acknowledging that the salt separation aspects of localized corrosion initiation on the waste package were not implemented in the localized corrosion initiation analysis. The note was incorporated to acknowledge an error in the model used for the analysis. Correction of this error is not expected to affect the conclusions of the localized corrosion initiation analysis. At the time of production of this LA update (October 2008), the salt separation aspects of localized corrosion initiation on the waste package had not been implemented in the TSPA or supporting analyses. These analyses have since been completed [MDL-WIS-PA-000005 ERD05, CAL-DN0-NU-000002 ERD02, ANL-DS0-NU-000001 ERD03]. The effects of the changes resulting from these analyses are minimal and will be reflected in a future LA update.	design/ analysis evolution
63	SAR 2.3.3.2.4.2.2 SAR Figure 2.3.3-24 SAR Figure 2.3.3-25 SAR Figure 2.3.3-26 SAR 2.3.4.5.1.3.6 SAR Table 2.3.4-6 SAR Table 2.3.4-20	This LA change corrected errors in information primarily associated with rockfall in drifts, and also made several editorial LA changes.	clarification/ correction
64	GI-5 Section 5.2.3.2.2 SAR Figure 2.3.2-9 SAR 2.3.9.2 SAR 2.3.9.3	This LA change corrected errors in information primarily associated with net infiltration (unsaturated zone) mass flow rates and percentages, and also made several editorial LA changes.	clarification/ correction



NOTE: This figure includes no SSCs that are ITS or ITWI. WP = waste package.

Figure 1.2.4-113. CRCF 1 Composite Ventilation Flow Diagram, Tertiary Confinement Non-ITS Exhaust and HVAC Supply Systems

Design/Analysis Evolution Changes

- Refinements to the repository design and analysis description in the LA that are the result of the development of the detailed design
- 18 changes in update

Design/Analysis Evolution Changes

EXAMPLE 1

LA Change Number 10

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
1	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect a revision to a Canister Receipt and Closure Facility (CRCF) Seismic Input Ground Motions calculation. This revision corrected editorial errors in the calculation. The results presented in the LA were not impacted by this revision.	updated reference
2	SAR 1.2.2.1 SAR 1.2.2.5	This LA change was a reference citation change only to reflect revisions to Initial Handling Facility (IHF) mass properties and damping calculations correcting a multiplier error for an equipment dead load. The results presented in the LA were not impacted by this revision.	updated reference
3	SAR 1.1.5.3 SAR Table 1.1-65 SAR Figure 1.1-73	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors. The results presented in the LA were not impacted by this revision.	editorial
4	GI-2 Figure 2-1	This LA change corrected surface aging pad area identifiers on the High-Level Project Schedule figure to be consistent with similar information presented elsewhere in the LA. The schedule itself was revised under LA Change Number 32 and included the correct identifiers.	clarification/ correction
5	SAR 1.3.2.1 SAR 1.3.2.3 SAR 1.3.3.5 SAR Table 1.3.3-5 SAR Table 1.3.3-6	This LA change clarified information associated with the Transport and Emplacement Vehicle (TEV) equipment descriptions and operational steps, and corrected the safety category classification of seismic motion switches to reflect that they are not important to safety (non-ITS). The LA change did not affect the nuclear safety design bases of the TEV.	clarification/ correction
6	SAR 2.2 SAR 2.3.6 SAR 2.3.7	This LA change clarified the cross reference tables and subheadings that map the Safety Analysis Report (SAR) subsections to the NUREG-1804 Acceptance Criteria. The LA change improved the accuracy of the mapping information presented in the LA.	editorial
7	SAR Table 2.4-12	This LA change corrected a typographical error.	editorial
8	GI-5 Figure 5-33 GI-5 Figure 5-35 SAR Figure 2.2-16 SAR Figure 2.3.4-21	This LA change reflected a change to the Yucca Mountain Site Description document correcting editorial errors.	editorial
9	SAR 2.3.8.5	This LA change deleted an incorrect statement describing an illustrative example comparing breakthrough curves for 12 colloidal species. Specifically, the following statement was deleted: "In this illustrative example, each species is modeled as a simple decaying species, with no daughter products tracked."	clarification/ correction
10	SAR Figure 1.4.3-1	This LA change reflected a revision to a Site Fire Water Distribution Piping and Instrumentation diagram implementing an additional underground yard fire water mains connection to the fire water riser valve room in the Initial Handling Facility (IHF). The additional yard firewater mains connection to IHF valve riser room #3 had not been originally shown in the source drawing. The LA change did not affect the nuclear safety design bases of the fire protection system.	design/ analysis evolution
11	SAR Figure 1.2.3-23 SAR Figure 1.2.4-36 SAR Figure 1.2.4-37 SAR Figure 1.2.5-22 SAR Figure 1.2.5-41	This LA change reflected revisions to crane hoist logic diagrams for several handling facilities to correct inconsistencies in terminology and equipment identification numbers. The LA change did not affect the nuclear safety design bases of the crane hoists.	clarification/ correction
12	SAR 1.5.1.4.2	This LA change corrected the number of naval spent nuclear fuel (SNF) types for which thermal analyses were presented in the Naval Nuclear Propulsion Program (NNPP) Technical Support Document (TSD). Specifically, the number of SNF types was changed from four to two.	clarification/ correction

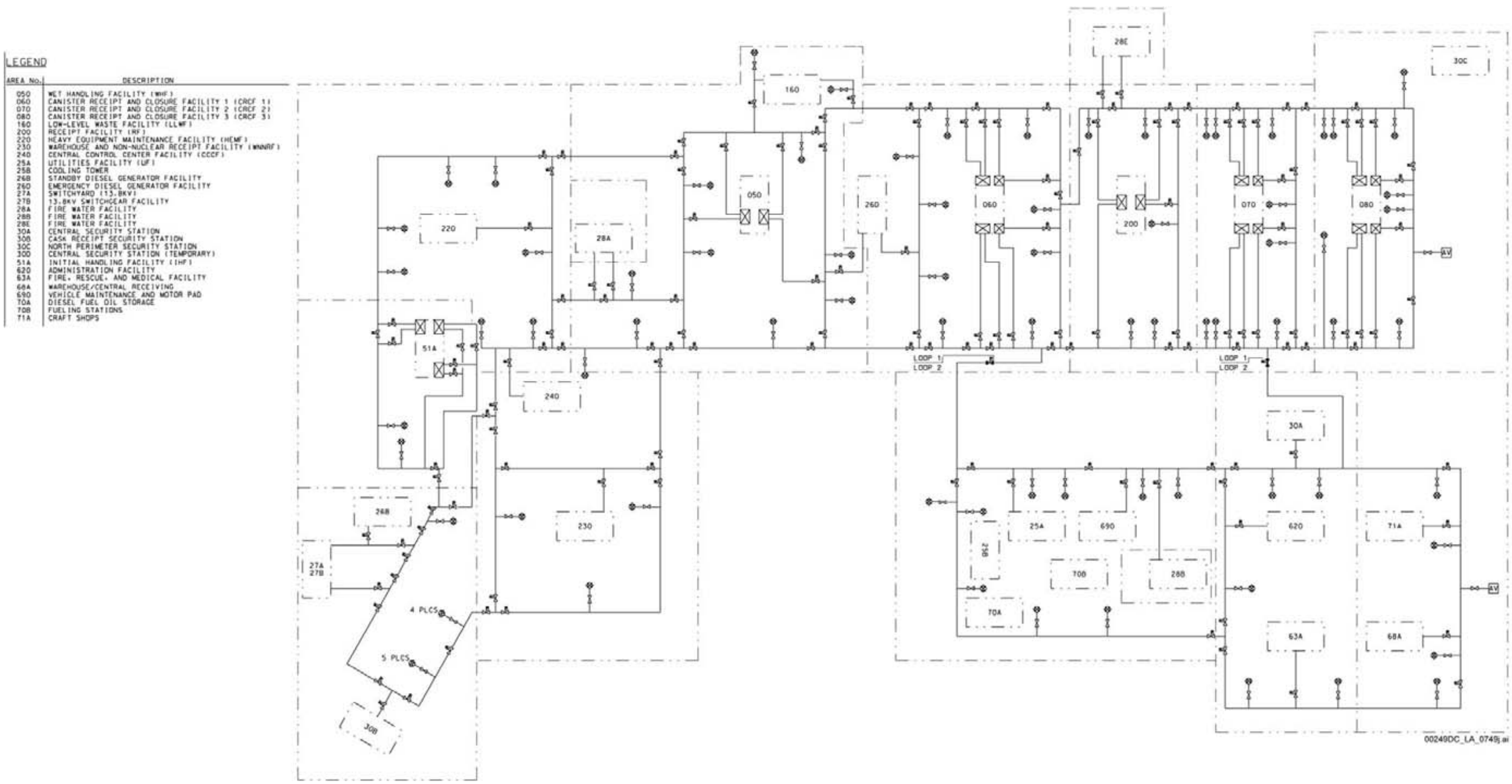


Figure 1.4.3-1. Fire Water Loop 1 and Loop 2 Flow Diagram

Design/Analysis Evolution Changes

EXAMPLE 2

LA Change Number 14/15

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
14	SAR Figure 1.2.4-2 SAR Figure 1.2.4-3 SAR Figure 1.2.4-4 [OUO] Appendix A Figure A-22 Figure A-23 Figure A-24	This LA change reflected revisions to Canister Receipt and Closure Facility (CRCF) general arrangement floor plans related to the location and configuration of several doors that are not important to safety (non-ITS). The door configurations were revised to improve life safety features in the CRCF. The LA change did not affect the nuclear safety design bases of the CRCF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
15	SAR Figure 1.2.6-2 SAR Figure 1.2.6-3 SAR Figure 1.2.6-4 [OUO] Appendix A Figure A-67 Figure A-68 Figure A-69	This LA change reflected revisions to Receipt Facility (RF) general arrangement floor plans related to the location and configuration of several doors that are not important to safety (non-ITS), and the location and configuration of electrical equipment. The drawings were revised to improve life safety features in the RF, and to make the electrical equipment number and sizes consistent with the underlying RF electrical equipment space requirements calculation. The LA change did not affect the nuclear safety design bases of the RF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
16	SAR 1.3.3.4 SAR 1.3.3.7	This LA change reflected revisions to an Access Mains Invert and Rails calculation incorporating the estimated weight information for the Transport and Emplacement Vehicle (TEV). The revision to the calculation did not change any technical information in the LA, only references used to support summary design statements. The LA change did not affect the nuclear safety design bases of the TEV.	design/ analysis evolution
17	SAR Figure 1.3.3-31 SAR Figure 1.3.3-32 SAR Figure 1.3.3-33	This LA change updated figures to reflect design details of the source drawings for Access Main Invert and Rail Sections. The LA change corrected errors in supporting design information presented in the LA figures and improved the consistency with similar information presented elsewhere in the LA. The changes included the details associated with the rail attachment and leveling bolts, the anchor bolt details on the rails was changed including some dimensions and the terminology of the “slice” to “soleplate splice” was changed. The LA change did not affect the nuclear safety design bases of the invert or the rails.	design/ analysis evolution
18	SAR Figure 1.3.3-24 SAR Figure 1.3.3-26	This LA change reflected revisions to an Underground Layout Configuration drawing and Ground Control for Non-Emplacement Drifts calculation updating emplacement area drift intersections and turnout configurations design details. The ground support design concepts for intersections and turnouts did not change. The LA change updated design information presented in the two LA figures, and improved the consistency with drift configurations shown in figures presented elsewhere in the LA.	design/ analysis evolution
20	GI-1 Section 1.1.2.1	This LA change corrected a reference to another LA section and made a clarifying grammatical change.	editorial
21	GI-5 Section 5.2.2.3 SAR 2.3.4.8 SAR Table 2.3.10-10	This LA change corrected typographical errors.	editorial
22	SAR 2.3.4.5.2.1.1	This LA change corrected the identification of a waste package, from naval to DOE.	clarification/ correction
23	SAR Figure 1.2.5-111 SAR Figure 1.2.5-113	This LA change reflected revisions to two Wet Handling Facility Process and Instrumentation diagrams changing duplicated tag numbers to unique numbers. The LA change did not affect the technical content of the LA.	editorial

Table 1 - LA Revision 1 Update – Change Summary by LA Page Number			
LA Section	**LA Page Number**	**LA Subsection Revised**	**Description of Change**
	2.4-370, 2.4-371	Table 2.4-8	Added “and Independent Mathematical Models” to the column heading. [See LA change number 61]
	2.4-405	Table 2.4-12	Changed “SEEPRM” to SEEPPRM” in last column.
	2.4-424	Figure 2.4-8	Deleted “amp” from between two left boxes on figure. [See LA change number 61]
SAR 4.0	4-30	4.2.2.2	Deleted text related to the specificity of a seismic monitoring station in the ESF. [See LA change number 65]
	4-41	4.3	Updated reference citation.
SAR 5.4	5.4-1	5.4	Deleted information stating that Acceptance Criterion 2 of NUREG-1804, Section 2.5.4.3, was not applicable (first change bar). Added Acceptance Criterion 2 of Section 2.5.4.3 for SAR Section 5.4.1 in table (second change bar). [See LA change number 46]
	5.4-3	5.4.1	Added AC 2 to the NUREG-1804 Section 2.5.4.3 references. [See LA change number 46]
	5.4-6	5.4.1	Modified PVHA discussion. [See LA change number 46]
	5.4-13	5.4.4	Updated reference citations.
SAR 5.7	5.7-19	5.7.7.2.2.3.5	Changed “Technical Support Center Manager” to “Technical Support Center Coordinator” in the title and twice in the paragraph).

Table 1 - LA Revision 1 Update – Appendix A Change Summary by LA Page Number (Note: actual SAR Appendix A pages are marked as “Official Use Only” and are to be withheld from public release)			
LA Section	**LA Page Number**	**LA Subsection Revised**	**Description of Change**
SAR Appendix A	A-3	Figure A-1 (SAR Figure 1.2.3-2)	Changed the general arrangement drawing to show the motor control center and load center in room 1023 resized and reconfigured, air compressors were relocated from room 1023 to outside east of room 1023, and location and quantities of electrical equipment in room 1002. [See LA change number 25]
	A-23	Figure A-11 (SAR Figure 1.2.3-12)	Removed redundant "Initial Handling Facility" wording in the figure title.
	A-27	Figure A-13 (SAR Figure 1.2.3-14)	Changed the general arrangement drawing to show revised configuration of MCC/LC in room 1023 and to show relocation of air compressors outside east of room 1023. [See LA change number 25]
	A-47	Figure A-22 (SAR Figure 1.2.4-2)	Changed the general arrangement drawing to add or change the configuration of doors in rooms 1036B, 1037, 1045, 1047, 1049, 1207, 1209, and 1212, and extend the wall labyrinth in rooms 1215 and 1216. Also changed “highe” to “high” in the note.
	A-49	Figure A-23 (SAR Figure 1.2.4-3)	Changed the general arrangement drawing to add or change the configuration of doors in rooms 1049, 2004 (top and bottom left), 2012 (bottom left), 2038, 2041, 2045, 2046, and 2048.
	A-51	Figure A-24 (SAR Figure 1.2.4-4)	Changed the general arrangement drawing to add or change the configuration of doors in rooms 1047, 1049, 3045, and 3046.
	A-53	Figure A-25 (SAR Figure 1.2.4-5)	Changed “conditiong” to “conditioning” in the note.

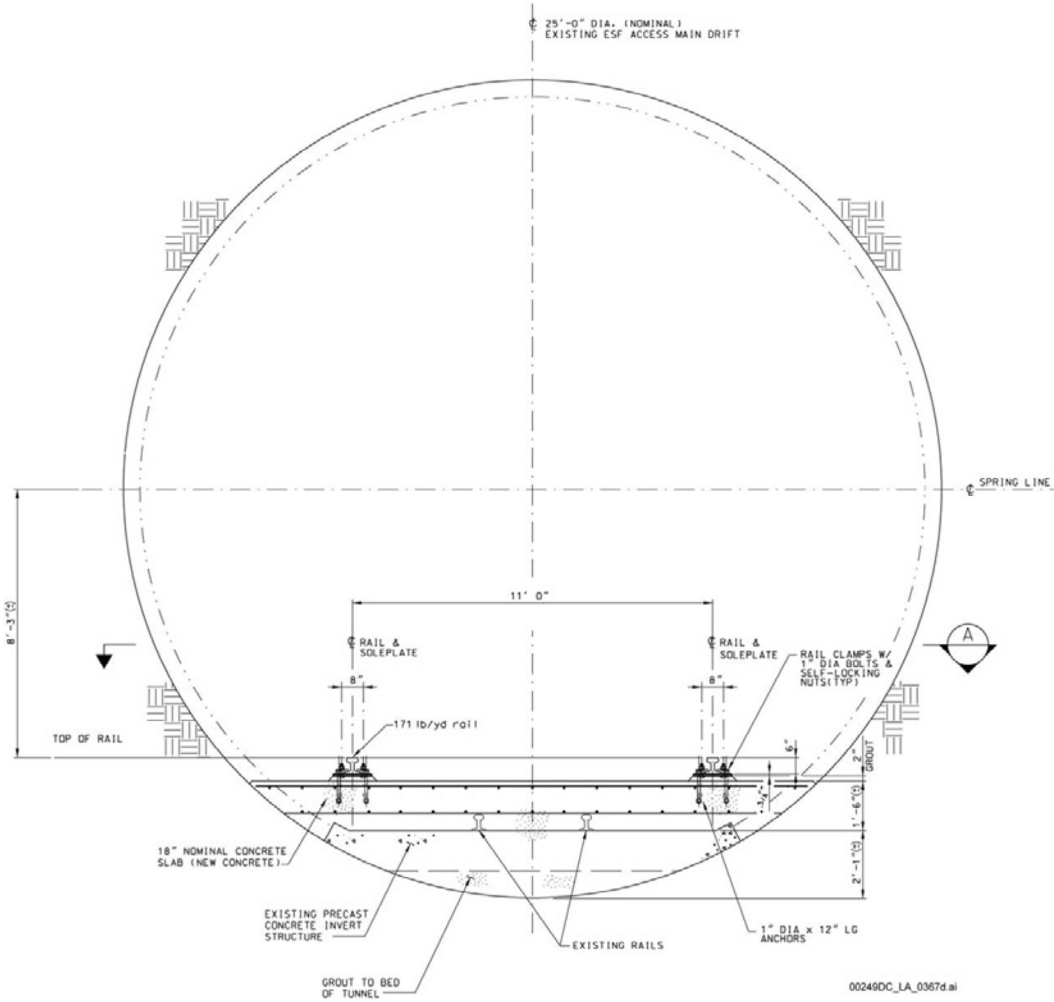
Table 1 - LA Revision 1 Update – Appendix A Change Summary by LA Page Number (Note: actual SAR Appendix A pages are marked as "Official Use Only" and are to be withheld from public release)			
LA Section	**LA Page Number**	**LA Subsection Revised**	**Description of Change**
	A-87	Figure A-39 (SAR Figure 1.2.5-2)	Changed the general arrangement drawings to show the relocation and reconfiguration of electrical and ventilation equipment and doorways in rooms 1002, 1003, 1017, and 1019, and relocated and reconfigured air compressors near rooms 1017 and 1046. Changed "particualte" to "particulate" in the note. [See LA change number 26]
	A-91	Figure A-41 (SAR Figure 1.2.5-4)	Changed the general arrangement drawing to add a lighting panel in room 2001. Inadvertently removed pointer arrow from label to battery rack in room 2001 (will be corrected in next LA update). [See LA change number 26]
	A-129	Figure A-57 (SAR Figure 1.2.5-34, Sheet 2 of 2)	Changed "cansiter" to "canister" in the note.
	A-133	Figure A-58 (SAR Figure 1.2.5-35, Sheet 2 of 2)	Changed "cansiter" to "canister" in the note.
	A-155	Figure A-67 (SAR Figure 1.2.6-2)	Changed the general arrangement drawing to show revised and added electrical equipment in rooms 1005, 1018, and 1020, and the removal and reconfiguration of doors in rooms 1028 and 1220. Also, changed "HEPA=high level radioactive waste" to "HEPA=high efficiency particulate air" in the note.
	A-157	Figure A-68 (SAR Figure 1.2.6-3)	Changed the general arrangement drawing to show revised electrical equipment in room 2012, and the reconfiguration of doors in rooms 2002E, 2006, 2010, and 2012
	A-159	Figures A-69 (SAR Figures 1.2.6-4)	Changed the general arrangement drawing to show the reconfiguration of doors in rooms 3001, 3026, and 3029.
	A-161	Figure A-70 (SAR Figure 1.2.6-5)	Changed "low=level" to "low-level" in the note.

Design/Analysis Evolution Changes

EXAMPLE 3

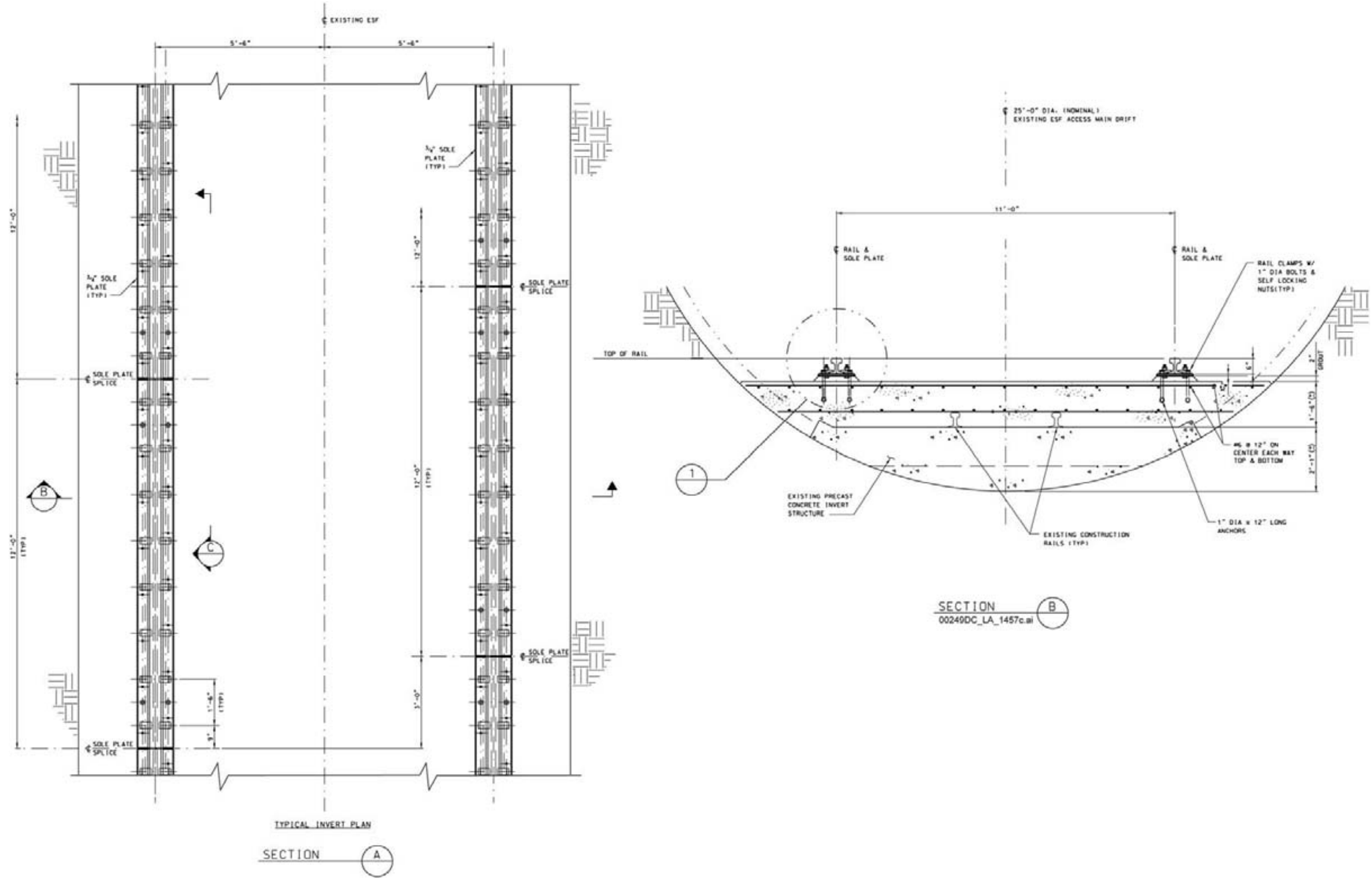
LA Change Number 17

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
14	SAR Figure 1.2.4-2 SAR Figure 1.2.4-3 SAR Figure 1.2.4-4 [OUO] Appendix A Figure A-22 Figure A-23 Figure A-24	This LA change reflected revisions to Canister Receipt and Closure Facility (CRCF) general arrangement floor plans related to the location and configuration of several doors that are not important to safety (non-ITS). The door configurations were revised to improve life safety features in the CRCF. The LA change did not affect the nuclear safety design bases of the CRCF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
15	SAR Figure 1.2.6-2 SAR Figure 1.2.6-3 SAR Figure 1.2.6-4 [OUO] Appendix A Figure A-67 Figure A-68 Figure A-69	This LA change reflected revisions to Receipt Facility (RF) general arrangement floor plans related to the location and configuration of several doors that are not important to safety (non-ITS), and the location and configuration of electrical equipment. The drawings were revised to improve life safety features in the RF, and to make the electrical equipment number and sizes consistent with the underlying RF electrical equipment space requirements calculation. The LA change did not affect the nuclear safety design bases of the RF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
16	SAR 1.3.3.4 SAR 1.3.3.7	This LA change reflected revisions to an Access Mains Invert and Rails calculation incorporating the estimated weight information for the Transport and Emplacement Vehicle (TEV). The revision to the calculation did not change any technical information in the LA, only references used to support summary design statements. The LA change did not affect the nuclear safety design bases of the TEV.	design/ analysis evolution
17	SAR Figure 1.3.3-31 SAR Figure 1.3.3-32 SAR Figure 1.3.3-33	This LA change updated figures to reflect design details of the source drawings for Access Main Invert and Rail Sections. The LA change corrected errors in supporting design information presented in the LA figures and improved the consistency with similar information presented elsewhere in the LA. The changes included the details associated with the rail attachment and leveling bolts, the anchor bolt details on the rails was changed including some dimensions and the terminology of the "slice" to "soleplate splice" was changed. The LA change did not affect the nuclear safety design bases of the invert or the rails.	design/ analysis evolution
18	SAR Figure 1.3.3-24 SAR Figure 1.3.3-26	This LA change reflected revisions to an Underground Layout Configuration drawing and Ground Control for Non-Emplacement Drifts calculation updating emplacement area drift intersections and turnout configurations design details. The ground support design concepts for intersections and turnouts did not change. The LA change updated design information presented in the two LA figures, and improved the consistency with drift configurations shown in figures presented elsewhere in the LA.	design/ analysis evolution
20	GI-1 Section 1.1.2.1	This LA change corrected a reference to another LA section and made a clarifying grammatical change.	editorial
21	GI-5 Section 5.2.2.3 SAR 2.3.4.8 SAR Table 2.3.10-10	This LA change corrected typographical errors.	editorial
22	SAR 2.3.4.5.2.1.1	This LA change corrected the identification of a waste package, from naval to DOE.	clarification/ correction
23	SAR Figure 1.2.5-111 SAR Figure 1.2.5-113	This LA change reflected revisions to two Wet Handling Facility Process and Instrumentation diagrams changing duplicated tag numbers to unique numbers. The LA change did not affect the technical content of the LA.	editorial



NOTE: Section A is shown in Figure 1.3.3-32.

Figure 1.3.3-31. Access Main Invert and Rail Elevation



NOTE: Section C and Detail 1 are shown in Figure 1.3.3-33.

Figure 1.3.3-32. Access Main Invert and Rail Sections

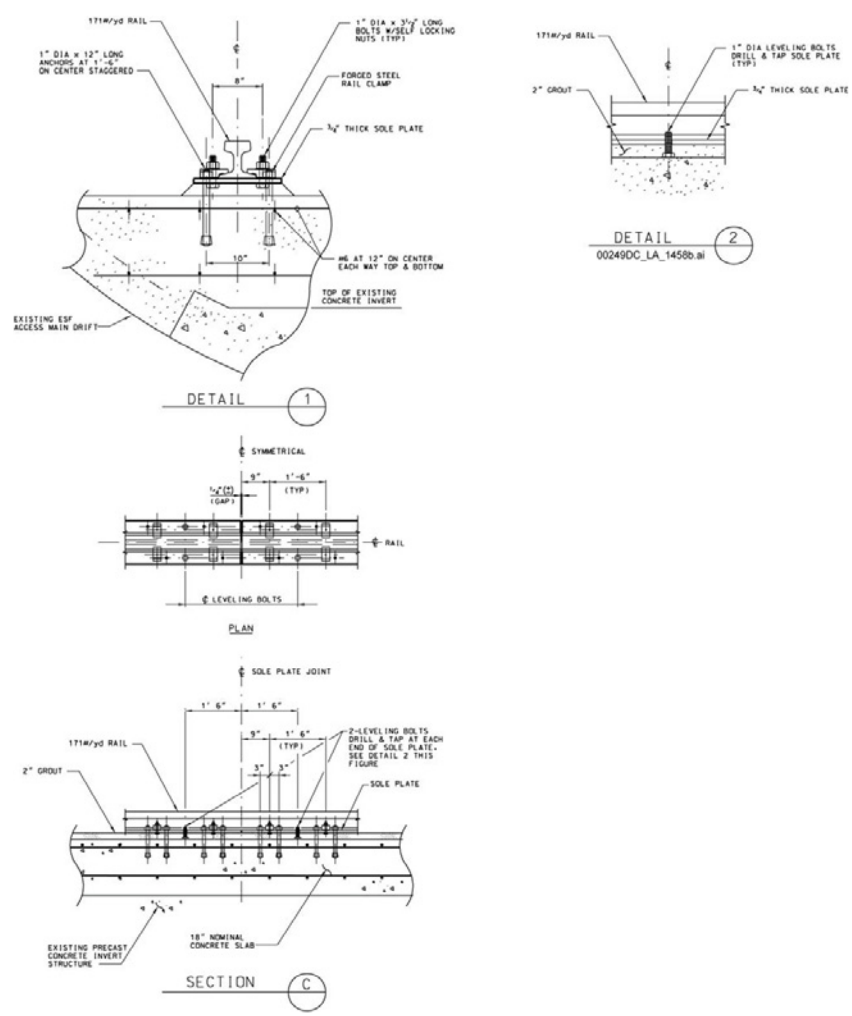


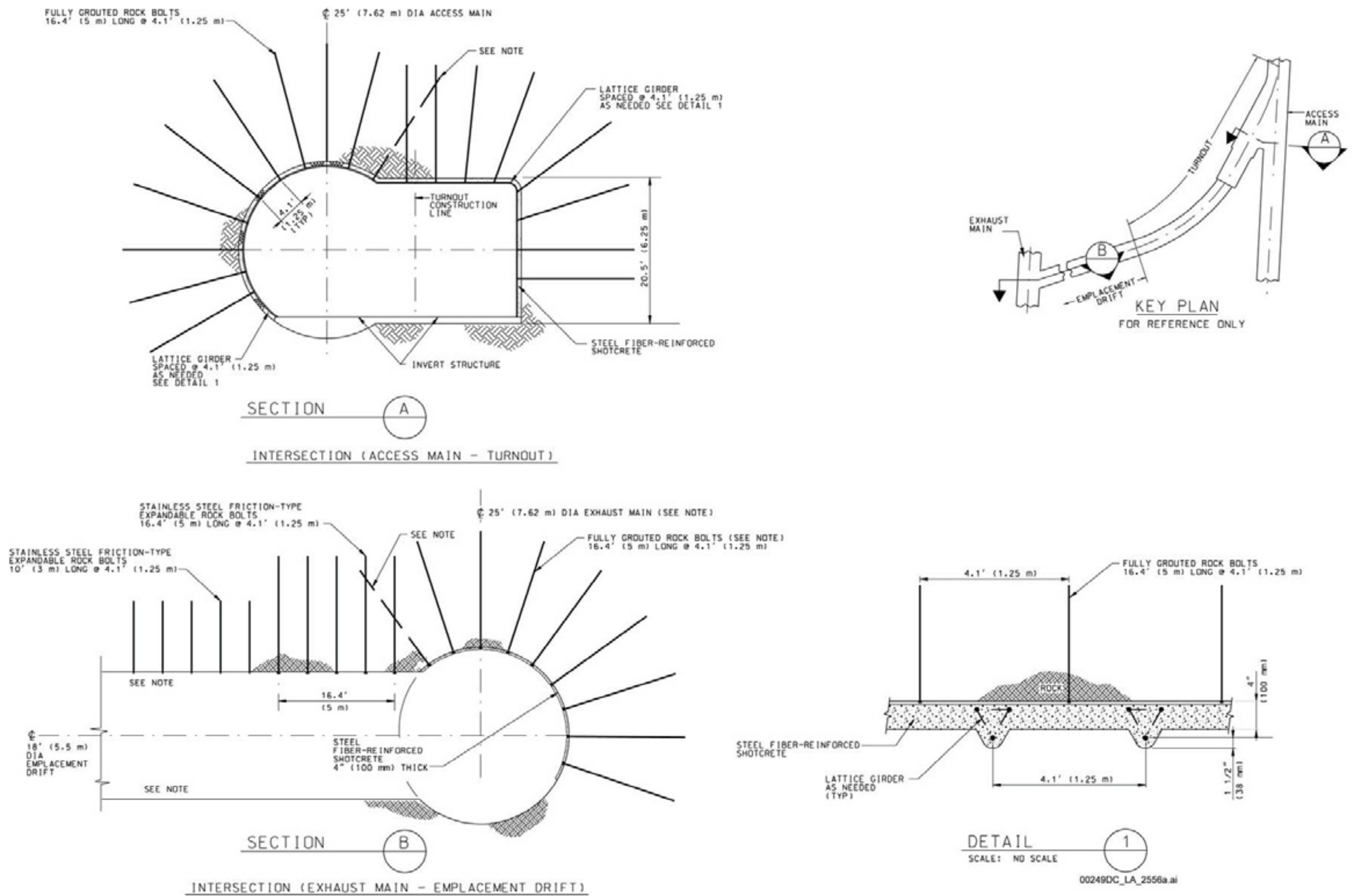
Figure 1.3.3-33. Access Main Invert and Rail Sections and Details

Design/Analysis Evolution Changes

EXAMPLE 4

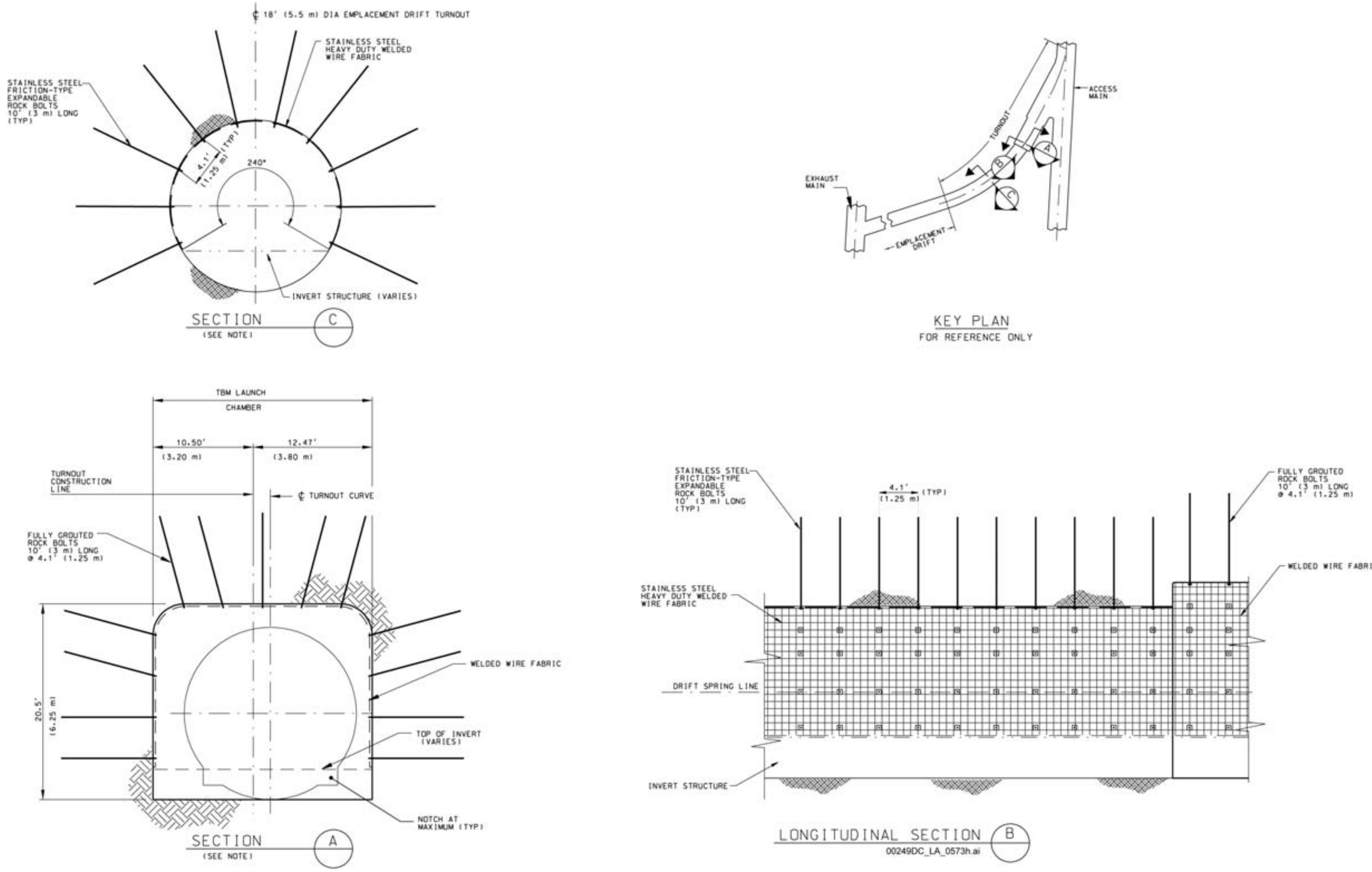
LA Change Number 18

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
14	SAR Figure 1.2.4-2 SAR Figure 1.2.4-3 SAR Figure 1.2.4-4 [OUO] Appendix A Figure A-22 Figure A-23 Figure A-24	This LA change reflected revisions to Canister Receipt and Closure Facility (CRCF) general arrangement floor plans related to the location and configuration of several doors that are not important to safety (non-ITS). The door configurations were revised to improve life safety features in the CRCF. The LA change did not affect the nuclear safety design bases of the CRCF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
15	SAR Figure 1.2.6-2 SAR Figure 1.2.6-3 SAR Figure 1.2.6-4 [OUO] Appendix A Figure A-67 Figure A-68 Figure A-69	This LA change reflected revisions to Receipt Facility (RF) general arrangement floor plans related to the location and configuration of several doors that are not important to safety (non-ITS), and the location and configuration of electrical equipment. The drawings were revised to improve life safety features in the RF, and to make the electrical equipment number and sizes consistent with the underlying RF electrical equipment space requirements calculation. The LA change did not affect the nuclear safety design bases of the RF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
16	SAR 1.3.3.4 SAR 1.3.3.7	This LA change reflected revisions to an Access Mains Invert and Rails calculation incorporating the estimated weight information for the Transport and Emplacement Vehicle (TEV). The revision to the calculation did not change any technical information in the LA, only references used to support summary design statements. The LA change did not affect the nuclear safety design bases of the TEV.	design/ analysis evolution
17	SAR Figure 1.3.3-31 SAR Figure 1.3.3-32 SAR Figure 1.3.3-33	This LA change updated figures to reflect design details of the source drawings for Access Main Invert and Rail Sections. The LA change corrected errors in supporting design information presented in the LA figures and improved the consistency with similar information presented elsewhere in the LA. The changes included the details associated with the rail attachment and leveling bolts, the anchor bolt details on the rails was changed including some dimensions and the terminology of the "slice" to "soleplate splice" was changed. The LA change did not affect the nuclear safety design bases of the invert or the rails.	design/ analysis evolution
18	SAR Figure 1.3.3-24 SAR Figure 1.3.3-26	This LA change reflected revisions to an Underground Layout Configuration drawing and Ground Control for Non-Emplacement Drifts calculation updating emplacement area drift intersections and turnout configurations design details. The ground support design concepts for intersections and turnouts did not change. The LA change updated design information presented in the two LA figures, and improved the consistency with drift configurations shown in figures presented elsewhere in the LA.	design/ analysis evolution
20	GI-1 Section 1.1.2.1	This LA change corrected a reference to another LA section and made a clarifying grammatical change.	editorial
21	GI-5 Section 5.2.2.3 SAR 2.3.4.8 SAR Table 2.3.10-10	This LA change corrected typographical errors.	editorial
22	SAR 2.3.4.5.2.1.1	This LA change corrected the identification of a waste package, from naval to DOE.	clarification/ correction
23	SAR Figure 1.2.5-111 SAR Figure 1.2.5-113	This LA change reflected revisions to two Wet Handling Facility Process and Instrumentation diagrams changing duplicated tag numbers to unique numbers. The LA change did not affect the technical content of the LA.	editorial



NOTE: Rock bolt shown with dashed line is out of plane.
For intersections in Panel 1, same ground support system with shorter bolts will be used because exhaust main is of smaller diameter (5.5 m).
Perforated stainless steel sheets and invert structure in emplacement drift are not shown in this figure.
Typical ground support shown is applicable for both lithophysal and nonlithophysal rocks.

Figure 1.3.3-24. Typical Ground Support for Intersections



NOTE: Section A is typical for tunnel boring machine launch chamber. Section C is typical for tunnel boring machine-excavated turnout. Typical ground support shown is applicable for both lithophysal and nonlithophysal rocks.

Figure 1.3.3-26. Ground Support System in Turnouts

Design/Analysis Evolution Changes

EXAMPLE 5

LA Change Number 24

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
24	SAR 1.2.4.4.2 SAR Figures 1.2.4-101, -102 1.2.4-103, -105 1.2.4-106, -107 1.2.4-108, -109 1.2.4-110, -111 SAR Figures 1.2.5-84, -85 1.2.5-88, -89 1.2.5-90, -91 SAR 1.2.8.3.1.2 SAR Figure 1.2.8-29 SAR Figure 1.2.8-34	This LA change reflected revisions to (18) logic diagrams and ventilation and instrumentation diagrams for several facilities to present the automatic signals for heating, ventilation, and air conditioning (HVAC) equipment. The change added an important to safety (ITS) interlock for automatic starting of standby fans upon an operating fan trip. The change was implemented to ensure availability of high-efficiency particulate air (HEPA) filtration of facility exhausts. The LA change updated design details without affecting the nuclear safety design bases and the procedural safety controls presented in the LA.	design/ analysis evolution
25	SAR Figure 1.2.3-2 SAR Figure 1.2.3-14 [OUO] Appendix A Figure A-1 Figure A-13	This LA change reflected revisions to Initial Handling Facility (IHF) general arrangement drawings. A Motor Control Center (MCC) and Load Center (LC) were resized and reconfigured, electrical equipment quantities and locations were changed, and air compressors were relocated. The drawings were revised to make them consistent with the IHF electrical space requirements calculation (for revised electrical quantities) and the general purpose and instrument air calculation (relocation of air compressors). The LA change updated design details without affecting the nuclear safety design bases of the IHF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
26	SAR Figure 1.2.5-2 SAR Figure 1.2.5-4 [OUO] Appendix A Figure A-39 Figure A-41	This LA change reflected revisions to Wet Handling Facility (WHF) general arrangement drawings. Air compressors, electrical equipment, and doorways were relocated, and an electrical lighting panel was added. The drawings were revised to make them consistent with the WHF electrical space requirements calculation (for revised electrical quantities) and the general purpose and instrument air calculation (relocation of air compressors). The LA change updated design details without affecting the nuclear safety design bases of the WHF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
27	SAR 1.3.1.1 SAR Table 1.9-8	This LA change corrected the criterion for naval waste package standoff distance from a mapped fault, and updated the referenced source document. Specifically, the phrase "mapped faults with vertical displacements greater than 6.5 ft (2 m)" was changed to "any mapped fault which is determined to have a cumulative offset of at least 6.6 ft (2 m)".	clarification/ correction
28	SAR Table 1.3.4-3 SAR Figure 1.3.4-15	This LA change corrected drip shield dimensions to be consistent with the source drawing. Changes due to rounding and unit conversion in the SAR Table were also included. The LA changes did not affect the nuclear safety design bases for the drip shields.	clarification/ correction
29	SAR Table 1.3.6-3	This LA change corrected a structure, system, and component (SSC) name in an LA table.	editorial
30	SAR 1.6.3.4.3	This LA change corrected the placement of a reference citation within a paragraph to make it consistent with the information presented in the source document.	editorial

Normal control of the ITS exhaust fan is through an adjustable speed drive receiving start/stop commands from the DCMIS as initiated by an operator from the facility operations room. Once started, the fan speed is controlled by the adjustable speed drive via an analog input from the DCMIS based on the differential pressure at the main exhaust duct. In the event that the analog input signal to the adjustable speed drive is lost or corrupted, the adjustable speed drive reverts to a predetermined set point that resides within the adjustable speed drive. The operating fan will shut down and the standby fan will automatically start via a hardwired logic interlock, if any of the following occurs: (1) low differential pressure across the operating fan coincident with low air flow (fan failure); (2) high differential pressure across the HEPA filter train; (3) low differential pressure across the HEPA filter train; (4) fan trip.

ITS Fan Coil Units during Normal Operation—ITS direct expansion fan coil units with remote ITS air-cooled condensing units are utilized to maintain space temperatures in each of the Train A or Train B ITS electrical and battery rooms. For added reliability, two fan coil units, each with an independent condensing unit, are provided for each ITS electrical and battery room. One fan coil unit is normally sufficient to maintain the unoccupied temperature criteria. However, the second fan coil unit starts when either of the following occurs: (1) low differential pressure across the operating fan coincident with low air flow (fan coil unit failure); (2) fan trip. If the operating fan coil unit cannot maintain the required room temperature (especially when there is an extended personnel presence and the room temperature has to be lowered for personnel comfort) then the standby unit is manually started. The exhaust fans for the battery room are interlocked with the fan coil units, preventing both fan coil units from operating unless both battery room exhaust fans are running (to preclude pressurizing the battery rooms). The operation of the refrigerant compressors in the condensing units is controlled by the signal from the temperature sensor/transmitter located in the electrical room or the battery room (whichever is higher) as determined by a signal selector. The battery room exhaust operates continuously with sufficient volume changes per hour to preclude accumulation of hydrogen. A redundant, explosion-proof exhaust HEPA assembly is provided for each battery room with the standby unit starting automatically when either of the following occurs: (1) low differential pressure across the operating fan coincident with low air flow (fan failure); (2) fan trip.

ITS Confinement Areas Air Supply Subsystems during Normal Operation—During normal operation, the temperature of the following ITS confinement areas is controlled as noted below:

- The cask preparation room is maintained at a maximum of 85°F by means of a dedicated recirculating air handling unit located in the second floor. Part of this air is cascaded to the cask unloading rooms to maintain a temperature that does not exceed 100°F in these rooms.

- The waste package loadout room is maintained at a maximum of 85°F by means of dedicated recirculating air handling units located inside the room. Part of this air is cascaded to the waste package positioning rooms and then to the cask unloading rooms to maintain these rooms at a temperature that does not exceed 100°F.

- The canister staging areas are supplied with conditioned air from the first level (south) recirculating air handling unit to maintain these areas at a temperature that does not exceed 100°F.

The CRCF exhaust effluent is monitored for radioactivity downstream of the exhaust fans. Upon detection of high effluent radiation, a high radiation alarm is annunciated locally, at the facility operations room, and in the Central Control Center. As the HEPA filter loading increases, the pressure drop across the filters increases. To compensate for this increase in differential pressure, the fan adjustable speed drive is modulated accordingly. If the pressure drop across the HEPA filters reaches the high set point, a high differential pressure condition is alarmed.

Non-ITS Nonconfinement HVAC System during Normal Operation—The non-ITS air handling units with economizers supply conditioned air to nonconfinement areas. The return air from the room is either recirculated or exhausted depending on the temperature of the outside air relative to the inside room temperature.

Failure of the operating unit, as determined by the differential pressure switch across the fan, shuts down the operating fan and starts the standby fan automatically.

Motor speed and differential pressure across the fans are continuously monitored. In the event low differential pressure across the operating fan and/or low speed are detected, the fan automatically shuts down, closes its associated inlet and discharge dampers, and fan failure is annunciated. This will also trigger the automatic start of the standby fan.

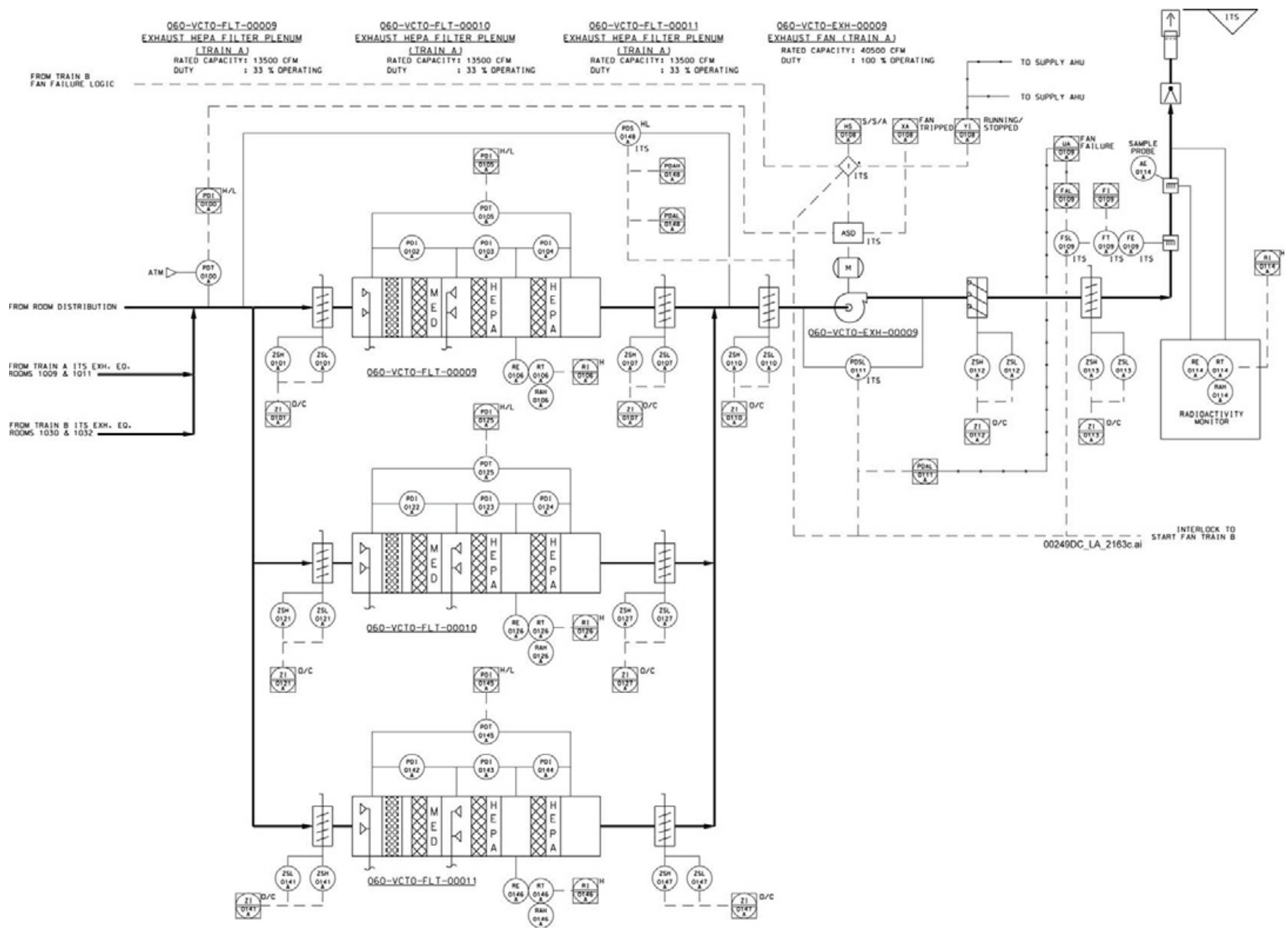
Fan coil units with chilled water for cooling and hot water for heating operate to maintain space temperatures in the various vestibules. Locally mounted thermostats provide the cooling or heating signals to modulate the control valves of the cooling or heating coils to maintain temperature set points. The standby fan coil unit starts upon failure of an operating fan coil unit. These units are non-ITS.

Confinement Operation with Loss of Normal Power—In the event of loss of offsite power, the non-ITS equipment shuts down or moves to the fail position and the ITS exhaust fans stop running. During the period of time while the ITS diesel generators start and the ITS exhaust fans are loaded on the ITS electrical busses, the ITS confinement areas are effectively isolated and there is negligible driving force to disperse potential radioactive material. Once the ITS exhaust fans are running, filtration of exhaust air can continue.

Shutdown—Fans continuously run until manually stopped. Automatic shutdown occurs when low differential pressure across the operating fan coincident with low air flow is detected, and fan or fan coil unit failure is annunciated. The shutdown event automatically starts the standby fan or fan coil unit.

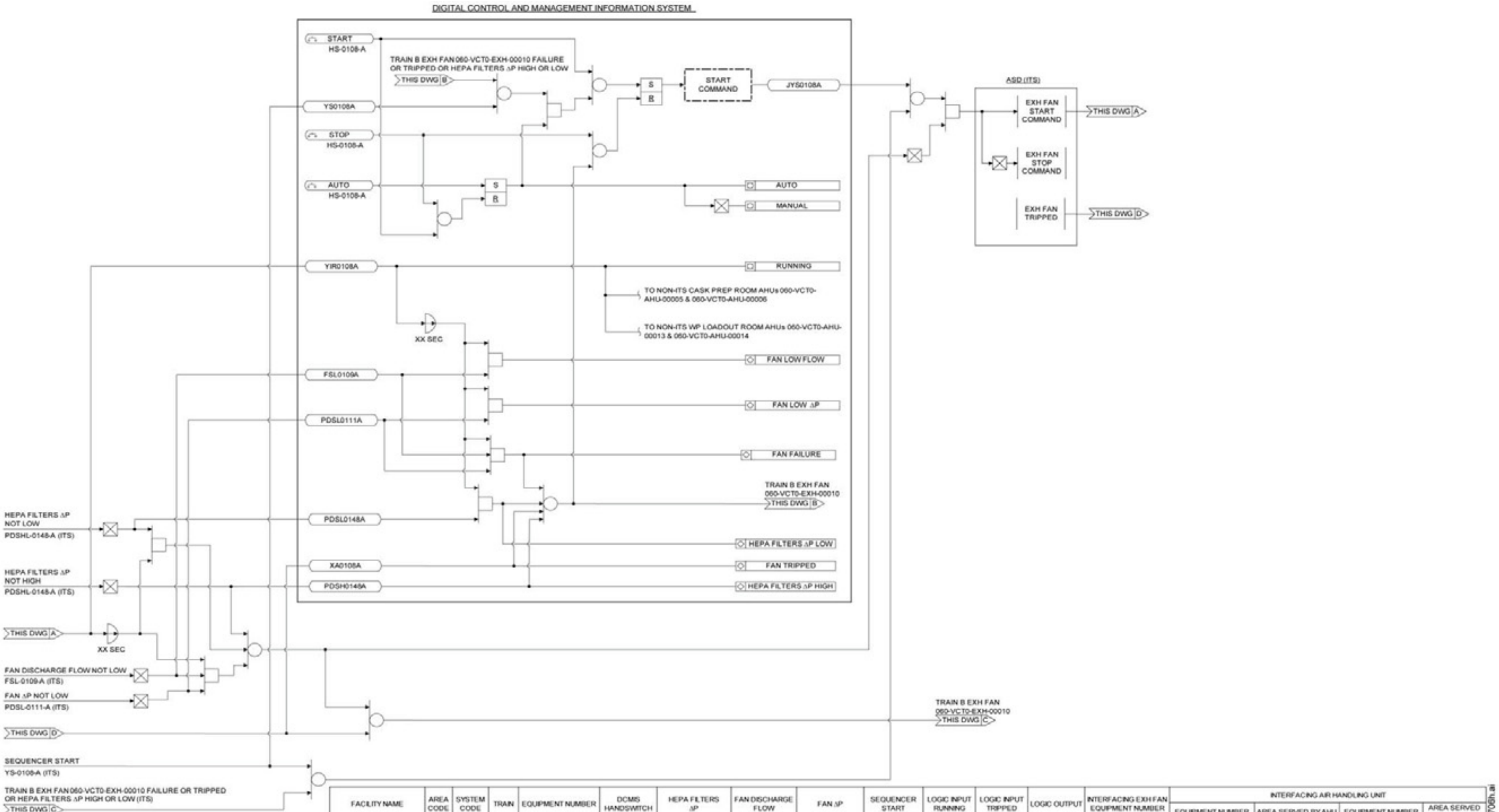
The inlet and discharge dampers automatically close on shutdown of their associated operating supply fan.

For planned maintenance and shutdown, the ventilation systems are taken out of service by shutting down the supply fans first before the exhaust fans. During normal operation, the shutdown sequence is the same as for removal from service.



NOTE: Interlocks are provided to shut down the operating fan and automatically start the standby fan if any of the following occur: (1) low differential pressure across the operating fan coincidental with low air flow; (2) high differential pressure across the HEPA filter train; (3) low differential pressure across the HEPA filter train; (4) fan trip. The HVAC equipment, ductwork, and dampers shown on this figure are ITS. ASD = adjustable speed drive.

Figure 1.2.4-101. CRCF 1 ITS Confinement Areas HEPA Exhaust System—Train A Ventilation and Instrumentation Diagram



FACILITY NAME	AREA CODE	SYSTEM CODE	TRAIN	EQUIPMENT NUMBER	DCMIS HANDSWITCH	HEPA FILTERS ΔP	FAN DISCHARGE FLOW	FAN ΔP	SEQUENCER START	LOGIC INPUT RUNNING	LOGIC INPUT TRIPPED	LOGIC OUTPUT	INTERFACING EXH FAN EQUIPMENT NUMBER	INTERFACING AIR HANDLING UNIT			
														EQUIPMENT NUMBER	AREA SERVED BY AHU	EQUIPMENT NUMBER	AREA SERVED BY AHU
CANISTER RECEIPT AND CLOSURE FACILITY	060	VCT0	A	060-VCT0-EXH-00009	HS-0108-A	PDSHL-0148-A (ITS)	FSL-0109-A (ITS)	PDSL-0111-A (ITS)	YS-0108-A (ITS)	YIR0108A	XA0108A	JYS0108A	060-VCT0-EXH-00010	060-VCT0-AHU-00005 060-VCT0-AHU-00006	CASK PREPARATION ROOM	060-VCT0-AHU-00013 060-VCT0-AHU-00014	WP LOADOUT ROOM
			B	060-VCT0-EXH-00010	HS-0108-B	PDSHL-0148-B (ITS)	FSL-0109-B (ITS)	PDSL-0111-B (ITS)	YS-0108-B (ITS)	YIR0108B	XA0108B	JYS0108B	060-VCT0-EXH-00009				
WET HANDLING FACILITY	050	VC00	A	050-VCS0-EXH-00001	HS-0108-A	PDSHL-0148-A (ITS)	FSL-0109-A (ITS)	PDSL-0111-A (ITS)	YS-0108-A (ITS)	YIR0108A	XA0108A	JYS0108A	050-VCS0-EXH-00002	050-VC00-AHU-00001 050-VC00-AHU-00002 050-VC00-AHU-00003	ITS CONFINEMENT AREAS	N/A	N/A
			B	050-VCS0-EXH-00002	HS-0108-B	PDSHL-0148-B (ITS)	FSL-0109-B (ITS)	PDSL-0111-B (ITS)	YS-0108-B (ITS)	YIR0108B	XA0108B	JYS0108B	050-VCS0-EXH-00001				

NOTE: ITS controls are identified by the letters "ITS" after the instrumentation tag number or control device identifier. The DCMIS is non-ITS and non-ITWI. Instrumentation tag numbers are prefixed by "XXX-YYYY-" and software tag numbers are prefixed by "XXXYYYY," where XXX is the area code and YYYY is the system code. AHU = air handling unit; ASD = adjustable speed drive; ΔP = differential pressure; WP = waste package.

Figure 1.2.4-103. CRCF and WHF ITS Confinement Areas HEPA Exhaust Fan (Trains A and B) Digital Logic Diagram

Design/Analysis Evolution Changes

EXAMPLE 6

LA Change Number 25/26

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
24	SAR 1.2.4.4.2 SAR Figures 1.2.4-101, -102 1.2.4-103, -105 1.2.4-106, -107 1.2.4-108, -109 1.2.4-110, -111 SAR Figures 1.2.5-84, -85 1.2.5-88, -89 1.2.5-90, -91 SAR 1.2.8.3.1.2 SAR Figure 1.2.8-29 SAR Figure 1.2.8-34	This LA change reflected revisions to (18) logic diagrams and ventilation and instrumentation diagrams for several facilities to present the automatic signals for heating, ventilation, and air conditioning (HVAC) equipment. The change added an important to safety (ITS) interlock for automatic starting of standby fans upon an operating fan trip. The change was implemented to ensure availability of high-efficiency particulate air (HEPA) filtration of facility exhausts. The LA change updated design details without affecting the nuclear safety design bases and the procedural safety controls presented in the LA.	design/ analysis evolution
25	SAR Figure 1.2.3-2 SAR Figure 1.2.3-14 [OUO] Appendix A Figure A-1 Figure A-13	This LA change reflected revisions to Initial Handling Facility (IHF) general arrangement drawings. A Motor Control Center (MCC) and Load Center (LC) were resized and reconfigured, electrical equipment quantities and locations were changed, and air compressors were relocated. The drawings were revised to make them consistent with the IHF electrical space requirements calculation (for revised electrical quantities) and the general purpose and instrument air calculation (relocation of air compressors). The LA change updated design details without affecting the nuclear safety design bases of the IHF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
26	SAR Figure 1.2.5-2 SAR Figure 1.2.5-4 [OUO] Appendix A Figure A-39 Figure A-41	This LA change reflected revisions to Wet Handling Facility (WHF) general arrangement drawings. Air compressors, electrical equipment, and doorways were relocated, and an electrical lighting panel was added. The drawings were revised to make them consistent with the WHF electrical space requirements calculation (for revised electrical quantities) and the general purpose and instrument air calculation (relocation of air compressors). The LA change updated design details without affecting the nuclear safety design bases of the WHF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution
27	SAR 1.3.1.1 SAR Table 1.9-8	This LA change corrected the criterion for naval waste package standoff distance from a mapped fault, and updated the referenced source document. Specifically, the phrase "mapped faults with vertical displacements greater than 6.5 ft (2 m)" was changed to "any mapped fault which is determined to have a cumulative offset of at least 6.6 ft (2 m)".	clarification/ correction
28	SAR Table 1.3.4-3 SAR Figure 1.3.4-15	This LA change corrected drip shield dimensions to be consistent with the source drawing. Changes due to rounding and unit conversion in the SAR Table were also included. The LA changes did not affect the nuclear safety design bases for the drip shields.	clarification/ correction
29	SAR Table 1.3.6-3	This LA change corrected a structure, system, and component (SSC) name in an LA table.	editorial
30	SAR 1.6.3.4.3	This LA change corrected the placement of a reference citation within a paragraph to make it consistent with the information presented in the source document.	editorial

Table 1 - LA Revision 1 Update – Change Summary by LA Page Number			
LA Section	**LA Page Number**	**LA Subsection Revised**	**Description of Change**
	2.4-370, 2.4-371	Table 2.4-8	Added “and Independent Mathematical Models” to the column heading. [See LA change number 61]
	2.4-405	Table 2.4-12	Changed “SEEPRM” to SEEPPRM” in last column.
	2.4-424	Figure 2.4-8	Deleted “amp” from between two left boxes on figure. [See LA change number 61]
SAR 4.0	4-30	4.2.2.2	Deleted text related to the specificity of a seismic monitoring station in the ESF. [See LA change number 65]
	4-41	4.3	Updated reference citation.
SAR 5.4	5.4-1	5.4	Deleted information stating that Acceptance Criterion 2 of NUREG-1804, Section 2.5.4.3, was not applicable (first change bar). Added Acceptance Criterion 2 of Section 2.5.4.3 for SAR Section 5.4.1 in table (second change bar). [See LA change number 46]
	5.4-3	5.4.1	Added AC 2 to the NUREG-1804 Section 2.5.4.3 references. [See LA change number 46]
	5.4-6	5.4.1	Modified PVHA discussion. [See LA change number 46]
	5.4-13	5.4.4	Updated reference citations.
SAR 5.7	5.7-19	5.7.7.2.2.3.5	Changed “Technical Support Center Manager” to “Technical Support Center Coordinator” in the title and twice in the paragraph).

Table 1 - LA Revision 1 Update – Appendix A Change Summary by LA Page Number (Note: actual SAR Appendix A pages are marked as “Official Use Only” and are to be withheld from public release)			
LA Section	**LA Page Number**	**LA Subsection Revised**	**Description of Change**
SAR Appendix A	A-3	Figure A-1 (SAR Figure 1.2.3-2)	Changed the general arrangement drawing to show the motor control center and load center in room 1023 resized and reconfigured, air compressors were relocated from room 1023 to outside east of room 1023, and location and quantities of electrical equipment in room 1002. [See LA change number 25]
	A-23	Figure A-11 (SAR Figure 1.2.3-12)	Removed redundant "Initial Handling Facility" wording in the figure title.
	A-27	Figure A-13 (SAR Figure 1.2.3-14)	Changed the general arrangement drawing to show revised configuration of MCC/LC in room 1023 and to show relocation of air compressors outside east of room 1023. [See LA change number 25]
	A-47	Figure A-22 (SAR Figure 1.2.4-2)	Changed the general arrangement drawing to add or change the configuration of doors in rooms 1036B, 1037, 1045, 1047, 1049, 1207, 1209, and 1212, and extend the wall labyrinth in rooms 1215 and 1216. Also changed “highe” to “high” in the note.
	A-49	Figure A-23 (SAR Figure 1.2.4-3)	Changed the general arrangement drawing to add or change the configuration of doors in rooms 1049, 2004 (top and bottom left), 2012 (bottom left), 2038, 2041, 2045, 2046, and 2048.
	A-51	Figure A-24 (SAR Figure 1.2.4-4)	Changed the general arrangement drawing to add or change the configuration of doors in rooms 1047, 1049, 3045, and 3046.
	A-53	Figure A-25 (SAR Figure 1.2.4-5)	Changed “conditiong” to “conditioning” in the note.

Table 1 - LA Revision 1 Update – Appendix A Change Summary by LA Page Number (Note: actual SAR Appendix A pages are marked as "Official Use Only" and are to be withheld from public release)			
LA Section	**LA Page Number**	**LA Subsection Revised**	**Description of Change**
	A-87	Figure A-39 (SAR Figure 1.2.5-2)	Changed the general arrangement drawings to show the relocation and reconfiguration of electrical and ventilation equipment and doorways in rooms 1002, 1003, 1017, and 1019, and relocated and reconfigured air compressors near rooms 1017 and 1046. Changed "particualte" to "particulate" in the note. [See LA change number 26]
	A-91	Figure A-41 (SAR Figure 1.2.5-4)	Changed the general arrangement drawing to add a lighting panel in room 2001. Inadvertently removed pointer arrow from label to battery rack in room 2001 (will be corrected in next LA update). [See LA change number 26]
	A-129	Figure A-57 (SAR Figure 1.2.5-34, Sheet 2 of 2)	Changed "cansiter" to "canister" in the note.
	A-133	Figure A-58 (SAR Figure 1.2.5-35, Sheet 2 of 2)	Changed "cansiter" to "canister" in the note.
	A-155	Figure A-67 (SAR Figure 1.2.6-2)	Changed the general arrangement drawing to show revised and added electrical equipment in rooms 1005, 1018, and 1020, and the removal and reconfiguration of doors in rooms 1028 and 1220. Also, changed "HEPA=high level radioactive waste" to "HEPA=high efficiency particulate air" in the note.
	A-157	Figure A-68 (SAR Figure 1.2.6-3)	Changed the general arrangement drawing to show revised electrical equipment in room 2012, and the reconfiguration of doors in rooms 2002E, 2006, 2010, and 2012
	A-159	Figures A-69 (SAR Figures 1.2.6-4)	Changed the general arrangement drawing to show the reconfiguration of doors in rooms 3001, 3026, and 3029.
	A-161	Figure A-70 (SAR Figure 1.2.6-5)	Changed "low=level" to "low-level" in the note.

Design/Analysis Evolution Changes

EXAMPLE 7

LA Change Number 31/60

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	LA Sections Revised	Description of Change	LA Change Type**
31/60	SAR 1.2.2.3.6 SAR 1.2.3.1.4 SAR 1.2.3.4 SAR 1.3.1.2.5 SAR 1.3.3.5.1.1 SAR 1.3.5.3 SAR 1.5.1.4.1.2.5.3 SAR 1.5.1.4.1.2.6.2 SAR 1.5.1.5 SAR Table 1.5.1-31 SAR 1.9.5 SAR Table 1.9-8	LA Change Number 31: This LA change modified the thermal limit for naval spent nuclear fuel (SNF) canister in the Initial Handling Facility (IHF) and transported in the Transport and Emplacement Vehicle (TEV), due to replacing a one-dimensional (1-D) thermal analysis with a more sophisticated three-dimensional (3-D) thermal analysis. As a result, the requirement for processing naval canisters was changed to limit the canister outside surface temperature to 400 degrees F with a processing time of 30 days. To ensure that these limits are met, preclosure handling requirements were added to the LA and operating conditions were modified to establish a temperature limit with an imposed administrative maximum handling duration. Since these limits exist to ensure naval SNF cladding integrity to support postclosure performance, a Postclosure Parameter limit on temperature and handling was added. This addition tot he LA supports the existing postclosure nuclear safety design basis of the naval SNF canister. These limits are not relied upon to limit of prevent potential preclosure event sequences or mitigate their consequences. LA Change Number 60: To support the changes in the IHF and TEV emplacement described above, this LA change replaced the description of the 1-D thermal analysis with a description of on-going 3-D thermal modeling for naval SNF canister handling in the IHF and the TEV. The new 3-D analysis will demonstrate that the thermal limit of 400 degrees F is met during handling operations in the IHF and emplacement. The safety bases for the Total System Performance Assessment (TSPA) and Preclosure Safety Analysis (PCSA) for naval SNF remain unchanged.	design/ analysis evolution
32	GI-1 Figure 1-7 GI-2 Figure 2-1 SAR 1.1.2.3 SAR 1.5.1 SAR Table 1.5.1-29 SAR 1.8.1.3.1 SAR Table 1.8-5 SAR 2.3.7.4.1.2	This LA change updated the Repository Operations Summary Timeline and the High-Level Project Schedule figures and other related LA information (e.g., population projections) to be consistent with revised schedule milestones (e.g., waste receipt) based on the initial LA submittal date and current estimated project funding. SAR Section 1.5.1 acknowledges that some SAR analyses are indexed to specific dates in order to calculate thermal and radioactive decay and identifies that in such cases re-analysis will be performed as necessary. Revision was made to the OCRWM Integrated Scope, Cost, and Schedule Baseline Summary document which resulted in changing milestone dates referenced throughout the LA.	design/ analysis evolution
33	SAR 2.3.4.4 SAR 2.3.4.5 SAR 2.3.4.9 SAR Table 2.3.4-51	This LA change corrected drip shield dimensions to be consistent with the source document. The errors were primarily due to rounding and unit conversion. Several related reference citations were updated, and editorial changes were also made. The LA change did not affect the nuclear safety design bases for the drip shield.	clarification/ correction
34	SAR 1.5.1.5	This LA change consisted of reference changes only to reflect administrative changes to a Canister Receipt and Closure Facility (CRCF) shielding calculation.	updated reference
35	SAR 1.4.4.2 SAR Table 1.4.4-2 SAR Figure 1.4.4-4	This LA change reflected revisions to the service gases to the Canister Receipt and Closure Facility (CRCF). The argon storage was changed from a liquid to a gaseous arrangement, and the service gas 30-day consumption rates for the various handling facilities were updated. The LA change did not affect the nuclear safety design bases of the CRCF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution

The ITS exhaust ducts are made of welded stainless steel in accordance with ASTM A 240/A 240M-06c, Type 304. The ducts are designed for concurrent dead weight, seismic load, and pressure load. The duct supports are evaluated for dead weight and seismic loads. The HVAC duct supports are constructed of bolted assemblies of cold-formed sections in accordance with “Specification for Design of Cold-Formed Steel Structural Members” (AISI 1993). The supports can also be made of structural steel members in accordance with the AISC *Manual of Steel Construction, Allowable Stress Design* (AISC 1997).

The ITS duct supports are attached to concrete or structural steel members of the building by bolted connections or welding. The supports are spaced at intervals as required by engineering evaluation.

Thermal Design—Thermal performance of various waste forms and waste containers in the handling facilities is evaluated. These evaluations of commercial SNF, DOE SNF, and HLW demonstrate that thermal performance of the waste forms, canisters, and waste packages is acceptable, given various heat loads during normal and off-normal HVAC conditions. These evaluations assess normal operating conditions (normal HVAC operations) and off-normal conditions, considering reduced heat removal (ventilation provided by ITS SSCs only) or no forced convective heat removal, as appropriate.

To bound the thermal evaluation, the thermally limiting room in the surface facilities is used. For commercial SNF, DOE SNF, and HLW, the CRCF cask unloading room is determined to be the thermally limiting room, primarily because waste containers are assumed to also be present in rooms adjacent to the cask unloading room.

The solution methods include the use of one-, two-, and three-dimensional analyses using ANSYS Version 8.0 and FLUENT Version 6.0.12 to determine the temperatures in the waste packages and canisters for several cases with varying heat loads, boundary conditions, and waste container types.

For ventilation cases representing the normal operating condition (normal HVAC operations) and the off-normal condition (ventilation provided by ITS SSCs only), transient and steady-state, computational fluid dynamics, numerical solutions are performed using FLUENT Version 6.0.12. For those cases where ANSYS Version 8 is used for these analyses, bounding conditions are applied to account for convection effects. ICEM computational fluid dynamics Version 5.0 is used to generate the meshes input into FLUENT Version 6.0.12. For ventilation cases representing the off-normal condition with no forced air flow (loss of ventilation), either a 30-day transient or a steady state, finite element, numerical solution is performed using ANSYS Version 8.0.

The waste package and the waste package transfer trolley shielded enclosure are represented together as a single, homogeneous, heat-generating cylinder in three-dimensional analyses to determine boundary conditions for the one- and two-dimensional analyses for commercial SNF, DOE SNF, and HLW in the CRCF. To determine the temperatures of the waste package and canister(s) contained therein, finite element numerical solutions are performed in ANSYS Version 8.0, using one- or two-dimensional representations of the waste package inside the trolley shielded enclosure.

Of the transportation casks that contain canistered commercial SNF, the thermally limiting cask is identified through a comparison on the bases of the maximum thermal power each cask is licensed to contain, as well as the resistance to heat dissipation across each cask wall. The thermal resistance of the cask wall is determined with a one-dimensional steady-state conduction heat transfer representation. The cask is conservatively modeled using unloading conditions, with the cask in a vertical orientation with its lid removed, and air present in the gap between the canister and cask. The cask is allowed to achieve thermal equilibrium, with active cooling from ventilation in the room.

The peak cladding temperature of a commercial SNF assembly from the TS-125 transportation cask SAR (Sisley 2002) is used as a reference. The difference in canister shell temperature between the transportation conditions and unloading conditions is conservatively evaluated using a one-dimensional steady-state conduction-only calculation through the cask solid layers. For the gap between the canister and cask, a conductive and radiative heat transfer calculation is included. The difference between canister shell temperature and peak cladding temperature is conservatively modeled to be the same in both transportation and unloading conditions. The resulting peak cladding temperature during unloading conditions is compared to the established limit of 400°C for commercial SNF.

The off-normal condition for cask unloading is defined as a failure of the ventilation system, resulting in the absence of forced convection cooling. The CRCF evaluation contains a calculation of surface temperatures in the CRCF cask unloading room, in the normal condition scenario with ventilation, as well as in the off-normal scenario of a loss of ventilation for 30 days. The difference in these temperatures is applied to the cask outer surface temperature in the licensing scenario. When recalculated with the same simplified cask representation, a new canister shell temperature for the off-normal condition is approximated. Applying the difference of normal and off-normal canister shell temperatures to the peak cladding temperature yields the peak cladding temperature for the off-normal condition. The estimated peak fuel assembly cladding temperature in the off-normal condition is then compared to the established limit of 570°C.

Analyses discussed in Section 1.5.1.4 of the Naval Nuclear Propulsion Program Technical Support Document demonstrate that naval SNF structural integrity is maintained when the naval SNF canister external surface temperature remains below 400°F during a maximum 30-day period starting with detensioning of the transportation cask closure in the IHF and ending with waste package emplacement. The transport and emplacement vehicle performance requirements are described in Section 1.3.3.

An evaluation that includes multiple axial peaks representing the potential loading of naval SNF canisters (both short and long configurations) is being performed to demonstrate that the naval SNF canister surface temperatures remain within acceptable limits while in the IHF. Scenarios represent the naval SNF canister in a transportation cask, starting with the detensioning of the closure on the naval transportation cask and continuing after the closure lid is removed, in a waste package, and in a waste package in a transfer trolley. The scenarios are being evaluated for loss-of-ventilation conditions for the entire permitted duration of naval SNF canister handling in the IHF. The duration for receipt (starting with detensioning of the transportation cask closure), handling, and emplacement operations of a naval SNF canister is limited to a maximum of 30 days. During this time, the temperature of the surface of the naval SNF canister may not exceed 400°F(DOE 2008, Section 10.3.2.2). Generally accepted, steady state and transient three dimensional heat transfer equations are being used to determine the naval SNF canister surface temperatures for the scenarios

During normal operations, the HVAC system operates to dissipate the heat gain from various sources to maintain the required room temperature for proper operation of equipment and personnel comfort. Air handling units and fan coil units are utilized to supply conditioned air to various areas and the supply air is then returned and/or exhausted. The air handling units and fan coil units are sized to dissipate the heat generated from lights, solar loads, and operating mechanical and electrical equipment, as well as the decay heat generated from waste forms that are present in the area served by the HVAC system.

A three-dimensional analysis with multiple axial peaks representing the potential loading of naval SNF canisters (both short and long configurations), is being performed. This analysis will be used to determine that the IHF design supports operational limits for the naval SNF canister remaining below 400°F during handling in the IHF. The thermal evaluation of naval SNF canister surface temperatures in the IHF will assess scenarios that represent the naval SNF canister in the naval transportation cask starting with the detensioning of the closure on the naval transportation cask and continuing after the closure lid is removed, in a waste package, and in a waste package in a waste package transfer trolley. The scenarios will be evaluated under loss-of-ventilation conditions for a 30-day duration of naval SNF canister handling in the IHF. The thermal evaluation of the naval SNF described in Section 1.5.1.4 of the Naval Nuclear Propulsion Program Technical Support Document shows that the naval SNF cladding performs acceptably as long as the operational constraints stated in Section 1.2.2.3.6 for the naval SNF canister are met.

The maximum thermal power for a HLW canister is 720 watts. HLW glass temperature, under both normal and off-normal conditions (no heat removal for 30 days), does not exceed 400°C.

1.2.3.4.1 System Description

The IHF HVAC system includes the following subsystems:

- HVAC supply and exhaust subsystems serving the tertiary confinement areas.
- HVAC supply subsystems serving the nonconfinement areas.

Each subsystem is provided with the necessary distribution ductwork and accessories, electrical power, and instrumentation and controls to operate, control, and monitor the system functions.

HVAC Supply and Exhaust Subsystems Serving the Tertiary Confinement Areas—The tertiary confinement areas are served by recirculating air handling units and exhaust HEPA filter assemblies. The recirculating air handling units serve the north and upper level confinement areas and several fan coil units (with standby capability) are utilized to supplement the air handling units. The fan coil units are located in the electrical equipment areas, the waste package loadout area, and the cask preparation areas.

There is no supply of outside air to the confinement area. The IHF relies on infiltration for makeup air for the confinement areas. Sufficient air is exhausted from the confinement areas by the exhaust subsystem to maintain appropriate confinement. The exhaust air is passed through a single stage of HEPA filters prior to discharging to the atmosphere. The exhaust is monitored for radioactivity downstream of the exhaust fans. Upon detection of high exhaust air radiation, a high radiation alarm ability of the materials and configuration of the shielded enclosure to accommodate and dissipate the anticipated heat loads associated with waste package transport. The thermal analysis for the shielded enclosure is based on a TAD waste package with a bounding heat load of near 22 kW. The shielded enclosure design for the TEV includes a combination of materials to provide for structural integrity and gamma and neutron radiation protection. The composite layer of the shielded enclosure that has the lowest thermal conductivity is the neutron shielding layer with an effective thermal conductivity of 6.5 W/m-K for the NS-4-FR neutron shield structure. This is a ten-fold increase in the thermal conductivity of NS-4-FR alone, but may be achieved in final design using a metallic grid structure for thermal shunts in the neutron shield material. The value (6.5 W/m-K) is reasonable when compared to the effective thermal conductivity (7.89 W/m-K) of the neutron shield structure in the NAC-UMS shipping cask (NAC 2002, Sections 1.2.1.2.1, 3.3.2, 3.4.1.1.1, and Table 3.2-1). The thermal studies for the TEV shielded enclosure used steady-state conditions, direct solar heating, no convective cooling, and a bounding ambient temperature of 50°C, thus showing thermal compliance for an indefinite period should the TEV become immobilized during the waste package transport process (BSC 2007m, Section 6.4).

Thermal conditions have been calculated for TAD and 5-DHLW/DOE SNF waste packages in the TEV (BSC 2007m, Section 7). The peak cladding temperatures for 18 and 25 kW TAD waste packages in the TEV were shown to be 356°C and 437°C, respectively (BSC 2007m, Table 35). Linear extrapolation shows the peak cladding temperature is 400°C for a 21.8 kW TAD waste package. These temperatures are valid for both normal and off-normal events, and considering the conservative assumptions used, it is concluded that cladding temperatures for TAD waste packages in the TEV will not exceed the 400°C/570°C normal/off-normal cladding temperature limits (BSC 2008f, Sections 11.2.2.4 and 11.2.2.18).

The design of the TEV and its operations will be controlled to limit the naval SNF canister surface temperature to less than 400°F during normal and off-normal conditions. The operational controls will be included in the naval SNF handling procedures discussed in Section 1.2.3.4.

The peak high-level radioactive waste (HLW) vitrified glass and DOE SNF cladding temperatures for a 7.1 kW 5-DHLW/DOE SNF waste package in the TEV were shown to be 288°C and 339°C, respectively (BSC 2007m, Attachments IV and V). The maximum thermal power for a HLW canister is 720 watts (BSC 2008g, Table 24), so the maximum thermal power for a HLW and DOE SNF waste package is less than 6 kW (BSC 2008h, Section 6.2.1.6). These peak temperatures for both normal and off-normal events are below their corresponding limits of 400°C for HLW vitrified glass and 350°C for DOE SNF cladding (BSC 2008f, Section 11.2.2.18).

1.3.3.5.1.2 Subsurface Rail and Invert System

Information regarding the subsurface rail and invert designs as they relate to waste package transportation is presented in Section 1.3.3.4. Commercial quality installation for the rail and invert system is sufficient to minimize derailment potential. The subsurface rail and invert system is classified as non-ITS (Table 1.9-1).

The design basis condition for criticality safety during the preclosure period is that naval SNF canisters remain unmoderated. Naval SNF remains subcritical when unmoderated as shown by meeting the above design criterion (Section 1.14 of the Naval Nuclear Propulsion Program Technical Support Document). Because breach of naval SNF canister is beyond Category 2 (Section 1.7.5.1), moderating materials cannot enter the naval SNF canister, and moderation of naval SNF is beyond Category 2. Therefore, naval SNF remains subcritical for the preclosure period. Additional information on configurations analyzed for preclosure nuclear safety is provided in Section 1.5.1.4.1.2.6.3.

For the postclosure period, the criticality safety design criterion is that the probability of criticality involving naval SNF will not cause the total probability of criticality to exceed the FEPs screening criterion (1 chance in 10,000 for the first 10,000 years) for all waste forms. The design basis conditions evaluated to determine the probability of criticality are the configurations that result from the postclosure structural and thermal analysis, which include consideration of the factors that could affect the reactivity of naval SNF in the postclosure environment (e.g., human errors in emplacing naval waste packages and degradation of naval SNF). Section 2.2.1.4.1 of the Naval Nuclear Propulsion Program Technical Support Document describes the process by which the criticality potential for naval SNF emplaced in the repository during the postclosure period is assessed.

1.5.1.4.1.2.5.3 Thermal Design Criteria and Design Bases

The principal thermal design criterion for naval SNF for disposal is that naval SNF cladding will not fail due to thermal damage before permanent repository closure. This condition is imposed for the preclosure period as a condition for permanent disposal; because breach of the naval SNF canister is beyond Category 2, naval SNF cladding integrity is not necessary to retain radionuclides and meet preclosure safety criteria. The Naval Nuclear Propulsion Program calculates cladding temperature using naval SNF canister surface temperatures as boundary conditions. The IHF design and emplacement operational controls will be established to ensure that the analyzed naval SNF canister surface temperature will remain below 400°F from the time of detensioning the transportation cask closure until completion of emplacement of the naval SNF waste package in the emplacement drift, and the overall duration of these handling operations shall not exceed 30 days (DOE 2008d, Section 10.3.2.2). This temperature limit does not apply in the unlikely event of a fire to which a naval SNF canister may be exposed (BSC 2008j, Section 3.2.1.9.4). Analyses of performance of a naval SNF canister during a fire event are discussed in Sections 1.5.1.4.1.2.6.1 and 1.7.2.3.3.1 and Table 1.7-7.

For preclosure analysis of naval SNF in the emplacement drifts, the naval SNF canister external surface temperature is calculated using the worst-case heat flux profiles for naval SNF and repository thermal boundary conditions (BSC 2006).

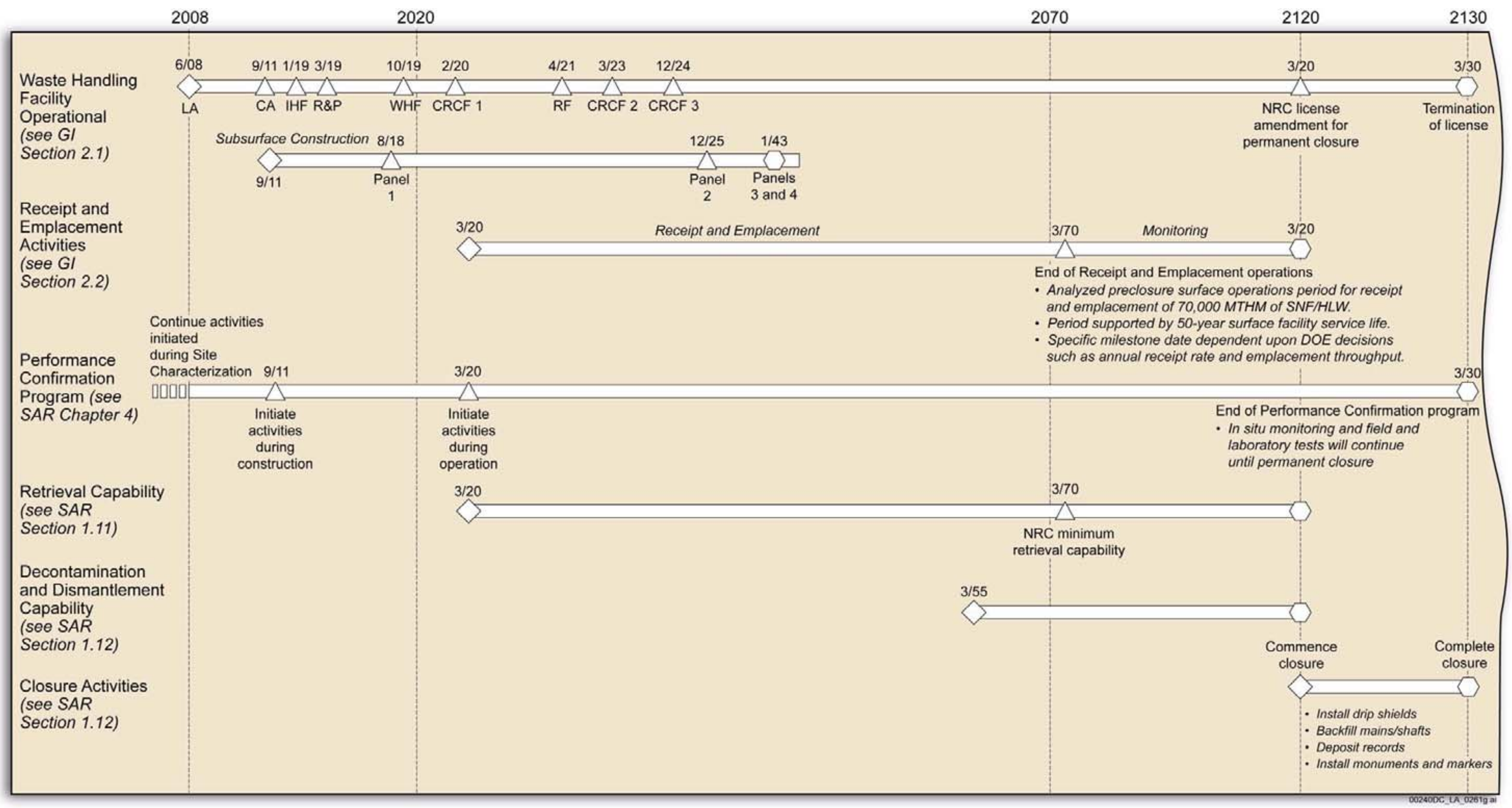
The principal thermal design criterion and the associated design bases for naval SNF for the postclosure period is that naval SNF cladding will not fail due to thermal damage for the early failure scenario class, drip shield early failure modeling case. This criterion supports representation of waste packages of naval SNF by an equal number of waste packages of commercial SNF in the TSPA by limiting the release of radionuclides from naval SNF in this scenario class to levels where the corresponding release of radionuclides important to dose from a commercial SNF waste

Design/Analysis Evolution Changes

EXAMPLE 8

LA Change Number 32

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
31/60	SAR 1.2.2.3.6 SAR 1.2.3.1.4 SAR 1.2.3.4 SAR 1.3.1.2.5 SAR 1.3.3.5.1.1 SAR 1.3.5.3 SAR 1.5.1.4.1.2.5.3 SAR 1.5.1.4.1.2.6.2 SAR 1.5.1.5 SAR Table 1.5.1-31 SAR 1.9.5 SAR Table 1.9-8	LA Change Number 31: This LA change modified the thermal limit for naval spent nuclear fuel (SNF) canister in the Initial Handling Facility (IHF) and transported in the Transport and Emplacement Vehicle (TEV), due to replacing a one-dimensional (1-D) thermal analysis with a more sophisticated three-dimensional (3-D) thermal analysis. As a result, the requirement for processing naval canisters was changed to limit the canister outside surface temperature to 400 degrees F with a processing time of 30 days. To ensure that these limits are met, preclosure handling requirements were added to the LA and operating conditions were modified to establish a temperature limit with an imposed administrative maximum handling duration. Since these limits exist to ensure naval SNF cladding integrity to support postclosure performance, a Postclosure Parameter limit on temperature and handling was added. This addition tot he LA supports the existing postclosure nuclear safety design basis of the naval SNF canister. These limits are not relied upon to limit of prevent potential preclosure event sequences or mitigate their consequences. LA Change Number 60: To support the changes in the IHF and TEV emplacement described above, this LA change replaced the description of the 1-D thermal analysis with a description of on-going 3-D thermal modeling for naval SNF canister handling in the IHF and the TEV. The new 3-D analysis will demonstrate that the thermal limit of 400 degrees F is met during handling operations in the IHF and emplacement. The safety bases for the Total System Performance Assessment (TSPA) and Preclosure Safety Analysis (PCSA) for naval SNF remain unchanged.	design/ analysis evolution
32	GI-1 Figure 1-7 GI-2 Figure 2-1 SAR 1.1.2.3 SAR 1.5.1 SAR Table 1.5.1-29 SAR 1.8.1.3.1 SAR Table 1.8-5 SAR 2.3.7.4.1.2	This LA change updated the Repository Operations Summary Timeline and the High-Level Project Schedule figures and other related LA information (e.g., population projections) to be consistent with revised schedule milestones (e.g., waste receipt) based on the initial LA submittal date and current estimated project funding. SAR Section 1.5.1 acknowledges that some SAR analyses are indexed to specific dates in order to calculate thermal and radioactive decay and identifies that in such cases re-analysis will be performed as necessary. Revision was made to the OCRWM Integrated Scope, Cost, and Schedule Baseline Summary document which resulted in changing milestone dates referenced throughout the LA.	design/ analysis evolution
33	SAR 2.3.4.4 SAR 2.3.4.5 SAR 2.3.4.9 SAR Table 2.3.4-51	This LA change corrected drip shield dimensions to be consistent with the source document. The errors were primarily due to rounding and unit conversion. Several related reference citations were updated, and editorial changes were also made. The LA change did not affect the nuclear safety design bases for the drip shield.	clarification/ correction
34	SAR 1.5.1.5	This LA change consisted of reference changes only to reflect administrative changes to a Canister Receipt and Closure Facility (CRCF) shielding calculation.	updated reference
35	SAR 1.4.4.2 SAR Table 1.4.4-2 SAR Figure 1.4.4-4	This LA change reflected revisions to the service gases to the Canister Receipt and Closure Facility (CRCF). The argon storage was changed from a liquid to a gaseous arrangement, and the service gas 30-day consumption rates for the various handling facilities were updated. The LA change did not affect the nuclear safety design bases of the CRCF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution



NOTE: CA = construction authorization; CRCF = Canister Receipt and Closure Facility; IHF = Initial Handling Facility; LA = license application; R&P = receive and possess; RF = Receipt Facility; WHF = Wet Handling Facility.

Figure 1-7. Repository Operations Summary Time Line

However, the area of Inyo County within the demographic study area is almost entirely within Death Valley National Park. Population and employment within the national park are primarily related to park activities (BSC 2003a). Population information for the area within the demographic study area is presented in Tables 1.1-2 and 1.1-3.

1.1.2.3 Population Projections
[NUREG-1804, Section 2.1.1.1.3: AC 2(1)]

Population projections are provided consistent with the format described in Regulatory Guide 4.2. Population estimates for 2003 (Table 1.1-2), developed using the housing unit method and based on the year 2000 census (Section 1.1.2.1), provide a baseline for population projections. From the starting point of population by grid cell in 2003, population by year in each grid cell is calculated through application of the same annual rate of growth or declination as the baseline projections for the county in which each respective cell lies (BSC 2007c, Section 4.3.1). The resident population within the demographic study area was projected to the expected first year of operation of the repository in 2017 (Table 1.1-3), and then, by census decade through the expected completion of spent nuclear fuel and high-level radioactive waste handling operations in 2067 (Table 1.1-4). Changes in population because of repository and rail corridor construction and operation are included in these projections. Projections are also provided for the year 2042 (Table 1.1-4), the midpoint year between 2017 and 2067. These midpoint population projections for the year 2042 are used to furnish age distributions of the projected population for the midpoint year (Table 1.1-5). Since these population projections were completed, the proposed operations period has been changed from the period of 2017 through 2067 to the period of 2020 through 2070.

1.1.3 Local Meteorology and Regional Climatology
[NUREG-1804, Section 2.1.1.1.3: AC 3]

Climatic and meteorological conditions in the Yucca Mountain region are one subset of natural phenomena that could pose hazards to repository safety during the preclosure period. This section summarizes site-specific and regional climatic and meteorological data that have been used to quantify the expected magnitude, frequency, and duration of climatological phenomena occurring in the Yucca Mountain region and repository vicinity. This section also provides a basis to evaluate climate-related hazards and events for their potential to affect repository safety during the preclosure period. Design bases are developed for structures, systems, and components (SSCs) based upon the information provided in this section and are discussed in Sections 1.2.2 and 1.3.2.

Atmospheric stability categories determined from temperature gradient data and wind speed and wind direction data are used for developing atmospheric dispersion factors for use in evaluating airborne radionuclide concentrations from hypothetical radioactivity release scenarios. Meteorological data are also incorporated into the event consequence analyses performed to evaluate the safety of the repository (Section 1.8).

Section 1.1.3.1 describes the meteorological monitoring program and addresses data collection techniques and instruments.

Section 1.1.3.2 includes descriptions of the precipitation, wind speed temperature, atmospheric humidity, solar radiation, and barometric pressure characteristics of the repository site.

The waste forms to be disposed of are categorized as follows:

- Commercial SNF
- HLW
- DOE SNF
- Naval SNF.

Naval SNF, described in Section 1.5.1.4, is one of the 34 DOE SNF groups described in Section 1.5.1.3. However, for the purposes of SNF inventory, characterization, and analyses, the naval SNF is treated as a separate waste form in the PCSA.

The waste forms described above are received at the repository as canistered. However, a small fraction of commercial SNF is expected to be received as uncanistered in transportation casks. Commercial SNF that is received in dual-purpose canisters (DPCs) or as uncanistered SNF in a transportation cask is placed into a transportation, aging, and disposal (TAD) canister before being placed into an aging overpack for aging or into waste packages for disposal (BSC 2008a).

The geologic repository operations area (GROA) is designed to receive and package canistered and uncanistered commercial SNF, canistered HLW, canistered DOE SNF, uncanistered DOE SNF of commercial origin, and canistered naval SNF, and, after packaging, to emplace those radioactive wastes. The repository inventory is 70,000 MTHM (Nuclear Waste Policy Act of 1982), consisting of approximately 63,000 MTHM of commercial SNF and HLW of commercial origin and approximately 7,000 MTHM of DOE materials (including 65 MTHM of naval SNF). The DOE materials are about one-third SNF and about two-thirds HLW by quantity of MTHM. The project cites the MTHM value of commercial SNF in terms of initial MTHM in fresh fuel assemblies as reported by the utilities (Thorpe 2004, Section 3). For naval SNF and DOE SNF, the analysis is based on the final MTHM quantities of the SNF (DOE 2007, Section 3.2, Footnote b). For DOE HLW, emplacement limits are based on comparing the curie content of a typical DOE HLW canister with the curie content of a typical commercial HLW canister (Knecht et al. 1999, Section 2.2). Table 1.5.1-1 summarizes the allocation of these wastes and represents the basis for facility expected throughputs in Table 1.2.1-1, used for the PCSA, and the emplacement inventory in Table 2.2-12, used for the TSPA. Regarding throughput, the total number of waste packages to be emplaced at the repository, while accepting 70,000 MTHM, is not firmly established because of the variability of the waste stream. Accordingly, there exists a similar variability in the number of waste packages considered as part of the safety analyses. Additional information on variability of the waste stream is in Section 1.3.1.2.5. Analyses that evaluate repository performance that require assumptions regarding thermal and radionuclide decay of the waste stream generally assume initiation of waste receipt in calendar year 2017 (with closure in 2117), although the proposed repository schedule identifies operations beginning in calendar year 2020 (with closure in 2120). Drift by drift analyses prior to the emplacement of waste packages, as described in Section 1.3.1.2.5, will account for any such decay variances.

The waste forms are analyzed differently in the preclosure and the postclosure periods. The preclosure waste form analyses address the physical, thermal, and nuclear properties of the waste forms as they exist through repository closure. Following closure, the postclosure analyses address the same properties as well as the interactions of the waste within the repository as the radioactive components of the waste decay in the repository drifts. The radionuclide inventory is further

In contrast to prior TSPAs, ^{126}Sn and ^{79}Se are now screened in (SNL 2007b, Section 6.7.1). Although ^{94}Nb could be potentially important because of its significant ground shine exposure pathway in the igneous eruptive modeling case, it has been screened out because it did not meet the 95% screening criteria on which included that exposure pathway (SNL 2007b, Section 6.7.2). Earlier TSPAs have considered ^{94}Nb, and their results are consistent with screening it out in the current analysis.

10 CFR 63.331 specifically requires consideration of the combined activity of ^{226}Ra and ^{228}Ra in groundwater. Both radionuclides are already included in the TSPA because they met the screening criteria. Because ^{228}Ra is produced by the decay of ^{236}U and ^{232}Th, both ^{236}U and ^{232}Th should be included in the inventory, and both are included because they already met the screening criteria. ^{230}Th must also be included because it decays into ^{226}Ra (SNL 2007b, Table 4-4), and ^{230}Th is already included because it met the screening criteria (SNL 2007b, Table 6-8).

As shown in Table 2.3.7-2, 32 isotopes of 18 elements are included in the TSPA model for scenario classes or modeling cases involving groundwater transport. Table 2.3.7-2 also shows the 25 isotopes of 15 elements included in the TSPA for the igneous eruptive modeling case.

The result of the radionuclide screening analysis and the initial radionuclide inventory analysis is the radionuclide inventory (in terms of mass) of those radionuclides determined to be potentially important to dose. The result is shown in Tables 2.3.7-3 and 2.3.7-4 (SNL 2007d, Table 7-1[a]). Tables 2.3.7-3 and 2.3.7-4 are not directly comparable to the inventory tables listed in Section 1.5.1, because the inventories are at different points in time, and because the inventories in Tables 2.3.7-3 and 2.3.7-4 are on a per waste package basis. Table 2.3.7-5 (SNL 2008, Table 6.3.7-5) shows the inventory in a commercial SNF waste package (including MOX) and the inventory in a codisposal waste package (including DOE SNF and combined HLW and LaBS glass). This table shows the inventory in both grams and curies per waste package, at the assumed repository closure date of 2117. Figures 2.3.7-11 and 2.3.7-12 show the decay of the radionuclide inventory in a commercial SNF waste package and in a codisposal waste package following closure.

The commercial SNF radionuclide quantities in Table 2.3.7-3 are for commercial SNF that is, on average, 23 years out of reactor on arrival at the repository, based on disposal rights (CRWMS M&O 2000a, Table 5, Case A - 63,000 MTU). For a later repository opening date than in previous TSPAs, use of the same waste stream at a later date, rather than an older waste stream due to decay, is conservative with respect to radionuclide inventory and heat. Waste will be emplaced for up to 50 years, depending on the amount of onsite aboveground aging required for the hottest waste packages. Ventilation will continue until the closure time used in the TSPA calculation, 2117, which is approximately 100 years after the start of emplacement. The radionuclide quantities shown in Tables 2.3.7-3 and 2.3.7-4 are at inventory times specific to the type of waste. The times of the waste form inventories are 2067 for commercial SNF (approximately 50 years after the start of emplacement), 2030 for HLW and DOE SNF, 2035 for MOX, and 2003 for lanthanide borosilicate glass. For the TSPA thermal calculation, it is assumed that the waste is emplaced simultaneously in 2067, and that it is 23 years old on-average at emplacement (SNL 2007d, Sections 6.4.1[a] and 7.1.1[a]). Waste that is 23 years old in 2067 has more radionuclide content than older waste, and hence is conservative with respect to radionuclide inventory and heat. HLW and DOE SNF radionuclide quantities in the above tables are those calculated at 2030 (SNL 2007d, Sections 6.4.1[a] and 7.1.1[a]). TSPA modeling of all three waste

Design/Analysis Evolution Changes

EXAMPLE 9

LA Change Number 35

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
31/60	SAR 1.2.2.3.6 SAR 1.2.3.1.4 SAR 1.2.3.4 SAR 1.3.1.2.5 SAR 1.3.3.5.1.1 SAR 1.3.5.3 SAR 1.5.1.4.1.2.5.3 SAR 1.5.1.4.1.2.6.2 SAR 1.5.1.5 SAR Table 1.5.1-31 SAR 1.9.5 SAR Table 1.9-8	LA Change Number 31: This LA change modified the thermal limit for naval spent nuclear fuel (SNF) canister in the Initial Handling Facility (IHF) and transported in the Transport and Emplacement Vehicle (TEV), due to replacing a one-dimensional (1-D) thermal analysis with a more sophisticated three-dimensional (3-D) thermal analysis. As a result, the requirement for processing naval canisters was changed to limit the canister outside surface temperature to 400 degrees F with a processing time of 30 days. To ensure that these limits are met, preclosure handling requirements were added to the LA and operating conditions were modified to establish a temperature limit with an imposed administrative maximum handling duration. Since these limits exist to ensure naval SNF cladding integrity to support postclosure performance, a Postclosure Parameter limit on temperature and handling was added. This addition tot he LA supports the existing postclosure nuclear safety design basis of the naval SNF canister. These limits are not relied upon to limit of prevent potential preclosure event sequences or mitigate their consequences. LA Change Number 60: To support the changes in the IHF and TEV emplacement described above, this LA change replaced the description of the 1-D thermal analysis with a description of on-going 3-D thermal modeling for naval SNF canister handling in the IHF and the TEV. The new 3-D analysis will demonstrate that the thermal limit of 400 degrees F is met during handling operations in the IHF and emplacement. The safety bases for the Total System Performance Assessment (TSPA) and Preclosure Safety Analysis (PCSA) for naval SNF remain unchanged.	design/ analysis evolution
32	GI-1 Figure 1-7 GI-2 Figure 2-1 SAR 1.1.2.3 SAR 1.5.1 SAR Table 1.5.1-29 SAR 1.8.1.3.1 SAR Table 1.8-5 SAR 2.3.7.4.1.2	This LA change updated the Repository Operations Summary Timeline and the High-Level Project Schedule figures and other related LA information (e.g., population projections) to be consistent with revised schedule milestones (e.g., waste receipt) based on the initial LA submittal date and current estimated project funding. SAR Section 1.5.1 acknowledges that some SAR analyses are indexed to specific dates in order to calculate thermal and radioactive decay and identifies that in such cases re-analysis will be performed as necessary. Revision was made to the OCRWM Integrated Scope, Cost, and Schedule Baseline Summary document which resulted in changing milestone dates referenced throughout the LA.	design/ analysis evolution
33	SAR 2.3.4.4 SAR 2.3.4.5 SAR 2.3.4.9 SAR Table 2.3.4-51	This LA change corrected drip shield dimensions to be consistent with the source document. The errors were primarily due to rounding and unit conversion. Several related reference citations were updated, and editorial changes were also made. The LA change did not affect the nuclear safety design bases for the drip shield.	clarification/ correction
34	SAR 1.5.1.5	This LA change consisted of reference changes only to reflect administrative changes to a Canister Receipt and Closure Facility (CRCF) shielding calculation.	updated reference
35	SAR 1.4.4.2 SAR Table 1.4.4-2 SAR Figure 1.4.4-4	This LA change reflected revisions to the service gases to the Canister Receipt and Closure Facility (CRCF). The argon storage was changed from a liquid to a gaseous arrangement, and the service gas 30-day consumption rates for the various handling facilities were updated. The LA change did not affect the nuclear safety design bases of the CRCF or the structures, systems, or components (SSCs) contained within.	design/ analysis evolution

Table 1.4.4-1. Compressed Air by Facility

Facility	General Purpose Receiver Tank Capacity (ft^3)	Air Compressor(s) Nominal Number/ Capacity (Each)	Instrument Air Receiver Tank Capacity (ft^3)
Canister Receipt and Closure Facility	1,000	4/990 scfm	630
Initial Handling Facility	770	2/1,170 scfm	170
Wet Handling Facility	1,000	3/990 scfm	400
Receipt Facility	770	3/990 scfm	400

Table 1.4.4-2. Service Gas Subsystem 30-Day Consumption Rate

Facility	Gas	Nominal 30-day Consumption Rate (acf)
Receipt Facility	Helium	600
	Argon	NA
Canister Receipt and Closure Facility	Helium	7,900
	Argon	3,900
Wet Handling Facility	Helium	8,100
	Argon	200
Initial Handling Facility	Helium	3,900
	Argon	1,700

NOTE: acf = actual cubic feet at site elevation; NA = not applicable.

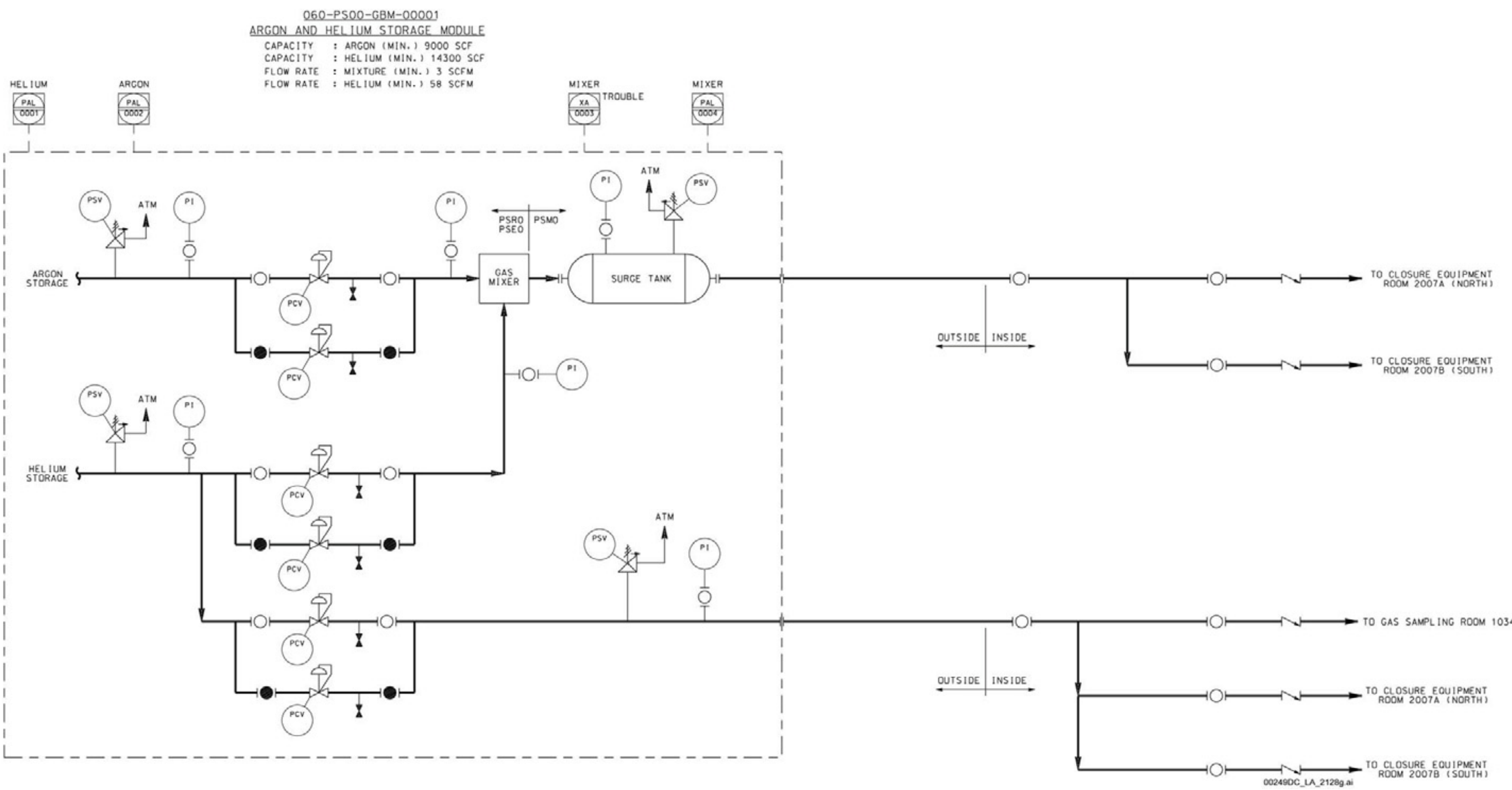


Figure 1.4.4-4. Canister Receipt and Closure Facility Helium and Argon-Helium Mixture Piping and Instrumentation Diagram

NOTE: AE = analysis sensor; FT = flow transmitter; PI = pressure indicator.

Design/Analysis Evolution Changes

EXAMPLE 10

LA Change Number 36

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	LA Sections Revised	Description of Change	LA Change Type**
36	SAR Table 1.4.4-1 SAR Figure 1.4.4-2 SAR Figure 1.4.4-3	This LA change reflected revisions to Canister Receipt and Closure Facility (CRCF) general purpose and instrument air piping and instrument diagrams incorporating pipe routing changes and updating number and location of end users. The LA change did not affect the nuclear safety design bases of the CRCF or the systems contained within.	design/ analysis evolution
38	SAR 1.10.3.3.1.2	This LA change deleted a specific thickness of the Transportation, Aging, and Disposal (TAD) canister shield plug that could be misinterpreted as a committed design feature detail. The dose reduction effectiveness of the shield plug was not changed. This LA change did not affect the nuclear safety design bases of the TAD.	clarification/ correction
39	SAR 1.3.1 SAR 1.3.2 SAR 1.3.3 SAR 1.3.4	This LA change consisted of reference changes only to reflect a revision to the Mechanical Handling Design Report: Waste Package Transport and Emplacement Vehicle primarily related to unit conversions.	updated reference
40	GI-5 Section 5.1.6.4 GI-5 Section 5.3 SAR 1.1.5.3.2 SAR 1.1.10	This LA change was a reference citation change only to reflect a revision to the Supplemental Soils Report updating ground motion information. The results presented in the LA were not impacted by this revision.	updated reference
41	SAR Figure 1.3.5-3	This LA change replaced a referenced source drawing for a figure with a more detailed drawing showing the subsurface ventilation exhaust fan installation configuration, section and plan view. Additional drawing details included the addition of drain valves, changes in the presentation of various shaft dimensions (no change in dimensions), and reference to a new source drawing.	design/ analysis evolution
42	GI-1 Section 1.2.2	This LA change clarified a statement regarding the design of the Canister Receipt and Closure Facility (CRCF). Specifically, the phrase stating that the CRCF "is designed to transfer canisters, transportation casks, and aging overpacks into waste packages for emplacement" was changed to "is designed to transfer canisters from the transportation casks and aging overpacks into waste packages for emplacement".	clarification/ correction
43	SAR 5.7.7.2.2.3.5	This LA change corrected a position title to be consistent with LA Figure 5.7-1. Specifically, Technical Support Center "Manager" was changed to "Coordinator".	editorial
44	SAR 1.1.3.1 SAR 1.1.10	This LA change clarified wording regarding the period of time during which meteorological data was collected. The results presented in the LA were not impacted by this change.	clarification/ correction
45	SAR 1.1.9.3.2.14 SAR 1.1.10 SAR Figure 1.1-57	This LA change corrected a typographical error in a cross-reference to another LA figure.	editorial
46	SAR 5.4 SAR 5.4.1 SAR 5.4.4	This LA change updated information related to expert elicitations to reflect completion of the Probabilistic Volcanic Hazard Analysis Update (PVHA-U). The LA change also added a reference to the PVHA-U document and identified the applicability of Acceptance Criterion 2 of NUREG-1804, Section 2.5.4.3. The initial LA submittal acknowledged that an update to the PVHA was in progress. The PVHA-U was completed in September 2008. The LA was updated to reflect the completed analysis, although the licensing basis did not change.	design/ analysis evolution
47	SAR 1.3.1 SAR 1.3.6	This LA change was a reference change only to reflect a revision to the Closure Design calculation.	updated reference
49	SAR 1.1.9.3.2.1	This LA change corrected a value in the description of the existing fill thickness on the North Portal pad.	clarification/ correction
50	SAR 2.3.4.5.2.1.3.2 SAR 2.3.4.9	This LA change corrected reference citations to a current source document.	updated reference

Table 1.4.4-1. Compressed Air by Facility

Facility	General Purpose Receiver Tank Capacity (ft^3)	Air Compressor(s) Nominal Number/ Capacity (Each)	Instrument Air Receiver Tank Capacity (ft^3)
Canister Receipt and Closure Facility	1,000	4/990 scfm	630
Initial Handling Facility	770	2/1,170 scfm	170
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Receipt Facility	770	3/990 scfm	400

Table 1.4.4-2. Service Gas Subsystem 30-Day Consumption Rate

Facility	Gas	Nominal 30-day Consumption Rate (acf)
Receipt Facility	Helium	600
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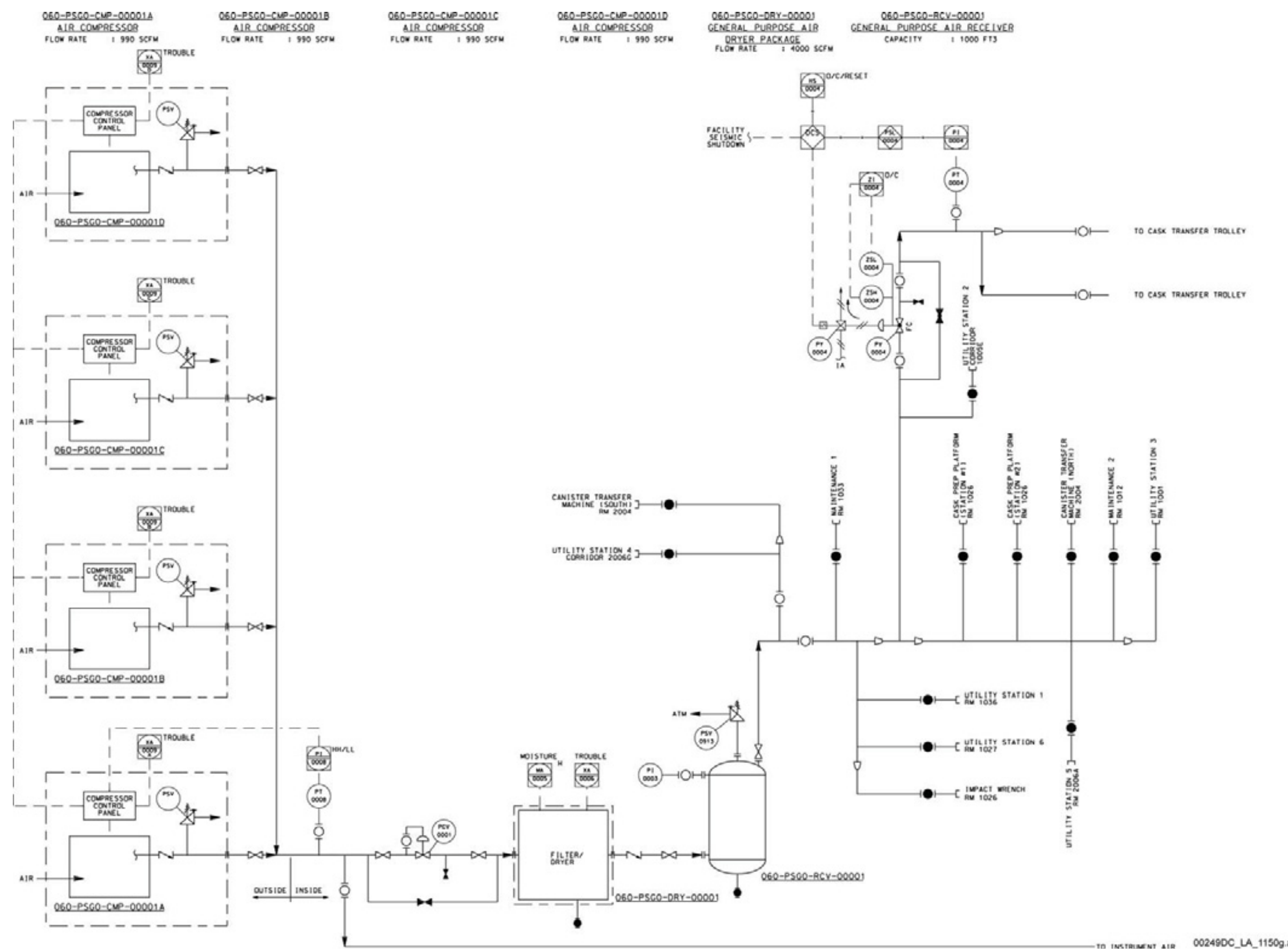
Wet Handling Facility	Helium	8,100
	Argon	200
Initial Handling Facility	Helium	3,900
	Argon	1,700

NOTE: acf = actual cubic feet at site elevation; NA = not applicable.



NOTE: PCV = pressure control valve; PI = pressure indicator;
PLC = programmable logic controller; PSV = pressure safety valve.

Figure 1.4.4-2. Canister Receipt and Closure Facility General Purpose Air System Piping and Instrumentation Diagram

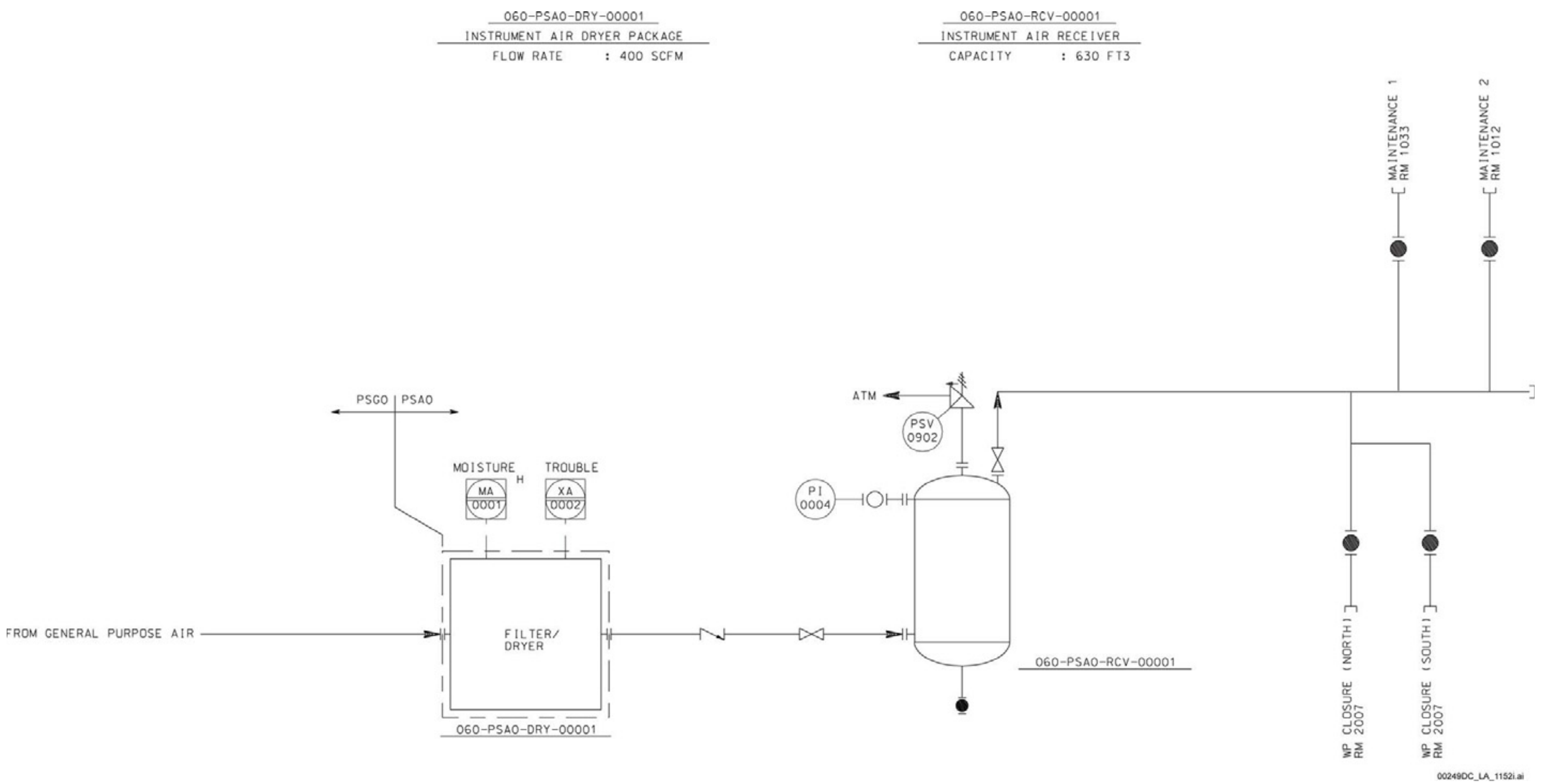


Figure 1.4.4-3. Canister Receipt and Closure Facility Instrument Air System Piping and Instrumentation Diagram

Design/Analysis Evolution Changes

EXAMPLE 11

LA Change Number 41

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
36	SAR Table 1.4.4-1 SAR Figure 1.4.4-2 SAR Figure 1.4.4-3	This LA change reflected revisions to Canister Receipt and Closure Facility (CRCF) general purpose and instrument air piping and instrument diagrams incorporating pipe routing changes and updating number and location of end users. The LA change did not affect the nuclear safety design bases of the CRCF or the systems contained within.	design/ analysis evolution
38	SAR 1.10.3.3.1.2	This LA change deleted a specific thickness of the Transportation, Aging, and Disposal (TAD) canister shield plug that could be misinterpreted as a committed design feature detail. The dose reduction effectiveness of the shield plug was not changed. This LA change did not affect the nuclear safety design bases of the TAD.	clarification/ correction
39	SAR 1.3.1 SAR 1.3.2 SAR 1.3.3 SAR 1.3.4	This LA change consisted of reference changes only to reflect a revision to the Mechanical Handling Design Report: Waste Package Transport and Emplacement Vehicle primarily related to unit conversions.	updated reference
40	GI-5 Section 5.1.6.4 GI-5 Section 5.3 SAR 1.1.5.3.2 SAR 1.1.10	This LA change was a reference citation change only to reflect a revision to the Supplemental Soils Report updating ground motion information. The results presented in the LA were not impacted by this revision.	updated reference
41	SAR Figure 1.3.5-3	This LA change replaced a referenced source drawing for a figure with a more detailed drawing showing the subsurface ventilation exhaust fan installation configuration, section and plan view. Additional drawing details included the addition of drain valves, changes in the presentation of various shaft dimensions (no change in dimensions), and reference to a new source drawing.	design/ analysis evolution
42	GI-1 Section 1.2.2	This LA change clarified a statement regarding the design of the Canister Receipt and Closure Facility (CRCF). Specifically, the phrase stating that the CRCF "is designed to transfer canisters, transportation casks, and aging overpacks into waste packages for emplacement" was changed to "is designed to transfer canisters from the transportation casks and aging overpacks into waste packages for emplacement".	clarification/ correction
43	SAR 5.7.7.2.2.3.5	This LA change corrected a position title to be consistent with LA Figure 5.7-1. Specifically, Technical Support Center "Manager" was changed to "Coordinator".	editorial
44	SAR 1.1.3.1 SAR 1.1.10	This LA change clarified wording regarding the period of time during which meteorological data was collected. The results presented in the LA were not impacted by this change.	clarification/ correction
45	SAR 1.1.9.3.2.14 SAR 1.1.10 SAR Figure 1.1-57	This LA change corrected a typographical error in a cross-reference to another LA figure.	editorial
46	SAR 5.4 SAR 5.4.1 SAR 5.4.4	This LA change updated information related to expert elicitations to reflect completion of the Probabilistic Volcanic Hazard Analysis Update (PVHA-U). The LA change also added a reference to the PVHA-U document and identified the applicability of Acceptance Criterion 2 of NUREG-1804, Section 2.5.4.3. The initial LA submittal acknowledged that an update to the PVHA was in progress. The PVHA-U was completed in September 2008. The LA was updated to reflect the completed analysis, although the licensing basis did not change.	design/ analysis evolution
47	SAR 1.3.1 SAR 1.3.6	This LA change was a reference change only to reflect a revision to the Closure Design calculation.	updated reference
49	SAR 1.1.9.3.2.1	This LA change corrected a value in the description of the existing fill thickness on the North Portal pad.	clarification/ correction
50	SAR 2.3.4.5.2.1.3.2 SAR 2.3.4.9	This LA change corrected reference citations to a current source document.	updated reference

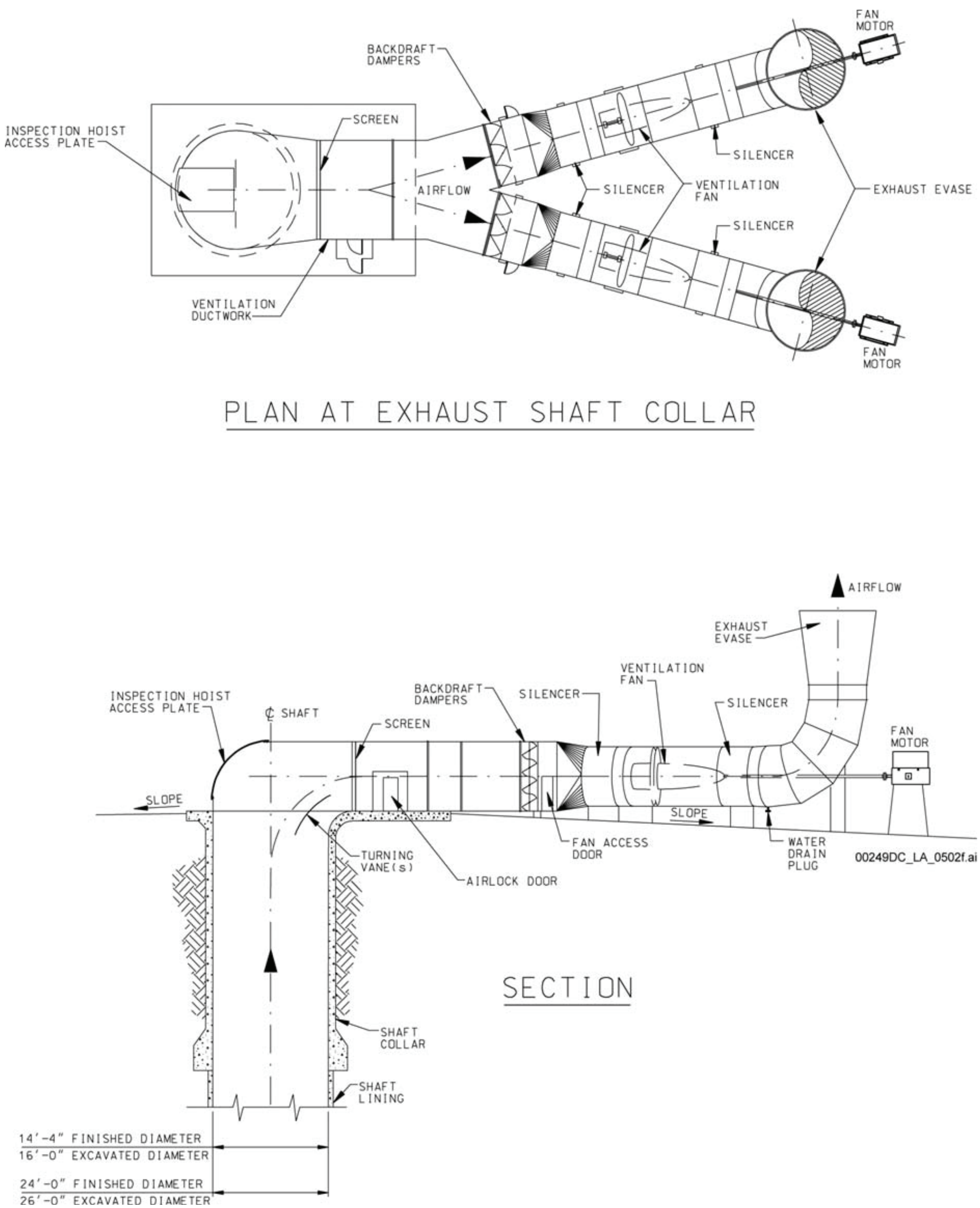


Figure 1.3.5-3. Typical Exhaust Fan Installation Configuration, Section and Plan View

Design/Analysis Evolution Changes

EXAMPLE 12

LA Change Number 46

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
36	SAR Table 1.4.4-1 SAR Figure 1.4.4-2 SAR Figure 1.4.4-3	This LA change reflected revisions to Canister Receipt and Closure Facility (CRCF) general purpose and instrument air piping and instrument diagrams incorporating pipe routing changes and updating number and location of end users. The LA change did not affect the nuclear safety design bases of the CRCF or the systems contained within.	design/ analysis evolution
38	SAR 1.10.3.3.1.2	This LA change deleted a specific thickness of the Transportation, Aging, and Disposal (TAD) canister shield plug that could be misinterpreted as a committed design feature detail. The dose reduction effectiveness of the shield plug was not changed. This LA change did not affect the nuclear safety design bases of the TAD.	clarification/ correction
39	SAR 1.3.1 SAR 1.3.2 SAR 1.3.3 SAR 1.3.4	This LA change consisted of reference changes only to reflect a revision to the Mechanical Handling Design Report: Waste Package Transport and Emplacement Vehicle primarily related to unit conversions.	updated reference
40	GI-5 Section 5.1.6.4 GI-5 Section 5.3 SAR 1.1.5.3.2 SAR 1.1.10	This LA change was a reference citation change only to reflect a revision to the Supplemental Soils Report updating ground motion information. The results presented in the LA were not impacted by this revision.	updated reference
41	SAR Figure 1.3.5-3	This LA change replaced a referenced source drawing for a figure with a more detailed drawing showing the subsurface ventilation exhaust fan installation configuration, section and plan view. Additional drawing details included the addition of drain valves, changes in the presentation of various shaft dimensions (no change in dimensions), and reference to a new source drawing.	design/ analysis evolution
42	GI-1 Section 1.2.2	This LA change clarified a statement regarding the design of the Canister Receipt and Closure Facility (CRCF). Specifically, the phrase stating that the CRCF "is designed to transfer canisters, transportation casks, and aging overpacks into waste packages for emplacement" was changed to "is designed to transfer canisters from the transportation casks and aging overpacks into waste packages for emplacement".	clarification/ correction
43	SAR 5.7.7.2.2.3.5	This LA change corrected a position title to be consistent with LA Figure 5.7-1. Specifically, Technical Support Center "Manager" was changed to "Coordinator".	editorial
44	SAR 1.1.3.1 SAR 1.1.10	This LA change clarified wording regarding the period of time during which meteorological data was collected. The results presented in the LA were not impacted by this change.	clarification/ correction
45	SAR 1.1.9.3.2.14 SAR 1.1.10 SAR Figure 1.1-57	This LA change corrected a typographical error in a cross-reference to another LA figure.	editorial
46	SAR 5.4 SAR 5.4.1 SAR 5.4.4	This LA change updated information related to expert elicitations to reflect completion of the Probabilistic Volcanic Hazard Analysis Update (PVHA-U). The LA change also added a reference to the PVHA-U document and identified the applicability of Acceptance Criterion 2 of NUREG-1804, Section 2.5.4.3. The initial LA submittal acknowledged that an update to the PVHA was in progress. The PVHA-U was completed in September 2008. The LA was updated to reflect the completed analysis, although the licensing basis did not change.	design/ analysis evolution
47	SAR 1.3.1 SAR 1.3.6	This LA change was a reference change only to reflect a revision to the Closure Design calculation.	updated reference
49	SAR 1.1.9.3.2.1	This LA change corrected a value in the description of the existing fill thickness on the North Portal pad.	clarification/ correction
50	SAR 2.3.4.5.2.1.3.2 SAR 2.3.4.9	This LA change corrected reference citations to a current source document.	updated reference

specific to the expert's interpretation. To ensure that an equal weight scheme was defensible, the following steps were completed:

1. The experts were selected using a formal selection process.

2. All experts were provided with all applicable data bases.

3. Expert interaction was encouraged.

4. Alternative interpretations were presented and challenged.

5. Sufficient feedback was provided to allow each team member the opportunity to understand the implications of their evaluations relative to the hazard results.

The final report also documented each individual expert's assessment so that the impact of an individual's assessment on the overall results was clear.

Step 9—Documentation—The technical basis for the expert evaluations was thoroughly documented. The documentation includes the individuals involved in the elicitation project and their specific roles, the details of the process followed, and the results of the elicitation.

The expert elicitation associated with the PVHA has been updated (SNL 2008a) in a manner that is consistent with NUREG-1563 (Kotra et al. 1996) and past practices. The differences between the PVHA (SNL 2008b) and updated PVHA distributions (SNL 2008a) would not significantly affect the estimates of repository performance for either 10,000 years or 1,000,000 years, demonstrating that the updated PVHA results are confirmatory of the original PVHA technical basis.

Sections 2.2 and 2.3.11 provide more information regarding the process and results of the PVHA.

5.4.2 Probabilistic Seismic Hazard Analysis
[NUREG-1804, Section 2.5.4.3: AC 1; Section 2.2.1.3.2.3: AC 3(4)]

In 1995, prior to NRC issuance of NUREG-1563 (Kotra et al. 1996), the DOE initiated a PSHA for Yucca Mountain using an expert elicitation process. Experts with the needed range of expertise in regional and local earthquake and fault tectonics, earthquake physics, ground motion modeling, and seismic hazard analyses were assembled to evaluate seismic hazards in the Yucca Mountain region. They characterized and assessed the uncertainty of seismic sources, earthquake recurrence, ground motion models, and fault displacement models for faulting conditions known to be present in the vicinity of the Yucca Mountain site. Six teams, with expertise in Basin and Range Province earthquake tectonics, earthquake seismology, and Quaternary fault displacement modeling, evaluated seismic source, fault displacement, and associated uncertainties using a structured elicitation process. A separate panel of seven ground motion experts was convened using a similarly structured elicitation process to evaluate ground motion attenuation and associated uncertainties. Using these inputs, the seismic hazard was calculated and expressed as a probability distribution on the annual frequency at which levels of ground motion or fault displacement will be exceeded. These results form part of the bases for developing preclosure seismic design inputs and provide information on the frequency of occurrence of potentially disruptive ground motions

Design/Analysis Evolution Changes

EXAMPLE 13

LA Change Number 62

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
51	SAR Figure 1.2.4-113	This LA change reflected a revision to a ventilation and instrumentation drawing for the Canister Receipt and Closure Facility (CRCF) exhaust discharge ventilation ductwork arrangement to atmosphere. The first and second floor exhausts discharge independently to the atmosphere instead of through a common exhaust. The LA change did not affect the nuclear safety design bases of the CRCF tertiary confinement exhaust and heating, ventilation, and air conditioning (HVAC) supply subsystem, which is not important to safety (non-ITS).	clarification/ correction
52	SAR 1.5.1.5 SAR 2.2.3 SAR 2.3.7.14	This LA change was a reference change only to reflect a revision to the Monitored Geologic Repository Systems Requirements Document. The analyses and conclusions presented in the LA were not impacted by this revision.	updated reference
53	SAR 1.2 SAR 1.3 SAR 1.4 SAR 1.9	This LA change was a reference citation change only to reflect a revision to the Basis of Design for the TAD Canister-Based Repository Design Concept (BOD) document incorporating clarifications and updates to design details. The analyses and conclusions presented in the LA were not impacted by this revision.	updated reference
59	SAR 1.8.7 SAR Table 1.8-3	This LA change revised three radionuclide inventories for Pressurized Water Reactor (PWR) representative spent nuclear fuel. Based on expert judgment, it was concluded that these changes were not likely to impact the values presented in the LA. Table 7 of the calculation was revised. The only impact on the LA was to correct the tabulated PWR inventories for the three affected radionuclides in SAR Table 1.8-3.	clarification/ correction
61	SAR 2.4.2 SAR Table 2.4-8 SAR Figure 2.4-8	This LA change improved the discussion of the Total System Performance Assessment (TSPA) model validation (e.g., added clarifying information). The TSPA model and associated calculations were not impacted.	clarification/ correction
62	SAR 2.2.1.4.1.3.2.2 SAR Table 2.2-8 SAR 2.3.5.3.3.3 SAR 2.3.5.5 SAR Figure 2.3.5-47 SAR Figure 2.3.5-55 SAR 2.3.6.4.4.1 SAR 2.4.2.3	This LA change incorporated a note acknowledging that the salt separation aspects of localized corrosion initiation on the waste package were not implemented in the localized corrosion initiation analysis. The note was incorporated to acknowledge an error in the model used for the analysis. Correction of this error is not expected to affect the conclusions of the localized corrosion initiation analysis. At the time of production of this LA update (October 2008), the salt separation aspects of localized corrosion initiation on the waste package had not been implemented in the TSPA or supporting analyses. These analyses have since been completed [MDL-WIS-PA-000005 ERD05, CAL-DN0-NU-000002 ERD02, ANL-DS0-NU-000001 ERD03]. The effects of the changes resulting from these analyses are minimal and will be reflected in a future LA update.	design/ analysis evolution
63	SAR 2.3.3.2.4.2.2 SAR Figure 2.3.3-24 SAR Figure 2.3.3-25 SAR Figure 2.3.3-26 SAR 2.3.4.5.1.3.6 SAR Table 2.3.4-6 SAR Table 2.3.4-20	This LA change corrected errors in information primarily associated with rockfall in drifts, and also made several editorial LA changes.	clarification/ correction
64	GI-5 Section 5.2.3.2.2 SAR Figure 2.3.2-9 SAR 2.3.9.2 SAR 2.3.9.3	This LA change corrected errors in information primarily associated with net infiltration (unsaturated zone) mass flow rates and percentages, and also made several editorial LA changes.	clarification/ correction

Note, the salt separation aspects of localized corrosion initiation were not implemented.

A seismic event can also induce fault displacement that can potentially result in drip shield and waste package failure for those structures intersecting the fault, which can then potentially allow advective and/or diffusive flow into the waste package and lead to conditions conducive to criticality. Additionally, new fractures that intersect the drift segments and the collapse of the drift due to a seismic event will have an effect on the seepage as to both location and rate. However, these changes in seepage have no impact on the repository's potential for criticality without drip shield failure resulting from fault displacement.

Seismic events that can cause significant displacement (>0.1 cm) along fault lines that do intersect the drifts have a low probability of occurrence (i.e., mean annual exceedance frequencies of less than about 10^{-6} per year) (Tables 2.3.4-54 and 2.3.4-55). Damage to the drip shield causing loss of function is not expected to result from seismic faulting until sufficient displacement occurs to make contact between the drip shield and the drift. The number of failed waste packages increases with increasing seismic energy (decreasing annual exceedance frequency) to a maximum number that depends on waste package design variants (Section 2.3.4). The exceedance frequency range per year for the commercial SNF TAD and codisposal waste packages is subdivided into multiple ranges, depending on the waste package design variants. The initiating event for this scenario is a seismic event with an annual exceedance frequency ranging between 2.5×10^{-7} to 10^{-8} per year (Table 2.3.4-59).

In order to calculate an upper bound to the probability of potential criticality resulting from a seismic initiating event, consideration is required of the following probabilities resulting in waste package breach:

1. Probability of a seismic vibratory ground motion event
2. Probability of waste package outer corrosion barrier damage from effects of the ground motion
3. Probability of drip shield failure
4. Probability of seepage collocated with the drip shield failure
5. Probability of localized corrosion occurring from the seepage
6. Probability of fault displacement damaging drip shield and waste package.

The combined probabilities for items 3, 4, and 5 were provided, above, and result in one or more waste package breaches of less than 4.2×10^{-5} over 10,000 years. The probability of item 6 is less than 2.2×10^{-3} over 10,000 years. The combined probability of items 1 and 2 were discussed above and shows that the commercial SNF breach probability is less than 2.6×10^{-4} over 10,000 years, and the codisposal outer corrosion barrier breach probability is 0.24 over 10,000 years. Based on these breach probabilities, the codisposal probability will dominate the sum of each of the independent breach probabilities.

Design/Analysis Evolution Changes

EXAMPLE 14

LA Change Number 65

Table 2 - LA Revision 1 Update – Change Summary by LA Change Number			
LA Change Number*	**LA Sections Revised**	**Description of Change**	**LA Change Type****
65	SAR Figure 2.3.8-48 SAR Figure 2.3.8-57 SAR Figure 2.3.8-58 SAR 4.2.2.2	This LA change deleted information associated with the subsurface seismic monitoring station located in the Exploratory Studies Facility (ESF). The change was made to emphasize the seismic monitoring system rather than any one particular seismic station. Implementation of the seismicity monitoring portion of the Performance Confirmation Program relies on a network or system of seismic monitoring stations not a specific seismic station. Seismic monitoring continues in the area as part of the Performance Confirmation Program. The subsurface seismic monitoring station was taken off line due to power being turned off in the underground due to safety requirements. Since then, the subsurface monitoring station has been restored using battery power. This LA change also corrected references cited in three LA figures.	design/ analysis evolution
68	GI-1 Section 1.4.2 GI-1 Section 1.5 GI-1 Table 1-1 SAR 1.1 SAR 1.2 SAR 1.5 SAR 2.2 SAR Table 2.2-4 SAR 2.4	This LA change modified references to specific revisions of the Quality Assurance Requirements and Description (QARD) document to refer to the description in SAR Section 5.1. A reference was added to GI Table 1-1 citing QARD Revision 20, which is the version currently identified as incorporated by reference in the LA.	clarification/ correction
70	SAR 2.3.10 SAR 2.4	This LA change consisted of reference changes only to remove references to proposed 40 CFR 197 (Environmental Protection Agency (EPA) standard). The final rule was effective on November 14, 2008. In general, the affected LA sections continue to refer to the proposed rule 10 CFR 63 (2005).	updated reference
73	SAR 1.5.1.4.1.2.5.1 SAR 1.5.1.5	This LA change removed a structural requirement associated with the naval spent nuclear fuel (SNF) canister which was less restrictive than the design criteria already presented in this LA section. No design change was made and there was no impact on the safety design bases of the naval SNF canister system.	clarification/ correction
74	SAR Figure 1.2.4-50	This LA change corrected the note in the LA figure associated with the canister transfer machine (CTM) mechanical equipment envelope to be consistent with similar information presented in the Preclosure Safety Analysis (PCSA) sections of the LA. The statement that the design ensured a flat bottom drop within 3 degrees of vertical was deleted. The LA change did not affect the nuclear safety design bases of the CTM.	clarification/ correction

***LA Change Number:**
LA Change Number corresponds to a DOE numbering scheme for changes and is identified for reference and discussion purposes. Only those change numbers associated with the LA Revision 1 update are provided.

****LA Change Type**:
editorial = 11 changes
updated references = 10 changes
clarification/correction = 21 changes
design/analysis evolution = 18 changes

performance of the Upper Natural Barrier and Lower Natural Barrier in the vicinity of the repository drifts and mains by observing subsurface conditions with respect to those in the geologic framework model, which was used to develop the unsaturated zone flow models (Section 2.3.2). This activity will be conducted in the subsurface and begins with construction, continuing as new underground openings are exposed (SNL 2008a, Section 3.3.2.1).

Purpose—The purpose of this activity is to confirm the actual subsurface conditions encountered during construction. Underground geologic mapping ensures that observed variations from the expected geologic conditions described in the license application are documented and provides the basis to evaluate the information on the geologic framework that was used to model and evaluate the performance of the natural systems of the repository (SNL 2008a, Section 3.3.2.1).

Description of Current Understanding—The detailed site stratigraphy, collected from surface mapping, boreholes, and underground mapping, is integrated into model stratigraphic units that represent anticipated subsurface conditions and are used to construct models pertinent to performance assessment and repository design. A detailed hydrogeologic stratigraphy based on hydrogeologic properties of the lithostratigraphic units has been developed for use in flow and transport modeling (Section 2.3.2.3).

The baseline data for mapping will be based on the integrated site model (SNL 2008a, Section 3.3.2.1).

Methodology—Fracture characteristics will be recorded. Fault characteristics such as amounts of offset, thickness, and types of fault breccia or rubble, angularity and size of clasts, and infilling will be noted. Lithostratigraphic contacts and lithophysal characteristics will be collected (SNL 2008a, Section 3.3.2.1).

Similar mapping will be conducted in nonemplacement drifts. Data will be collected with the permanent ground support in place. Mapping will also be conducted in shafts, and will be performed from the shaft sinking equipment or the shaft support infrastructure (SNL 2008a, Section 3.3.2.1).

4.2.2.2 Seismicity Monitoring

This activity includes monitoring regional seismic activity to confirm the site seismicity characteristics used to model ground motion for assessing repository performance. Seismicity monitoring began during site characterization. It is anticipated that the seismic monitoring system will be maintained through repository closure (SNL 2008a, Section 3.3.2.2).

Purpose—The purpose of this activity is to assess the regional seismic activity that is used in simulations of the seismic disruption scenario, relevant to evaluation of the EBS. The assessment of seismic hazards at Yucca Mountain focuses on characterizing the potential for rockfall, vibratory ground motion, and fault displacement that could be associated with earthquake activity in the vicinity of the site, as described in Section 2.3.4.

Description of Current Understanding—The technical basis for evaluating seismic hazards is described in Section 2.3.4.5 which discusses the probabilistic seismic hazard analysis process and results. Tectonic models proposed for the area and information from analogue sites in the Basin

Nature of Changes to Primary Reference Documents

• Editorial Changes	7
• Updated Reference Changes	5
• Clarification/Correction Changes	24
• Total Number of Documents Revised	36