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Document Title: *DOE Spent Nuclear Fuel Disposal Container System Description Document*

This document is a two-volume document. Block 1 indicates the number of pages in Volume I. Block 4 indicates the total number of pages in Volume I and Volume II.

The following TBVs are used in this document:
TBV-094, TBV-096, TBV-228, TBV-240, TBV-241, TBV-242, TBV-243, TBV-244, TBV-245, TBV-246, TBV-248, TBV-249, TBV-251, TBV-327, TBV-328

The following TBDs are used in this document:
TBD-179, TBD-233, TBD-234, TBD-235, TBD-276, TBD-323, TBD-324

Use additional sheets if necessary.

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SUMMARY

The DOE Spent Nuclear Fuel Disposal Container (SNF DC) supports the confinement and isolation of waste within the Engineered Barrier System of the Mined Geologic Disposal System (MGDS). Disposal containers are loaded and sealed in the surface waste handling facilities, transferred to the underground through the access mains, and emplaced in emplacement drifts. The DOE Spent Nuclear Fuel Disposal Container provides long term confinement of DOE SNF waste, and withstands the loading, transfer, emplacement, and retrieval loads and environments.

The DOE SNF Disposal Containers provide containment of waste for a designated period of time, and limit radionuclide release thereafter. The disposal containers maintain the waste in a designated configuration, withstand maximum handling and rockfall loads, limit the individual waste canister temperatures after emplacement. The disposal containers also limit the introduction of moderator into the disposal container during the criticality control period, resist corrosion in the expected repository environment, and provide complete or limited containment of waste in the event of an accident.

Multiple disposal container designs may be needed to accommodate the expected range of DOE Spent Nuclear Fuel. The disposal container will include outer and inner barrier walls and outer and inner barrier lids. Exterior labels will identify the disposal container and contents.

Differing metal barriers will support the design philosophy of defense in depth. The use of materials with different failure mechanisms prevents a single mode failure from breaching the waste package. The corrosion-resistant inner barrier and inner barrier lid will be constructed of a high-nickel alloy and the corrosion-allowance outer barrier and outer barrier lid will be made of carbon steel.

The DOE Spent Nuclear Fuel Disposal Containers interface with the emplacement drift environment by transferring heat from the waste to the external environment and by protecting the DOE waste canisters and their contents from damage/degradation by the external environment. The disposal containers also interface with the SNF by limiting access of moderator and oxidizing agents to the waste. The disposal containers interface with the Ex-Container System's emplacement drift disposal container supports. The disposal containers interface with the Canister Transfer System, Waste Emplacement System, Disposal Container Handling System, and Waste Package Remediation System during loading, handling, transfer, emplacement and remediation of the disposal container.

QUALITY ASSURANCE

The Quality Assurance (QA) program applies to this document. This activity can impact the proper functioning of the MGDS waste package. The *Classification of the Preliminary MGDS Repository Design* document[1] (TBV-228) has identified the DOE Spent Nuclear Fuel Disposal Container as an MGDS item important to radiological safety (QA-1), waste isolation (QA-2), and physical protection of facility and materials (QA-6). The MGDS Requirements Manager has evaluated this activity in accordance with QAP-2-0, *Conduct of Activities*. The *SDD Development/ Maintenance* activity evaluation has determined the preparation, checking, and review of this document to be subject to *Quality Assurance Requirements and Description* requirements. Unverified and undetermined criteria and engineering data are identified and tracked in accordance with NLP-3-15, *To Be Verified (TBV) and To Be Determined (TBD) Monitoring System*. This document was prepared in accordance with NLP-3-33, *System Description Documents*.

1. Categories of DOE SNF identified in the "classification" document may not entirely encompass the DOE SNF categories identified in this SDD. The classification SSCs should be evaluated and revised as required based on the DOE SNF categories that will be accepted at the repository.

1.0 FUNCTIONS AND DESIGN CRITERIA

The functions and design criteria for the system are identified in the following sections. Throughout this document the term "disposal container" shall be used to indicate the DOE Spent Nuclear Fuel Disposal Container. Additionally, the term "disposal container" shall be used to describe the suite of individual disposal containers designed.

1.1 SYSTEM FUNCTIONS

1.1.1 The disposal container contains individually canistered DOE SNF waste within its boundary until it is breached.

1.1.2 The disposal container restricts the transport of radionuclides to the outside of the disposal container's boundary after it is breached.

1.1.3 The disposal container provides sufficient criticality control during loading and after it is loaded with waste.

1.1.4 The disposal container accommodates the thermal loading strategy for the repository.

1.1.5 The disposal container shall provide identification of individual disposal containers and their contents.

1.1.6 The disposal container provides safety for personnel, equipment, and the environment.

1.1.7 The disposal container prevents adverse chemical reactions involving the SNF canister.

1.1.8 The disposal container withstands loading, handling, sealing, transfer, emplacement, and retrieval loads.

1.1.9 The disposal container withstands the emplacement drift environment.

1.1.10 The disposal container provides conditions needed to maintain the physical and chemical stability of the SNF canister.

1.1.11 The disposal container minimizes transport of radionuclides after it is loaded with waste.

1.1.12 The disposal container provides heat transfer between the SNF and the environment external to the disposal container.

1.1.13 The disposal container accommodates handling, sealing, loading, emplacement and retrieval operations.

1.1.14 The disposal container outer surface facilitates decontamination.

1.2 SYSTEM DESIGN CRITERIA

This section presents the design criteria for the disposal container. Each criterion in this section has a corresponding Criteria Basis Statement in Volume II (see Section 5) that describes the need for the criterion as well as a basis for the performance parameters imposed by the criterion. Also, each criterion traces, as applicable, to the functions (F) in Section 1.1; the *Controlled Design Assumptions Document* (CDA); the *Mined Geologic Disposal System Requirements Document* (MGDS RD); and 10CFR60, *Disposal of High Level Wastes in Geologic Repositories*

1.2.1 System Performance

1.2.1.1 The disposal container shall be designed to accommodate canistered DOE Spent Nuclear Fuel categories identified in Table 1-1A (TBV-327). Table 1-1B lists further groupings from Table 1-1A used in criticality, structural and thermal analysis. Table 1-1C lists further groupings from Table 1-1A used in Total System Performance Assessment (TSPA).

TABLE 1-1A: DOE SNF Categories

No.	DOE SNF Category	Compound (Cladding Material)
1	U-Metal (TBV)	Uranium Metal (Zircaloy)
2	U-Metal (TBV)	Uranium Metal (Aluminum)
3	U-Zr (HEU) (TBV)	Uranium Alloy (Zircaloy)
4	U-Mo (HEU) (TBV)	Uranium Alloy (Zircaloy)
5	U-Oxide (HEU) (TBV)	Uranium Oxide (Zircaloy)
6	U-Oxide (MEU) (TBV)	Uranium Oxide (Zircaloy)
7	U-Oxide (LEU) (TBV)	Uranium Oxide (Zircaloy)
8	U-Oxide (HEU) (TBV)	Uranium Oxide (Stainless Steel)
9	U-Oxide (MEU) (TBV)	Uranium Oxide (Stainless Steel)
10	U-Oxide (LEU) (TBV)	Uranium Oxide (Stainless Steel)
11	U-Oxide (HEU) (TBV)	Uranium Oxide (Failed or Declad)
12	U-Oxide (MEU) (TBV)	Uranium Oxide (Failed or Declad)
13	U-Oxide (LEU) (TBV)	Uranium Oxide (Failed or Declad)
14	U-Oxide (HEU) (TBV)	Uranium Oxide (Aluminum)
15	U-Oxide (MEU) (TBV)	Uranium Oxide (Aluminum)
16	U-Al or U-Alx (HEU) (TBV)	Uranium Alloy (Aluminum)
17	U-Al or U-Alx (MEU) (TBV)	Uranium Alloy (Aluminum)
18	U-Si (HEU, MEU) (TBV)	Uranium Alloy (Aluminum)

19	U/Th Carbide (HEU) (TBV)	Thorium/Uranium Carbide (Graphite)
20	U/Th Carbide (HEU) (TBV)	Thorium/Uranium Carbide (Graphite)
21	U or U/Pu Carbide (HEU) (TBV)	Uranium or Plutonium/Uranium Carbide (Stainless Steel, None)
22	MOX (HEU) (TBV)	Plutonium/Uranium Oxide (Zircaloy)
23	MOX (HEU) (TBV)	Plutonium/Uranium Oxide (Stainless Steel)
24	MOX (MEU & LEU) (TBV)	Plutonium/Uranium Oxide (Various materials)
25	U/Th Oxide (HEU) (TBV)	Thorium/Uranium Oxide (Zircaloy)
26	U/Th Oxide (HEU) (TBV)	Thorium/Uranium Oxide (Stainless Steel)
27	U-Zr-Hx (HEU) (TBV)	Uranium-Zirconium Hydride (Stainless Steel, Incoloy)
28	U-Zr-Hx (MEU) (TBV)	Uranium-Zirconium Hydride (Stainless Steel, Incoloy)
29	U-Zr-Hx (MEU) (TBV)	Uranium-Zirconium Hydride (Aluminum)
30	U-Zr-Hx (HEU) (TBV)	Uranium-Zirconium Hydride (Declad)
31	Na-Bonded (HEU, MEU & LEU)* (TBV)	Sodium Bonded (Stainless Steel & Various)
32	Canyon Stab. (HEU & LEU) (TBV)	Not Specified
33	Misc. SNF (HEU, MEU & LEU) (TBV)	(Various)

*Sodium bonded fuels cannot be accepted at the repository in their current state and would require some form of reprocessing in order to meet requirements of 10CFR60.135 (b) (1) for acceptance into the MGR.

TABLE 1-1B: Categorization for Criticality, Structural and Thermal Analysis

No.	DOE SNF Category	Compound (Cladding Material)
1	N-Reactor SNF	Uranium Metal (Zircaloy)
2	MOX (HEU, MEU, LEU)	Plutonium/Uranium Oxide (Zircaloy, SST)
3	U-Zr & U-Mo (HEU)	Uranium Alloy (Zircaloy)
4	U Oxide (HEU)	Uranium Oxide (Aluminum, Zircaloy, SST, Hastelloy)
5	U-Zr-Hx SNF	Uranium-Zirconium Hydride (Incoloy, SST, Aluminum)
6	Th/U Oxide (HEU)	Thorium/Uranium Oxide (SST, Zircaloy)
7	Th/Pu/U Carbide (HEU, MEU)	Uranium Carbide (SST), Plutonium/Uranium Carbide (SST), Thorium/Uranium Carbide (Graphite)
8	U Oxide (LEU)	Uranium Oxide (Zircaloy, SST)

Table 1-1C: Categorization for TSPA

No.	DOE SNF Category	Compound (Cladding Material)
1	U-Metal Fuels	Uranium Metal (Zircaloy, Aluminum)
2	U-Zr Fuels	Uranium Alloy (Zircaloy)
3	U-Mo Fuels	Uranium Alloy (Zircaloy)
4	U-Oxide Intact Fuels	Uranium Oxide (Zircaloy, Stainless Steel, Aluminum)
5	U-Oxide Failed/Declad Fuels	Uranium Oxide (Failed/ Declad)
6	U-Al or U-Alx Fuels	Uranium Alloy (Aluminum)

7	U-Si Fuels	Uranium Alloy (Aluminum)
8	U/Th Carbide Hi-integrity	Thorium/Uranium Carbide (Graphite)
9	U/Th Carbide Low-integrity	Thorium/Uranium Carbide (Graphite)
10	U or U/Pu Carbide Non-Graphite	Uranium or Plutonium/Uranium Carbide (Stainless Steel, None)
11	MOX Fuels	Plutonium/Uranium Oxide (Zircaloy, Stainless Steel)
12	U/Th Oxide Fuels	Thorium/Uranium Oxide (Zircaloy, Stainless Steel)
13	U-Zr-Hx Fuels	Uranium-Zirconium Hydride (Stainless Steel, Incoloy, Aluminum, Declad)
14	Na-Bonded Fuel	Sodium Bonded (Treated Waste Form)

[F 1.1.1][MGDS RD 3.2.A]

1.2.1.2 The disposal container shall be designed to accommodate the sealed DOE canister types identified in Table 1-2. The canister parameters (size, weight, & material) provided in Table 1-2 may be used in design of the disposal containers (TBD-323 & TBV-328).

Table 1-2: Disposable canisters Parameters

Type	Nominal O.D. mm (inch)	Maximum Length mm (inch)	Weight Kg (lb)	Shell Material
NSNFP Short (CLC)	(TBD)	3000 (118.1) (TBV)	2270 (5004) (TBV)	(TBD)
NSNFP Long (CLC)	(TBD)	4570 (179.9) (TBV)	3400 (7496) (TBV)	(TBD)
NSNFP Short (OLC))	610 (24.0) (TBV)	3000 (118.1) (TBV)	4080 (8995) (TBV)	(TBD)
NSNFP Long (OLC)	610 (24.0) (TBV)	4570 (179.9) (TBV)	6120 (13490) (TBV)	(TBD)
Hanford MCO	643 (25.31)	4202 (165.4)	8682.6 (19,142)	304L SS (TBV)
Shippingport LWBR	647 (25.5) (TBV)	4013 (158) (TBV)	(TBD)	(TBD)

CLC = Canisters located in the center location of the disposal container (Center Location Canister)
OLC = Canisters located in the outside location of the disposal container (Outside Location Canister)
NSNFP = National Spent Nuclear Fuel Program; MCO = Multi-Canister Overpack
LWBR = Light Water Breeder Reactor

[F 1.1.1][MGDS RD 3.2.A]

1.2.1.3 The disposal container shall be designed such that no more than one percent of all waste packages breach during the first 1,000 years after emplacement (breaching is defined as an opening through the wall of the waste package through which advective or diffusive transport of gas or radionuclides can occur).

[F 1.1.1, 1.1.2][MGDS RD 3.1.C, 3.2.G][10CFR60.113(a)(1)(i)(A), 10CFR60.113(a)(1)(ii)(A)]

1.2.1.4 The disposal container shall be designed such that for 10,000 years after permanent closure of the repository the release rate of any radionuclide from all disposal containers shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1,000 years following permanent closure; provided, that this requirement does not apply to any radionuclide which is released at a rate less than 0.1% of the calculated total release rate limit. The calculated total release rate limit shall be taken to be one part in 100,000 per year of the inventory of radioactive waste, originally emplaced in the underground facility, that remains after 1,000 years of radioactive decay.

[F 1.1.2][MGDS RD 3.1.C][10CFR60.112, 10CFR60.113(a)(1)(i)(B), 10CFR60.113(a)(1)(ii)(B)]

1.2.1.5 During the preclosure period, the disposal container shall be designed such that nuclear criticality shall not be possible unless at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety. The system must be designed for criticality safety assuming occurrence of design basis events, including those with the potential for flooding the disposal container prior to disposal container sealing (TBD-235) or misloading canisters (TBD-235). The calculated effective multiplication factor (k_{eff}) must be sufficiently below unity to show at least a five percent margin, after allowance for the bias in the method of calculation and the uncertainty in the experiments used to validate the method of calculation.

[F 1.1.3][CDA EBDRD 3.7.1.3.A] [MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(h)]

1.2.1.6 During the postclosure period, criticality events due to fissile material emplaced in the disposal container shall not increase the total radionuclide inventory of all the DOE SNF disposal containers by more than 1%. The percentage of radionuclide inventory increase for the disposal container shall be measured by the sum of the products of probability of criticality occurrence (for a single disposal container, as a function of time) multiplied by the radionuclide inventory increment (measured in curies) due to that criticality, divided by the radionuclide inventory of a single disposal container, with the sum taken over time and any other parameters which characterize the occurrence of criticality. Both the radionuclide inventory and the increment due to criticality shall be evaluated at 1000 years following the criticality shutdown. (TBV-096)

[F1.1.3][CDA EBDRD 3.7.1.3.A][MGDS RD 3.1.C][10CFR60.112, 10CFR60.131(h)]

1.2.1.7 The outer envelope of the disposal container shall be a right circular cylinder (TBV-240).

[CDA EBDRD 3.7.1.J.1][F 1.1.1, 1.1.13]

1.2.1.8 The disposal container shall limit the zircaloy and stainless steel cladding temperature to less than 350 °C (TBV-241). Temperature of other types of DOE fuel cladding shall be limited to (TBD-179) °C. Exceptions to these temperature limits are given in Section 1.2.2.1.

[CDA DCWP 001][F 1.1.4, 1.1.11, 1.1.12][MGDS RD 3.1.C][10CFR60.112, 10CFR60.113(a)(1)(i)(B), 10CFR60.113(a)(1)(ii)(B), 10CFR60.135(a)(1), 10CFR60.135(a)(2)]

1.2.1.9 The disposal container shall be designed to support/allow retrieval up to 134 years after emplacement.

[CDA Key 016][F 1.1.8, 1.1.13][MGDS RD 3.1.C, 3.2.H, 3.2.J] [10CFR60.111(b)(1), 10CFR60.111(b)(2)]

1.2.1.10 The disposal container shall maintain the concentration of O_2, H_2, H_2O, CO_2, and CO within a sealed disposal container to less than or equal to 0.25 vol% (TBV-094) during the period before waste package breach.

[F 1.1.7, 1.1.10, 1.1.11][MGDS RD 3.1.C][10CFR60.112, 10CFR60.113(a)(1), 10CFR60.135(a)(1), 10CFR60.135(a)(2), 10CFR60.135(b)(1), 10CFR60.135(b)(2)]

1.2.1.11 The disposal container, excluding the labels, shall have an external surface finish Roughness Average (R_a) of 125 μin (3.18 μm) (TBV-242) or less.

[F 1.1.14]

1.2.1.12 The disposal container shall have all external surfaces (surfaces exposed to the external environment after closing and sealing a disposal container) accessible for visual inspection and decontamination (e.g. no blind holes).

[F 1.1.14]

1.2.1.13 The disposal container shall have a label (or other means of identification) displaying the information in Table 1-3. (TBV-243)

Table 1-3: Disposal Container Label

Information
Unique Waste Package Identifier (TBV)
SNF (TBV)

Waste Type (TBV)
Quantity (TBV)

[F 1.1.5][MGDS RD 3.1.C, 3.1.D][10CFR60.135(b)(4)]

1.2.1.14 All labels (or other means of identification) applied to the disposal container shall not affect the integrity of the waste package.

[F 1.1.5][MGDS RD 3.1.C][10CFR60.135(a)(2), 10CFR60.135(b)(4)]

1.2.1.15 All information contained on the labels (or other means of identification) applied to the disposal container shall be legible or read by remote means until permanent closure of the repository.

[F 1.1.5][MGDS RD 3.1.C, 3.1.D][10CFR60.135(b)(4)]

1.2.1.16 Labels (or other means of waste package identification) shall be applied to the disposal container outer diameter. (TBV-244)

[F 1.1.5][MGDS RD 3.1.C, 3.1.D][10CFR60.135(a)(2), 10CFR60.135(b)(4)]

1.2.1.17 The disposal container shall retain the capability to be unloaded after the occurrence of the events listed in Section 1.2.2.1.

[F 1.1.13] [10CFR60.131(b), 10CFR60.131(c)]

1.2.1.18 The lifting features of the disposal container, considered as a single component, shall be designed for three times the maximum weight of the loaded and sealed disposal container without generating a combined shear stress or maximum tensile stress, at any point in the lifting features, in excess of the corresponding minimum tensile yield strength of the materials of construction. The lifting features shall also be designed for five times the weight of the disposal container without exceeding the ultimate tensile strength of the materials.

[F 1.1.8, 1.1.13][MGDS RD 3.1.C, 3.1.G][10CFR60.135(a)(2), 10CFR60.135(b)(3)]

1.2.1.19 The disposal container materials shall incorporate the use of noncombustible and heat resistant materials.

[F 1.1.7, 1.1.10][MGDS RD 3.1.C][10CFR60.131(d)(2), 10CFR60.135(a)(2)]

1.2.1.20 Disposal container materials shall exclude the use of chemically reactive, explosive, or pyrophoric materials.

[F 1.1.2, 1.1.11][MGDS RD 3.1.C][10CFR60.135(a)(2), 10CFR60.135(b)(1)]

1.2.1.21 The disposal container shall be designed to accept DOE waste canisters with a nominal waste moisture content of (TBD-324).

[F 1.1.1, 1.1.7, 1.1.10][MGDS RD 3.1.C][10CFR60.135(a)(2), 10CFR60.135(b)(2)]

1.2.1.22 The disposal container shall be designed to withstand transfer, emplacement, and retrieval operations without breaching.

[F 1.1.1, 1.1.8][MGDS RD 3.1.C][10CFR60.135(b)(3)]

1.2.2 Safety Criteria

1.2.2.1 Nuclear Safety Criteria

1.2.2.1.1 During the preclosure period, while in a horizontal orientation, the disposal container shall be designed to withstand a 25 MT (55,000 lbs.) (TBV-245) rock falling 3.1 m (10.2 ft.) (TBV-245) onto the side of the disposal container without breaching. (TBV-245)

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c)]

1.2.2.1.2 During the preclosure period, while in a vertical orientation, the disposal container shall be designed to withstand a 2.3 MT (5,100 lbs.) (TBV-245) object falling 2 m (6.6 ft.) (TBV-245) onto the end of the disposal container without breaching. (TBV-245)

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c)]

1.2.2.1.3 During the preclosure period, the disposal container, while in a vertical orientation, shall be designed to withstand a drop from a height of 2 m (6.6 ft.) (TBV-245) without breaching. (TBV-245)

[CDA EBDRD 3.7.1.1.F][F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c), 10CFR60.135(b)(3)]

1.2.2.1.4 During the preclosure period, the disposal container, while in a horizontal orientation, shall be designed to withstand a drop from a height of 2.4 m (7.9 ft.) (TBV-245) without breaching. (TBV-245)

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c), 10CFR60.135(b)(3)]

1.2.2.1.5 During the preclosure period, the disposal container, while in a horizontal orientation, shall be designed to withstand the greater stress resulting from a drop of 1.9 m (6.2 ft.) (TBV-245) onto a support in an emplacement drift, or a drop of 2.4 m (7.9 ft.) (TBV-245) onto a pier, without breaching by puncture. (TBV-245)

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c), 10CFR60.135(b)(3)]

1.2.2.1.6 During the preclosure period, the disposal container shall be designed to withstand a tip over from a vertical position with slap down onto a flat, unyielding surface without breaching. (TBV-245)

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c)]

1.2.2.1.7 The disposal container shall be designed to withstand a Design Basis Earthquake of Frequency Category 1 or Frequency Category 2, as appropriate to the seismic frequency classification assigned to a specific structure, system, and component. Both vibratory ground motion and fault displacement of the Design Basis Earthquakes must be considered, taking credit as appropriate for interfacing systems that alter or mitigate the effect of the Design Basis Earthquake on the disposal container. The Design Basis Earthquake Input parameters of the Design Basis Earthquakes are defined in Tables 1-4 through 1-10. (TBD-235, TBV-245)

Table 1-4 Surface Design Spectral Accelerations for Design Earthquake Derived for 5 – 10 Hz Frequency Range:

Response Frequency (Hz)	Horizontal Motion	Horizontal Motion	Vertical Motion	Vertical Motion
	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)
0.3	(TBD)	(TBD)	(TBD)	(TBD)
0.5	(TBD)	(TBD)	(TBD)	(TBD)
1	(TBD)	(TBD)	(TBD)	(TBD)
2	(TBD)	(TBD)	(TBD)	(TBD)
5	(TBD)	(TBD)	(TBD)	(TBD)
10	(TBD)	(TBD)	(TBD)	(TBD)
20	(TBD)	(TBD)	(TBD)	(TBD)
100	(TBD)	(TBD)	(TBD)	(TBD)

Table 1-5 Surface Design Spectral Accelerations for Design Earthquake Derived for 1 – 2 Hz Frequency Range:

Response Frequency (Hz)	Horizontal Motion	Horizontal Motion	Vertical Motion	Vertical Motion

	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)
0.3	(TBD)	(TBD)	(TBD)	(TBD)
0.5	(TBD)	(TBD)	(TBD)	(TBD)
1	(TBD)	(TBD)	(TBD)	(TBD)
2	(TBD)	(TBD)	(TBD)	(TBD)
5	(TBD)	(TBD)	(TBD)	(TBD)
10	(TBD)	(TBD)	(TBD)	(TBD)
20	(TBD)	(TBD)	(TBD)	(TBD)
100	(TBD)	(TBD)	(TBD)	(TBD)

Table 1-6 Surface Design Peak Velocity (cm/sec) for Design Earthquake Derived for 5 – 10 Hz and 1 – 2 Hz Frequency Ranges:

Design Earthquake Frequency Range (Hz)	Horizontal Motion	Horizontal Motion	Vertical Motion	Vertical Motion
	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)
5 – 10	(TBD)	(TBD)	(TBD)	(TBD)
1 – 2	(TBD)	(TBD)	(TBD)	(TBD)

Table 1-7 Subsurface Design Spectral Accelerations for Design Earthquake Scaled to 5 – 10 Hz Frequency Range:

Response Frequency (Hz)	Horizontal Motion	Horizontal Motion	Vertical Motion	Vertical Motion
	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)
0.3	0.0222 g(TBV)	0.0720 g(TBV)	0.0107 g(TBV)	0.0378 g(TBV)
0.5	0.0399 g(TBV)	0.125 g(TBV)	0.0205 g(TBV)	0.0688 g(TBV)
1	0.0649 g(TBV)	0.206 g(TBV)	0.0385 g(TBV)	0.130 g(TBV)
2	0.144 g(TBV)	0.458 g(TBV)	0.0532 g(TBV)	0.180 g(TBV)
5	0.226 g(TBV)	0.717 g(TBV)	0.128 g(TBV)	0.435 g(TBV)
10	0.242 g(TBV)	0.765 g(TBV)	0.182 g(TBV)	0.620 g(TBV)
20	0.216 g(TBV)	0.681 g(TBV)	0.179 g(TBV)	0.613 g(TBV)
100	0.123 g(TBV)	0.391 g(TBV)	0.083 g(TBV)	0.288 g(TBV)

Table 1-8 Subsurface Design Spectral Accelerations for Design Earthquake Scaled to 1 – 2 Hz Frequency Range:

Response Frequency (Hz)	Horizontal Motion	Horizontal Motion	Vertical Motion	Vertical Motion
	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)
0.3	0.0497 g(TBV)	0.186 g(TBV)	0.0266 g(TBV)	0.101 g(TBV)
0.5	0.0747 g(TBV)	0.252 g(TBV)	0.0428 g(TBV)	0.149 g(TBV)
1	0.0927 g(TBV)	0.286 g(TBV)	0.0659 g(TBV)	0.206 g(TBV)

2	0.163 g(TBV)	0.465 g(TBV)	0.0717 g(TBV)	0.212 g(TBV)
5	0.183 g(TBV)	0.471 g(TBV)	0.115 g(TBV)	0.309 g(TBV)
10	0.151 g(TBV)	0.374 g(TBV)	0.112 g(TBV)	0.295 g(TBV)
20	0.123 g(TBV)	0.302 g(TBV)	0.0936 g(TBV)	0.244 g(TBV)
100	0.0915 g(TBV)	0.231 g(TBV)	0.0591 g(TBV)	0.156 g(TBV)

Table 1-9 Subsurface Design Peak Velocity (cm/sec) for Design Earthquake Scaled to 5 – 10 Hz and 1 – 2 Hz Frequency Ranges:

Design Earthquake Frequency (Hz)	Horizontal Motion	Horizontal Motion	Vertical Motion	Vertical Motion
	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)	Frequency Category 1 (1000 yr Recurrence)	Frequency Category 2 (10,000 yr Recurrence)
5 – 10	13.42(TBV)	33.63(TBV)	6.26(TBV)	17.10(TBV)
1 – 2	14.73(TBV)	41.84(TBV)	7.55(TBV)	22.38(TBV)

Table 1-10 Parameters for the Ground Displacement Design Basis Earthquake – Surface and Subsurface

Ground Displacement Design Basis Earthquake	Surface Fault Displacement	Subsurface Fault Displacement	Comment
Frequency Category 1 (10,000 yr Recurrence)	(TBD)	Less than 1 cm(TBV)	Considered insignificant with respect to repository design
Frequency Category 2 (100,000 yr Recurrence)	(TBD)	Less than 1 cm(TBV)	Considered insignificant with respect to repository design except for block-bounding faults: Bow Ridge 12 cm Solitario Canyon 30 cm

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c)]

1.2.2.1.8 During the preclosure period, the disposal container shall be designed to withstand the impact of a 0.5 kg (1.1 lb.) (TBV-245) missile at 5.7 m/s (18.7 ft./sec.) (TBV-245) without breaching. (TBV-245)

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c)]

1.2.2.1.9 During the preclosure period, the disposal container shall be designed to withstand, without breaching, the maximum impact resulting from a transporter runaway, derailment, and impact at a speed of 63 km/hr (39 mi./hr.) (TBV-245), taking credit as appropriate for interfacing systems that prevent derailment and impact with walls of the repository drifts or mitigate the impact on the disposal container. (TBV-245)

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c), 10CFR60.135(b)(3)]

1.2.2.1.10 During the preclosure period, the disposal container shall be designed not to breach, and to assure that the cladding temperature of the enclosed spent nuclear fuel remains below 570 °C (1058 °F) (TBV-245) when the entire disposal container is exposed for 30 minutes (TBV-245) to a heat flux not less than that of a radiation environment of 800°C (1472°F) (TBV-245) with an emissivity of at least 0.9 (TBV-245) with surface absorptivity at least 0.8 (TBV-245). (TBV-245)

[F 1.1.1, 1.1.6, 1.1.9][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c), 10CFR60.131(d)(1), 10CFR60.135(a)(2)]

1.2.2.1.11 During the preclosure period, the disposal container shall be designed to withstand, without breaching, the maximum internal pressure of 1.04 MPa (150 psia) (TBV-245) at an ambient temperature less than or equal to 550 °C (1022 °F) (TBV-245) as generated by 1) rupture of 100% of fuel rods and the resulting release of 100% of fill gases and 30% of fission gases from the spent nuclear fuel contained in the disposable canister, and 2) any gases which may be produced by chemical reactions within the SNF. (TBV-245)

[F 1.1.1, 1.1.6][MGDS RD 3.1.C][10CFR60.131(b), 10CFR60.131(c), 10CFR60.131(d)(1)]

1.2.2.2 Non-nuclear Safety Criteria

There are no non-nuclear safety criteria for this system.

1.2.3 Environments

1.2.3.1 The disposal container shall meet all performance requirements during and after exposure to the emplacement drift external environments identified in Table 1-11. (TBD-234)

Table 1-11: Emplacement Drift External Environment

Environment	Range	Duration/Frequency of Occurrence
TBD	TBD	TBD

[F 1.1.9][MGDS RD 3.1.C][10CFR60.135(a)(1)]

1.2.4 System Interfacing Criteria

1.2.4.1 The disposal container outer diameter shall be between 1.25 m (49.2 in.) (TBV-246) and 2.00 m (78.7 in.) (TBV-246). This criteria identifies the primary disposal container interface with the Disposal Container Handling System, the Canister Transfer System, and the Waste Emplacement System.

[CDA EBDRD 3.7.1.J.1][F 1.1.13]

1.2.4.2 The disposal container outer length shall be between 3.70 m (145 in.) (TBV-246) and 6.20 m (244 in.) (TBV-246). This criteria identifies the primary disposal container interface with the Disposal Container Handling System, the Canister Transfer System, and the Waste Emplacement System.

[CDA EBDRD 3.7.1.J.1][F 1.1.13]

1.2.4.3 An unloaded disposal container shall not exceed 38,000 kg (83,776 lbs.) (TBV-246). This criteria identifies the primary disposal container interface with the Disposal Container Handling System and the Canister Transfer System.

[CDA EBDRD 3.7.1.2.H.2][F 1.1.13]

1.2.4.4 A fully loaded and sealed disposal container shall not exceed 83,000 kg (182,980 lbs.) (TBV-246). This criteria identifies the primary disposal container interface with the Disposal Container Handling System, the Canister Transfer System, and the Waste Emplacement System.

[CDA EBDRD 3.7.1.J.2][F 1.1.13]

1.2.4.5 The center of gravity of each unloaded and loaded disposal container shall be within (TBD-233) % (radially and axially) of the geometric center. This criteria identifies the primary disposal container interface with the Disposal Container Handling System, the Canister Transfer System, and the Waste Emplacement System.

[F 1.1.13]

1.2.4.6 The disposal container shall be designed for horizontal emplacement on a minimum of two supporting pedestals spaced 1.5 m apart at time of emplacement within an emplacement drift. This criteria identifies the primary disposal container interface with the Ex-Container System.

[CDA Key 066][F 1.1.13]

1.2.4.7 Disposal container design shall reduce the dose rate at all external surfaces of a loaded and sealed disposal container to 355 rem/hr (TBV-248) or less. This

criteria identifies the primary disposal container interface with the Waste Emplacement System and the Disposal Container Handling System.

[CDA EBDRD 3.2.4.5, Key 031][F 1.1.6, 1.1.13][MGDS RD 3.1.B, 3.1.C][10CFR60.131(a)(3)]

1.2.4.8 Disposal container design shall support a repository design that may or may not backfill with the following characteristics:

- Thermal conductivity equal or greater than 0.5 W/m-K (TBV-249),
- Partial backfill level top surface geometry (TBV-249),
- Minimum coverage of 0.6 m over the disposal container (TBV-249),
- Emplacement of backfill beginning 100 years or later after initiation of waste emplacement (TBV-249).

This criteria identifies the primary disposal container interface with the Ex-Container System.

[CDA Key 046][MGDS RD 3.1.C, 3.3.I][10CFR60.133(h)]

1.2.4.9 The disposal container shall be designed to have a maximum thermal output of 18 kW (1025 BTU/min.) (TBV-251) or less. This criteria identifies the primary disposal container interface with the Ex-Container System.

[CDA DCSS 023][F 1.1.4][MGDS RD 3.1.C, 3.2.F, 3.2.I][10CFR60.133(h), 10CFR60.133(i)]

1.2.4.10 The quantity of SNF disposed of in this suite of disposal containers shall not exceed 2,333 MTU of DOE waste.

[CDA Key 005][F 1.1.1][MGDS RD 3.1.A, 3.2.A]

1.2.4.11 The disposal container shall be designed to be loaded and sealed in a vertical orientation. This criteria identifies the primary disposal container interface with the Canister Transfer System and the Disposal Container Handling System.

[CDA Key 085][F 1.1.13][MGDS RD 3.2.B]

1.2.4.12 The disposal container shall be designed to be handled in both horizontal and vertical orientations. This criteria identifies the primary disposal container interface with the Disposal Container Handling System and the Waste Emplacement System.

[F 1.1.13][MGDS RD 3.2.B]

1.2.4.13 The disposal container shall prevent the failure of the structural components of the disposable canister due to disposal container loading, handling, sealing, transfer, emplacement, possible retrieval, and other normal operations by limiting the acceleration of loading and emplacement equipment to (TBD-276) in conjunction

with the systems that handle loaded disposable canisters and disposable containers..

[F 1.1.8, 1.1.10][MGDS RD 3.1.C, 3.4.2.C][10CFR60.112, 10CFR60.113(a)(1)(i)(B), 10CFR60.113(a)(1)(ii)(B)]

1.2.5 Operational Criteria

There are no operational criteria for this system.

1.2.6 Codes and Standards

As explained in the CBS for criterion 1.2.1.18, certain provisions of ANSI N14.6 apply to the design of the lifting features of the disposal container. No other codes or standards apply to this system.

1.3 SUBSYSTEM DESIGN CRITERIA

There are no subsystem design criteria for this system.

1.4 CONFORMANCE VERIFICATION

A conformance verification matrix for this system will be provided in a future revision.

2.0 DESIGN DESCRIPTION

A design description for this system will be provided in a future revision.

3.0 MAINTENANCE

A maintenance section for this system will be provided in a future revision.

4.0 OPERATIONS

An operations section for this system will be provided in a future revision.

APPENDIX A REFERENCES

This section provides a listing of references used in Volume I.

American National Standard for Radioactive Materials – Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4,500 Kg) or More. ANSI N14.6. 1993.

Classification of the Preliminary MGDS Repository Design. B00000000-01717-0200-00134, Rev. 00. October 6, 1997. Las Vegas, Nevada: U.S. Department of Energy, Civilian Radioactive Waste Management System Management and Operating Contractor.

Controlled Design Assumptions Document. B00000000-01717-4600-00032, Rev. 04, ICN 4. March 27, 1998. Las Vegas, Nevada: U.S. Department of Energy, Civilian Radioactive Waste Management System Management and Operating Contractor.

Disposal of High Level Radioactive Wastes in Geologic Repositories. Title 10, Part 60 of the Code of Federal Regulations. Washington, D. C.: U. S. Government Printing Office.

Mined Geologic Disposal System Requirements Document. YMP/CM-0025, Rev. 3. February 1998. Las Vegas, Nevada: U.S. Department of Energy, Civilian Radioactive Waste Management System Yucca Mountain Project.

Quality Assurance Requirements and Description. DOE/RW-0333P, Rev 8. June 5, 1998. Washington, District of Columbia: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

SDD Development/Maintenance. January 26, 1998. Las Vegas, Nevada: U.S. Department of Energy, Civilian Radioactive Waste Management System Management and Operating Contractor.

APPENDIX B ACRONYMS

This section provides a listing of acronyms used in this document.

10CFR60	Title 10, Part 60 of the Code of Federal Regulations
CDA	Controlled Design Assumptions Document
CLC	Center Location Canister
DC	Disposal container
DOE	Department of Energy
F	Function
HEU	High Enriched Uranium
LEU	Low Enriched Uranium
LWBR	Light Water Breeder Reactor
MCO	Multi-Canister Overpack
MEU	Medium Enriched Uranium
MGDS	Mined Geologic Disposal System
MGDS RD	Mined Geologic Disposal System Requirements Document
MOX	Mixed Oxide Uranium
NSNFP	National Spent Nuclear Fuel Program
MTU	Metric Tons of Uranium
OLC	Outside Location Canister
QA	Quality Assurance
SNF	Spent Nuclear Fuel
SS	Stainless Steel
SST	Stainless Steel
TBD	To Be Determined
TBV	To Be Verified

DOE Spent Nuclear Fuel Disposal Container System Description Document

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Volume II

TABLE OF CONTENTS

5.0 SDD CRITERIA BASIS STATEMENTS AND REFERENCES.

5.1 SDD CRITERIA BASIS STATEMENTS

This section presents the criteria basis statements for criteria in Section 1.2 of Volume I.

1.2.1.1 Criteria Basis Statement

I. Criteria Need Basis

This requirement establishes the types of waste that the suite of DOE SNF DC must be designed to contain. This criterion provides a lower level decomposition of MGDS RD 3.2.A by specifying the DOE SNF categories that will make up part of the 2,333 MTU of DOE SNF to be disposed of at the MGDS. In addition, this criterion provides the categories of DOE SNF which are to be evaluated for criticality, structural, and thermal analysis, and Total System Performance Assessment.

Source of the information contained in this criteria (Tables 1-1A, B, & C of Volume I) is "DOE SNF Categories. LV.WP.MEF.05/98-125, Michael E. Frankle to F. Habashi. June 25, 1998."

II. Criteria Performance Parameter Basis

N/A

1.2.1.2 Criteria Basis Statement

I. Criteria Need Basis

This requirement establishes the types of disposal containers that must be designed to contain the DOE disposal canisters. Disposal canister characteristics (outside diameter, maximum length, weight, and material) are provided for use, as needed, in the design of the disposal containers.

II. Criteria Performance Parameter Basis

The DOE canister data presented in Table 1-2 as a part of this criterion are obtained from the following sources:

Length and weight data for all four NSNFP canister types are obtained from Section 7.1.2 of the "Interface Control Document for U. S. Department of Energy Spent Nuclear Fuel to the Mined Geologic Disposal System for Mechanical and Envelope Interfaces". Material information for the Hanford MCO is from Section 7.2 of the same document.

Outside diameter data for the two OLC NSNFP canister types and the Shippingport LWBR canister type sizes are obtained from "Document Review (OPE-SFP-98-108), Memorandum from James H Boyd (National Spent Nuclear Fuel Program) to Paul Harrington (DOE-YMSCO), March 27, 1998."

The Hanford MCO canister type data (except for material) are obtained from "Revision of the Physical Dimensions of the MCO Waste Package. LV.WP.MJP.01/98-010, Michael J. Plinski to T.W. Doering. January 21, 1998.".

1.2.1.3 Criteria Basis Statement

I. Criteria Need Basis

This requirement provides a quantified definition of 'substantially complete containment' (10CFR60.113(a)(1)(i)(A)) relative to the disposal container and implements the upper limit of the substantially complete containment period (1,000 years) (10CFR60.113(a)(1)(ii)(A)).

II. Criteria Performance Parameter Basis

The 1,000 year waste package pre breach lifetime is derived from the MGDS RD requirement 3.2.G.

1.2.1.4 Criteria Basis Statement

I. Criteria Need Basis

This requirement defines the performance required of the disposal container to meet the to-be-established Environmental Protection Agency standard referenced in 10CFR60.112. It also defines the 'gradual process' and 'small fractional releases' relative to the disposal container as referenced in 10CFR60.113(a)(1)(i)(B). The requirement wording is further defined from 10CFR60.113(a)(1)(ii)(B).

This criteria contributes to lowering the expected annual doses to the critical group during the 10,000 year time period required by the "Interim Postclosure Requirement and Goal."

II. Criteria Performance Parameter Basis

The 10,000 year time frame is taken from the "Interim Postclosure Requirement and Goal." Other parameters are established by 10CFR60.113(a)(1)(ii)(B).

1.2.1.5 Criteria Basis Statement

I. Criteria Need Basis

This requirement applies the criticality requirement from 10CFR60.131(h) to the preclosure disposal container design.

Additional wording related to flooding or misloading of the disposal container is supported by "Safety Criteria for SDD WP-03, (DHLW) Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. It is reasonable to apply this analysis to the DOE Spent Nuclear Fuel disposal container SDD. This IOC provides input regarding Design Basis Events, therefore, this requirement partially supports 10CFR60.131(b).

II. Criteria Performance Parameter Basis

The performance parameters for this requirement are taken from 10CFR60.131(h).

1.2.1.6 Criteria Basis Statement

I. Criteria Need Basis

This requirement applies a proposed post-closure criticality requirement to the disposal container design. There is presently no specific regulatory guidance/criterion for postclosure criticality. 10CFR60.131(h) appears to be a simple prohibition of criticality, with the potential for exceptions only under conditions not found in the post-closure repository environment. Because of this limitation, the Department of Energy (DOE) has recommended ("Amendments to 10 CFR Part 60 on Disposal of High-Level Radioactive Wastes in Geologic Repositories--Design Basis Events for the Geologic Repository Operations Area--Final Rulemaking", Attachment 3, page 11) that the postclosure issue be moved to a new section to state the following:

"Postclosure criticality safety. The engineered barrier system shall be designed such that the probability and consequences of nuclear criticality provide reasonable assurance that the performance objective of 10CFR60.112 is met."

The proposed change to 10CFR60 has been adopted as an assumption in the "Controlled Design Assumptions Document" (EBDRD 3.7.1.3.A). The Nuclear Regulatory Commission (NRC) has not responded specifically to this request (i.e. no change to the 10CFR60 criticality requirement has been made), but has recognized the need for clarification or modification of 10CFR60.131(h), as applied to postclosure criticality, in the Federal Register, December 4, 1996, page 64264, "The Commission also believes that uncertainty remains with respect to the applicability of the criticality control requirements to the postclosure period. The commission intends to address the remaining uncertainty in a future rulemaking." Until this clarification is available, the DOE proposed regulation will serve as the basis for enforcing criticality safety during the pre-closure period as stated

in the current 10CFR60, while enforcing an alternate criticality control requirement (as stated in this criterion) during postclosure.

The criterion as stated quantifies the intent of the DOE suggested postclosure criticality control requirement. The wording of this criterion is a result of discussions between the SDD originator and Waste Package Operations personnel. This criterion wording, or a variation, is planned to be incorporated into the "Disposal Criticality Analysis Methodology Topical Report" to be published in the future.

II. Criteria Performance Parameter Basis

The actual content and quantification of the postclosure criticality criterion has not been confirmed. As a result, this criterion will need to be verified. A future rulemaking by the NRC will provide the basis to resolve this criteria and its parameters. The 1% inventory increase evaluated at 1000 years was chosen as the standard to which the consequences of postclosure criticality would be held below because the effect of the relatively small increase in the inventory (of 1% due to criticality events) will be negligible compared to the effect of other total system performance related parameters, such as infiltration rate, which can vary by over 100%.

1.2.1.7 Criteria Basis Statement

I. Criteria Need Basis

This requirement guides the design of the waste package to a design that is similar in outer shape to other disposal containers. This will provide consistency in the disposal container to repository interface and preclude unnecessary design activities to accommodate several disposal container outer geometry.

II. Criteria Performance Parameter Basis

The outer geometrical shape of the disposal container is inferred in "Controlled Design Assumptions Document" assumption 3.7.1.J.1.

1.2.1.8 Criteria Basis Statement

I. Criteria Need Basis

This requirement is intended to protect the SNF cladding, which acts as a radionuclide containment barrier. Loss of cladding integrity can lead to the potential for unacceptable radionuclide release rates in some fraction of the inventory. Larger release rates would increase the probability that 10CFR60.112, 10CFR60.113(a)(1(i)(B), and

10CFR60.113(a)(1(ii)(B) would not be met. This criterion is a consideration of some of the factors listed in 10CFR60.135(a)(1) and 10CFR60.135(a)(2).

II. Criteria Performance Parameter Basis

The temperature limit of 350 °F for Zircaloy cladding is taken from "Controlled Design Assumption Document" assumption DCWP 001. The temperature limit of 350 °F for stainless steel cladding is taken from "Temperature Limit for Stainless Steel Fuel Cladding. LV.WP.VP.5/98-082, Venkataraman Pasupathi to T.W. Doering. April 30, 1998." Temperature limit for SNF with other types of cladding is TBD.

1.2.1.9 Criteria Basis Statement

I. Criteria Need Basis

This requirement contributes to the ability to retrieve waste packages as required by 10 CFR 60.111(b)(1) & 60.111(b)(2).

This requirement dictates a time period in which the disposal containers must be capable of being moved after emplacement.

II. Criteria Performance Parameter Basis

The 134 year time period is composed of up to 100 years to initiate retrieval and 34 years to complete retrieval. Both time periods are specified in MGDS RD 3.2.H (the 100 year time period to initiate retrieval is specifically identified in MGDS RD and was assumed in the "Controlled Design Assumptions Document" assumption Key 016 prior to the MGDS RDs release.)

1.2.1.10 Criteria Basis Statement

I. Criteria Need Basis

This requirement is intended to preserve the waste form condition and configuration. Breach of the canisters due to oxidation/corrosion would remove the canister walls as barriers to radionuclide releases and therefore remove their contribution to overall repository performance. Overall repository performance is discussed in 10CFR60.112, 10CFR60.113(a)(1)(i)(B), and 10CFR60.113(a)(1)(ii)(B). As such, this criterion is a consideration of the items mentioned in 10CFR60.135(a)(1), 10CFR60.135(a)(2), and 10CFR60.135(b)(1). In addition, the possibility of a breach of the disposal container due to gas generation (with water being one such source of gas generation) is reduced, as discussed in 10CFR60.135(b)(2).

The need for a non-oxidizing environment is primarily established for the protection of commercial SNF. However, a non-oxidizing environment contributes to the defense-in-depth philosophy and is therefore reasonable to be applied to the DOE Spent Nuclear Fuel disposal container design.

II. Criteria Performance Parameter Basis

The performance parameters used in this criteria are taken from the criteria analysis that derives non-oxidizing environment characteristics found in the "Uncanistered Spent Nuclear Fuel Disposal Container System Description Document." That criteria analysis derives the non-oxidizing environment characteristics based on the emplacement of Uncanistered SNF Disposal Containers containing commercial SNF. The analysis to determine the appropriate concentration limit for each type of waste package has yet to be conducted. However, the concentration limit used for uncanistered SNF provides a reasonable basis to extend that same bound to canistered DOE Spent Nuclear Fuel.

1.2.1.11 Criteria Basis Statement

I. Criteria Need Basis

This requirement supports the decontamination of the disposal container such that a rough surface will not impede the decontamination process.

II. Criteria Performance Parameter Basis

The surface finish number (which will need to be verified) is from the "Multi-Purpose Canister Subsystem Design Procurement Specification" 5.1.4.B. This number will need to be verified since this number was intended and developed for the outer surface of a multi-purpose canister, and not a disposal container. Labels are excluded from this requirement to allow legibility through rougher surface finishes.

1.2.1.12 Criteria Basis Statement

I. Criteria Need Basis

This requirement guides disposal container design away from a design that would be difficult to decontaminate by precluding undesirable external geometries (e.g. blind holes). This requirement is intended to be assessed against the as-designed disposal container, without regard to actual disposal container use which would preclude surface visibility (e.g. disposal container emplacement on pedestals would preclude visibility of the pedestal to disposal container contact points).

II. Criteria Performance Parameter Basis

N/A

1.2.1.13 Criteria Basis Statement

I. Criteria Need Basis

This requirement defines the information required to be displayed on a disposal container. This requirement is based on the 10CFR60.135(b)(4) requirement for waste package labels.

This label criterion supports the QA-6 (Important to Physical Protection of Facility and Materials) classification defined for the DOE SNF DC in the "Classification of the Preliminary MGDS Repository Design" document. Specifically, labels are needed to support the physical protection of materials by facilitating the maintaining of knowledge of the identity, quantity, placement, and movement of materials within material access areas in a manner similar to 10 CFR73.45(d)(1)(iii), "Physical Protection of Plants and Materials. Title 10, Part 73 of the Code of Federal Regulations."

II. Criteria Performance Parameter Basis

The types of information required for display on the waste package label are derived from 10CFR70.42(d)(2), "Domestic Licensing of Special Nuclear Material. Title 10, Part 70 of the Code of Federal Regulations," which requires the waste form, type and quantity of special nuclear material to be known for special nuclear material transfers.

It is recognized that 10CFR70 is not directly applicable to the design of the MGDS, however, the data tracking required therein provides a reasonable initial basis for the types of information that will be expected to be displayed on individual disposal containers.

1.2.1.14 Criteria Basis Statement

I. Criteria Need Basis

This requirement responds to the 10CFR60 requirement that a label not degrade the performance of the disposal container. This requirement is based on the 10CFR60.135(b)(4) requirement for waste package labels. The consideration of many of the items listed in 10CFR60.135(a)(2) will be inherent in showing compliance with this criteria.

II. Criteria Performance Parameter Basis

N/A

1.2.1.15 Criteria Basis Statement

I. Criteria Need Basis

This requirement establishes the length of time that the labels must be legible. This requirement is based on the 10CFR60.135(b)(4) requirement for waste package labels.

This label criterion supports the QA-6 (Important to Physical Protection of Facility and Materials) classification defined for the DOE Spent Nuclear Fuel DC in the "Classification of the Preliminary MGDS Repository Design" document. Specifically, labels are needed to support the physical protection of materials by facilitating the maintaining of knowledge of the identity, quantity, placement, and movement of materials within material access areas in a manner similar to 10 CFR73.45(d)(1)(iii).

II. Criteria Performance Parameter Basis

N/A

1.2.1.16 Criteria Basis Statement

I. Criteria Need Basis

This requirement establishes the placement of the labels so that they may be read. This requirement is based on the 10CFR60.135(b)(4) requirement for waste package labels. In addition, it supports 10CFR60.135(a)(2) in that the impact of attachment and corrosion of the label have been considered in the placement of the label.

This label criterion supports the QA-6 (Important to Physical Protection of Facility and Materials) classification defined for the DOE Spent Nuclear Fuel DC in the "Classification of the Preliminary MGDS Repository Design" document. Specifically, labels are needed to support the physical protection of materials by facilitating the maintaining of knowledge of the identity, quantity, placement, and movement of materials within material access areas in a manner similar to 10 CFR73.45(d)(1)(iii).

II. Criteria Performance Parameter Basis

N/A

1.2.1.17 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). Since a potentially damaged disposal container will not be placed in the repository, retaining the capability to unload the disposal container after a design basis event is important to safety.

II. Criteria Performance Parameter Basis

N/A

1.2.1.18 Criteria Basis Statement

I. Criteria Need Basis

This requirement requires that the disposal container lifting features be designed to withstand handling loads. The integrity of the lifting features of the DC contribute to the safe handling of the DC as required by 10CFR60.135(b)(3). This is a consideration of mechanical stress and mechanical strength as required by 10CFR60.135(a)(2)

II. Criteria Performance Parameter Basis

The factors of safety are obtained from the "American National Standards for Radioactive Materials – Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4,500 Kg) or More. ANSI N14.6. 1993."

The scope of ANSI N14.6 encompasses special lifting devices and those features of the attachment members of the containers that affect the function and safety of the lift. The NRC endorses the stress design factors specified in Section 4.2.1.1 of ANSI N14.6 for special lifting devices for containers that include transportation cask trunnions. Although the NRC has endorsed Section 4.2.1.1 for cask trunnions and a parallel application is being made for the disposal container skirt, the NRC has not endorsed Section 4.2.1.1 specifically for use in DC designs at the repository. Since the stress design factors specified in ANSI N14.6 are not necessarily based on loading conditions that are representative of repository operations, the Yucca Mountain Project may develop, for use in its DC designs, different values based on loading conditions that are representative of repository operations. A technical report would provide the supporting technical basis for the project-specific values along with a rationale for not using ANSI N14.6. The stress design factors specified in ANSI N14.6 will be used in the DC designs until project-specific values are developed.

1.2.1.19 Criteria Basis Statement

I. Criteria Need Basis

This criterion is taken from 10CFR60.131(d)(2). In addition, this is a consideration of the fire hazards and thermal loads of the disposal container as required by 10CFR60.135(a)(2)

II. Criteria Performance Parameter Basis

N/A

1.2.1.20 Criteria Basis Statement

I. Criteria Need Basis

Use of pyrophoric, explosive, and chemically reactive materials is limited by 10CFR60.135(b)(1). This criterion imposes a more stringent requirement by excluding the use of these materials entirely. In addition, this is a consideration of the fire hazards (pyrophoric materials), explosion hazards (explosive materials), and thermal loads (conditions resulting in the ignition of a pyrophoric material and the results of an explosion or fire) of the disposal container as required by 10CFR60.135(a)(2).

II. Criteria Performance Parameter Basis

N/A

1.2.1.21 Criteria Basis Statement

I. Criteria Need Basis

The amounts of free liquids contained in the waste package are addressed in 10CFR60.135(b)(2). While the design of the disposal container cannot control the moisture content of the waste placed inside, the design can control the use of materials. Thus, the use of free liquids in disposal container design is not allowed. In addition, this is a consideration of several of the items listed in 10CFR60.135(a)(2)

II. Criteria Performance Parameter Basis

N/A

1.2.1.22 Criteria Basis Statement

I. Criteria Need Basis

This criterion is identified in 10CFR60.135(b)(3).

II. Criteria Performance Parameter Basis

N/A

1.2.2.1.1 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030.

1.2.2.1.2 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030.

1.2.2.1.3 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis,"

IOC LV.SA.DDO.04/98-030. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. This requirement is also supported by the "Controlled Design Assumption Document" assumption EBDRD 3.7.1.1.F.

1.2.2.1.4 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030.

1.2.2.1.5 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030.

1.2.2.1.6 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030.

1.2.2.1.7 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from " Seismic Criteria for Bin 2 and Bin 3 SDDs. LV.SA.KJM.04/98-049, D.W. Gwyn to R.M. Stambaugh. April 27, 1998."

1.2.2.1.8 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030.

1.2.2.1.9 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-03, DHLW Disposal Container and Basis," IOC LV.SA.DDO.04/98-030.

1.2.2.1.10 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-01, Uncanistered SNF Disposal Container and Basis," IOC LV.SA.DDO.02/97-020. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-01, Uncanistered SNF Disposal Container and Basis," IOC LV.SA.DDO.02/97-020.

1.2.2.1.11 Criteria Basis Statement

I. Criteria Need Basis

This requirement is necessary for design basis event mitigation as required by 10CFR60.131(b) and (c). The general wording and functional trace for this requirement are taken from "Safety Criteria for SDD WP-01, Uncanistered SNF Disposal Container and Basis," IOC LV.SA.DDO.02/97-020. It is reasonable to apply this to the DOE Spent Nuclear Fuel disposal container SDD.

II. Criteria Performance Parameter Basis

The event parameters are taken from "Safety Criteria for SDD WP-01, Uncanistered SNF Disposal Container and Basis," IOC LV.SA.DDO.02/97-020.

1.2.3.1 Criteria Basis Statement

I. Criteria Need Basis

This requirement defines the external (outside the disposal container) environment the disposal container should be designed for.

II. Criteria Performance Parameter Basis

N/A

1.2.4.1 Criteria Basis Statement

I. Criteria Need Basis

This requirement limits the size and shape of the DC, which impacts the design of the emplacement equipment, emplacement hardware, and underground opening size. The values given in the criterion are bounding for all types of disposal containers because the interface between the other systems and the disposal containers is not disposal container type specific.

II. Criteria Performance Parameter Basis

This requirement is supported by "Controlled Design Assumptions Document" assumption EBDRD 3.7.1.J.1. The extreme dimensions for all disposal container types from this assumption are used to establish the bounding values of the interface.

1.2.4.2 Criteria Basis Statement

I. Criteria Need Basis

This requirement limits the size and shape of the DC, which impacts the design of the emplacement equipment, emplacement hardware, and underground opening size. The values given in the criterion are bounding for all types of disposal containers because the interface between the other systems and the disposal containers is not disposal container type specific.

II. Criteria Performance Parameter Basis

This requirement is supported by "Controlled Design Assumptions Document" assumption EBDRD 3.7.1.J.1. The extreme dimensions for all disposal container types from this assumption are used to establish the bounding values of the interface.

1.2.4.3 Criteria Basis Statement

I. Criteria Need Basis

This requirement limits the weight of the unloaded disposal container, which affects the design of the emplacement equipment and hardware. The values given in the criterion are bounding for all types of disposal containers because the interface between the other systems and the disposal containers is not disposal container type specific.

II. Criteria Performance Parameter Basis

This requirement is supported by "Controlled Design Assumptions Document" assumption EBDRD 3.7.1.2.H.2.

1.2.4.4 Criteria Basis Statement

I. Criteria Need Basis

This requirement limits the weight of the fully loaded and sealed disposal container, which affects the design of the DC handling and emplacement equipment and hardware. The values given in the criterion are bounding for all types of disposal containers because the interface between the other systems and the disposal containers is not disposal container type specific.

II. Criteria Performance Parameter Basis

This requirement is supported by "Controlled Design Assumptions Document" assumption EBDRD 3.7.1.J.2.

1.2.4.5 Criteria Basis Statement

I. Criteria Need Basis

This requirement limits the location of the disposal container center of gravity, which affects the design of the emplacement equipment and hardware.

II. Criteria Performance Parameter Basis

N/A

1.2.4.6 Criteria Basis Statement

I. Criteria Need Basis

This requirement limits the emplacement design concept, which must be considered in surface, subsurface, and waste package design activities.

II. Criteria Performance Parameter Basis

Criteria Analysis: Waste Package Emplacement Support Spacing (Revision 01)

1. Purpose

The purpose of this statement is to establish the spacing of waste package emplacement supports. The spacing of supports must be such that the shortest waste package design still rests on more than one, regardless of where it is emplaced in the drift. This requirement limits the emplacement design concept.

2. Assumptions

2.1 The waste package support is sufficiently narrow that a waste package must rest on more than one in order to be stable.

2.2 The waste package support placement will be in the center of the precast invert segments to evenly load the invert. Therefore, the support spacing must be a multiple of the width of the precast invert segment.

2.3 The waste packages must be able to be placed anywhere along the drift to adjust the thermal loading.

3. Criteria Analysis

The drift lining segments are 1.5 m wide, Ref. 4.1.

Waste package length will not be less than 3.70 m, Ref. 4.2

The barrier skirts are thinner than the containment barriers, so credit is not taken for a support under the skirt. Therefore, the length of the skirts is subtracted.

3.70 - 2*0.225 = 3.250 m, Ref. 4.3

In order to ensure that the shortest package rests on two supports, it must be able to cover two spans so if it just misses one support, it will still rest on two. Therefore, the span between supports can be no more than half of the length of the package.

3.250 m /2 = 1.625 m

Since the center to center spacing of supports must be a multiple of the width of the precast invert segments, 1.5 m, the only solution is to put a support on each invert segment.

The spacing of the supports shall be 1.5 m, equal to the width of the invert segments.

4. References

4.1 Emplacement Drift Ground Support Pre-cast Concrete Lining, BCAA00000-01717-2700-83018 REV 00. *

4.2 Controlled Design Assumptions Document, B00000000-01717-4600-00032 REV 04, ICN 4. *

4.3 5-High Level Waste Corrosion Allowance Shell, BBAA00000-01717-2700-16037 REV 00. *

5. Conclusions

The waste package should rest on a minimum of two waste package supports. The support spacing must be equal to the width of the precast invert segments in order to fulfill this requirement. The center to center spacing of the supports shall be 1.5m. *The use of unqualified input in this analysis was necessary to establish the bounding characteristics for the design criteria. The inclusion of this input does not disqualify the results of the analysis due to the conservative margin used in establishing the bounding design criteria.

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	Name	Signature	Date

1.2.4.7 Criteria Basis Statement

I. Criteria Need Basis

This requirement is needed as an interface between the disposal container and the waste emplacement system to allow adequate waste package transporter shielding design (supporting 10CFR60.131(a)(3)) for an acceptable dose rate at the external surfaces of the transporter (in support of 10CFR20/MGDS RD 3.1.B requirements). This requirement is not intended to yield disposal container design features that are added solely for the purpose of shielding (unshielded waste packages recommended in the "Waste Package Size Study Report"), but is intended to establish the expected maximum dose rate the waste emplacement system will be designed to reduce. The use of an unshielded waste package is supported by "Controlled Design Assumptions Document" assumptions EBDRD 3.2.4.5 and Key 031.

II. Criteria Performance Parameter Basis

The 355 rem/hr is taken from the "DC Surface Dose Rate" IOC LV.WP.MEF.05/98-108.

1.2.4.8 Criteria Basis Statement

I. Criteria Need Basis

This requirement responds to the parent MGDS RD requirement that preserves the option of including backfill as part of the engineered barrier if it is determined that backfill is required to meet post-closure performance requirements of 10CFR60.133(h), "Engineered barriers shall be designed to assist the geologic setting in meeting the performance objectives for the period following permanent closure."

The requirement preserves the option of backfilling the repository by requiring disposal container design to be compatible with a repository design with or without backfill in the emplacement drifts.

II. Criteria Performance Parameter Basis

Since it is not feasible to place specialized backfill on each type of disposal container, it is desired that backfill characteristics be homogeneous throughout all emplacement drifts. The performance parameters used in this criteria are taken from the criteria analysis that derives backfill characteristics found in the "Uncanistered Spent Nuclear Fuel Disposal Container System Description Document." That analysis addressed three aspects of backfill in consideration of the interfacing parameters between the Ex-Container System and the Uncanistered SNF Disposal Container.

The first aspect of backfill considered was thermal conductivity of the backfill. The thermal conductivity of the backfill is dependent on the material chosen and independent of the disposal container upon which it is placed (thermal effects are considered later). Therefore, the thermal conductivity agreed to as an interface for the Uncanistered SNF Disposal Container is acceptable for the DOE Spent Nuclear Fuel Disposal Container.

The second aspect of backfill considered was backfill geometry. Again, the geometry of the emplaced backfill is dependent upon the machinery with which it is emplaced and independent of the disposal container upon which it is placed. Therefore, the backfill geometry agreed to as an interface for the Uncanistered SNF Disposal Container is acceptable for the DOE Spent Nuclear Fuel Disposal Container.

The third aspect of backfill considered was the SNF cladding temperature. Inherent in the consideration of the cladding temperature was the time of emplacement, thermal conductivity of the backfill, and the emplaced geometry of the backfill. The "worst case" 18 kW thermal output package was assessed and it was indicated that the 350 degrees Celsius cladding temperature limit was not exceeded. The assessment in the Uncanistered SNF DC is considered bounding since the types and quantities of waste to be disposed of within the DOE Spent Nuclear Fuel Disposal Container will generate a thermal output far lower than 18 kW, and the maximum allowable temperature of the wastes placed inside are equal to or greater than the cladding limit established in the Uncanistered SNF DC. Therefore, the time of backfill emplacement agreed to as an interface for the Uncanistered SNF Disposal Container is acceptable for the DOE Spent Nuclear Fuel Disposal Container..

1.2.4.9 Criteria Basis Statement

I. Criteria Need Basis

The division of systems between several disposal container systems and the Ex-Container Systems results in the need for a maximum heat load interface criteria for the waste package. This interface criteria will allow the designers of the Ex-Container Systems to design the emplacement drifts to the 200 degrees Celsius emplacement drift temperature criteria ("Controlled Design Assumptions Document" assumption DCSS 023).

This requirement contributes directly to the evaluation of thermal loads within the repository as an interface between disposal container design and the Ex-Container System design. This requirement therefore responds to the 10CFR60.133(h) requirement which states that "Engineered barriers shall be designed to assist the geologic setting in meeting the performance objectives for the period following permanent closure," and 10CFR60.133(i) requirement which states that "The underground facility shall be designed so that the performance objectives will be met taking into account the predicted thermal and thermomechanical response of the host rock, and surrounding strata, ground water system."

This requirement contributes to the limiting of the near ground surface temperature change (MGDS 3.2.F) by limiting the thermal output per waste package. The thermal output per waste package is a key element in the thermal loading of the repository (which is indirectly established through the areal mass loading MGDS RD requirement 3.2.I),

which is the determining factor in how much the near ground surface temperature will rise after emplacement.

The mass loading of the repository required in the MGDS RD (3.2.I) is meant to dictate a 'hot repository.' The thermal output per waste package is an important factor in the overall thermal loading of the repository.

II. Criteria Performance Parameter Basis

The maximum thermal output limit of 18 kW given in this criteria is taken from the "Uncanistered Spent Nuclear Fuel Disposal Container System Description Document." It is not anticipated that any change to either the design of the DOE Spent Nuclear Fuel disposal container and/or the waste to be disposed of in the DOE Spent Nuclear Fuel disposal container would cause the output of the DOE Spent Nuclear Fuel disposal container to exceed the 18 kW limit. Therefore, the thermal output limit agreed to as an interface for the Uncanistered SNF Disposal Container is acceptable for the DOE Spent Nuclear Fuel Disposal Container.

1.2.4.10 Criteria Basis Statement

I. Criteria Need Basis

This requirement defines the split of DOE SNF disposed of in the DOE Spent Nuclear Fuel Disposal Container and the Defense High Level Waste (DHLW) Disposal Container. Co-disposal of DOE SNF and HLW in the DOE Spent Nuclear Fuel Disposal Container is assumed in "Controlled Design Assumptions Document" assumption Key 005.

II. Criteria Performance Parameter Basis

The maximum amount of DOE owned SNF available to be disposed of at the MGDS (2,333 MTU) is taken from the MGDS RD requirement 3.2.A. The split of DOE SNF between the DOE Spent Nuclear Fuel Disposal Container and the DHLW Disposal Container is yet to be determined.

The DOE SNF disposed of in the DOE SNF Disposal Container is part of the 70,000 MTU to be disposed of at the repository, which supports the MGDS RD requirement 3.1.A.

1.2.4.11 Criteria Basis Statement

I. Criteria Need Basis

This criterion aligns the disposal container design with the surface repository disposal container handling concept, which supports the overall throughput rates identified in MGDS RD 3.2.B. In addition, it is assumed in the "Controlled Design Assumptions Document" (Key 085) that the MGDS will only accept waste forms that can be lifted and handled in a vertical orientation.

II. Criteria Performance Parameter Basis

N/A

1.2.4.12 Criteria Basis Statement

I. Criteria Need Basis

This criterion aligns the disposal container design with the surface repository disposal container handling concept, which supports the overall throughput rates identified in MGDS RD 3.2.B.

II. Criteria Performance Parameter Basis

N/A

1.2.4.13 Criteria Basis Statement

I. Criteria Need Basis

This requirement is intended to protect the disposable canister when in the disposal container during normal and off-normal waste handling operations, as required by MGDS RD 3.4.2.C. Damage/breach of the canisters would remove the canister walls as barriers to radionuclide releases and therefore remove their contribution to overall repository performance. Overall repository performance is discussed in 10CFR60.112 and 10CFR60.113(a)(1).

II. Criteria Performance Parameter Basis

The maximum acceleration value of loading and emplacement equipment is TBD.

5.2 SDD CRITERIA BASIS STATEMENT REFERENCES

This section presents the references used in Section 5.1.

5-High Level Waste Corrosion Allowance Shell. BBAA00000-01717-2700-16037, Rev. 00. September 9, 1997. Las Vegas, Nevada: U.S. Department of Energy, Civilian Radioactive Waste Management System Management and Operating Contractor.

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APPENDIX A FUTURE REVISION RECOMMENDATIONS & CONSIDERATIONS

1.0 Purpose

The purpose of this section is to document issues and actions that shall be considered in future revisions of the system description document. As the system criteria and design description matures, the usefulness of this section will become minimized. However, in the early phase of development of this system description document, this section will serve as a valuable tool.

2.0 Future Revision Recommendations & Considerations

2.1 Topic: Time to Disposal Container Breach and Subsequent Release Rate
Wording in current criteria should be revised to reflect a single value the disposal containers shall be designed for, without making reference to the performance of other waste packages and without involving probabilistic assessment of individual and collective waste package performance.

2.2 Topic: Label Legibility
Future criteria must consider observation by both human and electronic means.

2.3 Topic: Disposal Container Lid Matching
The need for unique identification of the fabricated disposal container to a set of matched inner and outer lids needs to be evaluated. If disposal containers will be matched to their lids, an identification system between the disposal container and its lids will be needed. The design criteria for such an identification will then be identified.

2.4 Topic: Disposal Container Capacity
The identification of the individual disposal container capacities will be an interface with the Canister Transfer System.

2.5 Topic: Handling Interface
The handling interface with the Disposal Container Handling System needs to be identified for empty disposal container handling, loaded disposal container handling, and lid handling.

2.6 Topic: Welding Interface
The welding interface with the Disposal Container Handling System needs to be identified for inner and outer lid welding operations.

2.7 Topic: Inerting Interface
The filling of the container with an inert gas needs to be identified as an interface with the Disposal Container.