Enclosure 4 to E-45666

Revision 7 to Proposed Technical Specifications

Revision 7 to Proposed Technical Specifications

CoC 1042

APPENDIX A

NUHOMS® EOS SYSTEM GENERIC TECHNICAL SPECIFICATIONS

Amendment 0

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1.0 USE AND APPLICATION

1.1 Definitions

-- NOTE --

The defined terms of this section appear in capitalized type and are applicable throughout these Technical Specifications and Bases.

Term	Definition
ACTIONS	ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.
BLEU FUEL MATERIAL	Blended Low Enriched Uranium (BLEU) fuel material is identical to UO_2 fuel material except for the presence of higher cobalt impurity.
DRY SHIELDED CANISTER (DSC)	An EOS-37PTH DSC and an EOS-89BTH DSC are welded pressure vessels that provide confinement of INTACT FUEL ASSEMBLIES in an inert atmosphere.
FUEL CLASS	A FUEL CLASS includes fuel assemblies of the same array size for a particular type of fuel design. For example, WEV 17x17, WEO 17x17, and ANP Advanced MK BW 17x17 fuel assemblies are part of a WE 17x17 FUEL CLASS.
HORIZONTAL STORAGE MODULE (HSM)	An HSM is a reinforced concrete structure for storage of a loaded DSC at a spent fuel storage installation. The generic term HSM refers both to the base unit as a single piece (EOS-HSM) or as a split base (EOS-HSMS).
INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)	The facility within a perimeter fence licensed for storage of spent fuel within HSMs.

(continued)

1.1 Definitions (continued)

INTACT FUEL ASSEMBLY	The definition for intact assemblies is located in the fuel specification tables for each DSC referred to in Section 2.1 and Section 2.2.
LOADING OPERATIONS	LOADING OPERATIONS include all licensed activities on a DSC while it is being loaded with fuel assemblies. LOADING OPERATIONS begin when the first fuel assembly is placed in the DSC and end when the TC is ready for TRANSFER OPERATIONS.
RECONSTITUTED FUEL ASSEMBLY	A RECONSTITUTED FUEL ASSEMBLY is an INTACT FUEL ASSEMBLY where one or more fuel rods are replaced by low enriched uranium or natural uranium fuel rods or non-fuel rods. The nominal volume of the replacement rods is equivalent to that of the replaced fuel rods in the active fuel region of the fuel assembly.
STORAGE OPERATIONS	STORAGE OPERATIONS include all licensed activities that are performed at the ISFSI, while a DSC containing fuel assemblies is located in an HSM, with the HSM door installed, on the storage pad within the ISFSI perimeter. STORAGE OPERATIONS do not include DSC transfer between the TC and the HSM.
TRANSFER CASK (TC)	A TRANSFER CASK (EOS-TC108, EOS-TC125, EOS-TC135) consists of a licensed NUHOMS® EOS System TC. The TRANSFER CASK will be placed on a transfer trailer for movement of a DSC to and from the HSM.
TRANSFER OPERATIONS	TRANSFER OPERATIONS include all licensed activities involving the movement of a TC loaded with a DSC containing fuel assemblies. TRANSFER OPERATIONS begin when the TC has been placed horizontal on the transfer trailer ready for TRANSFER OPERATIONS and end when the DSC is located in an HSM, with the HSM door installed, on the storage pad within the ISFSI perimeter. TRANSFER OPERATIONS include DSC transfer between the TC and the HSM.
UNLOADING OPERATIONS	UNLOADING OPERATIONS include all licensed activities on a DSC to unload fuel assemblies. UNLOADING OPERATIONS begin when the DSC is removed from the HSM and end when the last fuel assembly has been removed from the DSC.

1.0 USE AND APPLICATION

1.2 Logical Connectors

PURPOSE

The purpose of this section is to explain the meaning of logical connectors.

Logical connectors are used in Technical Specifications (TS) to discriminate between, and yet connect, Discrete Conditions, Required Actions, Completion Times, Surveillances, and Frequencies. The only logical connectors that appear in TS are AND and OR. The physical arrangement of these connectors constitutes logical conventions with specific meanings.

BACKGROUND

Several levels of logic may be used to state Required Actions. These levels are identified by the placement (or nesting) of the logical connectors and by the number assigned to each Required Action. The first level of logic is identified by the first digit of the number assigned to a Required Action and the placement of the logical connector in the first level of nesting (i.e., left justified with the number of the Required Action). The successive levels of logic are identified by additional digits of the Required Action number and by successive indentions of the logical connectors.

When logical connectors are used to state a Condition, Completion Time, Surveillance, or Frequency, only the first level of logic is used, and the logical connector is left justified with the statement of the Condition, Completion Time, Surveillance, or Frequency.

EXAMPLES

The following examples illustrate the use of logical connectors:

EXAMPLE 1.2-1

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO (Limiting Condition for Operation) not met.	A.1 Verify… AND A.2 Restore…	

In this example the logical connector AND is used to indicate that when in Condition A, both Required Actions A.1 and A.2 must be completed.

(continued)

1.2 Logical Connectors (continued)

EXAMPLES (continued)

EXAMPLE 1.2-2

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Stop… OR A.2 A.2.1 Verify… AND A.2.2 A.2.2.1 Reduce… OR A.2.2.2 Perform… OR A.3 Remove…	

This example represents a more complicated use of logical connectors. Required Actions A.1, A.2, and A.3 are alternative choices, only one of which must be performed as indicated by the use of the logical connector OR and the left justified placement. Any one of these three Actions may be chosen. If A.2 is chosen, then both A.2.1 and A.2.2 must be performed as indicated by the logical connector AND. Required Action A.2.2 is met by performing A.2.2.1 or A.2.2.2. The indented position of the logical connector OR indicates that A.2.2.1 and A.2.2.2 are alternative choices, only one of which must be performed.

1.0 USE AND APPLICATION

1.3 Completion Times

PURPOSE

The purpose of this section is to establish the Completion Time convention and to provide guidance for its use.

BACKGROUND

Limiting Conditions for Operation (LCOs) specify the lowest functional capability or performance levels of equipment required for safe operation of the facility. The ACTIONS associated with an LCO state Conditions that typically describe the ways in which the requirements of the LCO are not met. Specified with each stated Condition are Required Action(s) and Completion Times(s).

DESCRIPTION

The Completion Time is the amount of time allowed for completing a Required Action. It is referenced to the time of discovery of a situation (e.g., equipment or variable not within limits) that requires entering an ACTIONS Condition unless otherwise specified, providing the facility is in a specified condition stated in the Applicability of the LCO. Required Actions must be completed prior to the expiration of the specified Completion Time. An ACTIONS Condition remains in effect and the Required Actions apply until the Condition no longer exists or the facility is not within the LCO Applicability.

Once a Condition has been entered, subsequent subsystems, components, or variables expressed in the Condition, discovered to be not within limits, will not result in separate entry into the Condition unless specifically stated. The Required Actions of the Condition continue to apply to each additional failure, with Completion Times based on initial entry into the Condition.

EXAMPLES

The following examples illustrate the use of Completion Times with different types of Conditions and Changing Conditions.

EXAMPLE 1.3-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time not met.	B.1 Perform Action B.1 AND B.2 Perform Action B.2	12 hours 36 hours

(continued)

1.3 Completion Times (continued)

EXAMPLES (continued)

Condition B has two Required Actions. Each Required Action has its own separate Completion Time. Each Completion Time is referenced to the time that Condition B is entered.

The Required Actions of Condition B are to complete action B.1 within 12 hours AND complete action B.2 within 36 hours. A total of 12 hours is allowed for completing action B.1 and a total of 36 hours (not 48 hours) is allowed for completing action B.2 from the time that Condition B was entered. If action B.1 is completed within 6 hours, the time allowed for completing action B.2 is the next 30 hours because the total time allowed for completing action B.2 is 36 hours.

EXAMPLES

EXAMPLE 1.3-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One system not within limit.	A.1 Restore system to within limit.	7 days
B. Required Action and associated Completion Time not met.	B.1 Perform Action B.1. AND B.2 Perform Action B.2.	12 hours 36 hours

When a system is determined to not meet the LCO, Condition A is entered. If the system is not restored within 7 days, Condition B is also entered and the Completion Time clocks for Required Actions B.1 and B.2 start. If the system is restored after Condition B is entered, Condition A and B are exited, and therefore, the Required Actions of Condition B may be terminated.

(continued)

1.3 Completion Times (continued)

EXAMPLES (continued)

EXAMPLE 1.3-3

ACTIONS

---NOTE---
Separate Condition entry is allowed for each component.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Restore compliance with LCO.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Perform Action B.1. AND B.2 Perform Action B.2.	6 hours 12 hours

The Note above the ACTIONS Table is a method of modifying how the Completion Time is tracked. If this method of modifying how the Completion Time is tracked was applicable only to a specific Condition, the Note would appear in that Condition rather than at the top of the ACTIONS Table.

The Note allows Condition A to be entered separately for each component, and Completion Times tracked on a per component basis. When a component is determined to not meet the LCO, Condition A is entered and its Completion Time starts. If subsequent components are determined to not meet the LCO, Condition A is entered for each component and separate Completion Times start and are tracked for each component.

IMMEDIATE COMPLETION TIME

When "Immediately" is used as a Completion Time, the Required Action should be pursued without delay and in a controlled manner.

1.0 USE AND APPLICATION

1.4 Frequency

PURPOSE	The purpose of this section is to define the proper use and application of Frequency requirements
DESCRIPTION	Each Surveillance Requirement (SR) has a specified Frequency in which the Surveillance must be met in order to meet the associated Limiting Condition for Operation (LCO). An understanding of the correct application of the specified Frequency is necessary for compliance with the SR. The "Specified Frequency" is referred to throughout this section and each of the Specifications of Section 3.0, Limiting Condition for Operation (LCO) and Surveillance Requirement (SR) Applicability. The "Specified Frequency" consists of the requirements of the Frequency column of each SR, as well as certain Notes in the Surveillance column that modify performance requirements. Situations where a Surveillance could be required (i.e., its Frequency could expire), but where it is not possible or not desired that it be performed until sometime after the associated LCO is within its Applicability, represent potential SR 3.0.4 conflicts. To avoid these conflicts, the SR (i.e., the Surveillance or the Frequency) is stated such that it is only "required" when it can be and should be performed. With a SR satisfied, SR 3.0.4 imposes no restriction.

(continued)

1.4 Frequency (continued)

EXAMPLES

The following examples illustrate the various ways that Frequencies are specified:

EXAMPLE 1.4-1

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify pressure within limit.	12 hours

Example 1.4-1 contains the type of SR most often encountered in the Technical Specifications (TS). The Frequency specifies an interval (12 hours) during which the associated Surveillance must be performed at least one time. Performance of the Surveillance initiates the subsequent interval. Although the Frequency is stated as 12 hours, an extension of the time interval to 1.25 times the stated Frequency is allowed by SR 3.0.2 for operational flexibility. The measurement of this interval continues at all times, even when the SR is not required to be met per SR 3.0.1 (such as when the equipment is determined to not meet the LCO, a variable is outside specified limits, or the unit is outside the Applicability of the LCO). If the interval specified by SR 3.0.2 is exceeded while the facility is in a condition specified in the Applicability of the LCO, the LCO is not met in accordance with SR 3.0.1.

If the interval as specified by SR 3.0.2 is exceeded while the facility is not in a condition specified in the Applicability of the LCO for which performance of the SR is required, the Surveillance must be performed within the Frequency requirements of SR 3.0.2 prior to entry into the specified condition. Failure to do so would result in a violation of SR 3.0.4.

(continued)

1.4 Frequency (continued)

EXAMPLES (continued)

EXAMPLE 1.4-2

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify flow is within limits.	Once within 12 hours prior to starting activity AND 24 hours thereafter

Example 1.4-2 has two Frequencies. The first is a one-time performance Frequency, and the second is of the type shown in Example 1.4-1. The logical connector "AND" indicates that both Frequency requirements must be met. Each time the example activity is to be performed, the Surveillance must be performed prior to starting the activity.

The use of "once" indicates a single performance will satisfy the specified Frequency (assuming no other Frequencies are connected by "AND"). This type of Frequency does not qualify for the 25% extension allowed by SR 3.0.2.

"Thereafter" indicates future performances must be established per SR 3.0.2, but only after a specified condition is first met (i.e., the "once" performance in this example). If the specified activity is canceled or not performed, the measurement of both intervals stops. New intervals start upon preparing to restart the specified activity.

(continued)

1.4 Frequency (continued)

EXAMPLES (continued)

EXAMPLE 1.4-3

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
------------------- NOTE--------------------- Not required to be met until 96 hours after verifying the helium leak rate is within limit. ---	
Verify EOS DSC vacuum drying pressure is within limit.	Once after verifying the helium leak rate is within limit.

As the Note modifies the required performance of the Surveillance, it is construed to be part of the “specified Frequency.” Should the vacuum drying pressure not be met immediately following verification of the helium leak rate while in LOADING OPERATIONS, this Note allows 96 hours to perform the Surveillance. The Surveillance is still considered to be performed within the “specified Frequency.”

Once the helium leak rate has been verified to be acceptable, 96 hours, plus the extension allowed by SR 3.0.2, would be allowed for completing the Surveillance for the vacuum drying pressure. If the Surveillance was not performed within this 96 hour interval, there would then be a failure to perform the Surveillance within the specified Frequency, and the provisions of SR 3.0.3 would apply.

2.0 FUNCTIONAL AND OPERATING LIMITS

2.1 Fuel to be Stored in the EOS-37PTH DSC

PHYSICAL PARAMETERS: FUEL CLASS	INTACT unconsolidated B&W 15x15, WE 14x14, WE 15x15, WE 17x17, CE 14x14, CE 15x15 and CE 16x16 class PWR fuel assemblies (with or without control components (CCs)) that are enveloped by the fuel assembly design characteristics listed in Table 1.
FUEL CONDITION: INTACT FUEL	Fuel assembly with no known or suspected cladding defects in excess of pinhole leaks or hairline cracks, and with no missing rods.
RECONSTITUTED FUEL ASSEMBLIES:	
• Number of RECONSTITUTED FUEL ASSEMBLIES per DSC with irradiated stainless steel rods	≤ 37
• Number of irradiated stainless steel rods per RECONSTITUTED FUEL ASSEMBLY	≤ 5
• Minimum Cooling Time	Per Figure 1
BLENDED LOW ENRICHED URANIUM (BLEU) FUEL ASSEMBLIES:	
• Number of BLEU FUEL ASSEMBLIES per DSC	≤ 37
• BLEU Material Characteristics	BLEU fuel pellets contain a larger quantity of cobalt than standard UO_2 fuel pellets. The maximum Co-60 equivalent activity is specified in Table 2.

(continued)

2.1 Fuel to be Stored in the EOS-37PTH DSC (continued)

Control Components (CCs)	Authorized CCs include Burnable Poison Rod Assemblies (BPRAs), Thimble Plug Assemblies (TPAs), Control Rod Assemblies (CRAs), Control Element Assemblies (CEAs), Control Spiders, Rod Cluster Control Assemblies (RCCAs), Axial Power Shaping Rod Assemblies (APSRAs), Orifice Rod Assemblies (ORAs), Peripheral Power Suppression Assemblies (PPSAs), Vibration Suppression Inserts (VSIs), Neutron Source Assemblies (NSAs) and Neutron Sources. Non-fuel hardware that are positioned within the fuel assembly after the fuel assembly is discharged from the core such as Guide Tubes or Instrument Tube Tie Rods or Anchors, Guide Tube Inserts, BPRA Spacer Plates or devices that are positioned and operated within the fuel assembly during reactor operation such as those listed above are also considered to be authorized CCs. The maximum Co-60 equivalent activity for the CCs stored in the EOS-37PTH DSC is specified in Table 3.
Number of INTACT FUEL ASSEMBLIES	≤ 37
Maximum Assembly plus CC Weight	1900 lbs
THERMAL/RADIOLOGICAL PARAMETERS:	
Maximum Assembly Average Burnup	62 GWd/MTU
Minimum Assembly Average Enrichment	0.60 wt. % U-235
Minimum Cooling Time	3.0 years and as specified for the applicable heat load zoning configuration
Decay Heat per DSC	≤ 50.0 kW and as specified for the applicable heat load zoning configuration
Heat Load Zoning Configuration (HLZC) and Fuel Qualification	Per Figure 1 for HLZC #1 or HLZC #2 or HLZC#3. The licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are correctly accounted for during fuel qualification.
Maximum Planar Average Initial Fuel Enrichment	Per Table 4 as a function of minimum soluble boron concentration
Minimum B-10 Concentration in Poison Plates	Per Table 5

2.0 FUNCTIONAL AND OPERATING LIMITS

2.2 Fuel to be Stored in the EOS-89BTH DSC

PHYSICAL PARAMETERS: FUEL CLASS	 INTACT unconsolidated 7x7, 8x8, 9x9, and 10x10 BWR fuel assemblies (with or without channels) that are enveloped by the fuel assembly design characteristics listed in Table 6.
FUEL CONDITION: INTACT FUEL	 Fuel assembly with no known or suspected cladding defects in excess of pinhole leaks or hairline cracks, and with no missing rods.
RECONSTITUTED FUEL ASSEMBLIES: • Number of RECONSTITUTED FUEL ASSEMBLIES per DSC with irradiated stainless steel rods • Number of irradiated stainless steel rods per RECONSTITUTED FUEL ASSEMBLY • Minimum Cooling Time	 ≤ 89 ≤ 5 Per Figure 2
BLENDED LOW ENRICHED URANIUM (BLEU) FUEL ASSEMBLIES: • Number of BLEU FUEL ASSEMBLIES per DSC • BLEU Material Characteristics	 ≤ 89 BLEU fuel pellets contain a larger quantity of cobalt than standard UO_2 fuel pellets. The maximum Co-60 equivalent activity is specified in Table 7.
Number of INTACT FUEL ASSEMBLIES Channels Maximum Uranium Loading	≤ 89 Fuel may be stored with or without channels and associated channel hardware. 198 kg/assembly

(continued)

2.2 Fuel to be Stored in the EOS-89BTH DSC (continued)

Maximum Assembly Weight with a Channel	705 lbs.
THERMAL/RADIOLOGICAL PARAMETERS:	
Maximum Assembly Average Burnup	62 GWd/MTU
Minimum Assembly Average Enrichment	0.60 wt. % U-235
Minimum Cooling Time	3.0 Years and as specified for the applicable heat load zoning configuration
Decay Heat per DSC	≤ 43.6 kW and as specified for the applicable heat load zoning configuration
Heat Load Zoning Configuration (HLZC) and Fuel Qualification	Per Figure 2 for HLZC #1 or HLZC #2 or HLZC #3. The licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are correctly accounted for during fuel qualification.
Maximum Lattice Average Initial Fuel Enrichment	Per Table 8
Minimum B-10 Concentration in Poison Plates	Per Table 8

2.0 FUNCTIONAL OPERATING LIMITS

2.3 Functional and Operating Limits Violations

If any Functional and Operating Limit of 2.1 or 2.2 is violated, the following actions shall be completed:

2.3.1 The affected fuel assemblies shall be placed in a safe condition.

2.3.2 Within 24 hours, notify the NRC Operations Center.

2.3.3 Within 60 days, submit a special report which describes the cause of the violation and the actions taken to restore compliance and prevent recurrence.

3.0 LIMITING CONDITION FOR OPERATION (LCO) AND SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

LIMITING CONDITION FOR OPERATION

LCO 3.0.1	LCOs shall be met during specified conditions in the Applicability, except as provided in LCO 3.0.2.
LCO 3.0.2	Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as provided in LCO 3.0.5. If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required, unless otherwise stated.
LCO 3.0.3	Not applicable to a spent fuel storage cask.
LCO 3.0.4	When an LCO is not met, entry into a specified condition in the Applicability shall not be made except when the associated ACTIONS to be entered permit continued operation in the specified condition in the Applicability for an unlimited period of time. This Specification shall not prevent changes in specified conditions in the Applicability that are required to comply with ACTIONS, or that are related to the unloading of a DSC. Exceptions to this Specification are stated in the individual Specifications. These exceptions allow entry into specified conditions in the Applicability when the associated ACTIONS to be entered allow operation in the specified condition in the Applicability only for a limited period of time.
LCO 3.0.5	Equipment removed from service or not in service in compliance with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate it meets the LCO or that other equipment meets the LCO. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate that the LCO is met.
LCO 3.0.6	Not applicable to a spent fuel storage cask.
LCO 3.0.7	Not applicable to a spent fuel storage cask.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.0.1	SRs shall be met during the specified conditions in the Applicability for individual LCOs, unless otherwise stated in the SR. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO. Failure to perform a Surveillance within the specified Frequency shall be failure to meet the LCO except as provided in SR 3.0.3. Surveillances do not have to be performed on equipment or variables outside specified limits.
SR 3.0.2	The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the Frequency is met. For Frequencies specified as "once," the above interval extension does not apply. If a Completion Time requires periodic performance on a "once per . . ." basis, the above Frequency extension applies to each performance after the initial performance. Exceptions to this Specification are stated in the individual Specifications.
SR 3.0.3	If it is discovered that a Surveillance was not performed within its specified Frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Frequency, whichever is less. This delay period is permitted to allow performance of the Surveillance. If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered. When the Surveillance is performed within the delay period and the Surveillance is not met, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.
SR 3.0.4	Entry into a specified condition in the Applicability of an LCO shall not be made unless the LCO's Surveillances have been met within their specified Frequency. This provision shall not prevent entry into specified conditions in the Applicability that are required to comply with ACTIONS or that are related to the unloading of a DSC.

3.1 DSC Fuel Integrity

3.1.1 Fuel Integrity during Drying

LCO 3.1.1 Medium:

Helium shall be used for cover gas during drainage of bulk water (blowdown or draindown) from the DSC.

Pressure:

The DSC vacuum drying pressure shall be sustained at or below 3 Torr (3 mm Hg) absolute for a period of at least 30 minutes following evacuation.

APPLICABILITY: During LOADING OPERATIONS but before TRANSFER OPERATIONS.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. If the required vacuum drying pressure cannot be obtained.	A.1	30 days
	A.1.1 Confirm that the vacuum drying system is properly installed. Check and repair the vacuum drying system as necessary. <u>OR</u>	
	A.1.2 Establish helium pressure of at least 0.5 atm and no greater than 15 psig in the DSC. <u>OR</u>	
	A.2 Flood the DSC with spent fuel pool water or water meeting the requirements of LCO 3.2.1, if applicable, submerging all fuel assemblies.	30 days

(continued)

3.1 DSC Fuel Integrity (continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.1	Verify that the DSC vacuum drying pressure is less than or equal to 3 Torr (3 mm Hg) absolute for at least 30 minutes following evacuation.	Once per DSC, after an acceptable NDE of the inner top cover/shield plug assembly to DSC shell weld.

(continued)

3.1 DSC Fuel Integrity (continued)

3.1.2 DSC Helium Backfill Pressure

LCO 3.1.2 DSC helium backfill pressure shall be 2.5 ± 1 psig (stable for 30 minutes after filling) after completion of vacuum drying.

APPLICABILITY: During LOADING OPERATIONS but before TRANSFER OPERATIONS.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
-----------------NOTE----------------- Not applicable until SR 3.1.2 is performed. -- A. The required backfill pressure cannot be obtained or stabilized.	A.1 A.1.1 Maintain helium atmosphere in the DSC cavity. AND A.1.2 Confirm, check and repair or replace as necessary the vacuum drying system, helium source and pressure gauge. AND A.1.3 Check and repair, as necessary, the seal weld between the inner top cover plate and the DSC shell. OR A.2 Establish the DSC helium backfill pressure to within the limit. If pressure exceeds the criterion, release a sufficient quantity of helium to lower the DSC cavity pressure within the limit. OR	30 days 30 days

(continued)

3.1 DSC Fuel Integrity (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
	A.3	Flood the DSC with spent fuel pool water or water meeting the requirements of LCO 3.2.1, if applicable, submerging all fuel assemblies.	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.2	Verify that the DSC helium backfill pressure is 2.5 ± 1 psig stable for 30 minutes after filling.	Once per DSC, after the completion of SR 3.1.1 requirement.

(continued)

3.1 DSC Fuel Integrity (continued)

3.1.3 Time Limit for Completion of DSC Transfer

LCO 3.1.3 If the DSC and HLZC combination result in a time limit for completion of transfer from the table below, the air circulation system shall be assembled and be verified to be operable within 7 days before commencing the TRANSFER OPERATIONS of the loaded DSC.

DSC MODEL	MAXIMUM HEAT LOAD (kW/DSC)	TIME LIMITS (HOURS)
EOS-37PTH	Any Heat Load for HLZC 1 or 2	10
EOS-37PTH	≤ 36.35 for HLZC 3	No Limit
EOS-89BTH	Any Heat Load for HLZC 1 or 2	10
EOS-89BTH	≤ 34.44 for HLZC 3	No Limit

--NOTE--

The time limit for completion of a DSC transfer is defined as the time elapsed in hours after the initiation of draining of TC/DSC annulus water until the completion of insertion of the DSC into the HSM. The time limit of 10 hours for transfer operations is determined based on the EOS-37PTH DSC in EOS-TC125 with the maximum allowable heat load of 50 kW. If the maximum heat load of a DSC is less than 50 kW, a new time limit can be determined to provide additional time for transfer operations. The calculated time limit shall not be less than 10 hours. The calculation should be performed using the same methodology documented in the SAR.

(continued)

3.1 DSC Fuel Integrity (continued)

APPLICABILITY: During LOADING OPERATIONS AND TRANSFER OPERATIONS.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
------------------- NOTE ------------------ Not applicable until SR 3.1.3 is performed. --- A. The required time limit for completion of a DSC transfer not met.	A.1 If the TC is in the cask handling area in a vertical orientation, remove the TC top cover plate and fill the TC/DSC annulus with clean water. OR	2 hours
	A.2 If the TC is in a horizontal orientation on the transfer skid, initiate air circulation in the TC/DSC annulus by starting one of the redundant blowers. OR	1 hour *
	A.3 Return the TC to the cask handling area and follow action A.1 above.	5 hours

* If Action A.2 is initiated, run the blower for a minimum of 8 hours. After the blower is turned off, the time limit for completion of DSC transfer is 4 hours. If Action A.2 fails to complete within one hour, follow Action A.3 for the time remaining in the original Action A.3 completion time of 5 hours. The minimum duration of 8 hours to run the blower and the time limit of 4 hours after the blower is turned off for completion of the transfer operations are determined based on the EOS-37PTH DSC in EOS-TC125 with the maximum allowable heat load of 50 kW. If the maximum heat load of a DSC is less than 50 kW, new time limits can be determined to provide additional time for these transfer operations. The calculated time limits shall not be less than 4 hours for completion of transfer operation after the blower is turned off. The calculation should be performed using the same methodology documented in the SAR.

(continued)

3.1 DSC Fuel Integrity (continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.3	Verify that the time limit for completion of DSC transfer is met.	Once per DSC, after the completion of LCO 3.1.2 actions or at the initiation of draining of TC/DSC annulus water.

3.2 Cask Criticality Control

3.2.1 Soluble Boron Concentration

LCO 3.2.1 The boron concentration of the spent fuel pool water and the water added to the cavity of a loaded EOS-37PTH DSC shall be at least the boron concentration shown in Table 4 for the basket type and fuel enrichment selected.

APPLICABILITY: During LOADING and UNLOADING OPERATIONS with fuel and liquid water in the EOS-37PTH DSC cavity.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Dissolved boron concentration limit not met.	A.1 Suspend loading of fuel assemblies into DSC. <u>AND</u> A.2	Immediately
	A.2.1 Add boron and re-sample, and test the concentration until the boron concentration is shown to be at least that required. <u>OR</u>	Immediately
	A.2.2 Remove all fuel assemblies from DSC.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.1.1	Verify dissolved boron concentration limit in spent fuel pool water and water to be added to the DSC cavity is met using two independent measurements (two samples analyzed by different individuals) for LOADING OPERATIONS.	Within 4 hours before insertion of the first assembly into the DSC. AND Every 48 hours thereafter while the DSC is in the spent fuel pool or until the fuel has been removed from the DSC.
SR 3.2.1.2	Verify dissolved boron concentration limit in spent fuel pool water and water to be added to the DSC cavity is met using two independent measurements (two samples analyzed by different individuals) for UNLOADING OPERATIONS.	Once within 4 hours prior to flooding DSC during UNLOADING OPERATIONS. AND Every 48 hours thereafter while the DSC is in the spent fuel pool or until the fuel has been removed from the DSC.

3.3 Radiation Protection

3.3.1 DSC and TRANSFER CASK Surface Contamination

LCO 3.3.1 Removable surface contamination on the outer top 1 foot surface of the DSC AND the exterior surfaces of the TRANSFER CASK shall not exceed:

a. 2,200 dpm/100 cm^2 from beta and gamma sources; and

b. 220 dpm/100 cm^2 from alpha sources.

APPLICABILITY: During LOADING OPERATIONS

ACTIONS:

-- NOTE --
Separate condition entry is allowed for each DSC and TRANSFER CASK.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Top 1 foot exterior surface of the DSC removable surface contamination limits not met.	A.1 Decontaminate the DSC to bring the removable contamination to within limits.	7 days <u>AND</u> Prior to TRANSFER OPERATIONS
B. TRANSFER CASK removable surface contamination limits not met.	B.1 Decontaminate the TRANSFER CASK to bring the removable contamination to within limits	7 days <u>AND</u> Prior to TRANSFER OPERATIONS

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Verify by either direct or indirect methods that the removable contamination on the top 1 foot exterior surface of the DSC is within limits.	Once, prior to TRANSFER OPERATIONS.
SR 3.3.1.2	Verify by either direct or indirect methods that the removable contamination on the exterior surfaces of the TRANSFER CASK is within limits.	Once, prior to TRANSFER OPERATIONS.

4.0 DESIGN FEATURES

The specifications in this section include the design characteristics of special importance to each of the physical barriers and to the maintenance of safety margins in the NUHOMS® EOS System design.

4.1 Site

4.1.1 Site Location

Because this SAR is prepared for a general license, a discussion of a site-specific ISFSI location is not applicable.

4.2 Storage System Features

4.2.1 Storage Capacity

The total storage capacity of the ISFSI is governed by the plant-specific license conditions.

4.2.2 Storage Pad

For sites for which soil-structure interaction is considered important, the licensee is to perform site-specific analysis considering the effects of soil-structure interaction. Amplified seismic spectra at the location of the HSM center of gravity (CG) is to be developed based on the SSI responses. HSM seismic analysis information is provided in SAR Appendix 3.9.4, Section 3.9.4.9.2.

The storage pad location shall have no potential for liquefaction at the site-specific SSE level earthquake.

Additional requirements for the pad configuration are provided in Section 4.5.2.

4.3 Canister Criticality Control

The NUHOMS® EOS-37PTH DSC is designed for the storage of PWR fuel assemblies with a maximum planar average initial enrichment of less than or equal to 5.0 wt. % U-235 taking credit for soluble boron in the DSC cavity water during LOADING OPERATIONS and the boron content in the poison plates of the DSC basket. The EOS-37PTH DSC uses a boron carbide/aluminum metal matrix composite (MMC) poison plate material. The EOS-37PTH DSC has two different neutron poison loading options, A and B, based on the boron content in the poison plates as listed in Table 5. Table 4 also defines the requirements for boron concentration in the DSC cavity water as a function of the DSC basket type for the various FUEL CLASSES authorized for storage in the EOS-37PTH DSC.

The NUHOMS® EOS-89BTH DSC is designed for the storage of BWR fuel assemblies with a maximum lattice average initial enrichment of less than or equal to 4.80 wt. % U-235 taking credit for the boron content in the poison plates of the DSC basket. There are three neutron poison loading options specified for the EOS-89BTH DSC depending on the type of poison material and the B-10 areal density in the plates, as specified in Table 8.

(continued)

4.0 Design Features (continued)

4.3.1 Neutron Absorber Tests

The neutron absorber used for criticality control in the DSC baskets may be one of the following materials:

- Boron carbide/aluminum metal matrix composite (MMC)
- BORAL® (EOS-89BTH DSC only)

Acceptance Testing (MMC and BORAL®)

B-10 areal density is verified by neutron attenuation testing or by chemical analysis of coupons taken adjacent to finished panels, and isotopic analysis of the boron carbide powder. The minimum B-10 areal density requirements are specified in Table 5 and Table 8.

Finished panels are subject to visual and dimensional inspection.

Qualification Testing (MMC only)

MMCs are qualified for use in the NUHOMS® EOS System by verification of the following characteristics.

- The chemical composition is boron carbide particles in an aluminum alloy matrix.
- The form is with or without an aluminum skin.
- The median boron carbide particle size by volume is ≤ 80 microns with no more than 10% over 100 microns.
- The boron carbide content is ≤ 50% by volume.
- The porosity is ≤ 3%.

4.3.2 Low Alloy High Strength Steel for Basket Structure

The basket structural material shall be a low alloy high strength steel meeting the requirements specified in portions of SAR Section 10.1.7.

4.4 Codes and Standards

4.4.1 HORIZONTAL STORAGE MODULE (HSM)

The reinforced concrete HSM is designed in accordance with the provisions of ACI 349-06. Code alternatives are discussed in Section 4.4.4. Load combinations specified in ANSI 57.9-1984, Section 6.17.3.1 are used for combining normal operating, off-normal, and accident loads for the HSM.

(continued)

4.0 Design Features (continued)

4.4.2 DRY SHIELDED CANISTER (EOS-37PTH and EOS-89BTH DSC)

The DSC confinement boundary is designed, fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Division 1, 2010 Edition with Addenda through 2011, Subsection NB, for Class 1 components. Code alternatives are discussed in Section 4.4.4.

4.4.3 TRANSFER CASK (TC)

The TC design stress analysis, exclusive of the trunnions and the neutron shield enclosures, is performed in accordance with ASME Boiler and Pressure Vessel Code Section III, Division 1, 2010 Edition with Addenda through 2011, Article NF-3000, for Class 1 supports. The stress allowables for the upper trunnions conform to ANSI N14.6-1993 for single failure proof lifting.

4.4.4 Alternatives to Codes and Standards

ASME Code alternatives for the EOS-37PTH and EOS-89BTH DSC are listed below:

(continued)

4.0 Design Features (continued)

DSC ASME Code Alternatives, Subsection NB

REFERENCE ASME CODE SECTION/ARTICLE	CODE REQUIREMENT	JUSTIFICATION AND COMPENSATORY MEASURES
NCA	All	Not compliant with NCA
NB-1100	Requirements for Code Stamping of Components	The canister shell, the inner top cover, the inner bottom cover, the outer top cover, and the siphon and vent port covers are designed and fabricated in accordance with the ASME Code, Section III, Subsection NB to the maximum extent practical. However, Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME “N” or “NPT” stamp, or to be ASME Certified.
NB-2121	Permitted Material Specifications	Type 2205 and UNS S31803 are duplex stainless steels that provide enhance resistance to chloride-induced stress corrosion cracking. They are not included in Section II, Part D, Subpart 1, Tables 2A and 2B. UNS S31803 has been accepted for Class 1 components by ASME Code Case N-635-1, endorsed by NRC Regulatory Guide 1.84. Type 2205 falls within the chemical and mechanical requirements of UNS S31803. Normal and off-normal temperatures remain below the 600 °F operating limit. Accident conditions may exceed this limit, but only for durations too short to cause embrittlement.
NB-2130 NB-4121	Material must be supplied by ASME approved material suppliers Material Certification by Certificate Holder	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with the AREVA NRC approved QA program associated with CoC 1042.

(continued)

4.0 Design Features (continued)

DSC ASME Code Alternatives, Subsection NB
(continued)

REFERENCE ASME CODE SECTION/ARTICLE	CODE REQUIREMENT	JUSTIFICATION AND COMPENSATORY MEASURES
NB-2300	Fracture toughness requirements for material	Type 2205 and UNS S31803 duplex stainless steels are tested by Charpy V-notch only per NB-2300. Drop weight tests are not required. Impact testing is not required for the vent port plug.
NB-2531	Siphon port cover; straight beam ultrasonic testing (UT) per SA-578 for all plates for vessel	SA-578 applies to 3/8" and thicker plate only; allow alternate UT techniques to achieve meaningful UT results.
NB- 2531 and NB-2541	Vent port plug UT and liquid penetrant testing (PT)	This plug may be made from plate or bar. Due to its small area, it has no structural function. It is leak tested along with the inner top cover plate after welding. Therefore, neither UT nor PT are required.
NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or radiographic testing (RT) and either PT or magnetic particle testing (MT).	The shell to the outer top cover weld, the shell to the inner top cover weld and the siphon cover and vent plug welds are all partial penetration welds. As an alternative to the non-destructive examination (NDE) requirements of NB-5230 for Category C welds, all of these closure welds will be multi-layer welds and receive a root and final PT examination, except for the shell to the outer top cover weld. The shell to the outer top cover weld will be a multi-layer weld and receive multi-level PT examination in accordance with the guidance provided in NUREG 1536 Revision 1 for NDE. The multi-level PT examination provides reasonable assurance that flaws of interest will be identified. The PT examination is done by qualified personnel, in accordance with Section V and the acceptance standards of Section III, Subsection NB-5000. The cover to shell welds are designed to meet the guidance provided in ISG-15 for stress reduction factor.
NB-5520	NDE Personnel must be qualified to the 1992 edition of SNT-TC-1A	Permit use of the Recommended Practice SNT-TC-1A up to the 2006 edition as permitted by the 2013 Code Edition.

(continued)

4.0 Design Features (continued)

DSC ASME Code Alternatives, Subsection NB
(continued)

REFERENCE ASME CODE SECTION/ARTICLE	CODE REQUIREMENT	JUSTIFICATION AND COMPENSATORY MEASURES
NB-6000	All completed pressure retaining systems shall be pressure tested	The DSC is not a complete or “installed” pressure vessel until the top closure is welded following placement of fuel assemblies within the DSC. Due to the inaccessibility of the shell and lower end closure welds following fuel loading and top closure welding, as an alternative, the pressure testing of the DSC is performed in two parts. The DSC shell, shell bottom, including all longitudinal and circumferential welds, is pneumatically tested and examined at the fabrication facility. The shell to the inner top cover closure weld is pressure tested and examined for leakage in accordance with NB-6300 in the field. The siphon and vent cover welds will not be pressure tested; these welds and the shell to the inner top cover closure weld are helium leak tested after the pressure test. Per NB-6324 the examination for leakage shall be done at a pressure equal to the greater of the design pressure or three-fourths of the test pressure. As an alternative, if the examination for leakage of these field welds, following the pressure test, is performed using helium leak detection techniques, the examination pressure may be reduced to 1.5 psig. This is acceptable given the significantly greater sensitivity of the helium leak detection method.
NB-7000	Overpressure Protection	No overpressure protection is provided for the EOS-37PTH or EOS-89BTH DSC. The function of the DSC is to contain radioactive materials under normal, off-normal, and hypothetical accident conditions postulated to occur during transportation. The DSC is designed to withstand the maximum internal pressure considering 100% fuel rod failure at maximum accident temperature.
NB-8000	Requirements for nameplates, stamping and reports per NCA-8000	The EOS-37PTH and EOS-89BTH DSC are stamped or engraved with the information required by 10 CFR Part 72. Code stamping is not required for these DSCs. QA Data packages are prepared in accordance with requirements of the AREVA approved QA program associated with CoC 1042.

(continued)

4.0 Design Features (continued)

Code alternatives for the EOS-HSM concrete specifications are listed below:

REFERENCE ACI-349-06 SECTION/ARTICLE	CODE REQUIREMENT	ALTERNATIVES, JUSTIFICATION AND COMPENSATORY MEASURES
Appendix E, Section E.4-Concrete Temperatures	Section E.4.1 specifies that the concrete temperatures for normal operations shall not exceed 150 °F except for local areas such as around penetrations, which are allowed to have increased temperatures not to exceed 200 °F Section E.4.2 specifies that the concrete temperatures for accident condition shall not exceed 350 °F	The concrete temperature limit criteria in NUREG-1536, Section 8.4.14.2 is used for normal and off-normal conditions. Alternatively, per ACI 349-13, Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary, Section RE.4, the specified 28-day compressive strength is increased to 7,000 psi for HSM fabrication so that any losses in properties (e.g., compressive strength) resulting from long-term thermal exposure will not affect the safety margins based on the specified 5,000 psi compressive strength used in the design calculations. Additionally, also as indicated in Section RE.4, short, randomly oriented steel fibers may be used to provide increased ductility, dynamic strength, toughness, tensile strength, and improved resistance to spalling. The safety margin on compressive strength is 40% for a concrete temperature limit of 300 °F normal and off-normal conditions,

Proposed alternatives to the above-specified ASME and ACI codes, other than the aforementioned alternatives, may be used when authorized by the Director of the Office of Nuclear Material Safety and Safeguards, or designee. The applicant should demonstrate that:

1. The proposed alternatives would provide an acceptable level of quality and safety, or
2. Compliance with the specified requirements of above-specifed ASME and ACI codes would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The applicant should also submit information regarding the environmental impact of such a request to support the NRC's NEPA regulations in 10 CFR Part 51. Any proposed alternatives must be submitted and approved prior to implementation.

Requests for exceptions in accordance with this section should be submitted in accordance with 10 CFR 72.4.

(continued)

4.0 Design Features (continued)

4.5 Storage Location Design Features

The following storage location design features and parameters shall be verified by the system user to assure technical agreement with the SAR.

4.5.1 Storage Configuration

HSMs are placed together in single rows or back to back arrays. An end shield wall is placed on the outside end of any loaded outside HSM. A rear shield wall is placed on the rear of any single row loaded HSM.

4.5.2 Concrete Storage Pad Properties to Limit DSC Gravitational Loadings Due to Postulated Drops

The EOS-37PTH DSC and EOS-89BTH DSC have been evaluated for drops of up to 65 inches onto a reinforced concrete storage pad.

4.5.3 Site Specific Parameters and Analyses

The following parameters and analyses shall be verified by the system user for applicability at their specific site. Other natural phenomena events, such as lightning, tsunamis, hurricanes, and seiches, are site specific and their effects are generally bounded by other events, but they should be evaluated by the user.

1. Flood levels up to 50 ft and water velocity of 15 fps.
2. One-hundred year roof snow load of 110 psf.
3. Normal ambient temperature is based on the heat load of the DSC as follows:
   a. For the EOS-37PTH DSCs with a heat load less than or equal to 41.8 kW or for the EOS-89BTH DSCs with a heat load less than or equal to 41.6 kW, the minimum temperature is -20 °F. The maximum calculated normal average ambient temperature corresponding to a 24-hour period is 90 °F.
   b. For the EOS-37PTH DSCs with a heat load greater than 41.8 kW or for the EOS-89BTH DSCs with a heat load greater than 41.6 kW, the minimum temperature is -20 °F. The maximum calculated average yearly temperature is 70 °F.
4. Off-normal ambient temperature range of -40 °F without solar insolation to 117 °F with full solar insolation. The 117 °F off-normal ambient temperature corresponds to a 24-hour calculated average temperature of 103 °F.
5. The response spectra at the base of the EOS-HSMs shall be compared against the response spectra defined in SAR Section 2.3.4 and shown to be enveloped by the SAR response spectra. If it is not enveloped, stability can be demonstrated by either static or dynamic analysis.
6. The potential for fires and explosions shall be addressed, based on site-specific considerations.

4.0 Design Features (continued)

7. Supplemental Shielding: In cases where engineered features (i.e., berms, shield walls) are used to ensure that the requirements of 10 CFR 72.104(a) are met, such features are to be considered important to safety and must be evaluated to determine the applicable Quality Assurance Category.

8. If an INDEPENDENT SPENT FUEL STORAGE INSTALLATION site is located in a coastal salt water marine atmosphere, then any load-bearing carbon steel DSC support structure rail components of any associated HSM shall be procured with a minimum 0.20% copper content or stainless steel shall be used for corrosion resistance. For weld filler material used with carbon steel, 1% or more nickel bearing weld material would also be acceptable in lieu of 0.20% copper content.

5.0 ADMINISTRATIVE CONTROLS

5.1 Programs

Each user of the NUHOMS® EOS System will implement the following programs to ensure the safe operation and maintenance of the ISFSI:

- Radiological Environmental Monitoring Program (see 5.1.1 below)
- Radiation Protection Program (see 5.1.2 below)
- HSM Thermal Monitoring Program (see 5.1.3 below)

5.1.1 Radiological Environmental Monitoring Program

a. A radiological environmental monitoring program will be implemented to ensure that the annual dose equivalent to an individual located outside the ISFSI controlled area does not exceed the annual dose limits specified in 10 CFR 72.104(a).

b. Operation of the ISFSI will not create any radioactive materials or result in any credible liquid or gaseous effluent release.

5.1.2 Radiation Protection Program

The Radiation Protection Program will establish administrative controls to limit personnel exposure to As Low As Reasonably Achievable (ALARA) levels in accordance with 10 CFR Part 20 and Part 72.

a. As part of its evaluation pursuant to 10 CFR 72.212, the licensee shall perform an analysis to confirm that the limits of 10 CFR Part 20 and 10 CFR 72.104 will be satisfied under the actual site conditions and configurations considering the planned number of DSCs to be used and the planned fuel loading conditions.

b. On the basis of the analysis in TS 5.1.2(a), the licensee shall establish a set of HSM dose rate limits which are to be applied to DSCs used at the site. Limits shall establish peak dose rates for:

   i. HSM front air ventilation input opening,

   ii. HSM door centerline, and

   iii. End shield wall exterior.

c. Notwithstanding the limits established in TS 5.1.2(b), the dose rate limits may not exceed the following values as calculated for a content of design basis fuel as follows:

   i. 800 mrem/hr at the front air ventilation inlet opening,

   ii. 10 mrem/hr at the door centerline, and

   iii. 5 mrem/hr at the end shield wall exterior.

(continued)

5.0 ADMINISTRATIVE CONTROLS (continued)

If the measured dose rates do not meet the limits of TS 5.1.2(b) or TS 5.1.2(c), whichever are lower, the licensee shall take the following actions:

- Notify the U.S. Nuclear Regulatory Commission (Director of the Office of Nuclear Material Safety and Safeguards) within 30 days,
- Administratively verify that the correct fuel was loaded,
- Ensure proper installation of the HSM door,
- Ensure that the DSC is properly positioned on the support rails, and
- Perform an analysis to determine that placement of the as-loaded DSC at the ISFSI will not cause the ISFSI to exceed the radiation exposure limits of 10 CFR Part 20 and 10 CFR Part 72 and/or provide additional shielding to assure exposure limits are not exceeded.

d. A monitoring program to ensure the annual dose equivalent to any real individual located outside the ISFSI controlled area does not exceed regulatory limits is incorporated as part of the environmental monitoring program in the Radiological Environmental Monitoring Program of TS 5.1.1.

e. When using the EOS-TC108 with a liquid neutron shield (NS), the NS shall be verified to be filled when DSC cavity draining or TC/DSC annulus draining operations are initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled. The NS shall also be verified to be filled prior to the movement of the loaded TC from the decontamination area. Observation of water level in the expansion tank or some other means can be used to verify compliance with this requirement.

f. Following completion of the DSC shell assembly at the fabricator facility, the inner bottom cover plate, canister shell and all associated welds are leak-tested to demonstrate that these welds and components meet the “leak-tight” criterion ($\leq 1.0 \times 10^{-7}$ reference cm^3/sec) as defined in “American National Standard for Radioactive Materials – Leakage Tests on Packages for Shipment”, ANSI N14.5-1997. If the leakage rate exceeds 1.0×10^{-7} reference cm^3/sec, check and repair these welds or components.

Following completion of the welding of the DSC shell to the inner top cover and drain port cover and vent plug after fuel loading, these welds and components are leak-tested to demonstrate that they meet the “leak-tight” criterion ($\leq 1.0 \times 10^{-7}$ reference cm^3/sec) as defined in “American National Standard for Radioactive Materials - Leakage Tests on Packages for Shipment”, ANSI N14.5-1997. If the leakage rate exceeds 1.0×10^{-7} reference cm^3/sec, check and repair these welds or components.

(continued)

5.0 ADMINISTRATIVE CONTROLS (continued)

5.1.3 HSM Thermal Monitoring Program

This program provides guidance for temperature measurements that are used to monitor the thermal performance of each HSM. The intent of the program is to prevent conditions that could lead to exceeding the concrete and fuel clad temperature criteria. Each user must implement either TS 5.1.3(a) OR 5.1.3(b).

a. Daily Visual Inspection of HSM Inlets and Outlets (Front Wall and Roof Birdscreens) and Wind Deflectors

i. The user shall develop and implement procedures to perform visual inspection of HSM inlets and outlets on a daily basis. There is a possibility that the HSM air inlet and outlet openings could become blocked by debris, as postulated and analyzed in the SAR accident analyses for air vent blockage. The procedures shall ensure that blockage will not exist for periods longer than assumed in the SAR analyses.

Perform a daily visual inspection of the air vents to ensure that HSM air vents are not blocked for more than 40 hours. If visual inspection indicates blockage, clear air vents and replace or repair birdscreens if damaged. If the air vents are blocked or could have been blocked for more than 40 hours, evaluate existing conditions in accordance with the site corrective action program to confirm that conditions adversely affecting the concrete or fuel cladding do not exist.

ii. Daily Visual Inspection of Wind Deflectors

If wind deflectors are required per TS 5.5, the user shall develop and implement procedures to perform visual inspection of the wind deflectors on a daily basis.

There is a possibility that the wind deflectors could become damaged or lost by extreme winds, tornados, or other accidents. The condition caused by a damaged or lost wind deflector is bounded by the air vent blockage postulated and analyzed in the SAR accident analyses. The procedures shall ensure that the duration of a damaged or lost wind deflector will not exceed periods longer than 40 hours as assumed in the SAR analyses for vent blockage. If visual inspection indicates a damaged or lost wind deflector, replace or repair the wind deflector. If the wind deflectors are damaged or could have been damaged for more than 40 hours, evaluate existing conditions in accordance with the site corrective action program to confirm that conditions adversely affecting the concrete or fuel cladding do not exist.

(continued)

5.0 ADMINISTRATIVE CONTROLS (continued)

b. Daily HSM Temperature Measurement Program

i. The user shall develop a daily temperature measurement program to verify the thermal performance of each NUHOMS® EOS System. The user shall establish administrative temperature limits to (1) detect off-normal and accident blockage conditions before the HSM components and fuel cladding temperatures would exceed temperature design limits and (2) ensure the HSM air vents are not blocked for more than 40 hours. The daily temperature measurements shall include at least one of the following options:

1. direct measurement of the HSM concrete temperature
2. direct measurement of inlet and outlet air temperatures

If the direct measurement of the inlet and outlet air temperatures (option 2) is performed, the measured temperature differences of the inlet and outlet vents of each individual HSM must be compared to the predicted temperature differences for each individual HSM during normal operations. *The measured temperature difference between the inlet and outlet vents shall not exceed 138 °F.*

ii. The user shall establish in the program, measurement locations in the HSM that are representative of the HSM thermal performance and directly correlated to the predicted fuel cladding temperatures, air mass flow rates, and NUHOMS® EOS System temperature distributions that would occur with the off-normal and accident blockage conditions, as analyzed in the SAR. The administrative temperature limits shall employ appropriate safety margins that ensure temperatures would not exceed design basis temperature limits in the SAR, and be based on the SAR methodologies used to predict thermal performance of the NUHOMS® EOS System. If the direct measurement of the inlet and outlet air temperatures (option 2) is performed, the user must develop procedures to measure air temperatures that are representative of inlet and outlet air temperatures, as analyzed in the SAR. The user must also consider site-specific environmental conditions, loaded decay heat patterns, and the proximity of adjacent HSM modules in the daily air temperature measurement program. The user must ensure that measured air temperatures reflect only the thermal performance of each individual module, and not the combined performance of adjacent modules.

iii. The user shall establish in the program the appropriate actions to be taken if administrative temperature criteria are exceeded. If an administrative temperature limit is exceeded during a daily measurement, the user shall inspect the vents, wind deflectors if installed, and implement TS 5.1.3(a) for the affected system, until the cause of the excursion is determined and necessary corrective actions are completed under the site corrective action program.

(continued)

5.0 ADMINISTRATIVE CONTROLS (continued)

iv. If measurements or other evidence indicates that the HSM concrete temperatures have exceeded the concrete accident criteria of 500 °F for more than 40 hours, the user shall perform an analysis and/or tests of the concrete in accordance with TS 5.3. The user shall demonstrate that the structural strength of the HSM has an adequate margin of safety and take appropriate actions to return the HSM to normal operating conditions.

v. If measurements or other evidence indicates that off-normal or accident temperature limits for fuel cladding have been exceeded, verify that canister confinement is maintained and assess analytically the condition of the fuel. Additionally, within 30 days, take appropriate actions to restore the spent fuel to a safe configuration.

(continued)

5.0 ADMINISTRATIVE CONTROLS (continued)

5.2 Lifting Controls

5.2.1 Transfer Cask/DSC Lifting Height and Temperature Limits

The requirements of 10 CFR 72 apply to TC/DSC lifting/handling height limits outside the FUEL BUILDING. The requirements of 10 CFR Part 50 apply to TC/DSC lifting/handling height limits inside the FUEL BUILDING. Confirm the surface temperature of the TC before TRANSFER OPERATIONS of the loaded TC/DSC.

The lifting height of a loaded TC/ DSC is limited as a function of low temperature and the type of lifting/handling device, as follows:

- No lifts or handling of the TC/DSC at any height are permissible at TC surface temperatures below 0 °F
- The maximum lift height of the TC/DSC shall be 65 inches if the surface temperature of the TC is above 0 °F and a non-single failure proof lifting/handling device is used.
- No lift height restriction is imposed on the TC/DSC if the TC surface temperature is higher than 0 °F and a single failure proof lifting/handling system is used.

The requirements of 10 CFR Part 72 apply when the TC/DSC is in a horizontal orientation on the transfer trailer. The requirements of 10 CFR Part 50 apply when the TC/DSC is being lifted/handled using the cask handling crane/hoist. (This distinction is valid only with respect to lifting/handling height limits.)

5.2.2 Cask Drop

Inspection Requirement

The TRANSFER CASK will be inspected for damage and the DSC will be evaluated after any TRANSFER CASK with a loaded DSC side drop of 15 inches or greater.

Background

TC/DSC handling and loading activities are controlled under the 10 CFR Part 50 license until a loaded TC/DSC is placed on the transporter, at which time fuel handling activities are controlled under the 10 CFR Part 72 license.

Safety Analysis

The analysis of bounding drop scenarios shows that the TRANSFER CASK will maintain the structural integrity of the DSC confinement boundary from an analyzed side drop height of 65 inches. The 65-inch drop height envelopes the maximum height from the bottom of the TRANSFER CASK when secured to the transfer trailer while enroute to the ISFSI.

(continued)

5.0 ADMINISTRATIVE CONTROLS (continued)

Although analyses performed for cask drop accidents at various orientations indicate much greater resistance to damage, requiring the inspection of the DSC after a side drop of 15 inches or greater ensures that:

1. The DSC will continue to provide confinement.
2. The TRANSFER CASK can continue to perform its design function regarding DSC transfer and shielding.

5.3 Concrete Testing

HSM concrete shall be tested during the fabrication process for elevated temperatures to verify that there are no significant signs of spalling or cracking and that the concrete compressive strength is greater than that assumed in the structural analysis. Tests shall be performed at or above the calculated peak temperature and for a period no less than the 40 hour duration of HSM blocked vent transient for components exceeding 350 °F.

HSM concrete temperature testing shall be performed whenever:

- There is a change in the supplier of the cement, or
- There is a change in the source of the aggregate, or
- The water-cement ratio changes by more than 0.04.

5.4 Hydrogen Gas Monitoring

For DSCs, while welding the inner top cover during LOADING OPERATIONS, and while cutting the inner top cover to DSC shell weld when the DSC cavity is wet during UNLOADING OPERATIONS, hydrogen monitoring of the space under the inner top cover plug in the DSC cavity is required, to ensure that the combustible mixture concentration remains below the flammability limit of 4%. If this limit is exceeded, all welding operations shall be stopped and the DSC cavity purged with helium to reduce hydrogen concentration safely below the limit before welding or cutting operations can be resumed.

5.5 EOS-HSM Wind Deflectors

If the heat load of an EOS-37PTH DSC during STORAGE OPERATIONS is greater than 41.8 kW, wind deflectors shall be installed on the EOS-HSM.

If the heat load of an EOS-89BTH DSC during STORAGE OPERATIONS is greater than 41.6 kW, wind deflectors shall be installed on the EOS-HSM.

Table 1
Fuel Assembly Design Characteristics for the EOS-37PTH DSC

ASSEMBLY CLASS	B&W 15X15	WE 17X17	CE 15X15	WE 15X15	CE 14X14	WE 14X14	CE 16X16
Fissile Material	UO_2	UO_2	UO_2	UO_2	UO_2	UO_2	UO_2
Maximum Number of Fuel Rods	208	264	216	204	176	179	236
Maximum Number of Guide/ Instrument Tubes	17	25	9	21	5	17	5

Table 2
Co-60 Equivalent Activity for BLEU Fuel for the EOS-37PTH DSC

TC Type	Maximum Co-60 Activity in UO_2 (Curies/FA)
TC125/135	250
TC108	150

Note: This is equivalent to BLEU feedstock Cobalt impurity ≤1 g/MTU

Table 3
Co-60 Equivalent Activity for CCs Stored in the EOS-37PTH DSC

Fuel Region	Maximum Co-60 Activity per Heat Load Zone (1) (Curies/FA)		
	Zone 1(2)	Zone 2	Zone 3
Active Fuel	308	308	308
Plenum	44.1	44.1	14.8
Top Nozzle	18.9	18.9	9.5

Notes:

1. Heat Load Zones are shown in Figure 1.
2. NSAs and Neutron Sources shall only be stored in the interior compartments of the basket. Interior compartments are those compartments that are completely surrounded by other compartments, including the corners. There are thirteen interior compartments in the EOS-37PTH DSC, all in Zone 1.

Table 4
Maximum Planar Average Initial Enrichment for EOS-37PTH DSC
(2 Pages)

Fuel Assembly Class	Maximum Planar Average Initial Enrichment (wt. % U-235) as a Function of Soluble Boron Concentration and Basket Type (Fixed Poison Loading)				
	Minimum Soluble Boron Concentration (ppm)	Basket Type			
		A1 / A2 / A3		B1 / B2 / B3	
		without CCs	with CCs	without CCs	with CCs
WE 17x17 Class	2000	4.35	4.35	4.50	4.45
	2100	4.50	4.45	4.65	4.60
	2200	4.60	4.55	4.75	4.70
	2300	4.70	4.65	4.85	4.85
	2400	4.85	4.80	5.00	4.95
	2500	4.95	4.90	5.00	5.00
CE 16x16 Class	2000	5.00	5.00	5.00	5.00
BW 15x15 Class	2000	4.25	4.20	4.40	4.35
	2100	4.40	4.30	4.55	4.45
	2200	4.50	4.45	4.65	4.60
	2300	4.60	4.55	4.80	4.70
	2400	4.75	4.65	4.90	4.85
	2500	4.85	4.75	5.00	4.90
WE 15x15 Class	2000	4.45	4.40	4.55	4.55
	2100	4.60	4.55	4.65	4.65
	2200	4.70	4.65	4.80	4.80
	2300	4.85	4.75	5.00	4.95
	2400	4.95	4.90	5.00	5.00
	2500	5.00	5.00	5.00	5.00

Table 4
Maximum Planar Average Initial Enrichment for EOS-37PTH DSC
(2 Pages)

Fuel Assembly Class	Maximum Planar Average Initial Enrichment (wt. % U-235) as a Function of Soluble Boron Concentration and Basket Type (Fixed Poison Loading)				
	Minimum Soluble Boron Concentration (ppm)	Basket Type			
		A1 / A2 / A3		B1 / B2 / B3	
		without CCs	with CCs	without CCs	with CCs
CE 15x15 Class	2000	4.60	4.55	4.75	4.70
	2100	4.70	4.65	4.85	4.85
	2200	4.85	4.80	5.00	4.95
	2300	5.00	4.90	5.00	5.00
	2400	5.00	5.00	5.00	5.00
CE 14x14 Class	2000	5.00	5.00	5.00	5.00
WE 14x14 Class	2000	5.00	5.00	5.00	5.00

Notes:

1. The fixed poison loading requirements as a function of Basket Type are specified in Table 5.
2. Linear interpolation is allowed between adjacent maximum planar average initial enrichments and soluble boron concentration levels.

Table 5
Minimum B-10 Content in the Neutron Poison Plates of the EOS-37PTH DSC

Basket Type	Minimum B-10 Content (areal density) for MMC (mg/cm^2)
A1 / A2 / A3	28.0
B1 / B2 / B3	35.0

Table 6
Fuel Assembly Design Characteristics for the EOS-89BTH DSC

BWR Fuel Class	BWR Fuel ID	Example Fuel Designs [(1)(2)]
7 x 7	GE-7-A	GE-1, G2, GE3
8 x 8	GE-8-A	GE4, XXX-RCN
8 x 8	GE-8-B	GE5, GE-Pres GE-Barrier GE8 Type 1
8 x 8	GE-8-C	GE8 Type II
8 x 8	GE-8-D	GE9, GE10
9 x 9	GE-9-A	GE11, GE13
10 x 10	GE-10-A	GE12, GE14
10 x 10	GE-10-B	GNF2
7 x 7	ENC-7-A	ENC-IIIA
7 x 7	ENC-7-B	ENC-III ENC-IIIE ENC-IIIF
8 x 8	ENC-8-A	ENC Va and Vb
8 x 8	FANP-8-A	FANP 8x8-2
9 x 9	FANP-9-A	FANP-9x9-79/2 FANP-9x9-72 FANP-9x9-80 FANP-9x9-81
9 x 9	FANP-9-B	Siemens QFA ATRIUM 9
10 x 10	FANP-10-A	ATRIUM 10 ATRIUM 10XM
8 x 8	ABB-8-A	SVEA-64
8 x 8	ABB-8-B	SVEA-64
10 x 10	ABB-10-A	SVEA-92 SVEA-96Opt SVEA-100
10 x 10	ABB-10-B	SVEA-92 SVEA-96 SVEA-100
10 x 10	ABB-10-C	SVEA-96Opt2

Notes:

1. Any fuel channel average thickness up to 0.120 inch is acceptable on any of the fuel designs.
2. Example BWR fuel designs are listed herein and are not all-inclusive.

Table 7
Co-60 Equivalent Activity for BLEU Fuel for EOS-89BTH DSC

Transfer Cask Type	Maximum Co-60 Activity in UO_2 (Curies/FA)
TC125/135	100
TC108	50

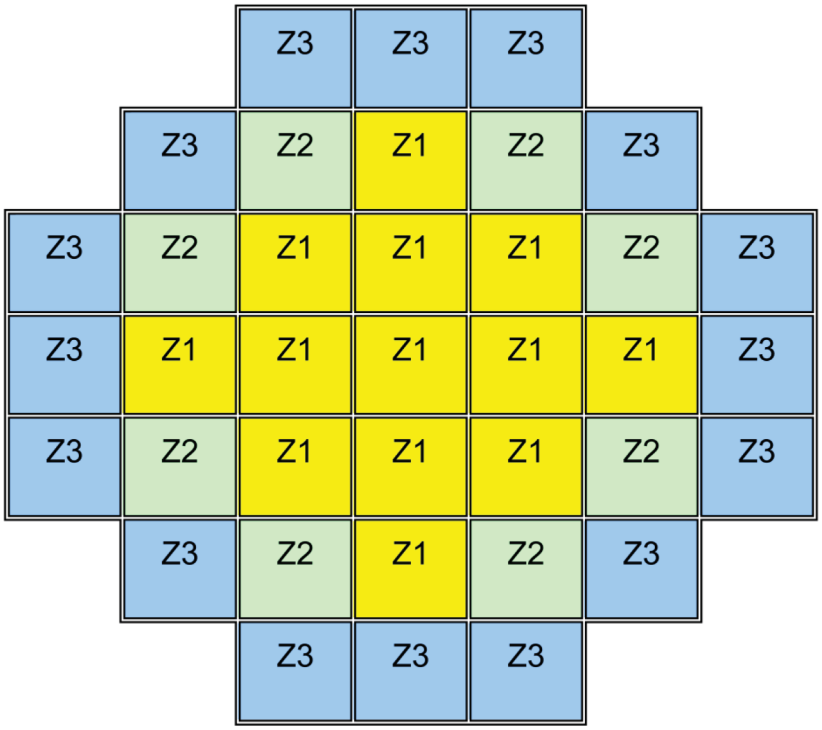
Note: This is equivalent to BLEU feedstock Cobalt impurity ≤1 g/MTU.

Table 8
Maximum Lattice Average Initial Enrichment for EOS-89BTH DSC

Basket Type	Maximum Lattice Average Enrichment(1) (wt. % U-235)	Minimum B-10 Areal Density (mg/cm^2)	
		MMC	BORAL®
A1 / A2 / A3	4.10	32.7	39.2
B1 / B2 / B3	4.45	41.3	49.6
C1 / C2 / C3	4.80	Not Allowed	60.0

Note:

1. For ABB-10-C Fuel Designs, the enrichment shall be reduced by 0.25 wt. % U-235 for Types A1 / A2 / A3 and Types B1 / B2 / B3 and reduced by 0.20 wt. % U-235 for Types C1 / C2 / C3.



Heat Load Zone Configuration #1 for the EOS-37PTH DSC in the TC125/135

Zone Number	1	2	3
Maximum Decay Heat(1)(4) (kW/FA plus CCs, if included)	1.0	2.0	1.3125
Minimum Cooling Time, Standard (years)	3.0	3.0	3.0
Minimum Cooling Time, Stainless Steel Rods(2) (years)	15.0	15.0	15.0
Maximum Number of Fuel Assemblies	13	8	16
Maximum Decay Heat per DSC (kW)	50.0		

Figure 1
EOS-37PTH DSC Heat Load Zoning Configurations and Fuel Qualification
(3 Pages)

Heat Load Zone Configuration #2 for the EOS-37PTH DSC in the TC108/125/135

Zone Number	1	2	3
Maximum Decay Heat(1)(4), (H), (kW/FA plus CCs, if included)	1.0	1.5	1.05
Minimum Cooling Time, Standard(3) (years)	3.0	3.0	5.0 for H ≤ 1.0 8.0 for H > 1.0
Minimum Cooling Time, Stainless Steel Rods(2) (years)	15.0	15.0	15.0
Maximum Number of Fuel Assemblies	13	8	16
Maximum Decay Heat per DSC (kW)	41.8		

Heat Load Zone Configuration #3 for the EOS-37PTH DSC in the TC108/125/135

Zone Number	1	2	3
Maximum Decay Heat(1)(4) (kW/FA plus CCs, if included)	0.95	1.0	1.0
Minimum Cooling Time, Standard (years)	3.0	3.0	9.0
Minimum Cooling Time, Stainless Steel Rods(2) (years)	15.0	15.0	15.0
Maximum Number of Fuel Assemblies	13	8	16
Maximum Decay Heat per DSC (kW)	36.35		

Note:

1. The maximum decay heat for each FA can be determined by the licensee using the thermal conductivity of the basket plates. The maximum decay heat for each FA shall not exceed the values specified herein.
2. The minimum cooling time applies to FAs containing stainless steel reconstituted rods that undergo further irradiation. For all other FAs, including reconstituted FAs, the minimum cooling time shown for “Standard” is applicable.
3. The minimum cooling time for Zone 3 is shown for TC108. The minimum cooling time for TC 125/135 is 3.0 years.

Figure 1
EOS-37PTH DSC Heat Load Zoning Configurations and Fuel Qualification
(3 Pages)

4. For FAs with active fuel length shorter than 144 inches, reduce the maximum heat load per FA in each loading zone of the HLZCs using a scaling factor (SF) as shown below.

$$q_{Short\ FA} = q_{Bounding\ FA} \cdot SF,$$

$$SF = \frac{L_{a,Short\ FA}}{L_{a,Bounding\ FA}} \cdot \frac{k_{eff,Short\ FA}}{k_{eff,Bounding\ FA}}.$$

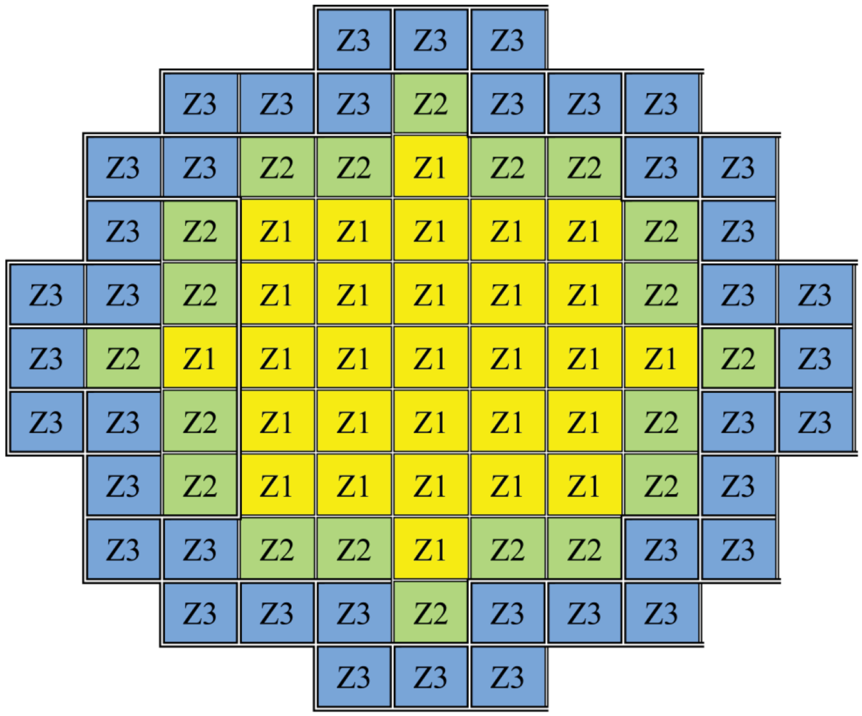
Where,
k_{eff} = Effective conductivity for FA,
q = Decay heat load per assembly defined for each loading zone,
L_a = Active fuel length,
SF = Scaling factor (SF) for short FAs.

The effective conductivity for the shorter FA should be determined using the same methodology documented in the SAR.

For FAs with active fuel length greater than 144 inches, no scaling is required and the maximum heat loads listed for each HLZC are applicable.

Figure 1
EOS-37PTH DSC Heat Load Zoning Configurations and Fuel Qualification

(3 Pages)



Heat Load Zone Configuration #1 for the EOS-89BTH DSC in the TC125

Zone Number	1	2	3
Maximum Decay Heat(1)(4) (kW/FA plus channel, if included)	0.4	0.6	0.5
Minimum Cooling Time, Standard (years)	3.0	3.0	3.0
Minimum Cooling Time, Stainless Steel Rods(2) (years)	15.0	15.0	15.0
Maximum Number of Fuel Assemblies	29	20	40
Maximum Decay Heat per DSC (kW)	43.6		

Figure 2
EOS-89BTH DSC Heat Load Zoning Configurations and Fuel Qualification
(3 Pages)

Heat Load Zone Configuration #2 for the EOS-89BTH DSC in the TC108/125

Zone Number	1	2	3
Maximum Decay Heat(1)(4) (kW/FA plus channel, if included)	0.4	0.5	0.5
Minimum Cooling Time, Standard(3) (years)	3.0	3.0	9.7
Minimum Cooling Time, Stainless Steel Rods(2) (years)	15.0	15.0	15.0
Maximum Number of Fuel Assemblies	29	20	40
Maximum Decay Heat per DSC (kW)	41.6		

Heat Load Zone Configuration #3 for the EOS-89BTH DSC in the TC108/125

Zone Number	1	2	3
Maximum Decay Heat(1)(4) (kW/FA plus channel, if included)	0.36	0.4	0.4
Minimum Cooling Time, Standard (years)	3.0	3.0	9.0
Minimum Cooling Time, Stainless Steel Rods(2) (years)	15.0	15.0	15.0
Maximum Number of Fuel Assemblies	29	20	40
Maximum Decay Heat per DSC (kW)	34.44		

Note:

1. The maximum decay heat for each FA can be determined by the licensee using the thermal conductivity of the basket plates. The maximum decay heat for each FA shall not exceed the values specified herein.
2. The minimum cooling time applies to FAs containing stainless steel reconstituted rods that undergo further irradiation. For all other FAs, including reconstituted fuel assemblies, the minimum cooling time shown for "Standard" is applicable.
3. The minimum cooling time for Zone 3 is shown for TC108. The minimum cooling time for TC125 is 3.0 years.

Figure 2
EOS-89BTH DSC Heat Load Zoning Configurations and Fuel Qualification

(3 Pages)

4. For FAs with active fuel length shorter than 144 inches, reduce the maximum heat load per FA in each loading zone of the HLZCs using a scaling factor (SF) as shown below.

$$q_{Short\ FA} = q_{Bounding\ FA} \cdot SF,$$

$$SF = \frac{L_{a,Short\ FA}}{L_{a,Bounding\ FA}} \cdot \frac{k_{eff,Short\ FA}}{k_{eff,Bounding\ FA}}.$$

Where,
k_{eff} = Effective conductivity for FA,
q = Decay heat load per assembly defined for each loading zone,
L_a = Active fuel length,
SF = Scaling factor (SF) for short FAs.

The effective conductivity for the shorter FA should be determined using the same methodology documented in the SAR.

For FAs with active fuel length greater than 144 inches, no scaling is required and the maximum heat loads listed for each HLZC are applicable.

Figure 2
EOS-89BTH DSC Heat Load Zoning Configurations and Fuel Qualification

(3 Pages)