# APPENDIX A TO CERTIFICATE OF COMPLIANCE NO. 1029

# TECHNICAL SPECIFICATIONS FOR THE STANDARDIZED ADVANCED NUHOMS® SYSTEM OPERATING CONTROLS AND LIMITS

TABLE OF CONTENTS


Operating Controls and Limits....1-1
1.0 Use and Application....1-1
1.1 Definitions....1-1
1.2 Logical Connectors....1-3
1.3 Completion Times....1-5
1.4 Frequency....1-9
2.0 Functional and Operating Limits....2-1
2.1 Fuel to Be Stored in the 24PT1-DSC....2-1
2.2 Fuel to Be Stored in the 24PT4-DSC....2-2
2.3 Fuel to Be Stored in the 32PTH2 DSC....2-4
2.4 Functional and Operating Limits Violation....2-4
3.0 Limiting Condition for Operation (LCO) and Surveillance Requirement (SR) Applicability....3-1
3.1 DSC Integrity....3-3
3.2 DSC Criticality Control....3-15
4.0 Design Features....4-1
4.1 Site....4-1
4.1.1 Site Location....4-1
4.2 Storage System Features....4-1
4.2.1 Storage Capacity....4-1
4.2.2 Storage Pad....4-1
4.2.3 Canister Neutron Absorber....4-1
4.2.4 Canister Flux Trap Configuration....4-2
4.2.5 Fuel Spacers....4-2
4.3 Codes and Standards....4-4
4.3.1 Advanced Horizontal Storage Module (AHSM and AHSM-HS)....4-4
4.3.2 Dry Shielded Canister....4-4
4.3.3 Transfer Cask....4-4
4.3.4 Alternatives to Codes and Standards....4-4
4.4 Storage Location Design Features....4-13
4.4.1 Storage Configuration....4-13
4.4.2 Concrete Storage Pad Properties to Limit DSC Gravitational Loadings Due to Postulated Drops....4-13
4.4.3 Site Specific Parameters and Analyses....4-13
5.0 Administrative Controls....5-1
5.1 Procedures....5-1
5.2 Programs....5-2
5.2.1 Safety Review Program....5-2
5.2.2 Training Program....5-2
5.2.3 Radiological Environmental Monitoring Program....5-3
5.2.4 Radiation Protection Program....5-3
5.2.5 AHSM/AHSM-HS Thermal Monitoring Program....5-6
5.2.6 Hydrogen Gas Monitoring for the 32PTH2 DSC....5-8
5.3 Lifting Controls....5-8
5.3.1 Transfer Cask Lifting Heights....5-8
5.3.2 Transfer Cask Drop....5-9

5.4 AHSM-HS Dose Rate Evaluation Program 5-9
5.4.1 Overview 5-9
5.4.2 Limits and Locations 5-10
5.4.3 Corrective Actions: 5-10
5.5 Concrete Testing for AHSM-HS 5-11
5.6 AHSM-HS Configuration Changes 5-11

LIST OF TABLES

Table 2-1 Fuel Specifications (24PT1-DSC) 2-5
Table 2-2 Fuel Dimension and Weights (24PT1-DSC) 2-6
Table 2-3 Maximum Neutron and Gamma Source Terms (24PT1-DSC) 2-7
Table 2-4 Fuel Qualification Table (24PT1-DSC) 2-8
Table 2-5 PWR Fuel Specification of Intact Fuel to be stored in NUHOMS® 24PT4-DSC 2-9
Table 2-6 PWR Fuel Specifications of DAMAGED FUEL to be Stored in NUHOMS® 24PT4-DSC 2-10
Table 2-7 PWR Fuel Assembly Design Characteristics (24PT4-DSC) 2-11
Table 2-8 Maximum Fuel Enrichment v/s Neutron Poison Requirements for 24PT4-DSC 2-12
Table 2-9 PWR Fuel Qualification Table for 1.26 kW per Assembly for the NUHOMS®-24PT4-DSC 2-13
Table 2-10 PWR Fuel Qualification Table for 1.2 kW per Assembly for the NUHOMS® 24PT4-DSC 2-14
Table 2-11 PWR Fuel Qualification Table for 1.0 kW per Assembly for the NUHOMS® 24PT4-DSC 2-15
Table 2-12 PWR Fuel Qualification Table for 0.9 kW per Assembly for the NUHOMS® 24PT4-DSC 2-16
Table 2-13 PWR Fuel Qualification Table for 1.26 kW per Assembly for the NUHOMS® 24PT4-DSC, Reconstituted Fuel with Stainless Steel Rods 2-17
Table 2-14 PWR Fuel Qualification Table for 1.2 kW per Assembly for the NUHOMS® 24PT4-DSC, Reconstituted Fuel with Stainless Steel Rods 2-18
Table 2-15 PWR Fuel Qualification Table for 1.0 kW per Assembly for the NUHOMS® 24PT4-DSC, Reconstituted Fuel with Stainless Steel Rods 2-19
Table 2-16 PWR Fuel Qualification Table for 0.9 kW per Assembly for the NUHOMS® 24PT4-DSC, Reconstituted Fuel with Stainless Steel Rods 2-20
Table 3–1 PWR Fuel Specification for the Fuel to be Stored in the 32PTH2 DSC 2-25
Table 3–2 Thermal and Radiological Characteristics for Control Components Stored in the 32PTH2 DSC 2-27
Table 3–3 PWR Fuel Assembly Design Characteristics for the 32PTH2 DSC 2-28
Table 3–4 Maximum Planar Average Initial Enrichment versus Neutron Poison Plate Requirements for the 32PTH2 DSC (INTACT FUEL ASSEMBLY) 2-29

Table 3–5 Maximum Planar Average Initial Enrichment versus Neutron Poison Plate Requirements for the 32PTH2 DSC (DAMAGED FUEL ASSEMBLY) ........ 2-30
Table 3–6 Allowable Fuel Assembly Burnup and Enrichment Combinations for the 32PTH2 DSC ........ 2-31
Table 3–7 Fuel Assembly Decay Heat for the 32PTH2 DSC ........ 2-32
Table 3-8 Additional Cooling Times (ΔT) in Years for RECONSTITUTED FUEL ASSEMBLIES with up to 7 Fuel Rods Reconstituted with Irradiated Stainless Steel Rods (Option 2) ........ 2-34
Table 3–9 B-10 Specification for the 32PTH2 DSC Neutron Poison Plates ........ 2-35

LIST OF FIGURES

Figure 2-1 24PT4-DSC Heat Load Configuration #1, kW/Assembly ........ 2-21
Figure 2-2 24PT4-DSC Heat Load Configuration #2, kW/Assembly ........ 2-22
Figure 2-3 24PT4-DSC Heat Load Configuration #3, kW/Assembly ........ 2-23
Figure 2-4 Location of FAILED FUEL CANS inside 24PT4-DSC ........ 2-24
Figure 3–1 Heat Load Zoning Configurations for the 32PTH2 DSC ........ 2-36
Figure 4-1 Minimum Spacer Disc Ligament Widths for 24PT1 and 24PT4-DSCs ........ 4-3

# 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. |
| ADVANCED HORIZONTAL STORAGE MODULE (AHSM/AHSM-HS) | The AHSM is a reinforced concrete structure for storage of a loaded 24PT1-DSC or 24PT4-DSC (DSC) at a spent fuel storage facility. The AHSM-HS is a modified version of the AHSM for storage of a loaded 32PTH2 DSC at a spent fuel storage facility. |
| DAMAGED FUEL ASSEMBLY (for 24PT1-DSC and 24PT4-DSC only) | A DAMAGED FUEL ASSEMBLY is a fuel assembly with known or suspected cladding defects greater than pinhole leaks or hairline cracks or an assembly with partial or missing rods. |
| DAMAGED FUEL ASSEMBLY (for 32PTH2 DSC only) | A DAMAGED FUEL ASSEMBLY is a fuel assembly with known or suspected cladding defects greater than pinhole leaks or hairline cracks or an assembly with partial or missing rods. The extent of damage in the fuel assembly is to be limited such that a fuel assembly is able to be handled by normal means. |
| DRY SHIELDED CANISTER (DSC) | A 24PT1-DSC, 24PT4-DSC, or 32PTH2 DSC is a welded pressure vessel that provides confinement of INTACT or DAMAGED FUEL ASSEMBLIES in an inert atmosphere. |
| FAILED FUEL CAN | A FAILED FUEL CAN confines any loose material and gross fuel particles to a known, subcritical volume during normal, off-normal and accident conditions and facilitates handling and retrievability. |
| FUEL DEBRIS | An intact or partial fuel rod not contained in a fuel assembly grid or an individual intact or partial fuel pellet not contained in a fuel rod. FUEL DEBRIS may be inserted in a ROD STORAGE BASKET. |
| INDEPENDENT SPENT FUEL STORAGE INSTALLATION | The facility within a perimeter fence licensed for storage of spent fuel within AHSMs or AHSM-HSs. |

| | |
|---|---|
| (ISFSI) | |
| INTACT FUEL ASSEMBLY | Spent nuclear fuel assemblies without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means. |
| LOADING OPERATIONS | LOADING OPERATIONS include all licensed activities on a DSC while it is being loaded with fuel assemblies, and on a TRANSFER CASK while it is loaded with a DSC containing fuel assemblies. LOADING OPERATIONS begin when the first fuel assembly is placed in the DSC and end when the TRANSFER CASK is ready for TRANSFER OPERATIONS. |
| RECONSTITUTED FUEL ASSEMBLY | RECONSTITUTED FUEL ASSEMBLIES include assemblies in which leaking fuel rods are replaced with either stainless steel rods or intact fuel rods, and which could undergo further irradiation. |
| ROD STORAGE BASKET | A 9x9 array of tubes in a lattice that has approximately the same dimensions as a standard fuel assembly. |
| STORAGE OPERATIONS | STORAGE OPERATIONS include all licensed activities that are performed at the ISFSI while a DSC containing INTACT or DAMAGED FUEL ASSEMBLIES is located in an AHSM or AHSM-HS on the storage pad within the ISFSI perimeter. |
| TRANSFER CASK (TC) | The TRANSFER CASK will consist of a licensed NUHOMS® OS197, OS197H, or OS200FC onsite transfer cask. The TRANSFER CASK will be placed on a transfer trailer for movement of a DSC to the AHSM or the AHSM-HS. |
| TRANSFER OPERATIONS | TRANSFER OPERATIONS include all licensed activities involving the movement of a TRANSFER CASK loaded with a DSC containing fuel assemblies. TRANSFER OPERATIONS begin when the TRANSFER CASK is placed on the transfer trailer following LOADING OPERATIONS and end when the DSC is located in an AHSM or AHSM-HS on the storage pad within the ISFSI perimeter. |
| 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 AHSM or the AHSM-HS and end when the last fuel assembly has been removed from the DSC. |

## 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 not met. | A.1 Verify<br>AND<br>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.

1.2 Logical Connectors

EXAMPLES (continued)

EXAMPLE 1.2-2:

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
| --- | --- | --- |
| A. LCO not met. | A.1 Stop<br><br>OR<br><br>A.2<br><br>A.2.1 Verify …<br><br>AND<br><br>A.2.2<br><br>A.2.2.1 Reduce<br><br>OR<br><br>A.2.2.2 Perform<br><br>OR<br><br>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.

| | |
|---|---|
| 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.<br><br>Once a Condition has been entered, subsequent subsystems, components, or variables expressed in the Condition, discovered to be not within limits, will <u>not</u> 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 (continued)

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.<br><br>AND<br><br>B.2 Perform Action B.2. | 12 hours<br><br><br><br>36 hours |

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 (continued)

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.<br><br>AND<br><br>B.2 Perform Action B.2. | 12 hours<br><br><br><br>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.

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.<br><br>AND<br><br>B.2 Perform Action B.2. | 6 hours<br><br><br><br>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.

| | |
|---|---|
| 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, 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.

EXAMPLES (continued)

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.

EXAMPLES (continued)

EXAMPLE 1.4-2:

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| Verify flow within limits. | Once within 12 hours prior to starting activity<br><br>AND<br><br>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.

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.<br>Verify 24PT1-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 24PT1-DSC

The spent nuclear fuel to be stored in each 24PT1-DSC/AHSM at the ISFSI shall meet the following requirements:

a. Fuel shall be INTACT FUEL ASSEMBLIES or DAMAGED FUEL ASSEMBLIES. DAMAGED FUEL ASSEMBLIES shall be placed in screened confinement cans (FAILED FUEL CANS) inside the 24PT1-DSC guidesleeves. DAMAGED FUEL ASSEMBLIES shall be stored in outermost guidesleeves located at the 45, 135, 225 and 315 degree azimuth locations.

b. Fuel types shall be limited to the following:

   $UO_2$ Westinghouse 14x14 (WE 14x14) Assemblies (with or without IFBA fuel rods), as specified in Table 2-1.

   WE 14x14 Mixed Oxide (MOX) Assemblies, as specified in Table 2-1.

   Fuel burnup and cooling time is to be consistent with the limitations specified in Table 2-4 for $UO_2$ fuel.

   Control Components stored integral to WE 14x14 Assemblies in a 24PT1-DSC, shall be limited to Rod Cluster Control Assemblies (RCCAs), Thimble Plug Assemblies (TPAs), and Neutron Source Assemblies (NSAs). Location of control components within a 24PT1-DSC shall be selected based on criteria which does not change the radial center of gravity by more than 0.1 inches.

c. The maximum heat load for a single fuel assembly, including control components, is 0.583 kW for SC fuel assemblies and 0.294 kW for MOX fuel assemblies. The maximum heat load per 24PT1-DSC, including any integral Control Components, shall not exceed 14 kW when loaded with all SC fuel assemblies and 13.706 kW when loaded with MOX fuel assemblies.

d. Fuel can be stored in the 24PT1-DSC in any of the following configurations:

   1) A maximum of 24 INTACT WE 14x14 MOX or SC FUEL ASSEMBLIES; or

   2) Up to four WE 14x14 SC DAMAGED FUEL ASSEMBLIES, with the balance INTACT WE 14x14 SC FUEL ASSEMBLIES; or

   3) One MOX DAMAGED FUEL ASSEMBLY with the balance INTACT WE 14x14 SC FUEL ASSEMBLIES.

   A 24PT1-DSC containing less than 24 fuel assemblies may contain dummy fuel assemblies in fuel assembly slots. The dummy FUEL assemblies are unirradiated, stainless steel encased structures that approximate the weight and center of gravity of a fuel assembly. The effect of dummy assemblies

or empty fuel assembly slots on the radial center of gravity of the DSC must meet the requirements of Section 2.1.b.

No more than two empty fuel assembly slots are allowed in each DSC. They must be located at symmetrical locations about the 0-180° and 90-270° axes.

No more than 14 fuel pins in each assembly may exhibit damage. A visual inspection of assemblies will be performed prior to placement of the fuel in the 24PT1-DSC, which may then be placed in storage or transported anytime thereafter without further fuel inspection.

e. Fuel dimensions and weights are provided in Table 2-2.

f. The maximum neutron and gamma source terms are provided in Table 2-3.

## 2.2 Fuel to Be Stored in the 24PT4-DSC

a. The spent fuel to be stored in the NUHOMS® 24PT4-DSC consists of INTACT (including RECONSTITUTED) Westinghouse-CENP 16x16 (CE 16x16) and/or DAMAGED CE 16x16 FUEL ASSEMBLIES with Zircaloy or ZIRLO™ cladding and $UO_2$, $(U, Er)O_2$ or $(U, Gd)O_2$ fuel pellets. Assemblies are with or without integral burnable poison rods or integral fuel burnable absorber (IFBA) rods.

b. Each 24PT4-DSC can accommodate a maximum of 12 DAMAGED FUEL ASSEMBLIES, with the remaining assemblies being intact.

RECONSTITUTED ASSEMBLIES containing up to eight replacement stainless steel rods in place of DAMAGED FUEL Rods or replacement Zircaloy clad uranium rods (any number per assembly) are acceptable for storage in the 24PT4-DSC as either INTACT or DAMAGED ASSEMBLIES.

DAMAGED FUEL may include assemblies with known or suspected cladding defects greater than pinhole leaks or hairline cracks or an assembly with partial and/or missing rods (i.e., extra water holes). DAMAGED FUEL ASSEMBLIES shall be encapsulated in individual FAILED FUEL CANS placed in locations as shown in Figure 2-4.

FUEL DEBRIS and DAMAGED FUEL Rods that have been removed from a DAMAGED FUEL ASSEMBLY and placed in a ROD STORAGE BASKET are also considered as DAMAGED FUEL. A ROD STORAGE BASKET is a 9x9 array of tubes in a lattice that has approximately the same dimensions as a standard fuel assembly. ROD STORAGE BASKETS may also include IFBA and Integral Burnable Poison Rods. Loose FUEL DEBRIS not contained in a ROD STORAGE BASKET may be placed in a FAILED FUEL CAN for storage provided the size of the debris is larger than the FAILED FUEL CAN screen mesh opening. FUEL DEBRIS may be associated with any type of $UO_2$ fuel provided that the maximum uranium content and

enrichment limits are met.

c. The INTACT and/or DAMAGED CE 16x16 FUEL ASSEMBLIES acceptable for storage in 24PT4-DSC are specified in Table 2-5, Table 2-6, and Table 2-7. The fuel to be stored in the 24PT4-DSC is limited to a maximum planar average initial enrichment of 4.85 wt. % U-235. The maximum allowable assembly burnup is given as a function of assembly average initial fuel enrichment but does not exceed 60,000 MWd/MTU. The minimum cooling time is 5 years.

d. A 24PT4-DSC containing less than 24 fuel assemblies may contain dummy fuel assemblies in fuel assembly slots, or empty slots. The dummy fuel assemblies are unirradiated, stainless steel encased structures that approximate the weight and center of gravity of a fuel assembly.

e. The 24PT4-DSC may store PWR assemblies in any one of the three alternate configurations shown in Figure 2-1 through Figure 2-3 with a maximum heat load of 1.26 kW per assembly and a maximum heat load of 24 kW per DSC. Table 2-9 through Table 2-12 define the fuel assembly cooling time (in years) based on fuel assembly burnup and initial fuel enrichment for the assembly, assuming that no reconstituted fuel with stainless steel rods is present. The fuel qualification tables to be used for reconstituted assemblies with stainless steel rods are provided in Table 2-13 through Table 2-16. These tables ensure that the fuel assembly decay heat load is less than that specified for each table and that the corresponding radiation source term is bounded by that analyzed in Chapter A.5.

f. Two different 24PT4-DSC basket configurations are provided, as shown in Table 2-8. These configurations differ in the boron loading in the Boral® plates. The minimum areal boron –10 (B-10) concentrations for the standard (Type A basket) and high (Type B basket) loadings are 0.025 and 0.068 g/cm$^2$, respectively. Fuel to be stored in the standard B-10 loading 24PT4-DSC is limited to a maximum planar average initial enrichment of 4.1 wt. % U-235. Fuel to be stored in the high B-10 loading 24PT4-DSC is limited to a maximum planar average initial enrichment of 4.85 wt. % U-235.

g. Up to four DAMAGED FUEL ASSEMBLIES may be stored in a 24PT4-DSC of either B-10 loading without impact upon the allowed maximum planar average U-235 enrichment and without the use of additional poison rodlets. The DAMAGED FUEL ASSEMBLIES shall be stored in FAILED FUEL CANS located at the 45, 135, 225 and 315 degree azimuth locations (Zone A of Figure 2-4).

Five to twelve DAMAGED FUEL ASSEMBLIES may be stored in a 24PT4-DSC of either B-10 loading without the use of poison rodlets if the maximum allowed U-235 enrichment is reduced for the DAMAGED FUEL ASSEMBLIES. The intact assembly enrichment limits remain at their maximum planar average values of 4.1 and 4.85 wt. % for the standard and

high B-10 loadings, respectively. DAMAGED FUEL to be stored in the standard B-10 loading 24PT4-DSC is limited to a maximum planar average initial enrichment of 3.7 wt. % U-235, and DAMAGED FUEL to be stored in the high B-10 loading 24PT4-DSC is limited to a maximum planar average initial enrichment of 4.1 wt. % U-235. All DAMAGED FUEL ASSEMBLIES shall be stored in FAILED FUEL CANS located in Zones A and B of Figure 2-4.

Five to twelve DAMAGED FUEL ASSEMBLIES may be stored in a 24PT4-DSC of either B-10 loading without impact upon the allowed maximum planar average U-235 enrichment if poison rodlets are utilized. For the standard B-10 loading, a single poison rodlet is inserted into the center guide tube of each INTACT FUEL ASSEMBLY located in Zone C of Figure 2-4. For the high B-10 loading, a poison rodlet is inserted into each of the five guide tubes in each INTACT FUEL ASSEMBLY located in Zone C of Figure 2-4. All DAMAGED FUEL ASSEMBLIES shall be stored in FAILED FUEL CANS located in Zones A and B of Figure 2-4.

The poison rodlets consist of $B_4C$ (pellets or powder) encased in a 0.75 inches nominal OD stainless steel tube with a wall thickness of 0.035 inches. The minimum linear $B_4C$ content is 0.70 g/cm with sufficient length to cover the active fuel length.

Fuel Assembly poison rods installed within the guide tubes for criticality control in the spent fuel pool racks may be stored with any INTACT FUEL ASSEMBLY or DAMAGED FUEL ASSEMBLIES as long as the total assembly weight is less than that specified in Table 2-5. Each poison rodlet may include a lifting mechanism to allow insertion into the selected SFA guide tube.

A summary of the storage configurations analyzed is presented in Table 2-8.

### 2.3 Fuel to Be Stored in the 32PTH2 DSC

As specified in Table 3-1.

### 2.4 Functional and Operating Limits Violation

If any Functional and Operating Limit of 2.0 is violated, the following actions shall be completed:

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

b. Within 24 hours, notify the NRC Operations Center.

c. Within 30 days, submit a special report which describes the cause of the violation and the actions taken to restore compliance and prevent recurrence.

## Table 2-1 Fuel Specifications (24PT1-DSC)

| Fuel Type | Maximum Planar Average Initial Enrichment | Cladding Material | Minimum Cooling Time | Minimum Assembly Average Initial Enrichment | Maximum Burnup |
|---|---|---|---|---|---|
| $UO_2$ WE 14x14 (with or without IFBA fuel rods) | 4.05 wt. % U-235 | Type 304 Stainless Steel | 10 years | See Table 2-4 for Enrichment, Burnup, and Cooling Time Limits. | |
| WE 14x14 MOX | 2.84 wt. % Fissile Pu – 64 rods<br>3.10 wt. % Fissile Pu – 92 rods<br>3.31 wt. % Fissile Pu – 24 rods | Zircaloy-4 | 20 years | 2.78 wt. % Fissile Pu – 64 rods<br>3.05 wt. % Fissile Pu – 92 rods<br>3.25 wt. % Fissile Pu – 24 rods | 25,000 MWd/MTU |
| Integral Control Components | N/A | N/A | 10 years | N/A | N/A |

## Table 2-2 Fuel Dimension and Weights (24PT1-DSC)

| Parameters | WE 14x14 SC[1] | WE 14x14 MOX[1] |
|---|---|---|
| Number of Rods | 180 | 180 |
| Number of Guide Tubes/Instrument Tubes | 16 | 16 |
| Cross Section (inches) | 7.763 | 7.763 |
| Unirradiated Length (inches) | 138.5 | 138.5 |
| Fuel Rod Pitch (inches) | 0.556 | 0.556 |
| Fuel Rod O.D. (inches) | 0.422 | 0.422 |
| Clad Material | Type 304 SS | Zircaloy-4 |
| Clad Thickness (inches) | 0.0165 | 0.0243 |
| Pellet O.D. (inches) | 0.3835 | 0.3659 |
| Maximum Planar Average Initial Enrichment (wt. % U-235) | 4.05 | Note 2 |
| Theoretical Density (%) | 93-95 | 91 |
| Active Fuel Length (inches) | 120 | 119.4 |
| Maximum U Content (kg) | 375 | Note 3 |
| Assembly Weight (lbs) | 1210 | 1150 |
| Maximum Assembly Weight including NFAH[4] (lbs) | 1320 | 1320 |

(1) Nominal values shown unless stated otherwise.

(2) Mixed-Oxide assemblies with 0.71 wt. % U-235 and maximum fissile Pu weight of 2.84 wt. % (64 rods), 3.10 wt. % (92 rods), and 3.31 wt. % (24 rods).

(3) Total weight of Pu is 11.24 kg and the total weight of U is 311.225 kg.

(4) Weights of TPAs and NSAs are enveloped by RCCAs.

## Table 2-3 Maximum Neutron and Gamma Source Terms (24PT1-DSC)

| Parameter | WE 14x14 SC | WE 14x14 MOX |
|---|---|---|
| Gamma Source (□/sec/assy) | 3.43E+15 | 9.57E+14 |
| Neutron Source (n/sec/assy) | 2.84E+08 | 4.90E+07 |

| Parameter | RCCAs | TPAs | NSAs |
|---|---|---|---|
| Gamma Source (□/sec/assy) | 7.60E+12 | 5.04E+12 | 1.20E+13 |
| Decay heat (Watts) | 1.90 | 1.2 | 1.66 |

## Table 2-4 Fuel Qualification Table (24PT1-DSC)

(Minimum required years of cooling time after reactor core discharge)

| Burnup GWd/MTU | Assembly Average Initial Enrichment (wt. % U-235) | | | |
|---|---|---|---|---|
| | **3.12** | **3.36** | **3.76** | **3.96** |
| **45.0** | **Not Analyzed** | | 15.2 | 15.2* |
| **43.3** | | | 15.2 | 11.5 |
| **40.0** | | 10.9 | 10.9** | 10.9** |
| **36.8** | | 10.9 | 10.0*** | 10.0*** |
| **35.0 or less** | 10.0*** | 10.0*** | 10.0*** | 10.0*** |

Notes

- * Cooling time based on 3.76 wt. % enrichment is conservatively used.
- ** Cooling time based on 3.36 wt. % enrichment is conservatively used.
- *** Cooling time based on shielding analysis source term.

General Notes:

- * Use burnup and enrichment to look up minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are correctly accounted for during fuel qualification.
- * Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- * Example: An assembly with an initial enrichment of 3.90 wt. % U-235 and a burnup of 37 GWd/MTU is acceptable for storage after a 10.9 year cooling time as defined at the intersection of 3.76 wt. % U-235 (rounding down) and 40 GWd/MTU (rounding up) on the qualification table.

## Table 2-5 PWR Fuel Specification of Intact Fuel to be stored in NUHOMS® 24PT4-DSC

| | |
|---|---|
| Fuel Design: | INTACT CE 16x16 PWR FUEL ASSEMBLY or equivalent reload fuel that is enveloped by the fuel assembly design characteristics as listed in Table 2-7 and the following requirements: |
| Fuel Damage: | Fuel with known or suspected cladding damage in excess of pinhole leaks or hairline cracks or an assembly with partial and/or missing rods is not authorized to be stored as "INTACT PWR FUEL." |
| **Physical Parameters(1)** | |
| Unirradiated Length (in) | 176.8 |
| Cross Section (in) | 8.290 |
| Assembly Weight (lbs) | 1500(2) |
| Number of Assemblies per DSC | ≤24 intact assemblies |
| Maximum U Content (kg) | 455.5 |
| Fuel Cladding | Zircaloy-4 or ZIRLO™ |
| RECONSTITUTED FUEL ASSEMBLIES | DAMAGED FUEL Rods replaced by either stainless steel rods (up to 8 rods per assembly) or Zircaloy clad uranium rods (any number of rods per assembly) |
| **Nuclear and Radiological Parameters** | |
| Maximum Planar Average Initial Enrichment (wt % U-235) | Per Table 2-8 and Figure 2-4 |
| Fuel Burnup and Cooling Time | Per Table 2-9, Table 2-10, Table 2-11 and Table 2-12<br><br>For RECONSTITUTED FUEL with stainless steel replacement rods per Table 2-13, Table 2-14, Table 2-15 and Table 2-16 |
| Decay Heat | Per Figure 2-1, or Figure 2-2 or Figure 2-3 |

**Notes:**

(1) Nominal values shown unless stated otherwise.
(2) Does not include weight of Poison Rodlets (25 lbs each).

## Table 2-6 PWR Fuel Specifications of DAMAGED FUEL to be Stored in NUHOMS® 24PT4-DSC

| | |
|---|---|
| Fuel Design: | DAMAGED CE 16x16 PWR FUEL ASSEMBLY or equivalent reload fuel that is enveloped by the fuel assembly design characteristics as listed in Table 2-7 and the following requirements: |
| Fuel Damage: | DAMAGED FUEL may include assemblies with known or suspected cladding defects greater than pinhole leaks or hairline cracks or an assembly with partial and/or missing rods (i.e., extra water holes).<br><br>DAMAGED FUEL ASSEMBLIES shall be encapsulated in individual FAILED FUEL CANS and placed in Zones A and/or B as shown in Figure 2-4.<br><br>FUEL DEBRIS and DAMAGED FUEL Rods that have been removed from a DAMAGED FUEL ASSEMBLY and placed in a ROD STORAGE BASKET are also considered as DAMAGED FUEL. Loose FUEL DEBRIS not contained in a ROD STORAGE BASKET, may also be placed in a FAILED FUEL CAN for storage, provided the size of the debris is larger than the FAILED FUEL CAN screen mesh opening.<br><br>FUEL DEBRIS may be associated with any type of $UO_2$ fuel provided that the maximum uranium content and enrichment limits are met. |
| **Physical Parameters(1)** | |
| Unirradiated Length (inches) | 176.8 |
| Cross Section (inches) | 8.290 |
| Assembly Weight (lbs) | 1500(2) |
| Number of Assemblies per DSC | ≤12 DAMAGED ASSEMBLIES, balance INTACT |
| Maximum U Content (kg) | 455.5 |
| Fuel Cladding | Zircaloy-4 or ZIRLO™ |
| RECONSTITUTED FUEL ASSEMBLIES | DAMAGED FUEL Rods replaced by either stainless steel rods (up to 8 rods per assembly) or Zircaloy clad uranium rods (any number of rods per assembly) |
| **Nuclear and Radiological Parameters** | |
| Maximum Planar Average Initial Enrichment (wt. % U-235) | Per Table 2-8 and Figure 2-4 |
| Fuel Burnup and Cooling Time | Per Table 2-9, Table 2-10, Table 2-11 and Table 2-12<br><br>For RECONSTITUTED FUEL with stainless steel replacement rods per Table 2-13, Table 2-14, Table 2-15 and Table 2-16 |
| Decay Heat | Per Figure 2-1, or Figure 2-2 or Figure 2-3 |

**Notes:**

(1) Nominal values shown unless stated otherwise.
(2) Does not include weight of Poison Rodlets (25 lbs each).

## Table 2-7 PWR Fuel Assembly Design Characteristics (24PT4-DSC)

| Assembly Class | CE 16x16(1) |
|---|---|
| Maximum Assembly Length | Table 2-5 or Table 2-6 |
| Maximum Planar Average Initial Enrichment (wt. % U-235) | 4.85 |
| Fissile Material | $UO_2$, or (U, ER)$O_2$, or (U, Gd)$O_2$ |
| Number of Rods | 236 |
| Fuel Rod Pitch (inches) | 0.506 |
| Fuel Rod O.D. (inches) | 0.382 |
| Clad Thickness (inches) | 0.025 |
| Nominal Pellet O.D., (inches) | 0.3255(2) |
| Number of Guide Tubes | 5 |

**Notes:**

(1) Nominal values shown unless stated otherwise.
(2) Bounds pellets with a nominal OD of 0.325 inches.

## Table 2-8 Maximum Fuel Enrichment v/s Neutron Poison Requirements for 24PT4-DSC

| Storage Configuration | Maximum No. of DAMAGED FUEL ASSEMBLIES[(1)] | Maximum Planar Average Fuel Enrichment (wt. % U-235) | DSC Basket, Minimum BORAL® Areal Density ($gm/cm^2$) | Minimum No. of Poison Rodlets Required[(2)] |
|---|---|---|---|---|
| All INTACT FUEL ASSEMBLIES | 0 | 4.1 | .025 Type A Basket) | 0 |
| | 0 | 4.85 | .068 Type B Basket) | 0 |
| Combination of DAMAGED and INTACT FUEL ASSEMBLIES | 4 | 4.1 | .025 Type A Basket) | 0 |
| | 4 | 4.85 | .068 Type B Basket) | 0 |
| | 12 | 3.7 (DAMAGED)<br>4.1 (INTACT) | .025 Type A Basket) | 0 |
| | 12 | 4.1 (DAMAGED)<br>4.85 (INTACT) | .068 Type B Basket) | 0 |
| | 12 | 4.1 | .025 Type A Basket) | 1[(2)]<br>(Located in center guide tube of each INTACT ASSEMBLY) |
| | 12 | 4.85 | .068 Type B Basket) | 5[(2)]<br>(Located in all five guide tubes of each INTACT ASSEMBLY) |

**Notes:**

(1) See Figure 2-4 for location of DAMAGED FUEL ASSEMBLIES within the 24PT4-DSC basket (Zones A and/or B only).

(2) Poison rodlets are only required for a specific DSC configuration with a payload of 5-12 DAMAGED ASSEMBLIES in combination with maximum fuel enrichment levels as shown. The poison rodlets are to be located within the guide tubes of the inner Zone C INTACT ASSEMBLIES as shown in Figure 2-4.

## Table 2-9 PWR Fuel Qualification Table for 1.26 kW per Assembly for the NUHOMS®-24PT4-DSC

(Minimum required years of cooling time after reactor core discharge)

| BU (GWd/ MTU) | Assembly Average Initial Enrichment (wt. % U-235) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 15 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 28 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 30 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 32 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 34 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 36 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 38 | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 39 | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 40 | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 41 | | | Not Analyzed | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 42 | | | | | | | | | | | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 43 | | | | | | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 44 | | | | | | | | | | | | | | | | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 45 | | | | | | | | | | | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 48 | | | | | | | | | | | | | | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 51 | | | | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 54 | | | | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 57 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 60 | | | | | | | | | | | | | | | | | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |

**Notes:**

- BU = Assembly average burnup.
- Use burnup and enrichment to lookup minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are conservatively applied in determination of actual values for these two parameters.
- This table does not apply to RECONSTITUTED FUEL ASSEMBLIES with stainless steel rods.
- Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- Fuel with an initial enrichment either less than 1.8 or greater than 4.85 wt. % U-235 is unacceptable for storage.
- Fuel with a burnup greater than 60 GWd/MTU is unacceptable for storage.
- Fuel with a burnup less than 10 GWd/MTU is acceptable for storage after 5-years cooling.
- Example: An assembly with an initial enrichment of 4.85 wt. % U-235 and a burnup of 41.5 GWd/MTU is acceptable for storage after a five-year cooling time as defined by 4.8 wt. % U-235 (rounding down) and 42 GWd/MTU (rounding up) on the qualification table.

## Table 2-10 PWR Fuel Qualification Table for 1.2 kW per Assembly for the NUHOMS® 24PT4-DSC

(Minimum required years of cooling time after reactor core discharge)

| BU (GWd/MTU) | Assembly Average Initial Enrichment (wt. % U-235) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 15 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 28 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 30 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 32 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 34 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 36 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 38 | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 39 | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 40 | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 41 | | | Not Analyzed | | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 42 | | | | | | | | | | | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 43 | | | | | | | | | | | | | | | | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 44 | | | | | | | | | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 45 | | | | | | | | | | | | | | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 48 | | | | | | | | | | | | | | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 51 | | | | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 54 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 |
| 57 | | | | | | | | | | | | | | | | | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 |
| 60 | | | | | | | | | | | | | | | | | | | | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 |

**Notes:**

- BU = Assembly average burnup.
- Use burnup and enrichment to lookup minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are conservatively applied in determination of actual values for these two parameters.
- This table does not apply to RECONSTITUTED FUEL ASSEMBLIES with stainless steel rods.
- Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- Fuel with an initial enrichment either less than 1.8 or greater than 4.85 wt. % U-235 is unacceptable for storage.
- Fuel with a burnup greater than 60 GWd/MTU is unacceptable for storage.
- Fuel with a burnup less than 10 GWd/MTU is acceptable for storage after 5-years cooling.
- Example: An assembly with an initial enrichment of 4.85 wt. % U-235 and a burnup of 41.5 GWd/MTU is acceptable for storage after a five-year cooling time as defined by 4.8 wt. % U-235 (rounding down) and 42 GWd/MTU (rounding up) on the qualification table.

## Table 2-11 PWR Fuel Qualification Table for 1.0 kW per Assembly for the NUHOMS® 24PT4-DSC

(Minimum required years of cooling time after reactor core discharge)

| BU (GWd/MTU) | Assembly Average Initial Enrichment (wt. % U-235) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 15 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 28 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 30 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 32 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 34 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 36 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 38 | | | | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 39 | | | | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 |
| 40 | | | | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 41 | | | Not Analyzed | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 42 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 43 | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 44 | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 |
| 45 | | | | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 48 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 51 | | | | | | | | | | | | | | | | | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| 54 | | | | | | | | | | | | | | | | | | | | | 11 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 10 |
| 57 | | | | | | | | | | | | | | | | | | | | | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 60 | | | | | | | | | | | | | | | | | | | | | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 14 | 14 | 14 | 14 |

**Notes:**

- BU = Assembly average burnup.
- Use burnup and enrichment to lookup minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are conservatively applied in determination of actual values for these two parameters.
- This table does not apply to RECONSTITUTED FUEL ASSEMBLIES with stainless steel rods.
- Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- Fuel with an initial enrichment either less than 1.8 or greater than 4.85 wt. % U-235 is unacceptable for storage.
- Fuel with a burnup greater than 60 GWd/MTU is unacceptable for storage.
- Fuel with a burnup less than 10 GWd/MTU is acceptable for storage after 5-years cooling.
- Example: An assembly with an initial enrichment of 4.85 wt. % U-235 and a burnup of 41.5 GWd/MTU is acceptable for storage after a six-year cooling time as defined by 4.8 wt. % U-235 (rounding down) and 42 GWd/MTU (rounding up) on the qualification table.

## Table 2-12 PWR Fuel Qualification Table for 0.9 kW per Assembly for the NUHOMS® 24PT4-DSC

(Minimum required years of cooling time after reactor core discharge)

| BU (GWd/ MTU) | Assembly Average Initial Enrichment (wt. % U-235) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 15 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 28 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 30 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 32 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 34 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 36 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 |
| 38 | | | | | | | | | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 39 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 40 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 41 | | | Not Analyzed | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 42 | | | | | | | | | | | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 43 | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 44 | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 |
| 45 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 48 | | | | | | | | | | | | | | | | | | | | | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| 51 | | | | | | | | | | | | | | | | | | | | | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 54 | | | | | | | | | | | | | | | | | | | | | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 57 | | | | | | | | | | | | | | | | | | | | | 17 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 15 | 15 | 15 |
| 60 | | | | | | | | | | | | | | | | | | | | | 20 | 19 | 19 | 19 | 19 | 19 | 19 | 18 | 18 | 18 | 18 |

**Notes:**

- BU = Assembly average burnup.
- Use burnup and enrichment to lookup minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are conservatively applied in determination of actual values for these two parameters.
- This table does not apply to RECONSTITUTED FUEL ASSEMBLIES with stainless steel rods.
- Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- Fuel with an initial enrichment either less than 1.8 or greater than 4.85 wt. % U-235 is unacceptable for storage.
- Fuel with a burnup greater than 60 GWd/MTU is unacceptable for storage.
- Fuel with a burnup less than 10 GWd/MTU is acceptable for storage after 5-years cooling.
- Example: An assembly with an initial enrichment of 4.85 wt. % U-235 and a burnup of 41.5 GWd/MTU is acceptable for storage after a seven-year cooling time as defined by 4.8 wt. % U-235 (rounding down) and 42 GWd/MTU (rounding up) on the qualification table.

## Table 2-13 PWR Fuel Qualification Table for 1.26 kW per Assembly for the NUHOMS® 24PT4-DSC, Reconstituted Fuel with Stainless Steel Rods

(Minimum required years of cooling time after reactor core discharge)

| BU (GWd/ MTU) | Assembly Average Initial Enrichment (wt. % U-235) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| 10 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 15 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 20 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 25 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 28 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 30 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 32 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 34 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 36 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 38 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 39 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 40 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 41 | | | Not Analyzed | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 42 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 43 | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 44 | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 45 | | | | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 48 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 51 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 54 | | | | | | | | | | | | | | | | | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| 57 | | | | | | | | | | | | | | | | | | | | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 60 | | | | | | | | | | | | | | | | | | | | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

**Notes:**

- BU = Assembly average burnup.
- This table is to be used only for RECONSTITUTED FUEL ASSEMBLIES.
- Use burnup and enrichment to lookup minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are conservatively applied in determination of actual values for these two parameters.
- Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- Fuel with an initial enrichment either less than 1.8 or greater than 4.85 wt. % U-235 is unacceptable for storage.
- Fuel with a burnup greater than 60 GWd/MTU is unacceptable for storage.
- Fuel with a burnup less than 10 GWd/MTU is acceptable for storage after 7-years cooling.
- Example: An assembly with an initial enrichment of 4.85 wt. % U-235 and a burnup of 41.5 GWd/MTU is acceptable for storage after a seven-year cooling time as defined by 4.8 wt. % U-235 (rounding down) and 42 GWd/MTU (rounding up) on the qualification table.

## Table 2-14 PWR Fuel Qualification Table for 1.2 kW per Assembly for the NUHOMS® 24PT4-DSC, Reconstituted Fuel with Stainless Steel Rods

(Minimum required years of cooling time after reactor core discharge)

| BU (GWd/ MTU) | Assembly Average Initial Enrichment (wt. % U-235) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| 10 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 15 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 20 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 25 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 28 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 30 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 32 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 34 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 36 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 38 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 39 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 40 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 41 | | | Not Analyzed | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 42 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 43 | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 44 | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 45 | | | | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 48 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 51 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 54 | | | | | | | | | | | | | | | | | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| 57 | | | | | | | | | | | | | | | | | | | | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 60 | | | | | | | | | | | | | | | | | | | | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

**Notes:**

- BU = Assembly average burnup.
- This table is to be used only for RECONSTITUTED FUEL ASSEMBLIES.
- Use burnup and enrichment to lookup minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are conservatively applied in determination of actual values for these two parameters.
- Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- Fuel with an initial enrichment either less than 1.8 or greater than 4.85 wt. % U-235 is unacceptable for storage.
- Fuel with a burnup greater than 60 GWd/MTU is unacceptable for storage.
- Fuel with a burnup less than 10 GWd/MTU is acceptable for storage after 7-years cooling.
- Example: An assembly with an initial enrichment of 4.85 wt. % U-235 and a burnup of 41.5 GWd/MTU is acceptable for storage after a seven-year cooling time as defined by 4.8 wt. % U-235 (rounding down) and 42 GWd/MTU (rounding up) on the qualification table.

## Table 2-15 PWR Fuel Qualification Table for 1.0 kW per Assembly for the NUHOMS® 24PT4-DSC, Reconstituted Fuel with Stainless Steel Rods

(Minimum required years of cooling time after reactor core discharge)

| BU (GWd/ MTU) | Assembly Average Initial Enrichment (wt. % U-235) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| 10 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 15 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 20 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 25 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 28 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 30 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 32 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 34 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 36 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 38 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 39 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 40 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 41 | | | Not Analyzed | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 42 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 43 | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 44 | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 45 | | | | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 48 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 51 | | | | | | | | | | | | | | | | | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| 54 | | | | | | | | | | | | | | | | | | | | | 11 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 10 |
| 57 | | | | | | | | | | | | | | | | | | | | | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 60 | | | | | | | | | | | | | | | | | | | | | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 14 | 14 | 14 | 14 |

**Notes:**

- BU = Assembly average burnup.
- This table is to be used only for RECONSTITUTED FUEL ASSEMBLIES.
- Use burnup and enrichment to lookup minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are conservatively applied in determination of actual values for these two parameters.
- Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- Fuel with an initial enrichment either less than 1.8 or greater than 4.85 wt. % U-235 is unacceptable for storage.
- Fuel with a burnup greater than 60 GWd/MTU is unacceptable for storage.
- Fuel with a burnup less than 10 GWd/MTU is acceptable for storage after 7-years cooling.
- Example: An assembly with an initial enrichment of 4.85 wt. % U-235 and a burnup of 41.5 GWd/MTU is acceptable for storage after a seven-year cooling time as defined by 4.8 wt. % U-235 (rounding down) and 42 GWd/MTU (rounding up) on the qualification table.

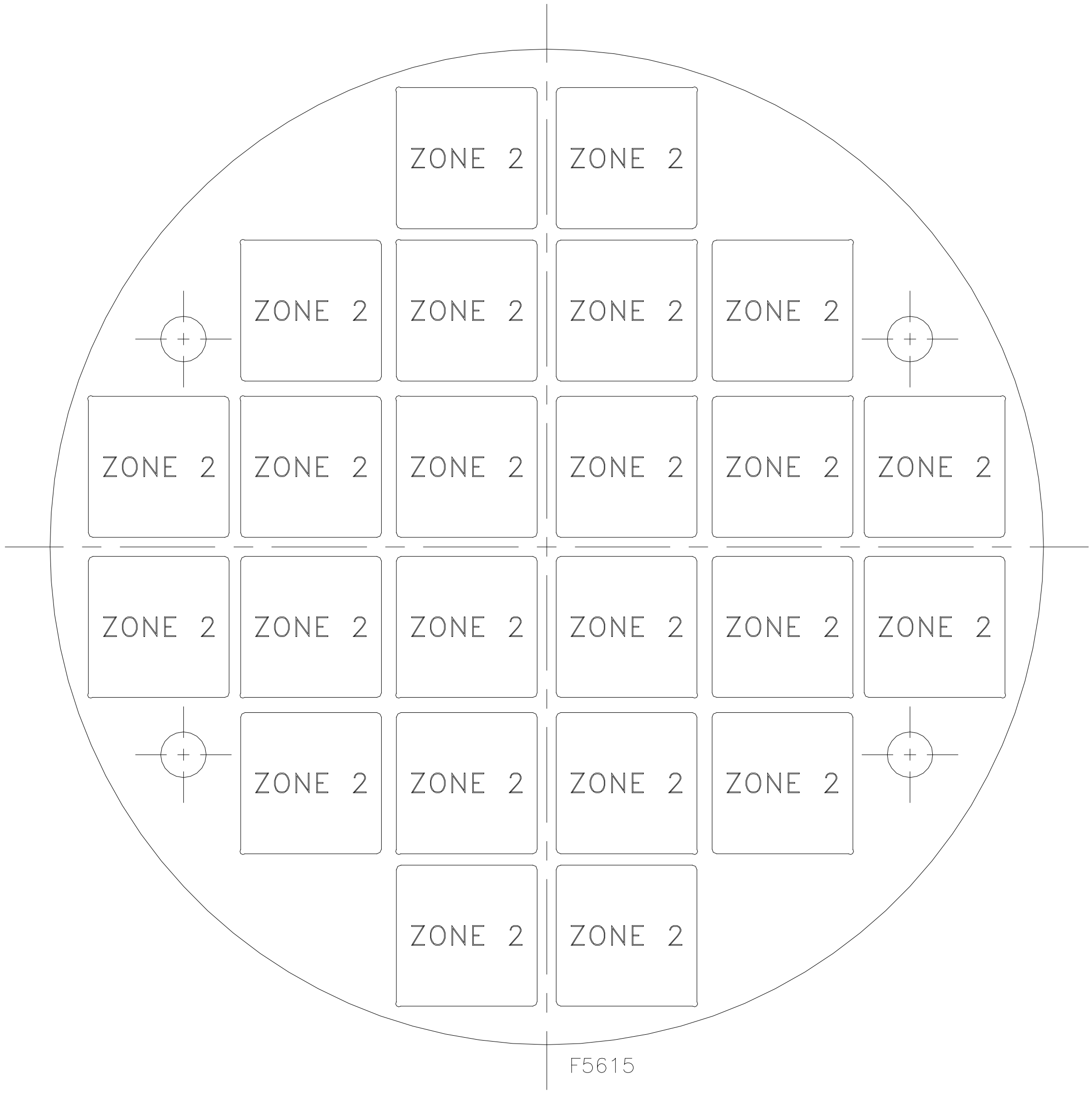
## Table 2-16 PWR Fuel Qualification Table for 0.9 kW per Assembly for the NUHOMS® 24PT4-DSC, Reconstituted Fuel with Stainless Steel Rods

(Minimum required years of cooling time after reactor core discharge)

| BU (GWd/MTU) | Assembly Average Initial Enrichment (wt. % U-235) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 | 4.7 | 4.8 |
| 10 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 15 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 20 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 25 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 28 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 30 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 32 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 34 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 36 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 38 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 39 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 40 | | | | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 41 | | | Not Analyzed | | | | | | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 42 | | | | | | | | | | | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 43 | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 44 | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 |
| 45 | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 48 | | | | | | | | | | | | | | | | | | | | | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| 51 | | | | | | | | | | | | | | | | | | | | | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 54 | | | | | | | | | | | | | | | | | | | | | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 57 | | | | | | | | | | | | | | | | | | | | | 17 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 15 | 15 | 15 |
| 60 | | | | | | | | | | | | | | | | | | | | | 20 | 19 | 19 | 19 | 19 | 19 | 19 | 18 | 18 | 18 | 18 |

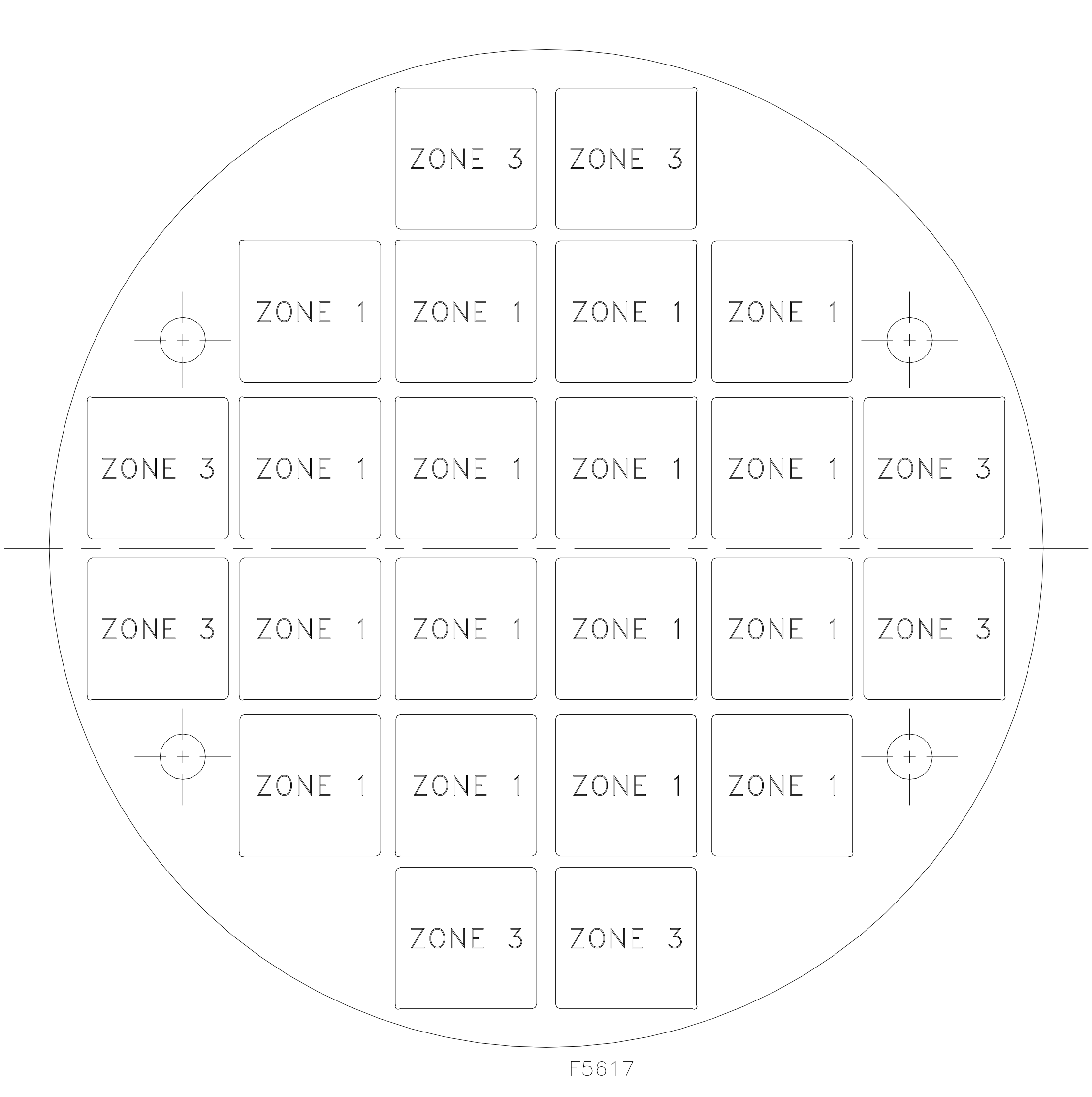
**Notes:**

- BU = Assembly average burnup.
- This table is to be used only for RECONSTITUTED FUEL ASSEMBLIES.
- Use burnup and enrichment to lookup minimum cooling time in years. Licensee is responsible for ensuring that uncertainties in fuel enrichment and burnup are conservatively applied in determination of actual values for these two parameters.
- Round burnup UP to next higher entry, round enrichments DOWN to next lower entry.
- Fuel with an initial enrichment either less than 1.8 or greater than 4.85 wt. % U-235 is unacceptable for storage.
- Fuel with a burnup greater than 60 GWd/MTU is unacceptable for storage.
- Fuel with a burnup less than 10 GWd/MTU is acceptable for storage after 7-years cooling.
- Example: An assembly with an initial enrichment of 4.85 wt. % U-235 and a burnup of 47 GWd/MTU is acceptable for storage after a nine-year cooling time as defined by 4.8 wt. % U-235 (rounding down) and 48 GWd/MTU (rounding up) on the qualification table.



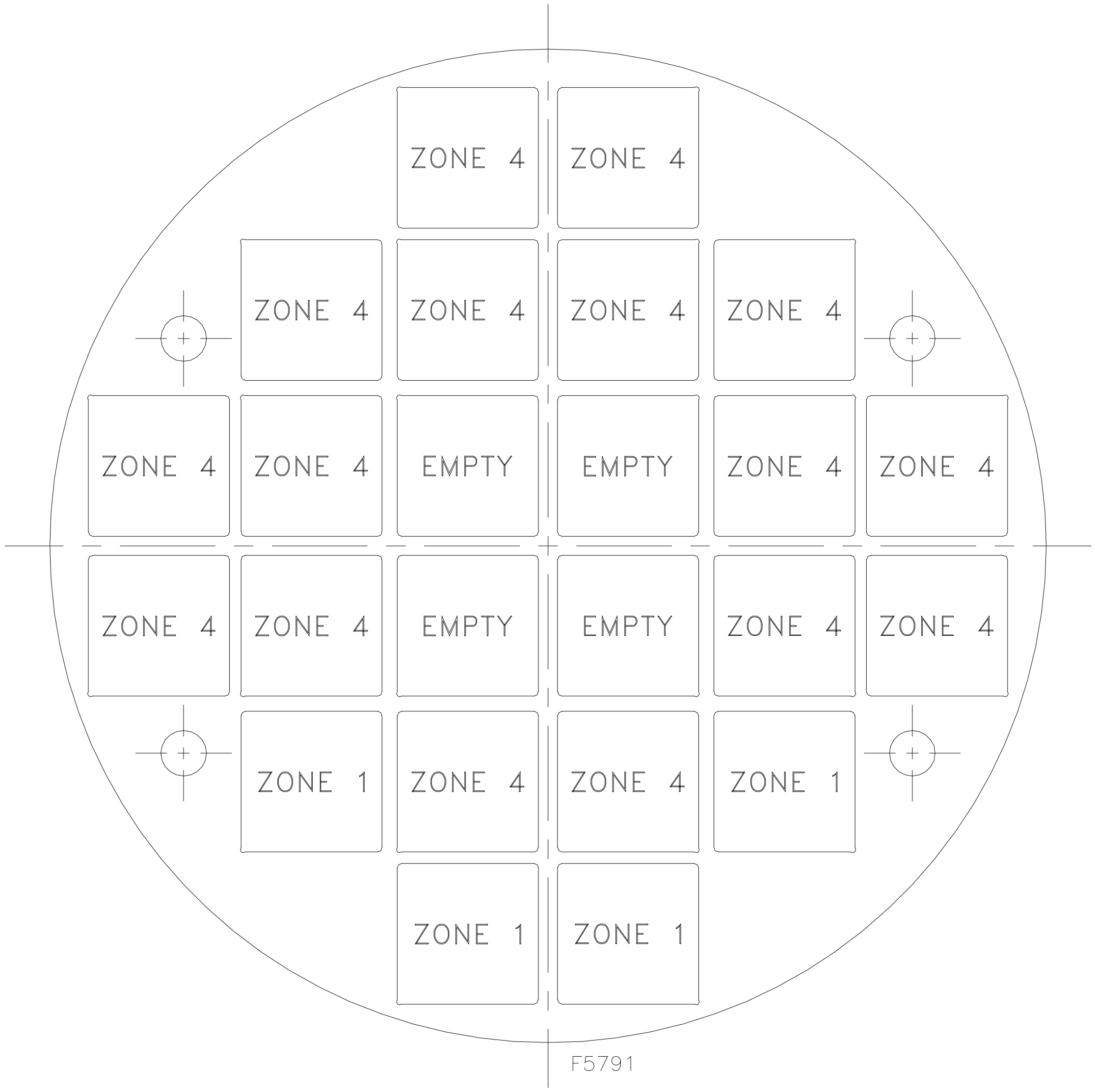

| | Zone 1 | Zone 2 | Zone 3 | Zone 4 |
|---|---|---|---|---|
| **Maximum Decay Heat (kW / FA)** | **NA** | **1.0** | **NA** | **NA** |
| **Maximum Decay Heat per Zone (kW)** | **NA** | **24.0** | **NA** | **NA** |

**Figure 2-1 24PT4-DSC Heat Load Configuration #1, kW/Assembly**




| | Zone 1 | Zone 2 | Zone 3 | Zone 4 |
|---|---|---|---|---|
| Maximum Decay Heat (kW / FA) | 0.9 | NA | 1.2 | NA |
| Maximum Decay Heat per Zone (kW) | 14.4 | NA | 9.6 | NA |

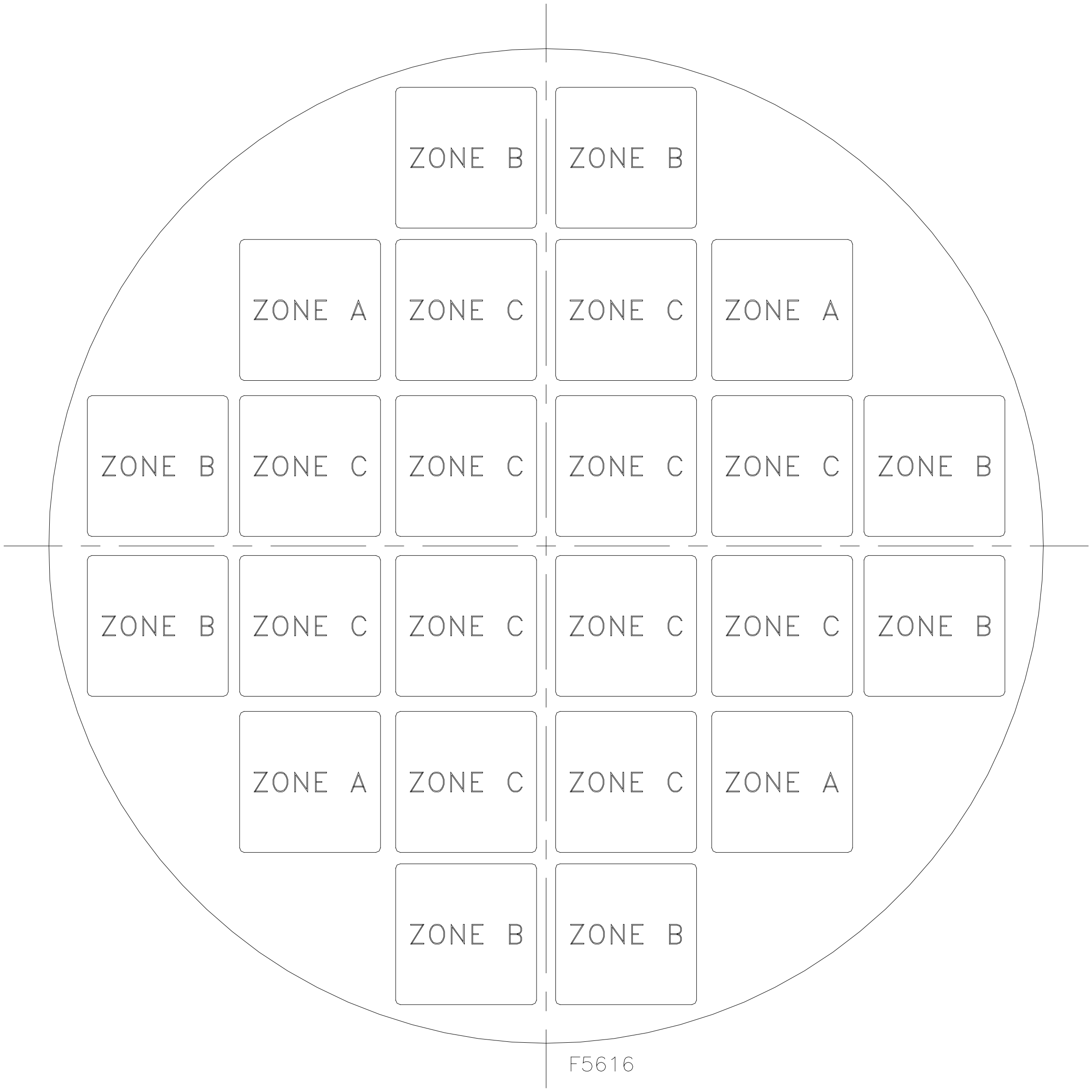
**Figure 2-2 24PT4-DSC Heat Load Configuration #2, kW/Assembly**




| | Zone 1 | Zone 2 | Zone 3 | Zone 4 |
|---|---|---|---|---|
| **Maximum Decay Heat (kW / FA)** | **0.9** | **NA** | **NA** | **1.26** |
| **Maximum Decay Heat per Zone (kW)** | **3.6** | **NA** | **NA** | **20.16** |

**Note:** fuel assemblies with a heat load of 0.9 kW (Zone 1) may also be placed anywhere in Zone 4.

**Figure 2-3 24PT4-DSC Heat Load Configuration #3, kW/Assembly**




**Notes:**

1 Locations identified as Zone A are for placement of up to 4 DAMAGED FUEL ASSEMBLIES.

2 Locations identified as Zone B are for placement of up to 8 additional DAMAGED FUEL ASSEMBLIES (Maximum of 12 DAMAGED FUEL ASSEMBLIES allowed, Zones A and B combined).

3 Locations identified as Zone C are for placement of up to 12 intact FUEL ASSEMBLIES, including 4 empty slots in the center as shown in Figure 2-3.

4 Poison Rodlets are to be located in the guide tubes of intact FUEL ASSEMBLIES placed in Zone C only per Table 2-4.

**Figure 2-4 Location of FAILED FUEL CANS inside 24PT4-DSC**

**Table 3–1 PWR Fuel Specification for the Fuel to be Stored in the 32PTH2 DSC**

(Part 1 of 2)

| | |
|---|---|
| **PHYSICAL PARAMETERS:**<br><br>Fuel Class | INTACT or DAMAGED unconsolidated CE 16x16 class FUEL ASSEMBLIES (with or without control components) that are enveloped by the fuel assembly design characteristics listed in Table 3-3. Reload fuel manufactured by other vendors but enveloped by the design characteristics listed in Table 3-3 is also acceptable. DAMAGED FUEL ASSEMBLIES beyond the definition contained below are not authorized for storage. |
| Fuel Damage | DAMAGED FUEL ASSEMBLIES are assemblies containing missing or partial fuel rods or fuel rods with known or suspected cladding defects greater than hairline cracks or pinhole leaks. The extent of damage in the fuel assembly is to be limited such that a fuel assembly is able to be handled by normal means. |
| **RECONSTITUTED FUEL ASSEMBLIES:**<br><br>A) With Irradiated Stainless Steel Rods<br>• Maximum Number of RECONSTITUTED FUEL ASSEMBLIES per DSC with Irradiated Stainless Steel Rods | Option 1: 8 in selected locations in Zone 2 of Figure 3-1.<br>Option 2: 32 (Additional cooling time requirements per Table 3-8 apply.) |
| • Maximum Number of Irradiated Stainless Steel Rods per RECONSTITUTED FUEL ASSEMBLY | Option 1: 11<br>Option 2: 7 |
| B) With All Other Alternate Rod Materials<br><br>• Maximum Number of RECONSTITUTED FUEL ASSEMBLIES per DSC with Unlimited Number of Low Enriched $UO_2$ Rods, or Zircaloy Rods or Unirradiated Stainless Steel Rods | 32 |
| Control Components (CCs) | • Up to 12 CCs are authorized for storage only in Zone 2 locations as shown in Figure 3-1.<br>• Authorized CCs include Burnable Poison Rod Assemblies (BPRAs), Control Rod Assemblies (CRAs), Thimble Plug Assemblies (TPAs), Axial Power Shaping Rod Assemblies (APSRAs), Control Element Assemblies (CEAs), Vibration Suppression Inserts (VSIs), Orifice Rod Assemblies (ORAs), Neutron Source Assemblies (NSAs), and Neutron Sources. Nonfuel hardware that is 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 other devices that are positioned and operated within the fuel assembly during reactor operation are also considered as CCs.<br>• Design basis thermal and radiological characteristics for the CCs are listed in Table 3-2. |
| Number of INTACT FUEL ASSEMBLIES | ≤ 32 |

**Table 3-1 PWR Fuel Specification for the Fuel to be Stored in the 32PTH2 DSC**

(Part 2 of 2)

| | |
|---|---|
| Maximum Assembly plus CC Weight | 1550 lbs |
| Number and Location of DAMAGED FUEL ASSEMBLIES | Up to 16 DAMAGED FUEL ASSEMBLIES. Balance may be INTACT FUEL ASSEMBLIES or dummy assemblies which are authorized for storage in 32PTH2 DSC.<br>DAMAGED FUEL ASSEMBLIES are to be placed in the outer 16 fuel compartments as shown in Figure 3-1. The DSC fuel compartments which store DAMAGED FUEL ASSEMBLIES are provided with top and bottom end caps. |
| <u>THERMAL/RADIOLOGICAL PARAMETERS:</u><br>Fuel Assembly Average Burnup, Assembly Average Enrichment and Cooling Time | Per Table 3-6, Table 3-7 and Table 3-8. |
| Decay Heat per DSC | Per Figure 3-1 |
| Maximum Planar Average Fuel Initial Enrichment | Per Table 3-4 or Table 3-5. |
| Minimum B-10 Content in Neutron Poison Plates | Per Table 3-9. |

## Table 3–2 Thermal and Radiological Characteristics for Control Components Stored in the 32PTH2 DSC

| Parameter | CC Source(1) |
|---|---|
| Maximum Gamma Source (γ/sec/assembly) | 8.74E+14 |
| Decay Heat(2) (Watts/assembly) | 20 |
| Minimum Cooling Time(3) (years) | 10 |

Note:

(1) Up to 8 Neutron Sources and NSAs are allowed in any location within Zone 2 of Figure 3-1 except at the four corner locations.

(2) The decay heat for the CCs for cooling time greater than 15 years is well within the uncertainty of the decay heat equation shown in Table 3-7.

(3) The decay heat value of 20 watts per CC shall be included to determine thermal and radiological qualification of fuel assemblies for CC cooling times between 10 years and 15 years.

**Table 3–3 PWR Fuel Assembly Design Characteristics for the 32PTH2 DSC**

| **Assembly Class[3]** | **CE 16x16 (Westinghouse)** | **CE 16x16 (Areva)** |
|---|---|---|
| Maximum Unirradiated Length (inches)[1] | 178.3 | 178.3 |
| Fissile Material | $UO_2$ or ($UO_2$, $Er_2O_3$) or ($UO_2$,$Gd_2O_3$) or ($UO_2$, $ZrB_2$) | $UO_2$ or ($UO_2$,$Gd_2O_3$) |
| Maximum MTU/Assembly[2] | 0.456 | 0.456 |
| Maximum Number of Fuel Rods | 236 | 236 |
| Maximum Number of Guide Tubes | 5 | 5 |

Notes:
(1) Maximum Assembly and + CC Length (unirradiated)
(2) The maximum MTU/assembly is based on the shielding analysis. The listed value is higher than the actual.
(3) Reload fuel from other manufacturers with these parameters is also acceptable.

**Table 3–4 Maximum Planar Average Initial Enrichment versus Neutron Poison Plate Requirements for the 32PTH2 DSC (INTACT FUEL ASSEMBLY)**

| Fuel Assembly Class | Minimum Soluble Boron ppm | Maximum Planar Average Initial Enrichment[(2)] (wt. % U-235) as a Function of Basket Type (Neutron Poison Plate Loading) | | | |
|---|---|---|---|---|---|
| | | | Basket Type[(1)] | | |
| | | | B | C | D |
| CE 16x16 | 2600 | With CC | 4.75 | 4.95 | 5.00 |
| | 2600 | Without CC | 4.80 | 5.00 | 5.00 |

Notes:

(1) The neutron poison plate loading requirements as a function of Basket Type are per Table 3-9.

(2) The maximum planar average initial enrichments are design nominal values. For the maximum planar average initial enrichment of 5.00 wt. % U-235, the criticality analysis is actually performed using 5.05 or 5.10 wt. % U-235.

**Table 3–5 Maximum Planar Average Initial Enrichment versus Neutron Poison Plate Requirements for the 32PTH2 DSC (DAMAGED FUEL ASSEMBLY)**

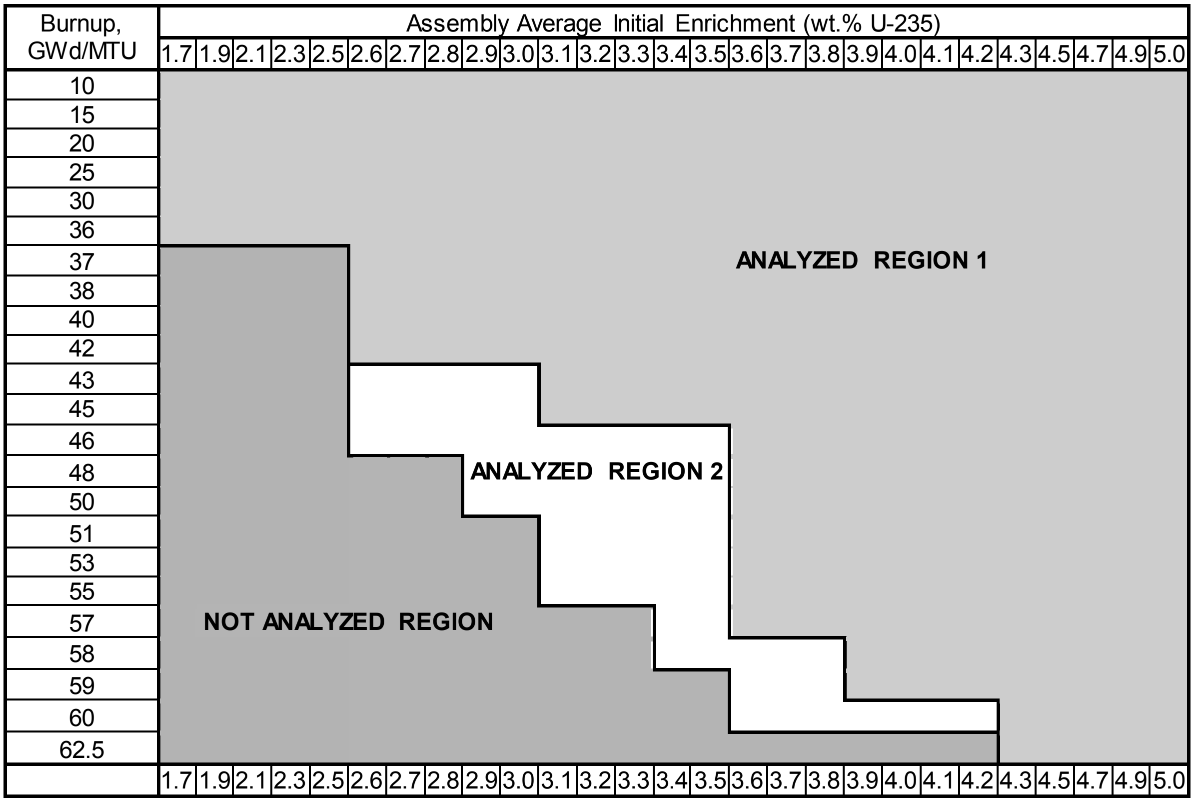
| Fuel Assembly Class | Minimum Soluble Boron ppm | Maximum Planar Average Initial Enrichment[(2)] (wt. % U-235) as a Function of Basket Type (Neutron Poison Plate Loading) | | | |
|---|---|---|---|---|---|
| | | | Basket Type[(1)] | | |
| | | | B | C | D |
| CE 16x16 | 2600 | With CC | 4.45 | 4.60 | 4.90 |
| | 2600 | Without CC | 4.50 | 4.70 | 5.00 |

Notes:

(1) The neutron poison plate loading requirements as a function of Basket Type are per Table 3-9.

(2) The maximum planar average initial enrichments are design nominal values.

## Table 3–6 Allowable Fuel Assembly Burnup and Enrichment Combinations for the 32PTH2 DSC




**Notes:**

- Burnup = Assembly Average burnup.
- Fuel Assemblies with a burnup and enrichment combination that is encompassed by the "Analyzed Region 1" or the "Analyzed Region 2" of Table 3–6 are qualified from a radiological standpoint.
- See additional notes provided for Table 3–7 regarding the thermal qualification of fuel assemblies for the 32PTH2 DSC.
- Fuel Assemblies with an average initial enrichment less than 0.7 wt. % U-235 (or less than the minimum analyzed enrichment provided above for each burnup) or greater than 5.00 wt. % U-235 are unacceptable for storage.
- Fuel Assemblies with an average initial enrichment between 0.7 wt. % U-235 and 1.7 wt. % U-235 are acceptable for storage provided the burnup is less than or equal to 15 GWd/MTU.
- Fuel Assemblies with a burnup greater than 62.5 GWd/MTU are unacceptable for storage.
- Fuel Assemblies with a burnup less than 10 GWd/MTU are acceptable for storage after 5.0 years cooling.

## Table 3–7 Fuel Assembly Decay Heat for the 32PTH2 DSC

**The Fuel Assembly Decay Heat (DH) in watts is expressed as:**

$$F1 = [55.4*X1 + 226*\ln(X2) + 0.691*X1^2 + 63.4*\ln(X2)^2 - 19.7*X1*\ln(X2)] - 55.1$$

$$DH = F1*[1.75*Exp(-0.483*X3) + 0.310*Exp(-0.022*X3)]$$

Where,

| | |
|---|---|
| F1 | Intermediate Function |
| X1 | Fuel Assembly Average Burnup in GWd/MTU, |
| X2 | Fuel Assembly Average Initial Enrichment in wt. % U-235 ($1.7 \leq X2 \leq 5.00$) |
| X3 | Fuel Assembly Cooling Time in Years (minimum 5.0 Years) |

**Notes for the use of Decay Heat Equation (DHE) of Table 3-7 (Part 1 of 2):**

- Licensee is responsible for ensuring that uncertainties in fuel enrichment are accounted for by rounding the enrichment DOWN.
- Licensee is responsible for ensuring that uncertainties in fuel burnup are correctly accounted for by rounding the burnup UP.
- For cooling times between 5.0 and 6.0 years, increase the calculated decay heat by 6% to account for methodology uncertainty; for cooling times greater than 6.0 years, increase the calculated decay heat by 3% to account for methodology uncertainty. Round the calculated decay heat UP to within 5 watts.
- When RECONSTITUTED FUEL ASSEMBLIES with stainless steel rods per Option 2 in Table 3–1 are loaded, the decay heat is calculated with X3 = (Cooling Time – ΔT) where ΔT is the additional cooling time (years) which is a function of assembly average burnup and cobalt content and is obtained from Table 3-8. These fuel assemblies are qualified if X3 is greater than 5.0 years. Further, this calculated decay heat shall be employed to determine the applicable HLZC shown in Figure 3-1.
- The calculated decay heat (including all applicable uncertainties) without additional cooling time shall be employed to determine the total heat load of the DSC as shown in Figure 3-1.
- Any fuel assembly that is qualified from a thermal standpoint is also qualified from a radiological standpoint.
- Fuel Assemblies with a burnup and enrichment combination that is encompassed by the "Analyzed Region 1" of Table 3-6 are qualified from a radiological standpoint without any additional restrictions.
- The decay heat of fuel assemblies with assembly average initial enrichment between 0.7 wt. % U-235 and 1.7 wt. % U-235 as a function of burnup and cooling time is shown below:

| Burnup (GWd/MTU) | Decay Heat (Watts) | |
|---|---|---|
| | 5 years | 10 years |
| 10 | 310 | 170 |
| 15 | 550 | 310 |

**Notes for the use of Decay Heat Equation (DHE) of Table 3-7 (Part 2 of 2):**

- The following methodology shall be employed to qualify fuel assemblies with burnup and enrichment combinations that fall in the “Analyzed Region 2” of Table 3-6.
  - The minimum cooling time shall be greater than 12.0 years.
  - An additional decay heat uncertainty of 2% shall be utilized.
- ***Example #1*:** The qualification of a fuel assembly with an assembly average initial enrichment of 3.75 wt. % U-235, a burnup of 52.4 GWd/MTU and a cooling time of 12.1 years with no control components or reconstituted rods is described below:
  - The decay heat calculated from the DHE using X1 = 52.4, X2 = 3.75 and X3 = 12.1 with a calculational uncertainty of 3% is 947 watts.
  - This fuel assembly can be loaded in Zone 2 and Zone 3 of all HLZCs. Further, this fuel assembly can also be loaded in Zone 1 under HLZC #3 only as described in Figure 3–1.
- ***Example #2*:** The qualification of a fuel assembly with an assembly average initial enrichment of 3.75 wt. % U-235, a burnup of 52.4 GWd/MTU and a cooling time of 12.1 years with irradiated stainless steel reconstituted rods per Option 2 of Table 3-1 is described below:
  - The decay heat calculated from the DHE using X1 = 52.4, X2 = 3.75 and X3 = 12.1 with a calculational uncertainty of 3% is 947 watts.
  - The additional cooling time penalty for a cobalt content of 2000 ppm in the Rods from Table 3–8 is 4.5 years.
  - The decay heat calculated from the DHE using X1 = 52.4, X2 = 3.75 and X3 = 7.6 with a calculational uncertainty of 3% is 1198 watts.
  - This fuel assembly can only be loaded in Zone 2 positions in HLZC #1 and HLZC #2, as described in Figure 3-1.
- ***Example #3*:** The qualification of a fuel assembly with an assembly average initial enrichment of 3.75 wt. % U-235, a burnup of 58.7 GWd/MTU and a cooling time of 12.1 years with no control components or reconstituted rods is described below:
  - This assembly is in the “Analyzed Region 2” region, and has a minimum cooling time greater than 12 years.
  - The decay heat calculated from the DHE using X1 = 58.7, X2 = 3.75 and X3 = 12.1 with a calculational uncertainty of 5% (3% + 2%) is 1136 watts.
  - This fuel assembly can only be loaded in Zone 2 positions in HLZC #1 and HLZC #2, as described in Figure 3-1.

**Table 3-8 Additional Cooling Times (ΔT) in Years for RECONSTITUTED FUEL ASSEMBLIES with up to 7 Fuel Rods Reconstituted with Irradiated Stainless Steel Rods (Option 2)**

| Burnup (GWd/MTU) | Additional Cooling Time (Years) as a Function of Cobalt Content in Stainless Steel Rods | |
|---|---|---|
| | Cobalt Content ≤ 800 ppm | 800 > Cobalt Content ≤ 2000 ppm |
| **17** | 0 | 0 |
| **18** | 0 | 0.5 |
| **19** | 0 | 1.0 |
| **20** | 0 | 1.5 |
| **21** | 0 | 2.0 |
| **22** | 0 | 2.5 |
| **23** | 0 | 3.0 |
| **24** | 0 | 3.5 |
| **25** | 0.5 | 3.5 |
| **26** | 1.0 | 4.0 |
| **27** | 1.5 | 4.5 |
| **28** | 2.0 | 5.0 |
| **29** | 2.0 | 5.5 |
| **30** | 2.5 | 5.5 |
| **45** | 3.0 | 6.0 |
| **46** | 2.5 | 5.5 |
| **47** | 2.0 | 5.0 |
| **50** | 2.0 | 4.5 |
| **51** | 1.5 | 4.5 |
| **53** | 1.5 | 4.5 |
| **54** | 1.0 | 4.0 |
| **55** | 1.0 | 4.0 |
| **56** | 0.5 | 3.5 |
| **57** | 0.5 | 3.5 |
| **58** | 0.5 | 3.0 |
| **59** | 0.5 | 3.0 |
| **60** | 0 | 2.5 |
| **62.5** | 0 | 2.5 |

**Table 3–9   B-10 Specification for the 32PTH2 DSC Neutron Poison Plates**

| 32PTH2 DSC Basket Type | Minimum B-10 Areal Density for MMC[1] ($gm/cm^2$) |
|---|---|
| B | 0.015 |
| C | 0.020 |
| D | 0.032 |

Note:

(1) MMC = Metal Matrix Composite

| | | | | | |
|---|---|---|---|---|---|
| | **Zone 3** | **Zone 3** | **Zone 3** | **Zone 3** | |
| **Zone 3** | **Zone 2** | **Zone 2** | **Zone 2** | **Zone 2** | **Zone 3** |
| **Zone 3** | **Zone 2** | **Zone 1** | **Zone 1** | **Zone 2** | **Zone 3** |
| **Zone 3** | **Zone 2** | **Zone 1** | **Zone 1** | **Zone 2** | **Zone 3** |
| **Zone 3** | **Zone 2** | **Zone 2** | **Zone 2** | **Zone 2** | **Zone 3** |
| | **Zone 3** | **Zone 3** | **Zone 3** | **Zone 3** | |

| **Number of Fuel Assemblies** | **4** | **12** | **16** | |
|---|---|---|---|---|
| | **Zone 1** | **Zone 2(2)** | **Zone 3(1)** | |
| **HLZC #** | **Maximum Decay Heat/Fuel Assembly(3), [kW]** | **Maximum Decay Heat/Fuel Assembly(3), [kW]** | **Maximum Decay Heat/Fuel Assembly(3), [kW]** | **Maximum Decay Heat/DSC, [kW]** |
| 1 | 0.8 | 1.5 | 1.0 | 37.2 |
| 2 | 0.9 | 1.3 | 1.0 | 35.2 |
| 3 | 1.0 | 1.0 | 1.0 | 32.0 |
| 4 | 0.8 | 1.0 | 1.0 | 31.2 |

Note 1: Damaged fuel assemblies, up to 16 damaged (balance intact), shall be placed in Zone 3 only.

Note 2: Zone 2 is for placement of up to 8 RECONSTITUTED FUEL ASSEMBLIES with irradiated stainless steel rods when stored in the Option 1 configuration (the four corner locations of Zone 2 are not allowed for storage of such assemblies). The Option 2 configuration for storage of up to 32 RECONSTITUTED FUEL ASSEMBLIES with irradiated stainless steel rods does not have any restriction on placement of fuel assemblies within the DSC. Option 1 and Option 2 are defined in Table 3-1.

Note 3: Decay heat per fuel assembly shall be determined per Table 3-7.

**Figure 3–1 Heat Load Zoning Configurations for the 32PTH2 DSC**

## 3.0 Limiting Condition for Operation (LCO) and Surveillance Requirement (SR) Applicability

| | |
|---|---|
| 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.<br><br>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 24PT1-DSC or 24PT4-DSC or 32PTH2 DSC.<br><br>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 | Not applicable to a spent fuel storage cask. |

| | |
|---|---|
| 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.<br><br>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.<br><br>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.<br><br>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.<br><br>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 Integrity

3.1.1.a 24PT1-DSC Vacuum Drying Time (Duration) and Pressure

LCO 3.1.1.a Duration: Vacuum Drying of the 24PT1-DSC shall be achieved with the following time durations after the start of bulk water removal (blowdown):

| **Heat Load (kW)** | Time Limit |
|---|---|
| kW ≤ 12 | No limit |
| 12 < kW ≤ 13 | 71 Hours |
| 13 < kW ≤ 14 | 54 Hours |

Pressure: The 24PT1-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 stepped evacuation.

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

------------------------------------ NOTE ------------------------------------
This specification is applicable to all 24PT1-DSCs.
--------------------------------------------------------------------------------

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. 24PT1-DSC vacuum drying pressure limit not met within 47 hours for a DSC with heat load greater than 12 kW and ≤ 13 kW or within 30 hours for a DSC with heat load greater than 13 kW and ≤ 14 kW. | A.1 Establish helium pressure of at least 1 atm and no greater than 20 psig in the 24PT1-DSC.<br>OR<br>A.2 Flood the 24PT1-DSC with water submerging all fuel assemblies. | 24 hours<br><br>24 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.1.a.1 | Verify that the 24PT1-DSC vacuum pressure is less than, or equal to, 3 Torr (3 mm Hg) absolute for at least 30 minutes, within the specified total time duration based on heat load. | Once per 24PT1-DSC, after an acceptable NDE of the inner top cover plate weld. |

### 3.1.1.b 24PT4-DSC Vacuum Drying Time (Duration) and Pressure

LCO 3.1.1.b Duration: Vacuum Drying of the 24PT4-DSC shall be achieved within the following durations (depending upon the 24PT4-DSC specific heat load configuration) following completion of blowdown using air. No time limits apply for vacuum drying of 24PT4-DSC if helium is used for blowdown. Transfer between air and helium blowdown within the time limits specified below is acceptable. Blowdown with helium with a volume equal to the DSC free volume is required within the air time limit.

| Heat Load Configuration | Time limit Using Air | Time limit Using Helium |
|---|---|---|
| 1 | 35 Hours | No Limit |
| 2 | 35 Hours | No Limit |
| 3 | 26 Hours | No Limit |

Pressure: The 24PT4-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 stepped evacuation.

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

---------------------------------- NOTE -----------------------------------
This specification is applicable to all 24PT4-DSCs.
-----------------------------------------------------------------------------

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. 24PT4-DSC vacuum drying pressure limit not met when using air for blowdown within 33 hours (Configurations #1 or 2) or 24 hours (Configuration #3). | A.1 Establish helium pressure of at least 1 atm and no greater than 20 psig in the 24PT4-DSC. Vacuum drying can proceed with no time limit. | 2 hours |
| | OR | |
| | A.2 Flood the 24PT4-DSC with water submerging all fuel assemblies. | 2 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.1.b.1 | Verify that the 24PT4-DSC vacuum pressure is less than, or equal to, 3 Torr (3 mm Hg) absolute for at least 30 minutes, within the specified total time duration based on heat load. | Once per 24PT4-DSC, after an acceptable NDE of the inner top cover plate weld. |

3.1.1.c 32PTH2 DSC Bulkwater Removal Medium and Vacuum Drying Pressure

| | |
|---|---|
| LCO 3.1.1.c | Medium:<br><br>Helium shall be used for all drainage of liquid water from the 32PTH2 DSC.<br><br>Pressure:<br><br>The 32PTH2 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.<br><br>Time Limit:<br><br>No time limits apply for vacuum drying of the 32PTH2 DSC. |
| APPLICABILITY: | 32PTH2 DSC during LOADING OPERATIONS, but before TRANSFER OPERATIONS. |

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| *Note: Not applicable until SR 3.1.1.c.1 is performed.*<br><br>A. If the required vacuum pressure cannot be obtained. | A.1<br><br>A.1.1 Confirm that the vacuum drying system is properly installed. Check and repair the vacuum drying system as necessary.<br><br><u>OR</u><br><br>A.1.2 Check and repair the seal weld between the inner top cover plate/ top shield plug assembly and the 32PTH2 DSC shell.<br><br><u>OR</u><br><br>A.2 Establish helium pressure of at least 1.0 atm absolute and no greater than 15 psig in the 32PTH2 DSC.<br><br><u>OR</u><br><br>A.3 Flood the 32PTH2 DSC with spent fuel pool water or water meeting the requirements of LCO 3.2.1, if applicable, submerging all fuel assemblies. | <br><br>30 days<br><br><br><br><br><br><br><br>30 days<br><br><br><br>30 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.1.c.1 | Verify that the 32PTH2 DSC vacuum pressure is less than, or equal to, 3 Torr (3 mm Hg) absolute for at least 30 minutes following evacuation. | Once per 32PTH2 DSC, after an acceptable NDE of the inner top cover plate/top shield plug assembly. |

## 3.1.2.a 24PT1-DSC Helium Backfill Pressure

LCO 3.1.2.a — 24PT1-DSC helium backfill pressure shall be 1.5 ± 1.5 psig (stable for 30 minutes after filling).

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

----------------------------------- NOTE -----------------------------------
*This specification is applicable to all 24PT1-DSCs.*

-----------------------------------------------------------------------------

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| *Note: Not applicable until SR 3.1.2.a.1 is performed.* | | |
| A. The required backfill pressure cannot be obtained or stabilized. | A.1 Establish the 24PT1-DSC helium backfill pressure to within the limit. | 24 hours |
| | OR | |
| | A.2 Flood the 24PT1-DSC with water submerging all fuel assemblies. | 24 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.2.a.1 | Verify that the 24PT1-DSC helium backfill pressure is 1.5 ± 1.5 psig. | Once per 24PT1-DSC, after the completion of TS 3.1.1.a actions. |

## 3.1.2.b 24PT4-DSC Helium Backfill Pressure

LCO 3.1.2.b — 24PT4-DSC helium backfill pressure shall be 6.0 + 1.0 / -0.0 psig (stable for 30 minutes after filling).

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

---------------------------------- NOTE -----------------------------------

This specification is applicable to all 24PT4-DSCs.

-----------------------------------------------------------------------------

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| *Note: Not applicable until SR 3.1.2.b.1 is performed.*<br><br>A. The required backfill pressure cannot be obtained or stabilized. | A.1 Establish the 24PT4-DSC helium backfill pressure to within the limit.<br><br><u>OR</u><br><br>A.2 Re-initiate vacuum drying. | 24 hours<br><br><br>24 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 3.1.2.b.1 Verify that the 24PT4-DSC helium backfill pressure is 6.0 + 1.0 / -0.0 psig. | Once per 24PT4-DSC, after the completion of TS 3.1.1.b actions. |

3.1.2.c 32PTH2 DSC Helium Backfill Pressure

| | |
|---|---|
| LCO 3.1.2.c | 32PTH2 DSC helium backfill pressure shall be 17.2 psia ± 1.0 psia (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.c.1 is performed.*<br><br>A. The required helium backfill pressure cannot be obtained or stabilized. | A.1<br><br>A.1.1 Maintain helium atmosphere in the 32PTH2 DSC cavity.<br><br>AND<br><br>A.1.2 Confirm, check and repair or replace as necessary the vacuum drying system, helium source and pressure gauge.<br><br>AND<br><br>A.1.3 Check and repair as necessary the seal weld between the inner top cover plate/top shield plug assembly and the 32PTH2 DSC shell.<br><br>OR<br><br>A.2 Establish the 32PTH2 DSC helium backfill pressure to within the limit. If pressure exceeds the criterion, release a sufficient quantity of helium to lower the 32PTH2 DSC cavity pressure. | 14 days<br><br><br><br><br><br><br><br><br><br><br><br><br><br>14 days |

(continued)

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| | OR<br><br>A.3 Flood the 32PTH2 DSC with spent fuel pool water or water meeting the requirements of LCO 3.2.1, if applicable, submerging all fuel assemblies. | <br><br>14 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.2.c.1 | Verify that the 32PTH2 DSC helium backfill pressure is 17.2 psia ± 1.0 psia (stable for 30 minutes after filling). | Once per 32PTH2 DSC, after the completion of LCO 3.1.1.c. |

## 3.1.3 Time Limit for Completion of DSC Transfer (32PTH2 DSC Only)

LCO 3.1.3

| Heat Load Zoning Configuration Number (HLZC per Figure 3-1) | Time Limit to Complete 32PTH2 DSC Transfer (hours) |
|---|---|
| 4 | No limit |
| 1 or 2 | 34 hours |
| 3 | 73 hours |

-------------------------------------------------- NOTE --------------------------------------------------

The time limit for completion of a 32PTH2 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 32PTH2 DSC into the AHSM-HS.

----------------------------------------------------------------------------------------------------------

APPLICABILITY: 32PTH2 DSC During LOADING OPERATIONS and TRANSFER OPERATIONS.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| *Note: Not applicable until SR 3.1.3 is performed.*<br>A. The required time limit for completion of a 32PTH2 DSC transfer not met. | A.1 If the TC is in a vertical orientation, fill the TC/DSC annulus with clean water.<br><u>OR</u><br>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 blowers provided on the transfer skid.<br><u>OR</u><br>A.3 Return the TC to the cask handling area and follow action A.1 above. | 2 hours<br><br>2 hours*<br><br>2 hours |

* After the blowers are turned off, the time limit for completion of 32PTH2 DSC transfer is 12 hours.

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.3 | Verify that the time limit for completion of 32PTH2 DSC transfer is met. | Once per 32PTH2 DSC, after the completion of LCO 3.1.2.c. or after the initiation of draining of TC/DSC annulus water. Initial draining of approximately 12 inches of water from the TC/DSC annulus before the welding of the inner top cover plate is not considered an initiation of draining for this LCO. |

## 3.2 DSC Criticality Control

LCO 3.2.1 The boron concentration of the spent fuel pool water and the water added to the cavity of a loaded 32PTH2 DSC shall be greater than or equal to 2600 ppm.

APPLICABILITY 32PTH2 DSC during LOADING OPERATIONS and UNLOADING OPERATIONS with fuel and liquid water in the 32PTH2 DSC Cavity.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Boron concentration limit not met. | A.1 Suspend loading of fuel assemblies into the 32PTH2 DSC. | Immediately |
| | AND | |
| | A.2 | |
| | A.2.1 Add boron and re-sample, and test the concentration until the boron concentration is shown to be greater than that required. | Immediately |
| | OR | |
| | A.2.2 Remove all fuel assemblies from the 32PTH2 DSC. | Immediately |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.2.1 | Verify boron concentration limit in spent fuel pool water and water to be added to the 32PTH2 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 fuel assembly into the 32PTH2 DSC.<br><br><u>AND</u><br><br>Every 48 hours thereafter while the 32PTH2 DSC is in the spent fuel pool or until the fuel has been removed from the 32PTH2 DSC. |
| SR 3.2.2 | Verify boron concentration limit in spent fuel pool water and water to be added to the 32PTH2 DSC cavity is met using two independent measurements (two samples analyzed by different individuals) for UNLOADING OPERATIONS. | Once within 4 hours prior to flooding 32PTH2 DSC during UNLOADING OPERATIONS.<br><br><u>AND</u><br><br>Every 48 hours thereafter while the 32PTH2 DSC is in the spent fuel pool or until the fuel has been removed from the 32PTH2 DSC. |

# 4.0 Design Features

The specifications in this section include the design characteristics of special importance to each of the physical barriers and to maintenance of safety margins in the Advanced NUHOMS® System design. The principal objective of this section is to describe the design envelope that may constrain any physical changes to essential equipment. Included in this section are the site environmental parameters that provide the bases for design, but are not inherently suited for description as LCOs.

## 4.1 Site

### 4.1.1 Site Location

Because these specifications are 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 AHSM/AHSM-HS center of gravity (CG) is to be developed based on the SSI responses. The AHSM center of gravity is shown in UFSAR Tables 3.2-1 and A.3.2-1 when loaded with the 24PT1 and 24PT4 DSC, respectively. The AHSM-HS center of gravity when loaded with the 32PTH2 DSC is shown in Table B.3.2-1. The site specific spectra at the AHSM/AHSM-HS CG must be bounded by the spectra presented in UFSAR Chapter 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 4.4.2.

### 4.2.3 Canister Neutron Absorber

For a 24PT1-DSC basket, neutron absorber with a minimum B-10 loading of 0.025 $gm/cm^2$ is provided for criticality control.

For a 24PT4-DSC basket, two alternate neutron absorber specifications are provided for criticality control depending upon the number of DAMAGED FUEL ASSEMBLIES and/or the maximum planar average initial fuel enrichment of the payload as shown in Table 2-8:

- Type A Basket (minimum areal B-10 loading of 0.025 $gm/cm^2$)
- Type B Basket (minimum areal B-10 loading of 0.068 $gm/cm^2$)

For the 32PTH2 DSC, three alternate basket types are provided for criticality control, depending on the B-10 loadings analyzed (designated as Type “B” basket for the lowest B-10 loading to Type “D” basket for the highest B-10 loading). Table 3-4 and Table 3-5 list the 3 basket types and the maximum allowable planar average initial fuel enrichment for each basket type.

For a 32PTH2 DSC basket, MMC shall be supplied in accordance with UFSAR Sections B.9.1.7.1, B.9.1.7.2, B.9.1.7.5 (portions of), B.9.1.7.6.4 (portions of), B.9.1.7.6.5, B.9.1.7.7.1 and B.9.1.7.7.2, with the minimum B-10 areal density in Table 3-9. These sections of the UFSAR are hereby incorporated into the NUHOMS® 1029 CoC.

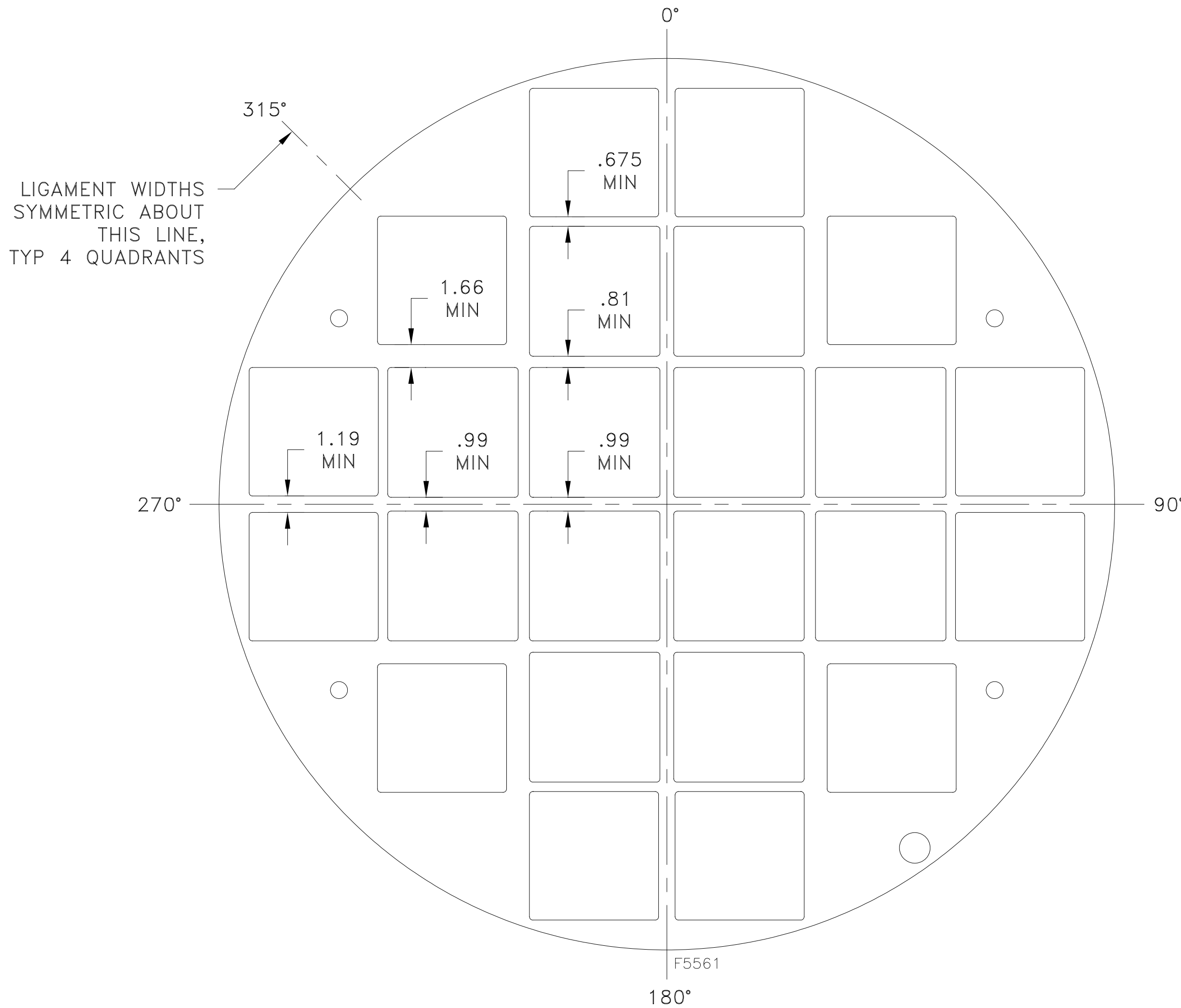
### 4.2.4 Canister Flux Trap Configuration

The canister flux trap configuration is defined by the spacer disc ligament width dimensions. Figure 4-1 (applicable to 24PT1-DSC and 24PT4-DSC) shows the location and dimensions of the ligaments (the dimensions shown in the one quadrant are applicable to all four quadrants).

### 4.2.5 Fuel Spacers

Bottom fuel spacers are required to be located at the bottom of the DSC below each fuel assembly stored in the 24PT1-DSC. Top fuel spacers are required to be located above each INTACT FUEL ASSEMBLY stored in the 24PT1-DSC (the FAILED FUEL CAN design includes an integral top fuel spacer and therefore does not require a top fuel spacer).

No fuel spacers are required for 24PT4-DSC or the 32PTH2 DSC.




Note: All ligament width dimensions are in inches.

**Figure 4-1 Minimum Spacer Disc Ligament Widths for 24PT1 and 24PT4-DSCs**

## 4.3 Codes and Standards

### 4.3.1 Advanced Horizontal Storage Module (AHSM and AHSM-HS)

The reinforced concrete AHSM and AHSM-HS are designed to meet the requirements of ACI 349-97 and ACI 349-06, respectively. 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 AHSM and AHSM-HS.

### 4.3.2 Dry Shielded Canister

For the 24PT1 or 24PT4, the DSC is designed fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Division 1, 1992 Edition with Addenda through 1994, including exceptions allowed by Code Case –595-1, Subsections NB, NF, and NG for Class 1 components and supports. In addition, Code Case –499-1 applies to 24PT4-DSC spacer discs.

The 32PTH2 DSC is designed, fabricated, and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Code Section III, Division 1, 2010 Edition, Subsections NB, NF, and NG for Class 1 components and supports.

Code alternatives are discussed in Section 4.3.4. ASME code requirements for basket assemblies apply only to important to safety category A components.

### 4.3.3 Transfer Cask

The TRANSFER CASK (OS197, OS197H, or OS200FC) shall meet the codes and standards that are applicable to its design under Certificate of Compliance 1004.

A solar shield is required for cask TRANSFER OPERATIONS at temperatures exceeding 100 ºF.

### 4.3.4 Alternatives to Codes and Standards

ASME Code alternatives for the 24PT1-DSC or 24PT4-DSC (DSC) are listed below:

**24PT1 or 24PT4 DSC Shell Assembly Alternatives to ASME Code, Subsection NB**

| Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|---|---|---|
| NCA | All | Not compliant with NCA. |
| NB-1100 | Requirements for Code Stamping of Components | The DSC shell is designed & 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. |

| Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|---|---|---|
| NB-2130<br><br>NB-4121 | Material must be supplied by ASME approved material suppliers<br><br>Material Certification by Certificate Holder | All materials designated as ASME on the UFSAR drawings are obtained from ASME approved MM or MS supplier(s) with ASME CMTR's. 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 & certification are maintained in accordance with TN's NRC approved QA program. |
| NB-6111 | All completed pressure retaining systems shall be pressure tested | The shield plug support ring and vent and siphon block are not pressure tested due to the manufacturing sequence. The support ring is not a pressure-retaining item and the siphon block weld is helium leak tested after fuel is loaded and the inner top closure plate installed in accordance with Code Case N-595-1. |
| NB-7000 | Overpressure Protection | No overpressure protection is provided for the DSC. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum internal pressure considering 100% fuel rod failure at maximum accident temperature. The DSC is pressure tested to 120% of normal operating design pressure. An overpressure protection report is not prepared for the DSC. |
| NB-8000 | Requirements for nameplates, stamping & reports per NCA-8000 | The DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. In lieu of code stamping, QA Data packages are prepared in accordance with the requirements of 10 CFR Part 71, 10 CFR Part 72 and TN's approved QA program. |

## 24PT1 or 24PT4 Basket Alternatives to ASME Code, Subsection NG/NF

| Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|---|---|---|
| NCA | All | Not compliant with NCA. |
| NG/NF-1100 | Requirements for Code Stamping of Components | The DSC baskets are designed & fabricated in accordance with the ASME Code, Section III, Subsection NG/NF to the maximum extent practical as described in the UFSAR, but 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 be ASME Certified. |

| Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|---|---|---|
| NG/NF-2130<br><br>NG/NF-4121 | Material must be supplied by ASME approved material suppliers<br><br>Material Certification by Certificate Holder | All materials designated as ASME on the UFSAR drawings are obtained from ASME approved MM or MS supplier with ASME CMTR's. 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 NG/NF-2130 is not possible. Material traceability & certification are maintained in accordance with TN's NRC approved QA program. |
| Table NG-3352-1 | Permissible Joint Efficiency Factors | Joint efficiency (quality) factor of 1 is assumed for the guidesleeve longitudinal weld. Table NG-3352-1 permits a quality factor of 0.5 for full penetration weld with visual inspection. Inspection of both faces provides n = (2*0.5) = 1. This is justified by this gauge of material (0.12 inch) with visual examination of both surfaces which ensures that any significant deficiencies would be observed and corrected. |
| NG/NF-8000 | Requirements for nameplates, stamping & reports per NCA-8000 | The DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. In lieu of code stamping, QA Data packages are prepared in accordance with the requirements of 10 CFR Part 71, 10 CFR Part 72 and TN's approved QA program. |
| N/A | N/A | Oversleeve to guidesleeve welds are non-code welds which meet the requirements of AWS D1.3-98, the Structural Welding Code-Sheet Steel. |
| NG-3000 / Section II, Part D, Table 2A | Maximum temperature limit for Type 304 plate material is 800ºF | For 24PT4-DSC only: The DSC guidesleeves, oversleeves and failed fuel cans do not comply with ASME Code limit of 800ºF for Type 304 steel for the postulated blocked vent accident for approximately 25 hours. The maximum predicted temperature of those components for this event is less than 900ºF. In accordance with Table I-14.5 of Article NH, the expected reduction in material strength is small (less than 1 ksi) and the calculated stress ratio is very small. |

ASME Code alternatives for the 32PTH2 DSC are listed below:

**32PTH2 DSC Shell Assembly Alternatives to the ASME Code**

| Reference ASME Code Section/Article | Code Requirement | Alternatives, Justification & Compensatory Measures |
|---|---|---|
| NCA | All | Not compliant with NCA. Quality Assurance is provided according to 10 CFR 72 Subpart G in lieu of NCA-4000. |
| NCA-1140 | Use of Code editions and addenda | Code edition and addenda other than those specified in Section 4.3.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.3.2 table.<br>Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.3.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction. |
| NB-1100 | Requirements for Code Stamping of Components, Code reports and certificates, etc. | 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-2130 | Material must be supplied by ASME approved material suppliers. | 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 TN's NRC approved QA program. |
| NB-4121 | Material Certification by Certificate Holder | |
| 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 RT and either PT or MT. | The shell to the outer top cover weld, the shell to the inner top cover/shield plug weld (including optional design configurations for the inner top cover as described in the 32PTH2 DSC drawings), the siphon/vent cover welds, and the vent and siphon block welds to the shell are all partial penetration welds. As an alternative to the NDE requirements of NB-5230, for Category C welds, all of these closure welds are 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 ISG-15 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. All of these welds are designed to meet the guidance provided in ISG-15 for stress reduction factor. |

| Reference ASME Code Section/Article | Code Requirement | Alternatives, Justification & Compensatory Measures |
|---|---|---|
| NB-1132 | Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component. | Bottom shield plug and outer bottom cover plate are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination. |
| NB-6100 and 6200 | All pressure retaining components and completed systems shall be pressure tested. The preferred method shall be hydrostatic test. | The 32PTH2 DSC is not a complete 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 and inner bottom plate/forging (including all longitudinal and circumferential welds), are pressure tested and examined at the fabrication facility.<br>The shell to the inner top cover/shield plug closure weld (including optional design configurations for the inner top cover as described in the 32PTH2 DSC drawings) is pressure tested and examined for leakage in accordance with NB-6300 in the field.<br>The siphon/vent cover welds are not pressure tested; these welds and the shell to the inner top cover/shield plug closure weld (including Optional design configurations for the inner top cover as described in the 32PTH2 DSC drawings) are helium leak tested after the pressure test.<br>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 $\geq$ 16.5 psia. 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 32PTH2 DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The 32PTH2 DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature. |
| NB-8000 | Requirements for nameplates, stamping & reports per NCA-8000. | The 32PTH2 DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the 32PTH2 DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program. |

| | | |
|---|---|---|
| NB-5520 | NDE Personnel must be qualified to a specific edition of SNT-TC-1A. | Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition. |

## 32PTH2 Basket Alternatives to the ASME Code

| Reference ASME Code Section/Article | Code Requirement | Alternatives, Justification & Compensatory Measures |
|---|---|---|
| NCA | All | Not compliant with NCA. Quality Assurance is provided according to 10 CFR 72 Subpart G in lieu of NCA-4000. |
| NCA-1140 | Use of Code editions and addenda | Code edition and addenda other than those specified in Section 4.3.2 may be used for construction, but in no case earlier than 3 years before that specified in Section 4.3.2.<br><br>Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.3.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction. |
| NG-1100 | Requirements for Code Stamping of Components, Code reports and certificates, etc. | 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. |
| NG-2000 | Use of ASME Material | Some baskets include neutron absorber and aluminum plates that are not ASME Code Class 1 material. They are used for criticality safety and heat transfer, and are only credited in the structural analysis with supporting their own weight and transmitting bearing loads through their thickness. Material properties in the ASME Code for Type 6061 aluminum are limited to 400 °F to preclude the potential for annealing out the hardening properties. Annealed properties (as published by the Aluminum Association and the American Society of Metals) are conservatively assumed for the aluminum transition rails for use above the Code temperature limits. |
| NG-2130 | Material must be supplied by ASME approved material suppliers. | 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 NG-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program. |
| NG-4121 | Material Certification by Certificate Holder | |
| NG-8000 | Requirements for nameplates, stamping & reports per NCA-8000. | The 32PTH2 DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the 32PTH2 DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program. |

| Reference ASME Code Section/Article | Code Requirement | Alternatives, Justification & Compensatory Measures |
|---|---|---|
| NG-3000/ Section II, Part D, Table 2A | Maximum temperature limit for Type 304 plate material is 800ºF. | Not compliant with ASME Section II Part D Table 2A material temperature limit for Type 304 steel for the postulated transfer accident case (117ºF, loss of sunshade, loss of neutron shield) and blocked vent accident (117ºF, 40 hr). The calculated maximum steady state temperatures for transfer accident case and blocked vent accident case are less than 1000 °F. The only primary stresses in the basket grid are deadweight stresses. The ASME Code allows use of SA240 Type 304 stainless steel to temperatures up to 1000 °F, as shown in ASME Code, Section II, Part D, Table 1A. In the temperature range of interest (near 800 °F), the $S_m$ values for SA240 Type 304 shown in ASME Code, Section II Part D, Table 2A are identical to the allowable S values for the same material shown in Section B, Part D, Table 1A. The recovery actions following these accident scenarios are as described in the UFSAR. |
| NG-3352 | Table NG-3352-1 lists the permissible welded joints. | The fusion welds between the stainless steel insert plates and the stainless fuel compartment tube are not included in Table NG-3352-1. These welds are qualified by testing. The required minimum tested capacity of the welded connection (at each side of the tube) shall be 35 kips (at room temperature). The capacity shall be demonstrated by qualification and production testing. Testing shall be performed using, or corrected to, the lowest tensile strength of material used in the basket assembly or to minimum specified tensile strength. Testing may be performed on individual welds, or on weld patterns representative of one wall of the tube.<br><br>ASME Code Section IX does not provide tests for qualification of these type of welds. Therefore, these welds are qualified using Section IX to the degree applicable together with the testing described here.<br><br>The welds will be visually inspected to confirm that they are located over the insert plates, in lieu of the visual acceptance criteria of NG-5260 which are not appropriate for this type of weld.<br><br>A joint efficiency (quality) factor of 1.0 is utilized for the fuel compartment longitudinal seam welds. Table NG-3352-1 permits a joint efficiency (quality) factor of 0.5 to be used for full penetration weld examined by ASME Section V visual examination (VT). For the 32PTH2 DSC, the compartment seam weld is thin and the weld will be made in one pass. Both surfaces of weld (inside and outside) will be fully examined by VT and therefore a factor of 2 x 0.5=1.0, will be used in the analysis. This is justified as both surfaces of the single weld pass/layer will be fully examined, and the stainless steel material that comprises the fuel compartment tubes is very ductile. |
| NG-5520 | NDE personnel must be qualified to a specific edition of SNT-TC-1A. | Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition. |

Proposed alternatives to the ASME code, other than the aforementioned ASME Code 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 ASME Codes listed in Section 4.3.2 above would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

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

### 4.4 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 UFSAR.

#### 4.4.1 Storage Configuration

AHSMs and/or AHSM-HSs are to be tied together in single rows or back to back arrays with not less than 3 modules tied together (side by side). Any 2 of the 3 modules may be empty (not contain a loaded DSC). Each group of modules not tied together must be separated from other groups by a minimum of 20 feet to accommodate possible sliding during a seismic event. The distance between any module and the edge of the ISFSI pad shall be no less than 10 feet for AHSMs and 8 feet for AHSM-HSs.

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

The TC/DSC has been evaluated for drops of up to 80 inches onto a reinforced concrete storage pad. The evaluations are based on the concrete parameters specified in EPRI Report NP-4830, "The Effects of Target Hardness on the Structural Design of Concrete Storage Pads for Spent Fuel Casks," October 1986.

#### 4.4.3 Site Specific Parameters and Analyses

The following parameters and analyses shall be verified by the system user for applicability at their specific site.

1. Tornado maximum wind speeds: 290 mph rotational<br>70 mph translational
2. Flood levels up to 50 ft. and water velocity of 15 fps.
3. One-hundred year roof snow load of 110 psf.
4. Normal ambient temperatures of 0 °F to 104 °F.
5. Off-normal ambient temperature range of –40 °F without solar insolation to 117 °F with full solar insolation.
6. The potential for fires and explosions shall be addressed, based on site-specific considerations.
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. Seismic restraints shall be provided to prevent overturning of a loaded TC in a vertical orientation in the plant's decontamination area during a seismic event if a certificate holder determines that the horizontal acceleration is 0.40 g or greater. The determination of horizontal acceleration acting at the center of gravity (CG) of the loaded TC must be based on a peak horizontal ground

acceleration at the site.

9. The effects of lightning, tsunamis, hurricanes and seiches, based on site-specific conditions shall be shown to be bounded by the design capability of the storage cask system.

10. Any load-bearing AHSM-HS support structure components and associated load bearing welds shall be fabricated as stainless steel, or as weathering steel, defined as carbon steel with a minimum of 0.20 percent copper content. Additionally, load-bearing welds for such weathering steel may be made with weld material bearing 1% or more nickel as an alternate to the copper-bearing weld material.

# 5.0 Administrative Controls

## 5.1 Procedures

Each user of the Advanced NUHOMS® System will prepare, review, and approve written procedures for all normal operations, maintenance, and testing at the ISFSI prior to its operation. Written procedures shall be established, implemented, and maintained covering the following activities that are important to safety:

- Organization and management
- Routine ISFSI operations
- Alarms and annunciators
- Emergency operations
- Design control and facility change/modification
- Control of surveillances and tests
- Control of special processes
- Maintenance
- Health physics, including ALARA practices
- Special nuclear material accountability
- Quality assurance, inspection, and audits
- Physical security and safeguards
- Records management
- Reporting
- All programs specified in Section 5.2

Procedures for UNLOADING OPERATIONS shall be maintained until all spent fuel is removed from the spent fuel pool and TRANSFER OPERATIONS have been completed for the last DSC.

The fuel removal procedure which shall be part of the users operating procedures as a minimum, shall include:

> If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with borated water. If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with the fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's

Radiation Protection Program.

## 5.2 Programs

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

- Safety Review Program
- Training Program
- Radiological Environmental Monitoring Program
- Radiation Protection Program
- AHSM/AHSM-HS Thermal Monitoring Program

### 5.2.1 Safety Review Program

Users shall conduct safety reviews in accordance with 10 CFR 72.48 to determine whether proposed changes, tests, and experiments require NRC approval before implementation. Changes to the Technical Specification Bases and other licensing basis documents will be conducted in accordance with approved administrative procedures. Changes may be made to Technical Specification Bases and other licensing basis documents without prior NRC approval, provided the changes meet the criteria of 10 CFR 72.48.

The safety review process will contain provisions to ensure that the Technical Specification Bases and other licensing basis documents are maintained consistent with the UFSAR.

Proposed changes that do not meet the criteria above will be reviewed and approved by the NRC before implementation. Changes to the Technical Specification Bases implemented without prior NRC approval will be provided to the NRC in accordance with 10 CFR 72.48.

### 5.2.2 Training Program

Training modules shall be developed as required by 10 CFR Part 72. Training modules shall require a comprehensive program for the operation and maintenance of the Advanced NUHOMS® System and the ISFSI. The training modules shall include the following elements, at a minimum:

- Advanced NUHOMS® System design (overview)
- ISFSI Facility design (overview)
- Systems, Structures, and Components Important to Safety (overview)
- Advanced NUHOMS® System Safety Analysis Report (overview)
- NRC Safety Evaluation Report (overview)
- Certificate of Compliance conditions
- Advanced NUHOMS® System Technical Specifications
- Applicable Regulatory Requirements (e.g., 10 CFR Part 72, Subpart K, 10 CFR Part 20, 10 CFR Part 73)
- Required Instrumentation and Use

- Operating Experience Reviews
- Advanced NUHOMS® System and Maintenance procedures, including:
  - Fuel qualification and loading,
  - Rigging and handling,
  - LOADING OPERATIONS as described in Chapters 8, A.8, B.8, and Sections 9.2, A.9.2, and B.9.2 of the UFSAR,
  - UNLOADING OPERATIONS including reflooding, as applicable,
  - Auxiliary equipment operations and maintenance (i.e., welding operations, vacuum drying, helium backfilling and leak testing, reflooding),
  - TRANSFER OPERATIONS including loading and unloading of the Transfer Vehicle,
  - ISFSI Surveillance operations,
  - Radiation Protection,
  - Maintenance,
  - Security,
  - Off-normal and accident conditions, responses and corrective actions.

5.2.3 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.

5.2.4 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. 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 Section 5.2.3.

c. When using a TC with a liquid neutron shield (NS), if draining the NS is required to meet the plant lifting crane capacity limits, the NS shall be verified to be filled after completion of the lift. If DSC cavity draining or TC/DSC annulus draining operations, as applicable, are initiated after the lift, the NS shall be verified to be

filled before these draining operations are initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled. Observation of water level in the expansion tank or some other means can be used to verify compliance with this requirement.

d. Following placement of each loaded TC into the cask decontamination area and prior to transfer to the ISFSI, the DSC smearable surface contamination levels on the outer surface of the DSC shall be less than 2,200 dpm/100 $cm^2$ from beta and gamma emitting sources, and less than 220 dpm/100 $cm^2$ from alpha emitting sources.

The contamination limits specified above are based on the allowed removable external radioactive contamination specified in 49 CFR 173.443 (as referenced in 10 CFR 71.87(i)) the system provides significant additional protection for the DSC surface than the transportation configuration). The AHSM/AHSM-HS will protect the DSC from direct exposure to the elements and will therefore limit potential releases of removable contamination. The probability of any removable contamination being entrapped in the AHSM/AHSM-HS air flow path released outside the AHSM/AHSM-HS is considered extremely small.

e. TC surface dose rates with 24PT4-DSC payload as specified below shall be confirmed prior to 24PT4-DSC closure to assure proper loading and consistency with the offsite dose analysis.

1 ≤ 260 mrem/hr (gamma) at 3 feet from the centerline of the top of the welder neutron shield prior to wet welding operations, with the shield plug in place and approximately 4 inches of water drained and the welder with its neutron shield in place.

2 ≤ 95 mrem/hr (gamma) at 3 feet from the surface of the TC neutron shield at the centerline (mid-height) of the TC prior to wet welding operations.

f. The OS200FC TC total dose rate shall be less than or equal to the values specified below with the 32PTH2 DSC as a payload. The dose rates should be measured as soon as possible after the OS200FC TC is removed from the spent fuel pool when in the configuration defined below but before the OS200FC TC is downended on the transfer trailer to be transferred to the ISFSI.

- OS200FC TC Axial Dose Rate Limit: 2900 mrem/hour
- OS200FC TC Radial Dose Rate Limit: 250 mrem/hour

The following configuration shall be employed for all OS200FC TC axial dose rate measurements:

- Neutron shielding material present in the OS200FC TC neutron shield cavity.
- OS200FC TC/32PTH2 DSC annulus filled with water and water level in the annulus is at least level with the top of the fuel assembly.
- Bulk water removed from the 32PTH2 DSC cavity.
- 32PTH2 DSC shield plug installed.

- 32PTH2 DSC inner top cover plate installed.
- Temporary shielding present above the inner top cover plate – minimum effective equivalent to 3 inches of NS-3 and 1 inch of steel combined.

The following locations shall be employed for all OS200FC TC axial dose rate measurements:

- Five locations are chosen within a radius of 10 to 25 inches (diameter of 20 to 50 inches) around the 32PTH2 DSC centerline on the top surface of the temporary shielding (as described earlier).

None of these measurements shall exceed the specified dose rate limits.

The following configuration shall be employed for all OS200FC TC radial dose rate measurements:

- Neutron shielding material present in the OS200FC TC neutron shield cavity
- OS200FC TC/32PTH2 DSC annulus water drained
- 32PTH2 DSC cavity vacuum drying is complete
- 32PTH2 DSC outer top cover plate welding completed
- OS200FC TC top lid installed
- OS200FC TC is in a vertical position

The following locations shall be employed for all OS200FC TC radial dose rate measurements:

- Eight approximately equally spaced locations around the radial surface of the OS200FC TC at an axial location corresponding to within approximately 24 inches of the center of the OS200FC TC.

None of these measurements shall exceed the specified dose rate limits.

The OS200FC TC dose rate limits are specified to maintain dose rates ALARA during the 32PTH2 DSC TRANSFER OPERATIONS. Additional temporary shielding can be employed before and/or after dose rate measurements to further reduce dose rates. These dose rate limits are based on the shielding analysis for the 32PTH2 DSC included in UFSAR Appendix B with some added margin for uncertainty.

If the measured dose rates exceed above values, place temporary shielding around the affected areas of the TC and review plant records of the fuel assemblies which have been placed in the 32PTH2 DSC to ensure that they conform to the fuel specification of Technical Specification 2.3 for the 32PTH2 DSC. Submit a letter report to the NRC within 30 days summarizing actions taken and the results of the surveillance, investigation and findings. The report must be submitted using instructions in 10 CFR 72.4 with a copy sent to the administrator of the appropriate NRC regional office.

g. Following completion of the 32PTH2 DSC inner top cover plate to shell weld and vent and siphon port cover welds, these welds shall be leak tested with a helium leak detection device. The leak testing is performed to the leaktight criteria listed

below:

| DSC Model | Leak Test Criterion |
|---|---|
| 32PTH2 | < $1x10^{-7}$ ref $cm^3/s$ |

If the measured leakage rate exceeds the specified criterion, determine the location of the leak and repair.

5.2.5 AHSM/AHSM-HS Thermal Monitoring Program

This program provides guidance for temperature measurements that are used to monitor the thermal performance of each AHSM/AHSM-HS. The intent of the program is to prevent conditions that could lead to exceeding the concrete and fuel clad temperature criteria.

a. AHSM/AHSM-HS Air Temperature Difference Verification

For a 24PT1 or 24PT4 DSC in an AHSM, following initial DSC transfer to the AHSM, the air temperature difference between ambient temperature and the roof vent temperature will be measured 24 hours (plus or minus 8 hours) after DSC insertion into the AHSM and again 5 to 7 days after insertion into the AHSM and prior to removing the AHSM door to perform the DSC retainer adjustment. If the air temperature differential is greater than 100 °F, the air inlets and exits should be checked for blockage. If after removing any blockage found, the temperature differential is still greater than 100 ºF, corrective actions and analysis of existing conditions will be performed in accordance with the site corrective action program to confirm that conditions adversely affecting the concrete or fuel cladding do not exist. Possible corrective actions may include, but are not limited to, ensuring that the instruments are measuring correctly, ensuring that the inlet and outlet vents internal ducts are not clogged, ensuring that the temperature sensors are positioned correctly, or review of plant records of the fuel assemblies to verify that appropriate allowed fuel assemblies have been placed in the DSC(s).

The specified air temperature rise ensures the fuel clad and concrete temperatures are maintained at or below acceptable long-term storage limits. If the temperature rise is within the ≤ 100 ºF, then the AHSM and DSC are performing as designed and no further temperature measurements are required.

For a 32PTH2 DSC in an AHSM-HS the requirements are the same as above, except that the maximum air temperature rise is ≤ 90 °F.

b. AHSM/AHSM-HS Concrete Temperature

Monitoring of the AHSM/AHSM-HS concrete temperature is initiated following successful completion of the AHSM/AHSM-HS Air Temperature Difference Verification per Section 5.2.5.a.

The temperature measurement will be a direct measurement of the

AHSM/AHSM-HS concrete temperature, or other means that would identify and allow for the correction of off-normal thermal conditions that could lead to exceeding the concrete and fuel clad temperature criteria. A temperature measurement of the thermal performance for each AHSM/AHSM-HS will be taken on a daily basis for the 24PT1-DSC with a 40 hour blocked vent time limit, twice a day for the 24PT4-DSC with a 25 hour blocked vent time limit, and daily for the 32PTH2 DSC with a 40 hour blocked vent time limit.

If the temperature of the AHSM/AHSM-HS at the monitored location rises by more than 80 °F for the 24PT1-DSC, 8.5 °F for the 24PT4-DSC, and 52 °F for the 32PTH2 DSC, based on this surveillance, then it is possible that some type of an inlet and or outlet vent blockage has occurred. Visual inspection of the vents will be initiated and appropriate corrective actions will be taken to avoid exceeding the concrete and cladding temperature limits.

The temperature rise limits for the AHSM with 24PT1 and 24PT4 DSCs are obtained from a review of a transient thermal analysis of the AHSM with a 24 kW heat load to ensure that the rapid heatup is detected in time to initiate corrective action prior to exceeding concrete or DSC basket material temperature limits for the respective AHSM DSC payloads.

In addition, if the temperature of the AHSM at the monitored location is greater than 225 °F for the 24PT1 DSC or 200 °F for the 24PT4 DSC, then it is possible that some type of an inlet and or outlet vent blockage has occurred. Visual inspection of the vents will be initiated and appropriate corrective actions need to be taken to avoid exceeding the concrete and cladding temperature limits. These temperature limits are chosen based on the expected concrete temperature for the 24 kW blocked vent scenarios to ensure that the associated fuel clad temperature is not exceeded.

The 52 °F value is obtained from a review of a transient thermal analysis of the AHSM-HS with a 37.2 kW heat load to ensure that the rapid heatup is detected in time to initiate corrective action prior to exceeding concrete or 32PTH2 DSC basket material temperature limits for the respective AHSM-HS DSC payloads.

In addition, if the temperature of the AHSM-HS at the monitored location is greater than 225 °F, then it is possible that some type of an inlet and or outlet vent blockage has occurred. Visual inspection of the vents will be initiated and appropriate corrective actions need to be taken to avoid exceeding the concrete and cladding temperature limits. The 225 °F temperature limit is chosen based on the expected initial concrete temperature for the 37.2 kW blocked vent scenario to ensure that the associated fuel clad temperature is not exceeded.

The AHSM/AHSM-HS Thermal Monitoring Program provides a positive means to identify conditions that could approach the temperature criteria for proper AHSM/AHSM-HS operation and allow for the correction of off-normal thermal conditions that could lead to exceeding the concrete and fuel clad temperature criteria.

c. AHSM/AHSM-HS Air Vents

Since the AHSMs/AHSM-HSs are located outdoors, there is a possibility that the AHSM/AHSM-HS air inlet and outlet openings could become blocked by debris. Although the ISFSI security fence and AHSM/AHSM-HS front inlet bird screens reduce the probability of AHSM/AHSM-HS air vent blockage, the ISFSI UFSAR postulates and analyzes the effects of air vent blockage.

The AHSM/AHSM-HS design and accident analyses demonstrate the ability of the ISFSI to function safely if obstructions in the air inlets or outlets impair airflow through the AHSM/AHSM-HS for extended periods. This specification ensures that blockage will not exist for periods longer than assumed in the analyses.

For the 24PT1-DSC and the 24PT4-DSC, credit will be taken for the temperature measurement taken in Section 5.2.5.b. Visual inspection of the AHSM air vents with the 24PT1-DSC and the 24PT4-DSC will be performed only if the temperature monitoring system data is unavailable or if the temperature limits specified in Section 5.2.5.b are exceeded to ensure that AHSM air vents are not blocked for more than 40 hours for the 24PT1-DSC, and more than 25 hours for the 24PT4-DSC.

For the 32PTH2 DSC, credit will be taken for the temperature measurement taken in Section 5.2.5.b. Visual inspection of the AHSM-HS air vents will be performed only if the temperature monitoring system data is unavailable or if the temperature limits specified in Section 5.2.5.b are exceeded to ensure that AHSM-HS air vents are not blocked for more than 40 hours.

For the AHSM-HS, if these visual inspections show blockage of air vents (any blockage of the outlet vents or more than 50% of the inlet vents), they shall be cleared. If the front inlet bird screen is damaged, it shall be replaced.

### 5.2.6 Hydrogen Gas Monitoring for the 32PTH2 DSC

For the 32PTH2 DSC, while welding the inner top cover plate during LOADING OPERATIONS, and while cutting the outer or inner top cover plates during UNLOADING OPERATIONS, hydrogen monitoring of the space under the shield plug in the 32PTH2 DSC cavity is required, to ensure that the combustible mixture concentration remains below the flammability limit of 4%.

## 5.3 Lifting Controls

### 5.3.1 Transfer Cask Lifting Heights

The lifting height of a loaded TC/DSC is limited as a function of location and temperature as follows:

a) The maximum lift height of the TC/DSC inside the Fuel Handling Building shall be 80 inches if the ambient temperature is below 0°F but higher than -80°F.

b) No lift height restriction other than 10 CFR Part 50 administrative controls is

imposed on the TC/DSC during LOADING OPERATIONS provided that a single-failure-proof crane is used and if the ambient temperature is higher than 0°F.

c) The maximum lift height and handling height for all TRANSFER OPERATIONS shall be 80 inches if the ambient temperature is greater than 0°F.

These restrictions ensure that any DSC drop as a function of location or low temperature is within the bounds of the accident analysis. If the ambient temperature is outside of the specification limits, LOADING and TRANSFER OPERATIONS will be terminated.

#### 5.3.2 Transfer Cask Drop

Inspection Requirement

The DSC will be inspected for damage after any TC drop of fifteen 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 transfer trailer, at which time fuel handling activities are controlled under the 10 CFR Part 72 license. Although the probability of dropping a loaded TC/DSC while en route from the Fuel Handling Building to the ISFSI is small, the potential exists to drop the TC 15 inches or more.

Safety Analysis

The analysis of bounding drop scenarios shows that the TC will maintain the structural integrity of the DSC confinement boundary from an analyzed drop height of 80 inches. The 80-inch drop height envelops the maximum vertical height of the TC when secured to the transfer trailer while en route to the ISFSI.

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

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

### 5.4 AHSM or AHSM-HS Dose Rate Evaluation Program

#### 5.4.1 Overview

The licensee shall establish a set of AHSM or AHSM-HS dose rate limits which are to be applied when loaded with the DSCs at the site to ensure that the limits of 10 CFR Part 20 and 10 CFR 72.104 are met. Limits shall establish peak dose rates at the following locations:

1. front inlet bird screen
2. Outside AHSM or AHSM-HS door

### 5.4.2 Limits and Locations

Notwithstanding the limits established in Section 5.4.1, the dose rate limits listed below for the AHSM or AHSM-HS shall be met when a DSC loaded with fuel is stored within an AHSM or AHSM-HS module:

| | | |
|---|---|---|
| 1. | Dose Rate Limit, AHSM-HS front inlet bird screen: | 300 mrem/hour |
| 2. | Dose Rate Limit, Outside surface of AHSM-HS door: | 10 mrem/hour |
| 3. | Dose Rate Limit, AHSM front inlet bird screen: | 50 mrem/hour |
| 4. | Dose Rate Limit, Outside surface of AHSM door: | 10 mrem/hour |

The number and locations of the dose rate measurements on the surface of the front inlet bird screen of the AHSM-HS are indicated below:

- Two dose rate measurements are taken for each front inlet bird screen for the AHSM-HS. These dose rate measurements are approximately 24 inches measured vertically from the surface of the ISFSI pad and are approximately 6 inches from the left and 6 inches from the right of the center of each front inlet bird screen.

The number and locations of the dose rate measurements on the surface of the front inlet bird screen of the AHSM are indicated below:

- Two dose rate measurements are taken for each front inlet bird screen for the AHSM. These dose rate measurements are approximately 30 inches measured vertically from the surface of the ISFSI pad and within 24 inches from the centerline horizontally of each front bird screen.

None of these measurements shall exceed the specified dose rate limits.

The number and locations of the dose rate measurements on the outside surface of the AHSM or AHSM-HS door are indicated below:

- Five locations on the door, one at the door center, and 4 others at equidistant locations around the door center at a radius of approximately 25 inches (diameter of approximately 50 inches).

None of these measurements shall exceed the specified dose rate limits.

### 5.4.3 Corrective Actions

If the measured dose rates do not meet the limits of Section 5.4.2, the licensee shall take the following actions until compliance is achieved:

a. Ensure proper installation of the AHSM or AHSM-HS door and check for any streaming around the door, AND

b. Administratively verify that the spent fuel assemblies loaded in the DSC meet Section 2.0 limits for the applicable DSC, AND

c. Ensure that the DSC is properly positioned on the support rails. If compliance is not achieved then proceed to d and e.

d. Perform an analysis to determine that placement of the as-loaded DSC in the AHSM or AHSM-HS at the ISFSI will not cause the ISFSI to exceed the radiation exposure limits of 10 CFR Part 20 and 10 CFR 72.104(a) and ALARA and/or provide additional temporary or permanent shielding to assure exposure limits are not exceeded, and

e. Notify the U.S. NRC (Director of the Office of Nuclear Material Safety and Safeguards) within 30 days, summarizing the actions taken and the results of the surveillance, investigation and findings. This report must be submitted using instructions in 10 CFR 72.4 with a copy sent to the administrator of the appropriate NRC regional office.

## 5.5 Concrete Testing for AHSM-HS

AHSM-HS 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 AHSM-HS blocked vent transient for components exceeding 350 °F.

AHSM-HS 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.

## 5.6 AHSM-HS Configuration Changes

The use of AHSM-HS thermal performance methodology is allowed for evaluating AHSM-HS configuration changes except for changes to the AHSM-HS cavity height, cavity width, elevation and cross-sectional areas of the AHSM-HS air inlet/outlet vents, total outside height, length and width of AHSM-HS that exceed 8% of their nominal design values as shown on the CoC Amendment Number 3 drawings.