Chapter 12

APPENDIX 12A

TECHNICAL SPECIFICATIONS FOR THE NAC-UMS® SYSTEM

Table of Contents

STORAGE OPERATIONS	STORAGE OPERATIONS include all licensed activities that are performed at the ISFSI, while an NAC-UMS® SYSTEM containing spent fuel is located on the storage pad within the ISFSI perimeter.
TRANSFER CASK	TRANSFER CASK is a shielded lifting device that holds the CANISTER during LOADING and UNLOADING OPERATIONS and during closure welding, vacuum drying, leak testing, and non-destructive examination of the CANISTER closure welds. The TRANSFER CASK is also used to transfer the CANISTER into and from the CONCRETE CASK and into the transport cask. TRANSFER CASK refers to either the standard or advanced transfer cask.
TRANSPORT OPERATIONS	TRANSPORT OPERATIONS include all licensed activities involved in moving a loaded NAC-UMS® CONCRETE CASK and CANISTER to and from the ISFSI. TRANSPORT OPERATIONS begin when the NAC-UMS® SYSTEM is first secured on the transporter and end when the NAC-UMS® SYSTEM is at its destination and no longer secured on the transporter.
TRANSPORTABLE STORAGE CANISTER (CANISTER)	TRANSPORTABLE STORAGE CANISTER is the sealed container that consists of a tube and disk fuel basket in a cylindrical canister shell that is welded to a baseplate, shield lid with welded port covers, and structural lid. The CANISTER provides the confinement boundary for the confined spent fuel.
TRANSFER OPERATIONS	TRANSFER OPERATIONS include all licensed activities involved in transferring a loaded CANISTER from a CONCRETE CASK to another CONCRETE CASK or to a TRANSPORT CASK.

(continued)

UNLOADING OPERATIONS	UNLOADING OPERATIONS include all licensed activities on a NAC-UMS® SYSTEM to be unloaded of the contained fuel assemblies. UNLOADING OPERATIONS begin when the NAC-UMS® SYSTEM is no longer secured on the transporter and end when the last fuel assembly is removed from the NAC-UMS® SYSTEM.
VERTICAL CONCRETE CASK (CONCRETE CASK)	VERTICAL CONCRETE CASK is the cask that receives and holds the sealed CANISTER. It provides the gamma and neutron shielding and convective cooling of the spent fuel confined in the CANISTER.
STANDARD FUEL	Irradiated fuel assemblies having the same configuration as when originally fabricated consisting generally of the end fittings, fuel rods, guide tubes, and integral hardware. For PWR fuel, a flow mixer, an in-core instrument thimble or a burnable poison rod insert is considered to be a component of standard fuel. For BWR fuel, the channel is considered to be integral hardware. The design basis fuel characteristics and analysis are based on the STANDARD FUEL configuration.
DAMAGED FUEL	A fuel assembly or fuel rod with known or suspected cladding defects greater than pinhole leaks or hairline cracks. DAMAGED FUEL must be placed in a MAINE YANKEE FUEL CAN.

(continued)

SR 3.0.3 (continued)	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 NAC-UMS® SYSTEM.

A 3.1 NAC-UMS® SYSTEM Integrity

A 3.1.1 <u>CANISTER Maximum Time in Vacuum Drying</u>

LCO 3.1.1

The following limits for vacuum drying time shall be met, as appropriate:

1. The time duration from completion of draining the CANISTER through completion of vacuum dryness testing and the introduction of helium backfill shall not exceed the following time limits:

<u>PWR</u>

Total Heat Load (L) (kW)	Time Limit (Hours)	Total Heat Load (L) (kW)	Time Limit (Hours)
$20 < L \leq 23$	32	$11 < L \leq 14$	68
$17.6 < L \leq 20$	37	$8 < L \leq 11$	600
$14 < L \leq 17.6$	44	$L \leq 8$	600

<u>BWR</u>

Total Heat Load (L) (kW)	Time Limit (Hours)	Total Heat Load (L) (kW)	Time Limit (Hours)
$20 < L \leq 23$	25	$11 < L \leq 14$	45
$17 < L \leq 20$	27	$8 < L \leq 11$	72
$14 < L \leq 17$	33	$L \leq 8$	600

(continued)

A 3.1 NAC-UMS® SYSTEM Integrity

A 3.1.4 CANISTER Maximum Time in TRANSFER CASK

LCO 3.1.4 The following limits for CANISTER time in TRANSFER CASK shall be met, as appropriate:

1. The time duration from completion of backfilling the CANISTER with helium through completion of the CANISTER transfer operation from the TRANSFER CASK to the CONCRETE CASK shall not exceed the following time limits for BWR fuel. The time duration for PWR fuel is ≤ 600 hours.

Total BWR Heat Load (L) (kW)	Time Limit (Hours)
20 < L ≤ 23	16
17 < L ≤ 20	30
L ≤ 17	600

2. The time duration from completion of in-pool or external forced air cooling of the CANISTER through completion of the CANISTER transfer operation from the TRANSFER CASK to the CONCRETE CASK shall not exceed the following time limits for BWR fuel after 24 hours of in-pool cooling or forced air cooling. The time duration for PWR fuel is ≤ 600 hours.

Total BWR Heat Load (L) (kW)	Time Limit (Hours)
20 < L ≤ 23	16
17 < L ≤ 20	30
L ≤ 17	600

APPLICABILITY: During LOADING OPERATIONS

(continued)

ACTIONS

---NOTE---

Separate Condition entry is allowed for each NAC-UMS® SYSTEM.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO time limits not met	A.1.1 Place TRANSFER CASK with helium filled loaded CANISTER in spent fuel pool	2 hours
	AND A.1.2 Maintain TRANSFER CASK and CANISTER in spent fuel pool for a minimum of 24 hours	Prior to restart of LOADING OPERATIONS
	OR	
	A.2.1 Commence supplying air to the TRANSFER CASK annulus fill/drain lines at a rate of 375 CFM and a maximum temperature of 76°F	2 hours
	AND A.2.2 Maintain airflow for a minimum of 24 hours	Prior to restart of LOADING OPERATIONS

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.4.1	Monitor elapsed time from completion of helium backfill until completion of transfer of loaded CANISTER into CONCRETE CASK	Once at completion of helium backfill AND 4 hours thereafter
SR 3.1.4.2	Monitor elapsed time from completion of in-pool or forced-air cooling until completion of transfer of loaded CANISTER into CONCRETE CASK	Once at completion of cooling operations AND 4 hours thereafter

CONDITION	REQUIRED ACTION	COMPLETION TIME

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.6.1	Verify the difference between the average CONCRETE CASK air outlet temperature and ISFSI ambient temperature is ≤ 102°F (for the PWR CANISTER) and ≤ 92°F (for the BWR CANISTER)	24 hours

A 3.1 NAC-UMS® SYSTEM Integrity

A 3.1.7 CANISTER Removal from the CONCRETE CASK

LCO 3.1.7	The following limits for TRANSFER OPERATIONS shall be met, as appropriate: 1. The time duration for holding the CANISTER in the TRANSFER CASK shall not exceed the limits defined in LCO 3.1.4(1). 2. The time duration for holding the CANISTER in the TRANSFER CASK using external forced air cooling of the CANISTER is 600 hours.
APPLICABILITY:	During TRANSFER OPERATIONS

ACTIONS

---NOTE---

Separate Condition entry is allowed for each NAC-UMS® SYSTEM.

Separate Condition entry to this LCO is allowed following each 24-hour period of continuous forced air cooling.

(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Loaded CANISTER held in TRANSFER CASK	A.1.1 Load CANISTER into operable CONCRETE CASK	4 hours
	<u>OR</u> A.1.2 Load CANISTER into TRANSPORT CASK	4 hours
	<u>OR</u> A.1.3 Perform A.1.1 or A.1.2 following a minimum of 24-hours of forced air cooling	4 hours
B. Required Actions in A and associated Completion Time not met	B.1.1 Commence supplying air to the TRANSFER CASK annulus fill/drain lines at a rate of 375 CFM and a maximum temperature of 76°F	2 hours
	<u>AND</u> B.1.2 Maintain forced air cooling. Condition A of this LCO may be re-entered after 24 hours of forced air cooling	24 hours

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.7.1	Monitor elapsed time from closing of the TRANSFER CASK bottom shield doors until unloading of the CANISTER from the TRANSFER CASK	Once at closing of the TRANSFER CASK bottom shield doors <u>AND</u> 2 hours thereafter
SR 3.1.7.2	Monitor continuous forced air cooling operation until unloading of the CANISTER from the TRANSFER CASK	Once at start of cooling operations <u>AND</u> 6 hours thereafter

A 3.2 NAC-UMS® SYSTEM Radiation Protection

A 3.2.2 CONCRETE CASK Average Surface Dose Rates

LCO 3.2.2 The average surface dose rates of each CONCRETE CASK shall not exceed the following limits unless required ACTIONS A.1 and A.2 are met.

a. 50 mrem/hour (neutron + gamma) on the side (on the concrete surfaces);

b. 50 mrem/hour (neutron + gamma) on the top;

c. 100 mrem/hour (neutron + gamma) at air inlets and outlets.

APPLICABILITY: During STORAGE OPERATIONS

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each NAC-UMS® SYSTEM.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. CONCRETE CASK average surface dose rate limits not met	A.1 Administratively verify correct fuel loading AND	24 hours

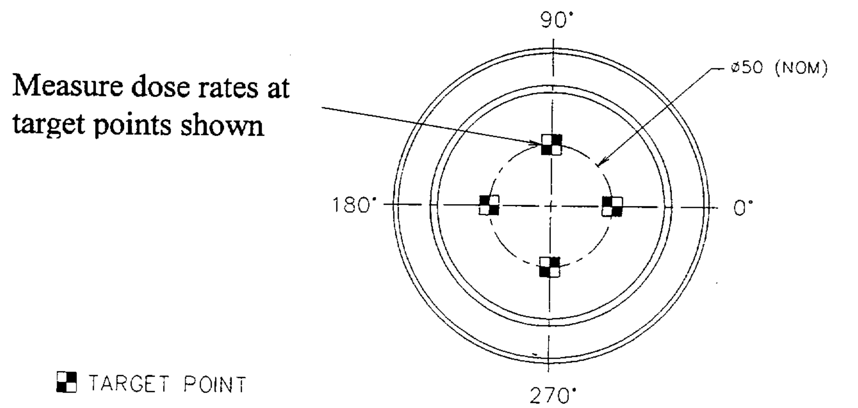
(continued)

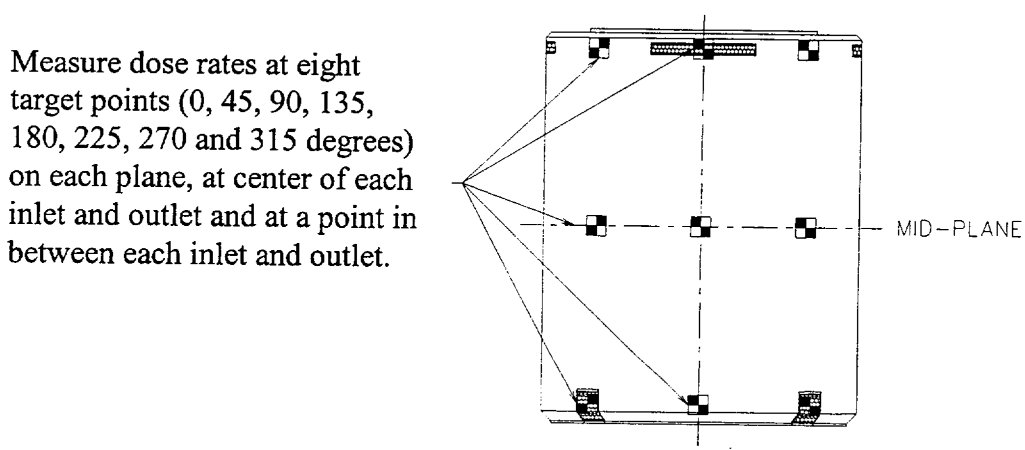
CONDITION	REQUIRED ACTION	COMPLETION TIME
	A.2 Perform analysis to verify compliance with the ISFSI offsite radiation protection requirements of 10 CFR 20 and 10 CFR 72	7 days
B. Required Action and associated Completion Time not met.	B.1 Remove all fuel assemblies from the NAC-UMS® SYSTEM	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.2.1	Verify average surface dose rates of CONCRETE CASK loaded with a CANISTER containing fuel assemblies are within limits. Dose rates shall be measured at the locations shown in Figure 12A3-1.	Once after completion of transfer of CANISTER into CONCRETE CASK and prior to beginning STORAGE OPERATIONS.

Figure 12A3-1 CONCRETE CASK Surface Dose Rate Measurement





A 3.3 NAC-UMS® SYSTEM Criticality Control

A 3.3.1 Dissolved Boron Concentration

LCO 3.3.1 The dissolved Boron concentration in the water in the CANISTER cavity shall be ≥ 1,000 ppm.

APPLICABILITY: During LOADING OPERATIONS and UNLOADING OPERATIONS with water and at least one fuel assembly in the CANISTER that exceeds the enrichment limits in Table 12B2-2 for fuel assemblies taking no boron credit.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each NAC-UMS® SYSTEM.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Dissolved Boron concentration not met.	A.1 Suspend loading of fuel assemblies into CANISTER and any other actions that increase reactivity.	Immediately
	AND	
	A.2 Initiate action to restore boron concentration to within limit.	Immediately
	AND	
	A.3 Remove all fuel assemblies from the CANISTER.	24 hours

Dissolved Boron Concentration
A 3.3.1

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.1.1	Verify the dissolved Boron concentration is met using two independent measurements.	Within 4 hours prior to commencing LOADING or UNLOADING OPERATIONS. AND Every 48 hours thereafter while the CANISTER is in the spent fuel pool or while water is in the CANISTER, except when no water is being introduced into the CANISTER cavity.

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A 5.0 ADMINISTRATIVE CONTROLS AND PROGRAMS

A 5.1 Training Program

A training program for the NAC-UMS® Universal Storage System shall be developed under the general licensee's systematic approach to training (SAT). Training modules shall include comprehensive instructions for the operation and maintenance of the NAC-UMS® Universal Storage System and the independent spent fuel storage installation (ISFSI).

A 5.2 Pre-Operational Testing and Training Exercises

A dry run training exercise on loading, closure, handling, unloading, and transfer of the NAC-UMS® Storage System shall be conducted by the licensee prior to the first use of the system to load spent fuel assemblies. The training exercise shall not be conducted with spent fuel in the CANISTER. The dry run may be performed in an alternate step sequence from the actual procedures, but all steps must be performed. The dry run shall include, but is not limited to the following:

a. Moving the CONCRETE CASK into its designated loading area
b. Moving the TRANSFER CASK containing the empty CANISTER into the spent fuel pool
c. Loading one or more dummy fuel assemblies into the CANISTER, including independent verification
d. Selection and verification of fuel assemblies requiring preferential loading
e. Installing the shield lid
f. Removal of the TRANSFER CASK from the spent fuel pool
g. Closing and sealing of the CANISTER to demonstrate pressure testing, vacuum drying, helium backfilling, welding, weld inspection and documentation, and leak testing
h. TRANSFER CASK movement through the designated load path
i. TRANSFER CASK installation on the CONCRETE CASK
j. Transfer of the CANISTER to the CONCRETE CASK

(continued)

A 5.2 Pre-Operational Testing and Training Exercises (continued)

k. CONCRETE CASK shield plug and lid installation
l. Transport of the CONCRETE CASK to the ISFSI
m. CANISTER unloading, including reflooding and weld removal or cutting
n. CANISTER removal from the CONCRETE CASK

Appropriate mockup fixtures may be used to demonstrate and/or to qualify procedures, processes or personnel in welding, weld inspection, vacuum drying, helium backfilling, leak testing and weld removal or cutting.

A 5.3 Special Requirements for the First System Placed in Service

The heat transfer characteristics and performance of the NAC-UMS® SYSTEM will be recorded by air inlet and outlet temperature measurements of the first system placed in service with a heat load equal to or greater than 10 kW. A letter report summarizing the results of the measurements will be submitted to the NRC in accordance with 10 CFR 72.4 within 30 days of placing the loaded cask on the ISFSI pad. The report will include a comparison of the calculated temperatures of the NAC-UMS® SYSTEM heat load to the measured temperatures. A report is not required to be submitted for the NAC-UMS® SYSTEMs that are subsequently loaded, provided that the performance of the first system placed in service with a heat load ≥ 10 kW is demonstrated by the comparison of the calculated and measured temperatures.

A 5.4 Control of Boron Concentration in Water in the CANISTER and in the Spent Fuel Pool During Loading or Unloading

The criticality analysis shows that PWR fuel with certain combinations of initial enrichment and fuel content require credit for the presence of at least 1,000 parts per million of boron in solution in the water in the CANISTER (see Section B3.2.1 for the requirements for the pool soluble boron concentration during loading). This water must be used to flood the canister cavity during underwater PWR fuel loading or unloading. The boron in the pool water ensures sufficient thermal neutron absorption to preserve criticality control during fuel loading in the basket. Consequently, if boron credit is required for the fuel being loaded or unloaded, the canister must be flooded with water that contains boron in the proper concentration in accordance with the requirements of LCO 3.3.1. Concentration of boron must also be measured and maintained in accordance with LCO 3.3.1.

(continued)

A 5.5 Surveillance After an Off-Normal, Accident, or Natural Phenomena Event

A Response Surveillance is required following off-normal, accident or natural phenomena events. The NAC-UMS® SYSTEMs in use at an ISFSI shall be inspected within 4 hours after the occurrence of an off-normal, accident or natural phenomena event in the area of the ISFSI. This inspection must specifically verify that all the CONCRETE CASK inlets and outlets are not blocked or obstructed. At least one-half of the inlets and outlets on each CONCRETE CASK must be cleared of blockage or debris within 24 hours to restore air circulation.

The CONCRETE CASK and CANISTER shall be inspected if they experience a drop or a tipover.

A 5.6 Radioactive Effluent Control Program

The program implements the requirements of 10 CFR 72.126.

a. The NAC-UMS® SYSTEM does not create any radioactive materials or have any radioactive waste treatment systems. Therefore, specific operating procedures for the control of radioactive effluents are not required. LCO 3.1.5, CANISTER Helium Leak Rate, provides assurance that there are no radioactive effluents from the NAC-UMS® SYSTEM.

b. This program includes an environmental monitoring program. Each general license user may incorporate NAC-UMS® SYSTEM operations into their environmental monitoring program for 10 CFR Part 50 operations.

(continued)

A 5.7 NAC-UMS® SYSTEM Transport Evaluation Program

This program provides a means for evaluating various transport configurations and transport route conditions to ensure that the design basis drop limits are met. For lifting of the loaded TRANSFER CASK or CONCRETE CASK using devices that are integral to a structure governed by 10 CFR Part 50 regulations, 10 CFR 50 requirements apply. This program is not applicable when the TRANSFER CASK or CONCRETE CASK is in the fuel building or is being handled by a device providing support from underneath (i.e., on a rail car, heavy haul trailer, air pads, etc.).

Pursuant to 10 CFR 72.212, this program shall evaluate the site specific transport route conditions.

a. The lift height above the transport surface prescribed in Section B3.4.1(6) of Appendix B to Certificate of Compliance (CoC) No. 1015 shall not exceed the limits in Table 12A5-1. Also, the program shall ensure that the transport route conditions (i.e., surface hardness and pad thickness) are equivalent to or less limiting than those prescribed for the reference pad surface which forms the basis for the values cited in the NAC-UMS® FSAR, Sections 11.2.12.3 and 11.2.15.1.1.

b. For site specific transport conditions which are not bounded by the surface characteristics in Section B3.4.1(6) of Appendix B to CoC No. 1015, the program may evaluate the site specific conditions to ensure that the impact loading due to design basis drop events does not exceed 60g. This alternative analysis shall be commensurate with the drop analyses described in the Safety Analysis Report for the NAC-UMS® SYSTEM. The program shall ensure that these alternative analyses are documented and controlled.

c. The TRANSFER CASK and CONCRETE CASK may be lifted to those heights necessary to perform cask handling operations, including CANISTER transfer, provided the lifts are made with structures and components designed in accordance with the criteria specified in Section B3.5 of Appendix B to CoC No. 1015, as applicable.

(continued)

A 5.8 Verification of Oxide Layer Thickness on High Burnup Fuel

A verification program is required to determine the oxide layer thickness on high burnup fuel by measurement or by statistical analysis. A fuel assembly having a burnup between 45,000 MWD/MTU and 50,000 MWD/MTU is classified as high burnup. The verification program shall be capable of classifying high burnup fuel as INTACT FUEL or DAMAGED FUEL based on the following criteria:

1. A HIGH BURNUP FUEL assembly may be stored as INTACT FUEL provided that no more than 1% of the fuel rods in the assembly have a peak cladding oxide thickness greater than 80 microns, and that no more than 3% of the fuel rods in the assembly have a peak oxide layer thickness greater than 70 microns, and that the fuel assembly is otherwise INTACT FUEL.

2. A HIGH BURNUP FUEL assembly not meeting the cladding oxide thickness criteria for INTACT FUEL or that has an oxide layer that is detached or spalled from the cladding is classified as DAMAGED FUEL.

A fuel assembly, having a burnup between 45,000 and 50,000 MWD/MTU, must be preferentially loaded in periphery positions of the basket.

Table 12A5-1 TRANSFER CASK and CONCRETE CASK Lifting Requirements

Item	Orientation	Lifting Height Limit
TRANSFER CASK	Horizontal	None Established
TRANSFER CASK	Vertical	None Established[1]
CONCRETE CASK	Horizontal	Not Permitted
CONCRETE CASK	Vertical	< 24 inches

Note:

1. See Technical Specification A5.7(c).

B 2.0 APPROVED CONTENTS

B 2.1 <u>Fuel Specifications and Loading Conditions</u>

The NAC-UMS® System is designed to provide passive dry storage of canistered PWR and BWR spent fuel. The system requires few operating controls. The principal controls and limits for the NAC-UMS® SYSTEM are satisfied by the selection of fuel for storage that meets the Approved Contents presented in this section and in Tables 12B2-1 through 12B2-5 for the standard NAC-UMS® SYSTEM design basis spent fuels.

This section also permits the loading of fuel assemblies that are unique to specific reactor sites. SITE SPECIFIC FUEL assembly configurations are either shown to be bounded by the analysis of the standard NAC-UMS® System design basis fuel assembly configuration of the same type (PWR or BWR), or are shown to be acceptable contents by specific evaluation of the configuration.

The separate specific evaluation may establish different limits, which are maintained by administrative controls for preferential loading. The preferential loading controls allow the loading of fuel configurations that may have higher burnup, additional hardware material or unique configurations as compared to the standard NAC-UMS® System design basis spent fuels.

Unless specifically excepted, SITE SPECIFIC FUEL must meet all of the controls and limits specified for the NAC-UMS® System, as presented in Table 12-1.

If any Fuel Specification or Loading Conditions of this section are violated, the following actions shall be completed:

- The affected fuel assemblies shall be placed in a safe condition.
- Within 24 hours, notify the NRC Operations Center.
- Within 30 days, submit a special report that describes the cause of the violation and actions taken to restore or demonstrate compliance and prevent recurrence.

(continued)

B 2.1.1 Fuel to be Stored in the NAC-UMS® SYSTEM

INTACT FUEL ASSEMBLIES meeting the limits specified in Tables 12B2-1 through 12B2-5 may be stored in the NAC-UMS® SYSTEM.

B 2.1.2 Preferential Fuel Loading

The normal temperature distribution in the loaded TRANSPORTABLE STORAGE CANISTER results in the basket having the highest temperature at its center and lowest temperature at the outer edge. Considering this temperature distribution, spent fuel with the shortest cooling time (and, therefore, having a higher allowable cladding temperature) is placed in the center of the basket. Fuel with the longest cooling time (and, therefore, having a lower allowable cladding temperature) is placed in the periphery of the basket.

Using a similar argument, fuel assemblies with cooling times between the highest and lowest cooling times of the designated fuel, are placed in intermediate fuel positions.

Loading of the fuel assemblies designated for a given TRANSPORTABLE STORAGE CANISTER must be administratively controlled to ensure that the dry storage fuel cladding temperature limits are not exceeded for any fuel assembly, unless all of the designated fuel assemblies have a cooling time of 7 years or more.

CANISTERS containing fuel assemblies, all of which have a cooling time of 7 years, or more, do not require preferential loading, because analyses have shown that the fuel cladding temperature limits will always be met for those CANISTERS.

CANISTERS containing fuel assemblies with cooling times from 5 to 7 years must be preferentially loaded based on cooling time. By controlling the placement of the fuel assemblies with the shortest cooling time (thermally hottest), preferential loading ensures that the allowable fuel cladding temperature for a given fuel assembly is not exceeded. The preferential loading of fuel into the CANISTER based on cooling time is described as follows.

(continued)

For the PWR fuel basket configuration, shown in Figure 12B2-1, fuel positions are numbered using the drain line as the reference point. Fuel positions 9, 10, 15 and 16 are considered to be basket center positions for the purpose of meeting the preferential loading requirement. The fuel with the shortest cooling times from among the fuel designated for loading in the CANISTER will be placed in the center positions. A single fuel assembly having the shortest cooling time may be loaded in any of these four positions. Fuel positions 1, 2, 3, 6, 7, 12, 13, 18, 19, 22, 23 and 24 are periphery positions, where fuel with the longest cooling times will be placed. Fuel with the longest cooling times may be loaded in any of these 12 positions. Similarly, designated fuel assemblies with cooling times in the midrange of the shortest and longest cooling times will be loaded in the intermediate fuel positions – 4, 5, 8, 11, 14, 17, 20 and 21.

For the BWR fuel basket configuration, shown in Figure 12B2-2, fuel positions are also numbered using the drain line as the reference point. Fuel positions 23, 24, 25, 32, 33 and 34 are considered to be basket center positions for the purpose of meeting the preferential loading requirement. The fuel with the shortest cooling times from among the fuel designated for loading in the CANISTER will be placed in the center positions. However, the single fuel assembly having the shortest cooling time will be loaded in either position 24 or position 33. Fuel positions 1, 2, 3, 4, 5, 6, 12, 13, 19, 20, 28, 29, 37, 38, 44, 45, 51, 52, 53, 54, 55 and 56 are periphery positions, where fuel with the longest cooling times will be placed. Fuel with the longest cooling times may be loaded in any of these 22 positions. Designated fuel assemblies with cooling times in the midrange of the shortest and longest cooling times will be divided into two tiers. The fuel assemblies with the shorter cooling times in the midrange will be loaded in the inner intermediate fuel positions - 15, 16, 17, 22, 26, 31, 35, 40, 41, and 42. Fuel assemblies with the longer cooling times in the midrange will be loaded in the outer intermediate fuel positions - 7, 8, 9, 10, 11, 14, 18, 21, 27, 30, 36, 39, 43, 46, 47, 48, 49 and 50. These loading patterns result in the placement of fuel such that the shortest-cooled fuel is in the center of the basket and the longest-cooled fuel is on the periphery. Based on engineering evaluations, this loading pattern ensures that fuel assembly allowable cladding temperatures are satisfied.

(continued)

B 2.1.3 Maine Yankee SITE SPECIFIC FUEL Preferential Loading

The estimated Maine Yankee SITE SPECIFIC FUEL inventory is shown in Table 12B2-6. As shown in this table, certain of the Maine Yankee fuel configurations must be preferentially loaded in specific basket fuel tube positions.

Corner positions are used for CONSOLIDATED FUEL, certain HIGH BURNUP FUEL and DAMAGED FUEL or FUEL DEBRIS loaded in a MAINE YANKEE FUEL CAN, for fuel assemblies with missing fuel rods, burnable poison rods or fuel assemblies with fuel rods that have been replaced by hollow Zircaloy rods. Designation for placement in corner positions results primarily from shielding or criticality evaluations of these fuel configurations. CONSOLIDATED FUEL is conservatively designated for a corner position, even though analysis shows that these lattices could be loaded in any basket position. Corner positions are positions 3, 6, 19, and 22 in Figure 12B2-1.

Preferential loading is also used for HIGH BURNUP fuel not loaded in the MAINE YANKEE FUEL CAN. This fuel is assigned to peripheral locations, positions 1, 2, 3, 6, 7, 12, 13, 18, 19, 22, 23, and 24 in Figure 12B2-1. The interior locations must be loaded with fuel that has lower burnup and/or longer cool times to maintain the design basis heat load and component temperature limits for the basket and canister, and the spent fuel short-term temperature limits, as described in Section B 2.1.2.

One of the three loading patterns (Standard, 1.05 kW (periphery), or 0.958 kW [periphery]) shown in Table 12B2-8 must be used to load each canister. Once selected, all of the spent fuel in that canister must be loaded in accordance with that pattern. Within a pattern, mixing of enrichment and cool time is allowed, but no mixing of loading patterns is permitted. For example, choosing a Perf (1.05) pattern restricts the interior fuel to the cool times shown in the Perf (1.05i) column, and the peripheral fuel to the cool times shown in the Perf (1.05p) column.

Fuel assemblies with a control element assembly (CEA) inserted will be loaded in a Class 2 canister and basket due to the increased length of the assembly with the CEA installed. However, these assemblies are not restricted as to loading position within the basket. Fuel assemblies with non-fuel items installed in corner guide tubes of the fuel assembly must also have a flow mixer installed and must be loaded in a basket corner fuel position in a Class 2 canister.

(continued)

Table 12B2-1

Fuel Assembly Limits

I. NAC-UMS® CANISTER: PWR FUEL

A. Allowable Contents

1. Uranium oxide PWR INTACT FUEL ASSEMBLIES listed in Table 12B2-2 and meeting the following specifications:

a.	Cladding Type:	Zircaloy with thickness as specified in Table 12B2-2 for the applicable fuel assembly class.
b.	Enrichment, Post-irradiation Cooling Time and Average Burnup Per Assembly:	Maximum enrichment limits are shown in Table 12B2-2. For variable enrichment fuel assemblies, maximum enrichments represent peak rod enrichments. Combined minimum enrichment, maximum burnup and minimum cool time limits are shown in Table 12B2-4.
c.	Decay Heat Per Assembly:	≤ 958.3 watts †
d.	Nominal Fresh Fuel Assembly Length (in.):	≤ 178.3
e.	Nominal Fresh Fuel Assembly Width (in.):	≤ 8.54
f.	Fuel Assembly Weight (lbs.):	≤ 1,602 ‡

† Decay heat may be higher for site-specific configurations, which control fuel loading position.

‡ Includes the weight of nonfuel-bearing components.

B. Quantity per CANISTER: Up to 24 PWR INTACT FUEL ASSEMBLIES.

C. PWR INTACT FUEL ASSEMBLIES may contain a flow mixer, an in-core instrument thimble or a burnable poison rod insert (Class 1 and Class 2 contents) consistent with Table 12B2-2.

D. PWR INTACT FUEL ASSEMBLIES shall not contain a control element assembly, except as permitted for site-specific fuel.

E. Stainless steel spacers may be used in CANISTERS to axially position PWR INTACT FUEL ASSEMBLIES that are shorter than the available cavity length to facilitate handling.

F. Unenriched fuel assemblies are not authorized for loading.

G. The minimum length of the PWR INTACT FUEL ASSEMBLY internal structure and bottom end fitting and/or spacers shall ensure that the minimum distance to the fuel region from the base of the CANISTER is 3.2 inches.

H. PWR INTACT FUEL ASSEMBLIES with one or more grid spacers missing or damaged such that the unsupported length of the fuel rods does not exceed 60 inches. End fitting damage including damaged or missing hold-down springs is allowed, as long as the assembly can be handled safely by normal means.

Table 12B2-1

Fuel Assembly Limits (continued)

II. NAC-UMS® CANISTER: BWR FUEL

A. Allowable Contents

1. Uranium oxide BWR INTACT FUEL ASSEMBLIES listed in Table 12B2-3 and meeting the following specifications:

a. Cladding Type:	Zircaloy with thickness as specified in Table 12B2-3 for the applicable fuel assembly class.
b. Enrichment:	Maximum and minimum INITIAL PEAK PLANAR-AVERAGE ENRICHMENTS are 4.0 and 1.9 wt % ^{235}U, respectively. Fuel enrichment, burnup and cooling time are related as shown in Table 12B2-5.
c. Decay Heat per Assembly:	$\leq$ 410.7 watts
d. Post-irradiation Cooling Time and Average Burnup Per Assembly:	As specified in Table 12B2-5 and for the applicable fuel assembly class.
e. Nominal Fresh Fuel Design Assembly Length (in.):	$\leq$ 176.1
f. Nominal Fresh Fuel Design Assembly Width (in.):	$\leq$ 5.51
g. Fuel Assembly Weight (lbs):	$\leq$ 702, including channels

Approved Contents
B 2.0

Table 12B2-1
Fuel Assembly Limits (continued)

B. Quantity per CANISTER: Up to 56 BWR INTACT FUEL ASSEMBLIES

C. BWR INTACT FUEL ASSEMBLIES can be unchanneled or channeled with Zircaloy channels.

D. BWR INTACT FUEL ASSEMBLIES with stainless steel channels shall not be loaded.

E. Stainless steel fuel spacers may be used in CANISTERS to axially position BWR INTACT FUEL ASSEMBLIES that are shorter than the available cavity length to facilitate handling.

F. Unenriched fuel assemblies are not authorized for loading.

G. The minimum length of the BWR INTACT FUEL ASSEMBLY internal structure and bottom end fitting and/or spacers shall ensure that the minimum distance to the fuel region from the base of the CANISTER is 6.2 inches.

Table 12B2-2 PWR Fuel Assembly Characteristics

Fuel Class	Vendor[1]	Array	Max. MTU	W/0 Boron Max. wt % ^{235}U [4]	With Boron Max. wt % ^{235}U [5]	No of Fuel Rods	No of Water Holes	Max. Pitch (in)	Min. Rod Dia. (in)	Min. Clad Thick (in)	Max. Pellet Dia.(in)	Max. Active Length (in)	Min. Guide Tube Thick (in)
1	CE	14×14	0.404	4.7	5.0	176	5	0.590	0.438	0.024	0.380	137.0	0.034
1	Ex/ANF	14×14	0.369	5.0	- -	179	17	0.556	0.424	0.030	0.351	142.0	0.034
1	WE	14×14	0.362	5.0	- -	179	17	0.556	0.400	0.024	0.345	144.0	0.034
1	WE	14×14	0.415	5.0	- -	179	17	0.556	0.422	0.022	0.368	145.2	0.034
1	WE, Ex/ANF	15×15	0.465	4.4	5.0	204	21	0.563	0.422	0.024	0.366	144.0	0.015
1	Ex/ANF	17×17	0.413	4.4	5.0	264	25	0.496	0.360	0.025	0.303	144.0	0.016
1	WE	17×17	0.468	4.4	5.0	264	25	0.496	0.374	0.022	0.323	144.0	0.016
1	WE	17×17	0.429	4.3	5.0	264	25	0.496	0.360	0.022	0.309	144.0	0.016
2	B&W	15×15	0.481	4.4	5.0	208	17	0.568	0.430	0.026	0.369	144.0	0.016
2	B&W	17×17	0.466	4.4	5.0	264	25	0.502	0.379	0.024	0.324	143.0	0.017
3	CE	16×16	0.442	4.8	5.0	236[3]	5	0.506	0.382	0.023	0.3255	150.0	0.035
1	Ex/ANF[2]	14×14	0.375	5.0	- -	179	17	0.556	0.417	0.030	0.351	144.0	0.036
1	CE[2]	15×15	0.432	4.2	5.0	216	9 [6]	0.550	0.418	0.026	0.358	132.0	----
1	Ex/ANF[3]	15×15	0.431	4.2	5.0	216	9 [6]	0.550	0.417	0.030	0.358	131.8	----
1	CE[2]	16×16	0.403	4.8	5.0	236	5	0.506	0.382	0.023	0.3255	136.7	0.035

Note: Parameters shown are nominal pre-irradiation values.

1. Vendor ID indicates the source of assembly base parameters, which are nominal, pre-irradiation values. Loading of assemblies meeting above limits is not restricted to the vendor(s) listed.
2. 14×14, 15×15 and 16×16 fuel manufactured for Prairie Island, Palisades and St. Lucie 2 cores, respectively. These are not generic fuel assemblies provided to multiple reactors.
3. Fuel rod positions may be occupied by burnable poison rods or solid filler rods.
4. Maximum initial enrichment without boron credit. Assemblies meeting this limit may contain a flow mixer, an ICI thimble or a burnable poison rod insert.
5. Maximum initial enrichment with taking credit for a minimum soluble boron concentration of 1000-ppm in the spent fuel pool water. Assemblies meeting this limit may contain a flow mixer.
6. 9 non-fuel locations, which may be filled by solid non-fuel rods.

Table 12B2-3 BWR Fuel Assembly Characteristics

Fuel Class[1,5]	Vendor[4]	Array	Max. MTU	Max. wt % ^{235}U [5]	No of Fuel Rods	Max. Pitch (in)	Min. Rod Dia. (in)	Min. Clad Thick (in)	Max. Pellet Dia.(in)	Max. Active Length (in)[2]
4[5]	Ex/ANF	7 × 7	0.196	4.5	48	0.738	0.570	0.036	0.490	144.0
4	Ex/ANF	8 × 8	0.177	4.7	63	0.641	0.484	0.036	0.405	145.2
4	Ex/ANF	9 × 9	0.173	4.4	79	0.572	0.424	0.030	0.357	145.2
4	GE	7 × 7	0.199	4.5	49	0.738	0.570	0.036	0.488	144.0
4	GE	7 × 7	0.198	4.5	49	0.738	0.563	0.032	0.487	144.0
4	GE	8 × 8	0.173	4.5	60	0.640	0.484	0.032	0.410	145.2
4	GE	8 × 8	0.179	4.5	62	0.640	0.483	0.032	0.410	145.2
4	GE	8 × 8	0.186	4.7	63	0.640	0.493	0.034	0.416	144.0
5	Ex/ANF	8 × 8	0.180	4.6	62	0.641	0.484	0.036	0.405	150.0
5	Ex/ANF	9 × 9	0.167	4.4	74[3]	0.572	0.424	0.030	0.357	150.0
5[6]	Ex/ANF	9 × 9	0.178	4.5	79[3]	0.572	0.424	0.030	0.357	150.0
5	GE	7 × 7	0.193	4.7	49	0.738	0.563	0.037	0.477	146.0
5	GE	7 × 7	0.198	4.5	49	0.738	0.563	0.032	0.487	144.0
5	GE	8 × 8	0.179	4.5	60	0.640	0.484	0.032	0.410	150.0
5	GE	8 × 8	0.185	4.5	62	0.640	0.483	0.032	0.410	150.0
5	GE	8 × 8	0.188	4.7	63	0.640	0.493	0.034	0.416	146.0
5	GE	9 × 9	0.186	4.5	74[3]	0.566	0.441	0.028	0.376	150.0
5	GE	9 × 9	0.198	4.6	79[3]	0.566	0.441	0.028	0.376	150.0

Note: Parameters shown are nominal pre-irradiation values.

1. All fuel rods are Zircaloy clad.
2. 150 inch active fuel length assemblies contain 6" natural uranium blankets on top and bottom.
3. Shortened active fuel length in some rods.
4. Vendor ID indicates the source of assembly base parameters, which are nominal, pre-irradiation values. Loading of assemblies meeting above limits is not restricted to the vendor(s) listed.
5. UMS Class 4 and 5 for BWR 2/3 fuel.
6. Assembly width including channel. Unchanneled or channeled assemblies may be loaded based on a maximum channel thickness of 120 mil.

Table 12B2-4 Minimum Cooling Time Versus Burnup/Initial Enrichment for PWR Fuel

Minimum Initial Enrichment wt % ^{235}U (E)	**Burnup ≤30 GWD/MTU Minimum Cooling Time [years]**				**30< Burnup ≤35 GWD/MTU Minimum Cooling Time [years]**			
	14×14	**15×15**	**16×16**	**17×17**	**14×14**	**15×15**	**16×16**	**17×17**
1.9 ≤ E < 2.1	5	5	5	5	7	7	5	7
2.1 ≤ E < 2.3	5	5	5	5	7	6	5	6
2.3 ≤ E < 2.5	5	5	5	5	6	6	5	6
2.5 ≤ E < 2.7	5	5	5	5	6	6	5	6
2.7 ≤ E < 2.9	5	5	5	5	6	5	5	5
2.9 ≤ E < 3.1	5	5	5	5	5	5	5	5
3.1 ≤ E < 3.3	5	5	5	5	5	5	5	5
3.3 ≤ E < 3.5	5	5	5	5	5	5	5	5
3.5 ≤ E < 3.7	5	5	5	5	5	5	5	5
3.7 ≤ E ≤ 4.9	5	5	5	5	5	5	5	5
E ≥ 4.9	5	5	5	5	5	5	5	5
Minimum Initial Enrichment wt % ^{235}U (E)	**35< Burnup ≤40 GWD/MTU Minimum Cooling Time [years]**				**40< Burnup ≤45 GWD/MTU Minimum Cooling Time [years]**			
	14×14	**15×15**	**16×16**	**17×17**	**14×14**	**15×15**	**16×16**	**17×17**
1.9 ≤ E < 2.1	10	10	7	10	15	15	11	15
2.1 ≤ E < 2.3	9	9	7	9	14	13	10	13
2.3 ≤ E < 2.5	8	8	6	8	12	13	10	12
2.5 ≤ E < 2.7	8	8	6	8	11	13	10	12
2.7 ≤ E < 2.9	7	8	6	8	10	12	9	12
2.9 ≤ E < 3.1	7	8	6	8	9	12	9	11
3.1 ≤ E < 3.3	6	8	6	7	8	12	9	10
3.3 ≤ E < 3.5	6	8	6	7	8	12	9	10
3.5 ≤ E < 3.7	6	8	6	6	8	11	9	10
3.7 ≤ E ≤3.9	6	7	6	6	8	10	9	10
3.9 ≤ E ≤4.1	6	6	6	6	8	10	9	10
4.1 ≤ E ≤4.3	5	6	6	6	8	10	9	10
4.3 ≤ E ≤4.7	5	6	6	6	7	10	8	9
4.7 ≤ E ≤4.9	5	6	5	6	6	10	8	9
E ≥ 4.9	5	6	5	6	6	10	8	9

B 3.0 DESIGN FEATURES

B 3.1 Site

B 3.1.1 Site Location

The NAC-UMS® SYSTEM is authorized for general use by 10 CFR 50 license holders at various site locations under the provisions of 10 CFR 72, Subpart K.

B 3.2 Design Features Important for Criticality Control

B 3.2.1 CANISTER-INTACT FUEL ASSEMBLIES

a) Minimum ^{10}B loading in the BORAL neutron absorbers:
   1. PWR – $0.025 g/cm^2$
   2. BWR – $0.011 g/cm^2$

b) Minimum length of INTACT FUEL ASSEMBLY internal structure and bottom end fitting and/or spacers shall ensure the minimum distance to the fuel region from the base of the CANISTER is:
   1. PWR – 3.2 inches
   2. BWR – 6.2 inches

c) Soluble boron concentration in the PWR fuel pool and CANISTER water:
   1. Fuel meeting the enrichment limits in Table 12B2–2 without boron - 0 ppm.
   2. Fuel meeting the enrichment limits in Table 12B2–2 with boron ≥ 1000 ppm.

d) Minimum water temperature for PWR fuel to ensure boron is soluble:
   1. Temperature should be 5 - 10°F higher than the minimum needed to ensure solubility.

B 3.3 Codes and Standards

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), 1995 Edition with Addenda through 1995, is the governing Code for the NAC-UMS® CANISTER.

The American Concrete Institute Specifications ACI-349 (1985) and ACI-318 (1995) govern the NAC-UMS® CONCRETE CASK design and construction, respectively.

The American National Standards Institute ANSI N14.6 (1993) and NUREG-0612 govern the NAC-UMS® TRANSFER CASK design, operation, fabrication, testing, inspection and maintenance.

(continued)

B 3.3.1 Exceptions to Codes, Standards, and Criteria

Table 12B3-1 lists exceptions to the ASME Code for the design of the NAC-UMS® SYSTEM.

B 3.3.2 Construction/Fabrication Exceptions to Codes, Standards, and Criteria

Proposed alternatives to ASME Code, Section III, 1995 Edition with Addenda, through 1995, including exceptions listed in Specification B3.3.1, may be used when authorized by the Director of the Office of Nuclear Material Safety and Safeguards or designee. The request for such alternatives 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 Code, Section III, 1995 Edition with Addenda through 1995, would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Requests for exceptions shall be submitted in accordance with 10 CFR 72.4.

Table 12B3-1 List of ASME Code Exceptions for the NAC-UMS® SYSTEM

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification and Compensatory Measures
CANISTER	NB-1100	Statement of requirements for Code stamping of components.	CANISTER is designed and will be fabricated in accordance with ASME Code, Section III, Subsection NB to the maximum practical extent, but Code stamping is not required. The completion of an ASME Design Specification, Design Report and Overpressure Protection Report are not required.
CANISTER	NB-2000	Requirements to be supplied by ASME-approved material supplier.	Materials will be supplied by NAC-approved suppliers with Certified Material Test Reports (CMTRs) in accordance to NB-2000 requirements.
CANISTER Shield Lid and Structural Lid Welds	NB-4243	Full penetration welds required for Category C joints (flat head to main shell per NB-3352.3).	Shield lid and structural lid to CANISTER shell welds are not full penetration welds. These field welds are performed independently to provide a redundant closure. Leaktightness of the CANISTER is verified by testing.
CANISTER Structural Lid Weld	NB-4421	Requires removal of backing ring.	Structural lid to CANISTER shell weld uses a backing ring that is not removed. The backing ring permits completion of the groove weld; it is not considered in any analyses; and it has no detrimental effect on the CANISTER's function.
CANISTER Vent Port Cover and Drain Port Cover to Shield Lid Welds; Shield Lid to Canister Shell Weld	NB-5230	Radiographic (RT) or ultrasonic (UT) examination required.	Root and final surface liquid penetrant examination to be performed per ASME Code Section V, Article 6, with acceptance in accordance with ASME Code, Section III, NB-5350.

Table 12B3-1 List of ASME Code Exceptions for the NAC-UMS® SYSTEM (continued)

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification and Compensatory Measures
CANISTER Structural Lid to Shell Weld	NB-5230	Radiographic (RT) or ultrasonic (UT) examination required.	The CANISTER structural lid to CANISTER shell closure weld is performed in the field following fuel assembly loading. The structural lid-to-shell weld will be verified by either ultrasonic (UT) or progressive liquid penetrant (PT) examination. If progressive PT examination is used, at a minimum, it must include the root and final layers and each approximately 3/8 inch of weld depth. If UT examination is used, it will be followed by a final surface PT examination. For either UT or PT examination, the maximum, undetectable flaw size is demonstrated to be smaller than the critical flaw size. The critical flaw size is determined in accordance with ASME Code, Section XI methods. The examination of the weld will be performed by qualified personnel per ASME Code Section V, Articles 5 (UT) and 6 (PT) with acceptance per ASME Code Section III, NB-5332 (UT) per 1995 Addenda, and NB-5350 for (PT).

APPENDIX 12C

TECHNICAL SPECIFICATION BASES FOR THE NAC-UMS® SYSTEM

Appendix 12C
Table of Contents

C 3.1 NAC-UMS® SYSTEM Integrity

C 3.1.1 CANISTER Maximum Time in Vacuum Drying

BASES

BACKGROUND	A TRANSFER CASK with an empty CANISTER is placed into the spent fuel pool and loaded with fuel assemblies meeting the requirements of the Approved Contents limits. A shield lid is then placed on the CANISTER. The TRANSFER CASK and CANISTER are raised out of the spent fuel pool. The TRANSFER CASK and CANISTER are then moved into the cask decontamination area, where dose rates are measured and the CANISTER shield lid is welded to the CANISTER shell and the lid weld is examined, pressure tested, and leak tested. The water is drained from the CANISTER, and CANISTER cavity vacuum drying is performed. The CANISTER cavity is then backfilled with helium. Additional dose rates are measured, and the CANISTER vent port and drain port covers and structural lid are installed and welded. Non-destructive examinations are performed on the welds. Contamination measurements are completed prior to moving the TRANSFER CASK and CANISTER in position to transfer the CANISTER to the CONCRETE CASK. After the CANISTER is transferred, the CONCRETE CASK is then moved to the ISFSI. Average CONCRETE CASK dose rates are measured at the ISFSI pad. Limiting the elapsed time from the end of CANISTER draining operations through dryness verification testing and subsequent backfilling of the CANISTER with helium ensures that the short-term temperature limits established in the Safety Analyses Report for the spent fuel cladding and CANISTER materials are not exceeded and that the minimum test duration of 30 days (720 hours) considered in PNL-4835 for Zircaloy clad fuel for storage in air is not exceeded.
APPLICABLE SAFETY ANALYSIS	Limiting the total time for loaded CANISTER vacuum drying operations ensures that the short-term temperature limits for the fuel cladding and CANISTER materials are not exceeded. If vacuum drying operations are not completed in the required time period, the CANISTER is backfilled with helium, the TRANSFER CASK and loaded CANISTER are submerged in the spent fuel pool, and the TRANSFER CASK and loaded CANISTER are kept in the pool for a minimum of 24 hours.

(continued)

APPLICABLE SAFETY ANALYSIS (continued)	Analyses reported in the Safety Analysis Report conclude that spent fuel cladding and CANISTER material short-term temperature limits will not be exceeded for total elapsed time in the vacuum drying operation and in the TRANSFER CASK with the CANISTER filled with helium. Since the rate of heat up is slower for lower total heat loads, the time required to reach component limits is longer than for the design basis heat load. Consequently, longer time limits are specified for heat loads below the design basis for the PWR and BWR fuel configurations as shown in LCO 3.1.1. As shown in the LCO, for total heat loads not specified, the time limit for the next higher specified heat load is conservatively applied. Analysis also shows that the fuel cladding and CANISTER component temperatures are well below the allowable temperatures for the time durations specified from the end of in-pool cooling, or end of forced air cooling, of the CANISTER through the completion of the vacuum drying and for the time specified in LCO 3.1.4 for the CANISTER in the TRANSFER CASK when backfilled with helium.
LCO	Limiting the length of time for vacuum drying operations for the CANISTER ensures that the spent fuel cladding and CANISTER material temperatures remain below the short-term temperature limits for the NAC-UMS® SYSTEM.
APPLICABILITY	The elapsed time restrictions for vacuum drying operations on a loaded CANISTER apply during LOADING OPERATIONS from the completion point of CANISTER draining operations through the completion point of the CANISTER dryness verification testing. The LCO is not applicable to TRANSPORT OPERATIONS or STORAGE OPERATIONS.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each NAC-UMS® SYSTEM. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory measures for each NAC-UMS® SYSTEM not meeting the LCO. Subsequent NAC-UMS® SYSTEMS that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

(continued)

C 3.1 NAC-UMS® SYSTEM Integrity

C 3.1.2 CANISTER Vacuum Drying Pressure

BASES

BACKGROUND	A TRANSFER CASK with an empty CANISTER is placed into the spent fuel pool and loaded with fuel assemblies meeting the requirements of the Approved Contents Limits. A shield lid is then placed on the CANISTER. The TRANSFER CASK and CANISTER are raised out of the spent fuel pool. The TRANSFER CASK and CANISTER are then moved into the cask decontamination area, where dose rates are measured and the CANISTER shield lid is welded to the CANISTER shell and the lid weld is examined, pressure tested, and leak tested. The water is drained from the CANISTER, and CANISTER cavity vacuum drying is performed. The CANISTER cavity is then backfilled with helium. Additional dose rates are measured, and the CANISTER vent port and drain port covers and structural lid are installed and welded. Non-destructive examinations are performed on the welds. Contamination measurements are completed prior to moving the TRANSFER CASK and CANISTER in position to transfer the CANISTER to the CONCRETE CASK. After the CANISTER is transferred, the CONCRETE CASK is then moved to the ISFSI. Average CONCRETE CASK dose rates are measured at the ISFSI pad. CANISTER cavity vacuum drying is utilized to remove residual moisture from the CANISTER cavity after the water is drained from the CANISTER. Any water not drained from the CANISTER cavity evaporates due to the vacuum. This is aided by the temperature increase, due to the heat generation of the fuel.
APPLICABLE SAFETY ANALYSIS	The confinement of radioactivity (including fission product gases, fuel fines, volatiles, and crud) during the storage of design basis spent fuel in the CANISTER is ensured by the multiple confinement boundaries and systems. The barriers relied on are: the fuel pellet matrix, the metallic fuel cladding tubes where the fuel pellets are contained, and the CANISTER where the fuel assemblies are stored. Long-term integrity of the fuel and cladding depends on storage in an inert atmosphere. This is accomplished by removing water from the CANISTER and backfilling the cavity with helium. The thermal analysis assumes that the CANISTER cavity is dried and filled with helium.

(continued)

APPLICABLE SAFETY ANALYSIS (continued)	The heat-up of the CANISTER and contents will occur during CANISTER vacuum drying, but is controlled by LCO 3.1.1.
LCO	A vacuum pressure, meeting the limit specified in LCO 3.1.2, indicates that liquid water has evaporated and been removed from the CANISTER cavity. Removing water from the CANISTER cavity helps to ensure the long-term maintenance of fuel cladding integrity.
APPLICABILITY	Cavity vacuum drying is performed during LOADING OPERATIONS before the TRANSFER CASK holding the CANISTER is moved to transfer the CANISTER into the CONCRETE CASK. Therefore, the vacuum requirements do not apply after the CANISTER is backfilled with helium and leak tested prior to TRANSPORT OPERATIONS and STORAGE OPERATIONS.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each CANISTER. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory measures for each CANISTER not meeting the LCO. Subsequent CANISTERs that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. <u>A.1</u> If the CANISTER cavity vacuum drying pressure limit cannot be met, actions must be taken to meet the LCO. Failure to successfully complete cavity vacuum drying could have many causes, such as failure of the vacuum drying system, inadequate draining, ice clogging of the drain lines, or leaking CANISTER welds. The Completion Time is sufficient to determine and correct most failure mechanisms. Excessive heat-up of the CANISTER and contents is precluded by LCO 3.1.1. <u>B.1</u> If the CANISTER fuel cavity cannot be successfully vacuum dried, the fuel must be placed in a safe condition. Corrective actions may be taken after the fuel is placed in a safe condition to perform the A.1 action provided that the initial conditions for performing A.1 are met.

(continued)

APPLICABLE SAFETY ANALYSIS (continued)	environment. This is accomplished by removing water from the CANISTER cavity and backfilling the cavity with an inert gas. The heat-up of the CANISTER and contents will continue following backfilling with helium, but is controlled by LCO 3.1.4. The thermal analyses of the CANISTER assume that the CANISTER cavity is dried and filled with dry helium.
LCO	Backfilling the CANISTER cavity with helium at a pressure equal to atmospheric pressure ensures that there is no air in-leakage into the CANISTER, which could decrease the heat transfer properties and result in increased cladding temperatures and damage to the fuel cladding over the storage period. The helium backfill pressure specified in LCO 3.1.3 was selected based on a minimum helium purity of 99.9% to ensure that the CANISTER internal pressure and heat transfer from the CANISTER to the environment are maintained consistent with the design and analysis basis of the CANISTER.
APPLICABILITY	Helium backfill is performed during LOADING OPERATIONS, before the TRANSFER CASK and CANISTER are moved to the CONCRETE CASK for transfer of the CANISTER. Therefore, the backfill pressure requirements do not apply after the CANISTER is backfilled with helium and leak tested prior to TRANSPORT OPERATIONS and STORAGE OPERATIONS.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each CANISTER. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory measures for each CANISTER not meeting the LCO. Subsequent CANISTERs that do not meet the LCO are governed by subsequent condition entry and application of associated Required Actions. <u>A.1</u> If the backfill pressure cannot be established within limits, actions must be taken to meet the LCO. The Completion Time is sufficient to determine and correct most failures, which would prevent backfilling of the CANISTER cavity with helium. These actions include identification and repair of helium leak paths or replacement of the helium backfill equipment.

(continued)

ACTIONS (continued) B.1

If the CANISTER cavity cannot be backfilled with helium to the specified pressure, the fuel must be placed in a safe condition. Corrective actions may be taken after the fuel is placed in a safe condition to perform the A.1 action provided that the initial conditions for performing A.1 are met. A.1 may be repeated as necessary prior to performing B.1. The time frame for completing B.1 cannot be extended by reperforming A.1. The Completion Time is reasonable based on the time required to re-flood the CANISTER, perform cooldown operations, cut the CANISTER shield lid weld, move the TRANSFER CASK and CANISTER into the spent fuel pool, remove the CANISTER shield lid, and remove the spent fuel assemblies in an orderly manner and without challenging personnel.

SURVEILLANCE REQUIREMENTS SR 3.1.3.1

The long-term integrity of the stored fuel is dependent on storage in a dry, inert atmosphere and maintenance of adequate heat transfer mechanisms. Filling the CANISTER cavity with helium at a pressure within the range specified in LCO 3.1.3 will ensure that there will be no air in-leakage, which could potentially damage the fuel. This pressure of helium gas is sufficient to maintain fuel cladding temperatures within acceptable levels.

Backfilling of the CANISTER cavity must be performed successfully on each CANISTER before placing it in storage. The surveillance must verify that the CANISTER helium backfill pressure is within the limit specified prior to installation of the structural lid.

REFERENCES

1. SAR Sections 4.4, 7.1 and 8.1.

C 3.1 NAC-UMS® SYSTEM Integrity

C 3.1.4 CANISTER Maximum Time in the TRANSFER CASK

BASES

BACKGROUND	A TRANSFER CASK with an empty CANISTER is placed into the spent fuel pool and loaded with fuel assemblies meeting the requirements of the Approved Contents limits. A shield lid is then placed on the CANISTER. The TRANSFER CASK and CANISTER are raised out of the spent fuel pool. The TRANSFER CASK and CANISTER are then moved into the cask decontamination area, where dose rates are measured and the CANISTER shield lid is welded to the CANISTER shell and the lid weld is examined, pressure tested, and leak tested. The water is drained from the CANISTER, and CANISTER cavity vacuum drying is performed. The CANISTER cavity is then backfilled with helium. Additional dose rates are measured, and the CANISTER vent port and drain port covers and structural lid are installed and welded. Non-destructive examinations are performed on the welds. Contamination measurements are completed prior to moving TRANSFER CASK and CANISTER in position to transfer the CANISTER to the CONCRETE CASK. After the CANISTER is transferred, the CONCRETE CASK is then moved to the ISFSI. Average CONCRETE CASK dose rates are measured at the ISFSI pad. Backfilling the CANISTER cavity with helium promotes heat transfer from the fuel and the inert atmosphere protects the fuel cladding. Limiting the total time the loaded CANISTER is in the TRANSFER CASK, prior to its placement in the CONCRETE CASK, ensures that the short-term temperature limits established in the Safety Analysis Report for the spent fuel cladding and CANISTER materials are not exceeded.
APPLICABLE SAFETY ANALYSIS	Limiting the total time that a loaded CANISTER backfilled with helium may be in the TRANSFER CASK, prior to placement in the CONCRETE CASK, ensures that the short-term temperature limits for the spent fuel cladding and CANISTER materials are not exceeded. Upon placement of the loaded CANISTER in the CONCRETE CASK, the temperatures of the CANISTER and stored spent fuel will return to normal storage condition values due to the more efficient passive heat transfer characteristics of the CONCRETE CASK. Ensuring temperatures are maintained below short-term limits

(continued)

APPLICABLE SAFETY ANALYSIS (continued)	for a limited time period and returning them to values below long-term limits will prevent damage to the spent fuel cladding and the CANISTER materials. Analyses reported in the Safety Analysis Report conclude that spent fuel cladding and CANISTER material short-term temperature limits will not be exceeded for the total elapsed times specified in LCO 3.1.4, in the TRANSFER CASK. Since the rate of heat up is slower for lower total heat loads, the time required to reach component limits is longer than for the design basis heat load. As shown in the LCO, for total heat loads not specified, the time limit for the next higher specified heat load is conservatively applied. The thermal analysis shows that the fuel cladding and CANISTER component temperatures are below their allowable temperatures for the time durations specified, with the CANISTER in the TRANSFER CASK and backfilled with helium, after completion of 24 hours of in pool or forced air cooling. The basis for forced air cooling is an inlet maximum air temperature of 76°F which is the maximum normal ambient air temperature in the thermal analysis. The specified 375 CFM air flow rate exceeds the CONCRETE CASK natural convective cooling flow rate by a minimum of 10 percent. This comparative analysis conservatively excludes the higher flow velocity resulting from the smaller annulus between the TRANSFER CASK and CANISTER, which would result in improved heat transfer from the CANISTER.
LCO	Limiting the length of time that the loaded CANISTER backfilled with helium is allowed to remain in the TRANSFER CASK ensures that the spent fuel cladding and CANISTER material temperatures remain below the short-term temperature limits established in the SAR for the NAC-UMS® SYSTEM. The time duration is a function of the design of the TRANSFER CASK and the NAC-UMS® SYSTEM.
APPLICABILITY	The elapsed time restrictions on the loaded CANISTER apply during LOADING OPERATIONS from the completion point of the CANISTER vacuum dryness verification through completion of the transfer from the TRANSFER CASK to the CONCRETE CASK.

(continued)

C 3.1 NAC-UMS® SYSTEM Integrity

C 3.1.5 CANISTER Helium Leak Rate

BASES

BACKGROUND	A TRANSFER CASK with an empty CANISTER is placed into the spent fuel pool and loaded with fuel assemblies meeting the requirements of the Approved Contents limits. A shield lid is then placed on the CANISTER. The TRANSFER CASK and CANISTER are raised out of the spent fuel pool. The TRANSFER CASK and CANISTER are then moved into the cask decontamination area, where dose rates are measured and the CANISTER shield lid is welded to the CANISTER shell and the lid weld is examined, pressure tested, and leak tested. The water is drained from the CANISTER, and CANISTER cavity vacuum drying is performed. The CANISTER cavity is then backfilled with helium. Additional dose rates are measured, and the CANISTER vent port and drain port covers and structural lid are installed and welded. Non-destructive examinations are performed on the welds. Contamination measurements are completed prior to moving TRANSFER CASK and CANISTER in position to transfer the CANISTER to the CONCRETE CASK. After the CANISTER is transferred, the CONCRETE CASK is then moved to the ISFSI. Average CONCRETE CASK dose rates are measured at the ISFSI pad. Backfilling the CANISTER cavity with helium promotes heat transfer from the fuel to the CANISTER shell. The inert atmosphere protects the fuel cladding. Prior to transferring the CANISTER to the CONCRETE CASK, the CANISTER helium leak rate is verified to meet leaktight requirements to ensure that the fuel and helium backfill gas is confined.
APPLICABLE SAFETY ANALYSIS	The confinement of radioactivity (including fission product gases, fuel fines, volatiles, and crud) during the storage of spent fuel in the CANISTER is ensured by the multiple confinement boundaries and systems. The barriers relied on are: the fuel pellet matrix, the metallic fuel cladding tubes where the fuel pellets are contained, and the CANISTER where the fuel assemblies are stored. Long-term integrity of the fuel and cladding depends on maintaining an inert atmosphere, and maintaining the cladding temperatures below established long-term limits. This is accomplished by removing water from the CANISTER and backfilling the cavity with helium. The heat-up of the CANISTER and contents will continue following backfilling the cavity and leak testing the shield lid-to-shell weld, but is controlled by LCO 3.1.4.

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LCO	Verifying that the CANISTER cavity helium leak rate is below the leaktight limit specified in LCO 3.1.5 ensures that the CANISTER shield lid is sealed. Verifying that the helium leak rate is below leaktight levels will also ensure that the assumptions in the accident analyses and radiological evaluations are maintained.
APPLICABILITY	The leaktight helium leak rate verification is performed during LOADING OPERATIONS before the TRANSFER CASK and integral CANISTER are moved for transfer operations to the CONCRETE CASK. TRANSPORT OPERATIONS would not commence if the CANISTER helium leak rate was not below the test sensitivity. Therefore, CANISTER leak rate testing is not required during TRANSPORT OPERATIONS or STORAGE OPERATIONS.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each CANISTER. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory measures for each CANISTER not meeting the LCO. Subsequent CANISTERs that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. <u>A.1</u> If the helium leak rate limit is not met, actions must be taken to meet the LCO. The Completion Time is sufficient to determine and correct most failures, which could cause a helium leak rate in excess of the limit. Actions to correct a failure to meet the helium leak rate limit would include, in ascending order of performance, 1) verification of helium leak test system performance; 2) inspection of weld surfaces to locate helium leakage paths using a helium sniffer probe; and 3) weld repairs, as required, to eliminate the helium leakage. Following corrective actions, the helium leak rate verification shall be reperformed.

(continued)

REFERENCES	1.	SAR Chapter 4 and Chapter 11, Section 11.2.13.

C 3.1 NAC-UMS® SYSTEM Integrity

C 3.1.7 CANISTER Removal from the CONCRETE CASK

BASES

BACKGROUND	A loaded CANISTER is removed from a CONCRETE CASK using the TRANSFER CASK, so that the CANISTER may be transferred to another CONCRETE CASK or transferred to a TRANSPORT CASK for purposes of transport. The CANISTER is removed from the CONCRETE CASK using the procedure provided in Section 8.2. Once in the TRANSFER CASK, the CANISTER begins to heat up due to the decay heat of the contents and the reduced heat transfer provided by the TRANSFER CASK compared to the CONCRETE CASK. The CANISTER time in the TRANSFER CASK is limited when forced air cooling is not used to ensure that the short-term temperature limits established in the Safety Analysis Report for the spent fuel cladding and CANISTER materials are not exceeded. If forced air cooling is maintained, then the CANISTER time in the TRANSFER CASK is limited to 600 hours. This limit ensures that the short-term temperature limits of the spent fuel cladding and of the CANISTER components are not exceeded and that the minimum test duration of 30 days (720 hours) considered in PNL-4835 for Zircaloy clad fuel for storage in air is not exceeded.
APPLICABLE SAFETY ANALYSIS	Limiting the total time that a loaded CANISTER backfilled with helium may be in the TRANSFER CASK, prior to unloading the CANISTER from the TRANSFER CASK, ensures that the short-term temperature limits for the spent fuel cladding and CANISTER materials are not exceeded. Upon placement of the loaded CANISTER in the CONCRETE CASK or TRANSPORT CASK, the temperatures of the

(continued)

APPLICABLE SAFETY ANALYSIS (continued)

CANISTER and stored spent fuel will return to normal storage or transport condition values due to the more efficient passive heat transfer characteristics of the CONCRETE CASK or TRANSPORT CASK.

This ensures that temperatures are maintained below short-term limits for a limited time period. Returning these temperatures to values below long-term limits will prevent damage to the spent fuel cladding and the CANISTER materials.

From calculated temperatures reported in the Safety Analysis Report, it can be concluded that spent fuel cladding and CANISTER material short-term temperature limits will not be exceeded for a total elapsed time of greater than 6 hours (PWR or BWR configurations), if the loaded CANISTER backfilled with helium is in the TRANSFER CASK. After 4 hours, forced airflow cooling is used to ensure cooling of the CANISTER. The analysis provided in the Safety Analysis Report shows that the spent fuel cladding and CANISTER temperatures will be at or below their long-term limits, as long as the cooling airflow is maintained. This forced airflow provides a similar rate of cooling to that provided by the passive airflow cooling provided by the CONCRETE CASK. The basis for forced air cooling is an inlet maximum air temperature of 76°F, which is the maximum normal ambient air temperature in the thermal analysis. The specified 375 CFM air flow rate exceeds the CONCRETE CASK natural

(continued)

APPLICABLE SAFETY ANALYSIS (continued)	convective cooling flow rate by a minimum of 10 percent. This comparative analysis conservatively excludes the higher flow velocity resulting from the smaller annulus between the TRANSFER CASK and CANISTER, which would result in improved heat transfer from the CANISTER. If forced air flow is continuously maintained for a period of 24 hours, or longer, then the temperatures of the spent fuel cladding and CANISTER components are at the values calculated for the CONCRETE CASK normal conditions. Consequently, forced air cooling may be ended, allowing a new entry into Condition A. This provides a new minimum 4-hour period in which continuation of the TRANSFER OPERATIONS may occur.
LCO	Limiting the length of time that the loaded CANISTER backfilled with helium is allowed to remain in the TRANSFER CASK without forced air cooling ensures that the spent fuel cladding and CANISTER material temperatures remain below the short-term temperature limits established in the SAR for the NAC-UMS® SYSTEM. Once forced air cooling is established, the amount of time the CANISTER resides in the TRANSFER CASK is not limited since the cooling provided by the forced air is equivalent to the passive cooling that is provided by the CONCRETE CASK or TRANSPORT CASK. If forced air flow is continuously maintained for a period of 24 hours, or longer, then the temperatures of the spent fuel cladding and CANISTER components are at, or below, the values calculated for the CONCRETE CASK normal conditions. Therefore, forced air cooling

(continued)

LCO (continued)	may be ended, allowing a new entry into Condition A of this LCO. This provides a new minimum 4-hour period in which continuation of TRANSFER OPERATIONS may occur.
APPLICABILITY	The elapsed time restrictions on the loaded CANISTER apply during TRANSFER OPERATIONS from the completion point of the closing of the TRANSFER CASK shield doors through completion of the unloading of the CANISTER from the TRANSFER CASK.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each NAC-UMS® SYSTEM. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory measures for each NAC-UMS® SYSTEM not meeting the LCO. Subsequent NAC-UMS® SYSTEMS that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. Separate Condition A re-entry is also permitted after 24-hours of continuous forced air cooling in accordance with this LCO. <u>A.1.1</u> If the CANISTER can be loaded into an operable CONCRETE CASK without the LCO time limit being exceeded, then no further action is required since the spent fuel cladding and CANISTER component short-term temperature limits are not exceeded.

(continued)

ACTIONS (continued)

OR

A.1.2

If the CANISTER can be loaded into a TRANSPORT CASK without the LCO time limit being exceeded, then no further action is required since the spent fuel cladding and CANISTER component short-term temperature limits are not exceeded.

OR

A.1.3

If forced air flow is continuously maintained for a period of 24 hours, or longer, then the temperatures of the spent fuel cladding and CANISTER components are at, or below, the values calculated for the CONCRETE CASK normal conditions. Consequently, forced air cooling may be ended, allowing a new entry into Condition A of this LCO. This provides a new minimum 4-hour period in which continuation or completion of TRANSFER OPERATIONS may occur.

B.1.1

Commence supplying air to the TRANSFER CASK annulus using the fill/drain lines at a rate of 375 CFM and a maximum temperature of 76°F. This action provides the equivalent cooling that would be provided by the passive heat removal systems of the CONCRETE CASK or TRANSPORT CASK in normal operations. Consequently, no short-term spent fuel cladding or CANISTER component temperature limits are exceeded.

AND

B.1.2

Maintain the airflow established by B.1.1 for the time period that the CANISTER remains in the TRANSFER CASK. This action provides the equivalent cooling that would be provided by the passive heat removal systems of the CONCRETE CASK or TRANSPORT CASK in normal operations. Consequently, no short-term spent fuel cladding or CANISTER component temperature limits are exceeded.

C 3.3 NAC-UMS® SYSTEM Criticality Control

C 3.3.1 Dissolved Boron Concentration

BASES

BACKGROUND	A TRANSFER CASK with an empty CANISTER is placed into a PWR spent fuel pool and loaded with fuel assemblies meeting the requirements of the Approved Contents Limits shown in Table 12B2-2. A shield lid is then placed on the CANISTER. The TRANSFER CASK and CANISTER are raised out of the spent fuel pool. The TRANSFER CASK and CANISTER are then moved into the cask decontamination area, where dose rates are measured and the CANISTER shield lid is welded to the CANISTER shell and the lid weld is examined, pressure tested, and leak tested. The water is drained from the CANISTER, and CANISTER cavity vacuum drying is performed. The CANISTER cavity is then backfilled with helium. Additional dose rates are measured, and the CANISTER vent port and drain port covers and structural lid are installed and welded. Non-destructive examinations are performed on the welds. Contamination measurements are completed prior to moving the TRANSFER CASK and CANISTER in position to transfer the CANISTER to the CONCRETE CASK. After the CANISTER is transferred, the CONCRETE CASK is then moved to the ISFSI. Average CONCRETE CASK dose rates are measured at the ISFSI pad. CANISTER cavity vacuum drying is utilized to remove residual moisture from the CANISTER cavity after the water is drained from the CANISTER. Any water not drained from the CANISTER cavity evaporates due to the vacuum. This is aided by the temperature increase, due to the heat generation of the fuel.
APPLICABLE SAFETY ANALYSIS	The confinement of radioactivity (including fission product gases, fuel fines, volatiles, and crud) during the storage of design basis spent fuel in the CANISTER is ensured by the multiple confinement boundaries and systems. The barriers relied on are: the fuel pellet matrix, the metallic fuel cladding tubes where the fuel pellets are contained, and the CANISTER where the fuel assemblies are stored. Long-term integrity of the fuel and cladding depends on storage in an inert atmosphere. This is accomplished by removing water from the CANISTER and backfilling the cavity with helium.

(continued)

APPLICABLE SAFETY ANALYSIS (continued)	During loading into, or unloading from, the CANISTER, criticality control of certain PWR fuel requires that the water in the CANISTER contains dissolved boron in a concentration of 1,000 parts per million, or greater. As shown in Table 12B2-2, spent fuel with the enrichments shown in the "without (w/o) boron" column may be loaded with no assured level of boron in the water in the CANISTER. However, spent fuel with the enrichments shown in the "with boron" column must be loaded or unloaded from the CANISTER when the water in the CANISTER has a boron concentration of 1,000 part per million or greater. Since boron concentration varies with water temperature, water temperature must be considered in measuring the boron concentration.
LCO	The criticality analysis shows that PWR fuel with certain combinations of initial enrichment and fuel content requires credit for the presence of at least 1,000 parts per million of boron in solution in the water in the CANISTER (see Section B3.2.1 for the requirements for assuring soluble boron concentration during loading or unloading). This water must be used to flood the canister cavity during underwater PWR fuel loading or unloading. The boron in the pool water ensures sufficient thermal neutron absorption to preserve criticality control during fuel loading in the basket. Consequently, if boron credit is required for the fuel being loaded or unloaded, the canister must be flooded with water that contains boron in the proper concentration in accordance with the requirements of LCO 3.3.1. Concentration of boron must also be measured and maintained in accordance with LCO 3.3.1. The dissolved boron concentration requirement, and measurement requirement, applies to both the spent fuel pool water and to water in the CANISTER, when pool water is not used to fill the CANISTER.
APPLICABILITY	Control of Boron concentration is required during LOADING or UNLOADING OPERATIONS when the CANISTER holds at least one spent fuel assembly that requires dissolved boron for criticality control as described in Table 12B2-2. This LCO does not apply to spent fuel having an enrichment within the limits specified in the table in the "without (w/o) boron" column.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each CANISTER. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory measures for each CANISTER not meeting the LCO. Subsequent CANISTERs that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

(continued)

A.1

If the required dissolved Boron concentration of the water in the CANISTER is not met, immediate actions must be taken to restore the required dissolved boron concentration. No actions, including continued loading, may be taken that increases system reactivity.

AND

A.2

The required concentration of dissolved Boron must be immediately restored.

AND

A.3

If the required boron concentration in the water in the CANISTER cannot be established, all fuel assemblies must be removed from the CANISTER within 24 hours to bring the system to a safe configuration. The 24 hour period provides adequate time to restore the required boron concentration.

SURVEILLANCE REQUIREMENTS	SR 3.3.1.1 The assurance of an adequate concentration of dissolved boron in the water in the CANISTER must be established within 4 hours of beginning any LOADING or UNLOADING OPERATION, using two different methods of determining boron concentration. During LOADING or UNLOADING OPERATIONS, verification of continued adequate dissolved boron concentration must be performed every 48 hours after the beginning of operations. The 48-hour boron concentration verification is not required when no water is being introduced into the CANISTER cavity. In this situation, no potential exists for the boron in the CANISTER to be diluted, so verification of the boron concentration is not necessary.
REFERENCES	Sections 12B3.2.1 and Table 12B2-2.

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