CERTIFICATE OF COMPLIANCE FOR SPENT FUEL STORAGE CASKS

The U.S. Nuclear Regulatory Commission is issuing this Certificate of Compliance pursuant to Title 10 of the Code of Federal Regulations, Part 72, "Licensing Requirements for Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste" (10 CFR Part 72). This certificate is issued in accordance with 10 CFR 72.238, certifying that the storage design and contents described below meet the applicable safety standards set forth in 10 CFR Part 72, Subpart L, and on the basis of the Final Safety Analysis Report (FSAR) of the cask design. This certificate is conditional upon fulfilling the requirements of 10 CFR Part 72, as applicable, and the conditions specified below.

Certificate No.	Effective Date	Expiration Date	Docket Number	Amendment No.	Amendment Date	Package Identification No.
1008	10/4/1999	10/4/2019	72-1008			USA/72-1008

Issued To: (Name/Address)

Holtec International
Holtec Center
555 Lincoln Drive West
Marlton, NJ 08053

Safety Analysis Report Title

Holtec International Inc., Safety Analysis Report for the HI-STAR 100 Cask System, Revision 10
Holtec Report HI-941184

Docket No. 72-1008

NDITIONS

1. CASK

The HI-STAR 100 Cask System is certified as described in the Safety Analysis Report (SAR) and in NRC's Safety Evaluation Report (SER) accompanying the Certificate of Compliance. It is designed for both storage and transfer of irradiated nuclear fuel.

a. Model No.: HI-STAR 100 (MPC-24, MPC-68, MPC-68F)

The HI-STAR 100 Cask System is comprised of the multi-purpose canister (MPC), which contains the fuel, and the overpack which contains the MPC. The two digits after the MPC designate the number of reactor fuel assemblies for which the respective MPCs are designed. The MPC-24 is designed to contain up to 24 pressurized water reactor (PWR) fuel assemblies. The MPC-68 is designed to contain up to 68 boiling water reactor (BWR) fuel assemblies. Any MPC-68 containing fuel assemblies with known or suspected defects, such as ruptured fuel rods, severed rods, loose fuel pellets, or which cannot be handled by normal means due to fuel cladding damage, is designated as MPC-68F. The MPC-24 and the MPC-68 (including the MPC-68F) are identical in external dimensions and will fit into the same overpack design.

b. Description

The complete HI-STAR 100 Cask System for storage of spent nuclear fuel is comprised of two discrete components: the MPC and the storage/transport overpack. The HI-STAR 100 Cask System consists of interchangeable MPCs which constitute the confinement boundary for BWR or PWR spent nuclear fuel and an overpack which provides the helium retention boundary, gamma and neutron radiation shielding, and heat rejection capability. All MPCs have identical exterior dimensions which render them interchangeable. A single overpack design is provided which is capable of storing each type of MPC.

The HI-STAR 100 MPCs are welded cylindrical structures with flat ends. Each MPC is an assembly consisting of a honeycombed fuel basket, a baseplate, canister shell, a lid, and a closure ring. The outer diameter and cylindrical height of each MPC is fixed. However, the number of spent nuclear fuel storage locations in each of the MPCs depends on the fuel assembly characteristics. The MPC provides the confinement boundary for the stored fuel. The confinement boundary is a seal-welded enclosure constructed entirely of a stainless steel alloy. The inner surfaces of the HI-STAR 100 overpack form an internal cylindrical cavity for housing the MPC. The outer surface of the overpack inner shell is buttressed with intermediate shells of gamma shielding.

The fuel transfer and auxiliary equipment necessary for Independent Spent Fuel Storage Installation operation are not included as part of the HI-STAR 100 Cask System reviewed for a Certificate of Compliance under 10 CFR Part 72, Subpart L. Such equipment may include, but is not limited to, special lifting devices, transfer trailers or equipment, and vacuum drying/helium leak test equipment.

2. OPERATING PROCEDURES

Written operating procedures shall be prepared for cask handling, loading, movement, surveillance, and maintenance. The user's site-specific written operating procedures shall be consistent with the technical basis described in the SAR.

3. QUALITY ASSURANCE

Activities in the areas of design, procurement, fabrication, assembly, inspection, testing, operation, maintenance, repair, modification of structures, systems and components, and decommissioning that are important to safety shall be conducted in accordance with a Commission-approved quality assurance program which satisfies the applicable requirements of 10 CFR Part 72, Subpart G, and which is established, maintained, and executed with regard to the cask system.

4. HEAVY LOADS REQUIREMENTS

Each lift of a HI-STAR 100 spent fuel storage cask must be made in accordance with the existing heavy loads requirements and procedures of the licensed facility in which the lift is made. A plant-specific safety review (in accordance with 10 CFR 50.59 or 10 CFR 72.48, if applicable) is required to show operational compliance with existing plant-specific heavy loads requirements.

5. APPROVED CONTENTS

Contents of the HI-STAR 100 Cask System must meet the fuel specifications given in Appendix B to this certificate.

6. APPROVED DESIGN FEATURES

Features or characteristics for the site or cask must be in accordance with Appendix B to this certificate.

7. CHANGES TO THE CERTIFICATE OF COMPLIANCE

The holder of this certificate who desires to make changes to the certificate, which includes Appendix A (Technical Specifications) and Appendix B (Approved Contents and Design Features), shall submit an application for amendment of the certificate.

8. AUTHORIZATION

The HI-STAR 100 Cask System, which is authorized by this certificate, is hereby approved for general use by holders of 10 CFR Part 50 licenses for nuclear reactors at reactor sites under the general license issued pursuant to 10 CFR 72.210, subject to the conditions specified by 10 CFR 72.212, and the attached Appendix A and Appendix B.

FOR THE NUCLEAR REGULATORY COMMISSION

E. William Brach

E. William Brach, Director
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Attachments: 1. Appendix A
2. Appendix B

CERTIFICATE OF COMPLIANCE NO. 1008

APPENDIX A

TECHNICAL SPECIFICATIONS

FOR THE HI-STAR 100 CASK SYSTEM

TABLE OF CONTENTS

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.
DAMAGED FUEL ASSEMBLY	DAMAGED FUEL ASSEMBLIES are fuel assemblies with known or suspected cladding defects greater than pinhole leaks or hairline cracks, missing fuel rods that are not replaced with dummy fuel rods, or those that cannot be handled by normal means. Fuel assemblies which cannot be handled by normal means due to fuel cladding damage are considered to be FUEL DEBRIS.
DAMAGED FUEL CONTAINER (DFC)	DFCs are specially designed enclosures for DAMAGED FUEL ASSEMBLIES or FUEL DEBRIS which permit gaseous and liquid media to escape while minimizing dispersal of gross particulates.
FUEL BUILDING	The FUEL BUILDING is the site-specific power plant facility, licensed pursuant to 10 CFR Part 50, where the loaded OVERPACK is transferred to or from the transporter.
FUEL DEBRIS	FUEL DEBRIS is fuel with known or suspected defects, such as ruptured fuel rods, severed rods, or loose fuel pellets. Fuel assemblies which cannot be handled by normal means due to fuel cladding damage are considered to be FUEL DEBRIS.

1.1 Definitions

INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)	The facility within the perimeter fence licensed for storage of spent fuel within SFSCs. (see also 10 CFR 72.3)
INTACT FUEL ASSEMBLY	INTACT FUEL ASSEMBLIES are fuel assemblies without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means. Partial fuel assemblies, that is fuel assemblies from which fuel rods are missing, shall not be classified as INTACT FUEL ASSEMBLIES unless dummy fuel rods are used to displace an amount of water greater than or equal to that displaced by the original fuel rod(s).
LOADING OPERATIONS	LOADING OPERATIONS include all licensed activities on an SFSC while it is being loaded with fuel assemblies. LOADING OPERATIONS begin when the first fuel assembly is placed in the SFSC and end when the SFSC is suspended from or secured on the transporter.
MULTI-PURPOSE CANISTER (MPC)	MPCs are the sealed spent nuclear fuel canisters which consist of a honeycombed fuel basket contained in a cylindrical canister shell which is welded to a baseplate, lid with welded port cover plates, and closure ring. The MPC provides the confinement boundary for the contained radioactive materials.
OVERPACK	OVERPACKs are the casks which receive and contain the sealed MPCs. They provide the helium retention boundary, gamma and neutron shielding, and a set each of lifting and pocket trunnions for handling.
PLANAR-AVERAGE INITIAL ENRICHMENT	PLANAR-AVERAGE INITIAL ENRICHMENT is the average of the distributed fuel rod initial enrichments within a given axial plane of the assembly lattice.

1.1 Definitions

SPENT FUEL STORAGE CASKS (SFSCs)	SFSCs are storage containers approved for casks of spent fuel assemblies at the ISFSI. The HI-STAR 100 SFSC System consists of the OVERPACK and its integral MPC.
STORAGE OPERATIONS	STORAGE OPERATIONS include all licensed activities that are performed at the ISFSI while an SFSC containing spent fuel is sitting on a storage pad within the ISFSI perimeter.
TRANSPORT OPERATIONS	TRANSPORT OPERATIONS include all licensed activities performed on an SFSC loaded with one or more fuel assemblies when it is being moved to or from the ISFSI. TRANSPORT OPERATIONS begin when the SFSC is first suspended from or secured on the transporter and end when the SFSC is at its destination and no longer suspended from the transporter.
UNLOADING OPERATIONS	UNLOADING OPERATIONS include all licensed activities on an SFSC to be unloaded of the contained fuel assemblies. UNLOADING OPERATIONS begin when the SFSC is no longer suspended from or secured on the transporter and end when the last fuel assembly is removed from the SFSC.

1.0 USE AND APPLICATION

1.2 Logical Connectors

PURPOSE	The purpose of this section is to explain the meaning of logical connectors. Logical connectors are used in Technical Specifications (TS) to discriminate between, and yet connect, discrete Conditions, Required Actions, Completion Times, Surveillances, and Frequencies. The only logical connectors that appear in TS are AND and OR. The physical arrangement of these connectors constitutes logical conventions with specific meanings.
BACKGROUND	Several levels of logic may be used to state Required Actions. These levels are identified by the placement (or nesting) of the logical connectors and by the number assigned to each Required Action. The first level of logic is identified by the first digit of the number assigned to a Required Action and the placement of the logical connector in the first level of nesting (i.e., left justified with the number of the Required Action). The successive levels of logic are identified by additional digits of the Required Action number and by successive indentations 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.

1.2 Logical Connectors

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 . . . AND A.2 Restore . . .	

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

1.2 Logical Connectors

EXAMPLES (continued)

EXAMPLE 1.2-2

ACTIONS

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

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

1.0 USE AND APPLICATION

1.3 Completion Times

PURPOSE	The purpose of this section is to establish the Completion Time convention and to provide guidance for its use.
BACKGROUND	Limiting Conditions for Operation (LCOs) specify the lowest functional capability or performance levels of equipment required for safe operation of the SFSC. The ACTIONS associated with an LCO state Conditions that typically describe the ways in which the requirements of the LCO can fail to be 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, provided that the SFSC 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 SFSC is not within the LCO Applicability. Once a Condition has been entered, subsequent subsystems, components, or variables expressed in the Condition, discovered to be not within limits, will <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.

---NOTE---

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

1.3 Completion Times

EXAMPLES

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

EXAMPLE 1.3-1

ACTIONS

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

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.

1.3 Completion Times

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 Complete action B.1. AND B.2 Complete action B.2.	12 hours 36 hours

When a system is determined not to 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, Conditions A and B are exited, and therefore, the Required Actions of Condition B may be terminated.

1.3 Completion Times

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 Complete action B.1. AND B.2 Complete action B.2.	6 hours 12 hours

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

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

1.0 USE AND APPLICATION

1.4 Frequency

PURPOSE

The purpose of this section is to define the proper use and application of Frequency requirements.

DESCRIPTION

Each Surveillance Requirement (SR) has a specified Frequency in which the Surveillance must be met in order to meet the associated Limiting Condition for Operation (LCO). An understanding of the correct application of the specified Frequency is necessary for compliance with the SR.

The "specified Frequency" is referred to throughout this section and each of the Specifications of Section 2.0, Surveillance Requirement (SR) Applicability. The "specified Frequency" consists of the requirements of the Frequency column of each SR.

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 2.0.4 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 an SR satisfied, SR 2.0.4 imposes no restriction.

EXAMPLES

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

EXAMPLE 1.4-1

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify pressure is within limits.	12 hours

1.4 Frequency

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 interval specified in the Frequency is allowed by SR 2.0.2 for operational flexibility. The measurement of this interval continues at all times, even when the SR is not required to be met per SR 2.0.1 (such as when the equipment or variables are outside specified limits, or the facility is outside the Applicability of the LCO). If the interval specified by SR 2.0.2 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 2.0.1.

If the interval as specified by SR 2.0.2 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 2.0.2 prior to entry into the specified condition. Failure to do so would result in a violation of SR 2.0.4

<u>EXAMPLE 1.4-2</u>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify vacuum drying pressure is within limits.	Once within 12 hours prior to starting activity <u>AND</u> 24 hours thereafter

1.4 Frequency

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 within 12 hours 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 2.0.2.

"Thereafter" indicates future performances must be established per SR 2.0.2, 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.

2.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

LCO 2.0.1	LCOs shall be met during specified conditions in the Applicability, except as provided in LCO 2.0.2.
LCO 2.0.2	Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as provided in LCO 2.0.5. If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required, unless otherwise stated.
LCO 2.0.3	Not applicable.
LCO 2.0.4	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 an SFSC.
LCO 2.0.5	Equipment removed from service or not in service in compliance with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate it meets the LCO or that other equipment meets the LCO. This is an exception to LCO 2.0.2 for the system returned to service under administrative control to perform the testing.

2.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

SR 2.0.1 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 2.0.3. Surveillances do not have to be performed on equipment or variables outside specified limits.

SR 2.0.2 The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the Frequency is met.

For Frequencies specified as "once," the above interval extension does not apply. If a Completion Time requires periodic performance on a "once per..." basis, the above Frequency extension applies to each performance after the initial performance.

Exceptions to this Specification are stated in the individual Specifications.

SR 2.0.3 If it is discovered that a Surveillance was not performed within its specified Frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Frequency, whichever is less. This delay period is permitted to allow performance of the Surveillance.

If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.

2.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

SR 2.0.3 (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 2.0.4	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 an SFSC.

2.1 SFSC INTEGRITY

2.1.1 Multipurpose Canister (MPC)

LCO 2.1.1 The MPC shall be dry and helium filled.

APPLICABILITY: TRANSPORT OPERATIONS AND STORAGE OPERATIONS.

ACTIONS

-----NOTE-----

Separate Condition entry is allowed for each SFSC.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MPC cavity vacuum drying pressure limit not met.	A.1 Perform an engineering evaluation to determine quantity of moisture left in MPC.	7 days
	AND	
	A.2 Determine and complete corrective actions necessary to return MPC to analyzed condition.	30 days
B. MPC helium backfill density limit not met.	B.1 Perform an engineering evaluation to determine impact of helium differential.	72 hours
	AND	
	B.2 Determine and complete corrective actions necessary to return MPC to analyzed condition.	14 days

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. MPC helium leak rate limit not met.	C.1 Perform an engineering evaluation to determine impact of increased helium leak rate on heat removal capability and off-site dose release effects.	24 hours
	AND	
	C.2 Determine and complete corrective actions necessary to return MPC to analyzed condition.	7 days
D. Required Actions and Associated Completion Time not met.	D.1 Remove all fuel assemblies from the SFSC.	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 2.1.1.1	Verify MPC cavity vacuum drying pressure is within the limit specified in Table 2-1 for the applicable MPC model.	During LOADING OPERATIONS
SR 2.1.1.2	Verify MPC helium backfill density is within the limit specified in Table 2-1 for the applicable MPC model.	During LOADING OPERATIONS
SR 2.1.1.3	Verify that the total helium leak rate through the MPC lid confinement weld and the drain and vent port confinement welds is within the limit specified in Table 2-1 for the applicable MPC model.	During LOADING OPERATIONS

Table 2-1
MPC Model-Dependent Limits

MPC MODEL	LIMITS
1. MPC-24	
a. MPC Cavity Vacuum Drying Pressure	≤ 3 torr for ≥ 30 min
b. OVERPACK Annulus Vacuum Drying Pressure	≤ 3 torr for ≥ 30 min
c. MPC Helium Backfill Density[1]	0.1212 g-moles/liter +0% or -10%
d. OVERPACK Annulus Helium Backfill Pressure	≥ 10 psig and ≤ 14 psig
e. MPC Helium Leak Rate	≤ 5.0E-6 std cc/sec (He)
f. OVERPACK Helium Leak Rate	≤ 4.3E-6 std cc/sec (He)
2. MPC-68	
a. MPC Cavity Vacuum Drying Pressure	≤ 3 torr for ≥ 30 min
b. OVERPACK Annulus Vacuum Drying Pressure	≤ 3 torr for ≥ 30 min
c. MPC Helium Backfill Density[1]	0.1218 g-moles/liter +0% or -10%
d. OVERPACK Annulus Helium Backfill Pressure	≥ 10 psig and ≤ 14 psig
e. MPC Helium Leak Rate	≤ 5.0E-6 std cc/sec (He)
f. OVERPACK Helium Leak Rate	≤ 4.3E-6 std cc/sec (He)
3. MPC-68F	
a. MPC Cavity Vacuum Drying Pressure	≤ 3 torr for ≥ 30 min
b. OVERPACK Annulus Vacuum Drying Pressure	≤ 3 torr for ≥ 30 min
c. MPC Helium Backfill Density[1]	0.1218 g-moles/liter +0% or -10%
d. OVERPACK Annulus Helium Backfill Pressure	≥ 10 psig and ≤ 14 psig
e. MPC Helium Leak Rate	≤ 5.0E-6 std cc/sec (He)
f. OVERPACK Helium Leak Rate	≤ 4.3E-6 std cc/sec (He)

[1]Helium used for backfill of MPC shall have a purity of ≥ 99.995%.

2.1 SFSC INTEGRITY

2.1.2 OVERPACK

LCO 2.1.2 The OVERPACK shall be dry and helium filled.

APPLICABILITY: TRANSPORT OPERATIONS AND STORAGE OPERATIONS.

ACTIONS

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

Separate Condition entry is allowed for each SFSC.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. OVERPACK annulus vacuum drying pressure limit not met.	A.1 Perform an engineering evaluation to determine quantity of moisture left in the OVERPACK.	7 days
	<u>AND</u>	
	A.2 Determine and complete corrective actions necessary to return the OVERPACK to analyzed condition.	30 days
B. OVERPACK annulus helium backfill pressure limit not met.	B.1 Perform an engineering evaluation to determine impact of helium pressure differential.	72 hours
	<u>AND</u>	
	B.2 Determine and complete corrective actions necessary to return the OVERPACK to analyzed condition.	30 days

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. OVERPACK helium leak rate limit not met.	C.1 Perform engineering evaluation to determine impact of increased helium leak rate on heat removal capability and off-site dose release effects.	7 days
	AND	30 days
	C.2 Determine and complete corrective actions necessary to return the OVERPACK to analyzed condition.	

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 2.1.2.1	Verify OVERPACK annulus vacuum drying pressure is within limit specified in Table 2-1 for the applicable MPC model.	During LOADING OPERATIONS
SR 2.1.2.2	Verify OVERPACK annulus helium backfill pressure is within the limit specified in Table 2-1 for the applicable MPC model.	During LOADING OPERATIONS
SR 2.1.2.3	Verify that the total helium leak rate through the OVERPACK closure plate inner mechanical seal, the OVERPACK vent port plug seal, and the OVERPACK drain port plug seal is within the limit specified Table 2-1 for the applicable MPC model.	During LOADING OPERATIONS

2.1 SFSC INTEGRITY

2.1.3 SFSC Lifting Requirements

LCO 2.1.3 — An OVERPACK loaded with spent fuel shall be lifted in accordance with either of the following requirements:

a. i A lift height ≤ 21 inches when oriented vertically.

AND

ii A lift height ≤ 72 inches when oriented horizontally.

OR

b. The OVERPACK is lifted with lifting devices designed in accordance with ANSI N14.6 and having redundant drop prevention design features.

OR

c. Site-specific analysis to evaluate site-specific conditions to ensure that the drop accidents impact loads remain with HI-STAR 100 TSAR limits of 60g.

APPLICABILITY: During TRANSPORT OPERATIONS.

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

This LCO is not applicable when the SFSC 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, ect.).

ACTIONS

-----NOTE-----

Separate Condition entry is allowed for each SFSC.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SFSC lifting requirements not met.	A.1 Initiate actions to meet SFSC lifting requirements.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 2.1.3.1	Verify SFSC lifting requirements are met.	After the SFSC is suspended from, or secured in the transporter and prior to the transporter beginning to move the SFSC within the ISFSI.

2.1 SFSC INTEGRITY

2.1.4 Fuel Cool-Down

LCO 2.1.4 The MPC exit gas temperature shall be ≤ 200° F.

-----NOTE-----
The LCO is only applicable to wet UNLOADING OPERATIONS.

APPLICABILITY: UNLOADING OPERATIONS prior to flooding.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MPC exit temperature not within limit.	A.1 Establish MPC helium gas exit temperature within limit.	Prior to initiating MPC re-flooding operations.
	<u>AND</u>	
	A.2 Ensure adequate heat transfer from MPC to the environment.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 2.1.4.1	Verify MPC helium gas exit temperature within the limit.	Prior to initiation of MPC re-flooding operations.

2.2 SFSC RADIATION PROTECTION

2.2.1 Overpack Average Surface Dose Rates

LCO 2.2.1 The average surface dose rates of each overpack shall not exceed:

a. 125 mrem/hour (neutron + gamma) on the side;

b. 80 mrem/hour (neutron + gamma) on the top;

APPLICABILITY: TRANSPORT OPERATIONS AND STORAGE OPERATIONS

ACTIONS

-----NOTE-----

Separate Condition entry is allowed for each SFSC.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Overpack average surface dose rate limits not met.	A.1 Administratively verify correct fuel loading. AND A.2 Perform written evaluations to verify compliance with the ISFSI offsite radiation protection requirements of 10 CFR Part 20 and 10 CFR Part 72.	24 hours 48 hours
B. Required Action and Associated Completion Time not met.	B.1 Remove all fuel assemblies from the SFSC.	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 2.2.1.1	Verify average surface dose rates of overpack containing fuel assemblies are within limits. Overpack dose rates shall be measured at the locations shown in Figure 2.2.1-1.	During LOADING OPERATIONS
NOTE:	SR 2.2.1.1 shall be performed after the MPC has been vacuum dried.	
NOTE:	If a loaded OVERPACK is placed into storage after transport from an off-site location, SR 2.2.1.1 shall be performed after receipt of the OVERPACK and prior to STORAGE OPERATIONS.	

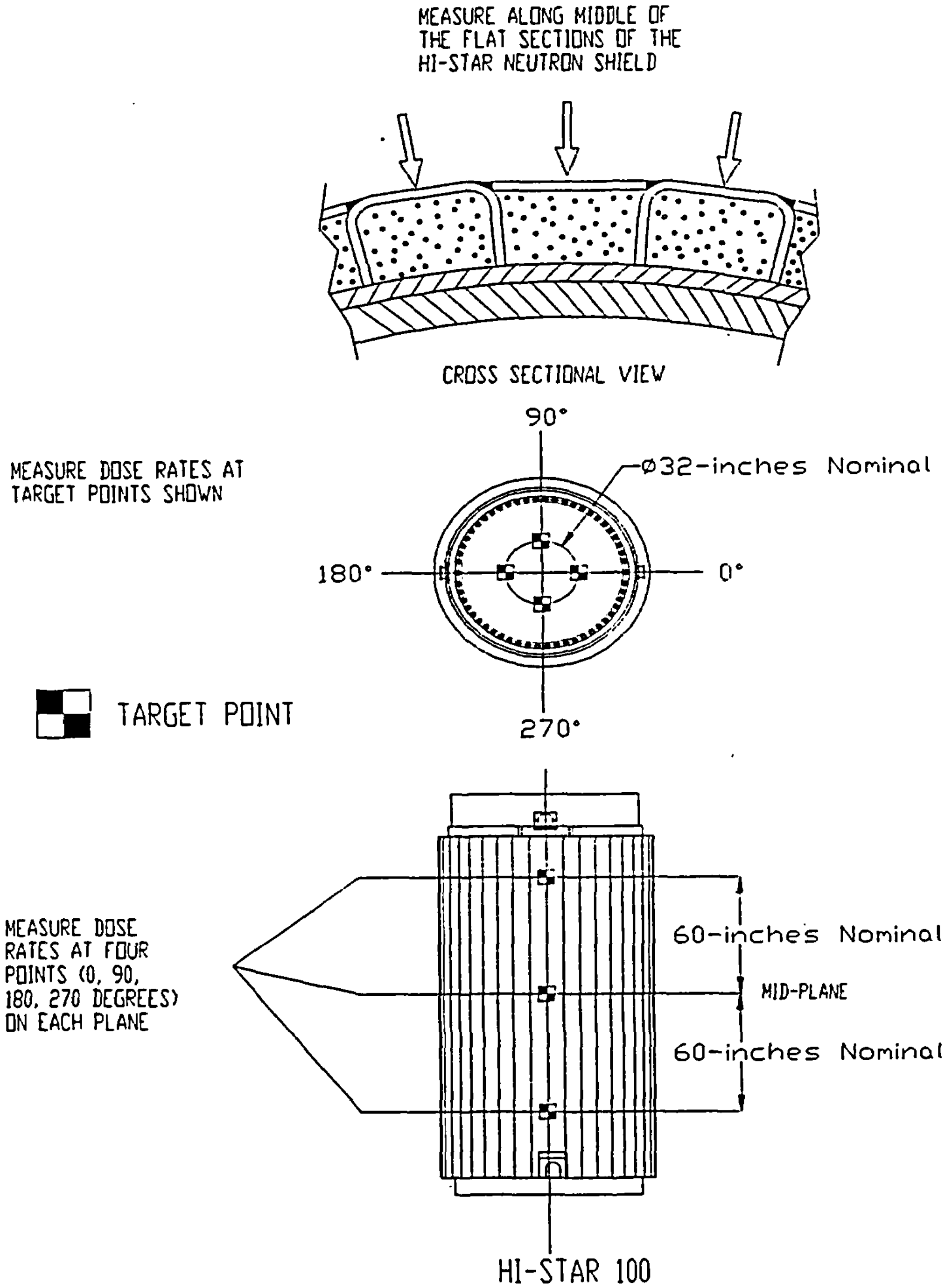

Figure 2.2.1-1
OVERPACK Surface Dose Rate Measurement Locations

2.2 SFSC RADIATION PROTECTION

2.2.2 SFSC Surface Contamination

LCO 2.2.2 Removable contamination on the exterior surfaces of the OVERPACK and accessible portions of the MPC shall each not exceed:

a. 1000 dpm/100 cm^2 from beta and gamma sources; and

b. 20 dpm/100 cm^2 from alpha sources.

APPLICABILITY:. TRANSPORT OPERATIONS AND STORAGE OPERATIONS

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SFSC removable surface contamination limits not met.	A.1 Restore SFSC removable surface contamination to within limits.	7 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 2.2.2.1	Verify that the removable contamination on the exterior surfaces of the OVERPACK and accessible portions of the MPC containing fuel is within limits.	During LOADING OPERATIONS
NOTE:	If a loaded OVERPACK is placed into storage after transport from an off-site location, SR 2.2.2.1 shall be performed after receipt of the OVERPACK and prior to STORAGE OPERATIONS.	

CERTIFICATE OF COMPLIANCE NO. 1008

APPENDIX B

APPROVED CONTENTS AND DESIGN FEATURES

FOR THE HI-STAR 100 CASK SYSTEM

APPENDIX B DESIGN FEATURES

1.0 Definitions

NOTE

The defined terms of this section appear in capitalized type and are applicable throughout this Appendix.

Term	Definition
DAMAGED FUEL ASSEMBLY	DAMAGED FUEL ASSEMBLIES are fuel assemblies with known or suspected cladding defects greater than pinhole leaks or hairline cracks, missing fuel rods that are not replaced with dummy fuel rods, or those that cannot be handled by normal means. A DAMAGED FUEL ASSEMBLY's inability to be handled by normal means must be due to mechanical damage and must not be due to fuel rod cladding damage.
DAMAGED FUEL CONTAINER (DFC)	DFCs are specially designed enclosures for DAMAGED FUEL ASSEMBLIES or FUEL DEBRIS which permit gaseous and liquid media to escape while minimizing dispersal of gross particulates.
FUEL DEBRIS	FUEL DEBRIS is ruptured fuel rods, severed rods, loose fuel pellets or fuel assemblies with known or suspected defects which cannot be handled by normal means due to fuel cladding damage.
INTACT FUEL ASSEMBLY	INTACT FUEL ASSEMBLIES are fuel assemblies without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means. Partial fuel assemblies, that is fuel assemblies from which fuel rods are missing, shall not be classified as INTACT FUEL ASSEMBLIES unless dummy fuel rods are used to displace an amount of water greater than or equal to that displaced by the original fuel rod(s)
PLANAR-AVERAGE INITIAL ENRICHMENT	PLANAR-AVERAGE INITIAL ENRICHMENT is the simple average of the distributed fuel rod enrichments within a given axial plane of the assembly lattice.

1.1 Fuel Specifications

1.1.1 Fuel To Be Stored In The HI-STAR 100 SFSC System

a. INTACT FUEL ASSEMBLIES, DAMAGED FUEL ASSEMBLIES, and FUEL DEBRIS meeting the limits specified in Table 1.1-1 (which refers to Tables 1.1-2 through 1.1-5) may be stored in the HI-STAR 100 SFSC System.

b. For MPCs partially loaded with stainless steel clad fuel assemblies, all remaining fuel assemblies in the MPC shall meet the maximum decay heat generation limit for the stainless steel clad fuel assemblies.

c. For MPCs partially loaded with DAMAGED FUEL ASSEMBLIES or FUEL DEBRIS, all remaining Zircaloy clad INTACT FUEL ASSEMBLIES in the MPC shall meet the maximum decay heat generation limits for the DAMAGED FUEL ASSEMBLIES.

c. For MPC-68's partially loaded with array/class 6x6A, 6x6B, 6x6C, or 8x8A fuel assemblies, all remaining Zircaloy clad INTACT FUEL ASSEMBLIES in the MPC shall meet the maximum decay heat generation limits for the 6x6A, 6x6B, 6x6C, and 8x8A fuel assemblies.

1.1.2 Preferential Fuel Loading

Preferential fuel loading shall be used whenever fuel assemblies with significantly different post-irradiation cooling times (equal to or greater than one year) are to be loaded in the same MPC. That is, fuel assemblies with the longest post-irradiation cooling times shall be loaded into fuel storage locations at the periphery of the basket. Fuel assemblies with shorter post-irradiation cooling times shall be placed toward the center of the basket.

1.2 Functional and Operating Limits Violations

If any Fuel Specifications defined in Section 1.1 are violated, the following actions shall be completed:

a. The affected fuel assemblies shall be placed in a safe condition without delay and in a controlled manner.

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 actions taken to restore compliance and prevent recurrence.

The above actions are not a substitute for the reporting requirements contained in 10 CFR 72.75

1.3 Codes and Standards

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), 1995 Edition with Addenda through 1997, is the governing Code for the HI-STAR 100 Cask System, as clarified in Specification 1.3.1 below.

1.3.1 Exceptions to Codes, Standards, and Criteria

Table 1.3-1 lists approved exceptions to the ASME Code for the design of the HI-STAR 100 Cask System.

1.3.2 Construction/Fabrication Exceptions to Codes, Standards, and Criteria

Proposed alternatives to the ASME Code, Section III, 1995 Edition with Addenda through 1997 including exceptions allowed by Specification 1.3.1 may be used when authorized by the Director of the Office of Nuclear Material Safety and Safeguards or designee. The request for such alternative should demonstrate that:

1. The proposed alternatives would provide an acceptable level of quality and safety, or

2. Compliance with the specified requirements of the ASME Code, Section III, 1995 Edition with Addenda through 1997, 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

1.4 Site Specific Parameters and Analyses

Site-specific parameters and analyses that will need verification by the system user, as a minimum, are as follows:

1. The temperature of 80°F is the maximum allowed average yearly temperature.

2. The allowed temperature extremes, averaged over a three day period, shall be greater than -40°F, and less than 125 °F.

3. The horizontal and vertical seismic acceleration levels are bounded by the values listed below in Table 1-4.

Table 1-4
Design-Basis Earthquake Input on the Top Surface of an ISFSI Pad

Horizontal g-level in each of two orthogonal directions	Horizontal g-level Vector Sum	Corresponding Vertical g-level (upward)
0.222 g	0.314 g	1.00 x 0.222 g = 0.222 g
0.235 g	0.332 g	0.75 x 0.235 g = 0.176 g
0.24 g	0.339 g	0.667 x 0.24 g = 0.160 g
0.25 g	0.354 g	0.500 x 0.25 g = 0.125 g

4. The analyzed flood condition of 13 fps water velocity and a height of 656 feet of water (full submergence of the loaded cask) are not exceeded.

5. The potential for fire and explosion shall be addressed, based on site-specific considerations. This includes the condition that the on-site transporter fuel tank will contain no more than 50 gallons of combustible transporter fuel.

6. In addition to the requirement of 10 CFR 72.212(b)(2)(ii), the cask storage pads and foundation shall include the following characteristics as applicable to the drop and tipover analyses:

   a. Concrete thickness: ≤ 36 inches

   b. Concrete compressive strength: ≤ 4,200 psi

   c. Reinforcement top and bottom (Both Directions):
      Reinforcement area and spacing determined by analysis
      Reinforcement yield strength: ≤ 60,000 psi

   d. Soil effective modulus of elasticity: ≤ 28,000 psi

      An acceptable method of defining the soil effective modulus of elasticity applicable to the drop and tipover analyses is provided

in Table 13 of NUREG/CR-6608 with soil classification in accordance with ASTM-D2487-93, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System USCS) and density determination in accordance with ASTM-D1586-84, Standard Test Method for Penetration Test and Split/Barrel Sampling of Soils.

7. 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.

1.5 Design Specifications

1.5.1 Specifications Important for Criticality Control

1.5.1.1 MPC-24

1. Minimum flux trap size: 1.09 in

2. Minimum ^{10}B loading in the Boral neutron absorbers: 0.0267 g/cm^2

1.5.1.2 MPC-68 and MPC-68F

1. Minimum fuel cell pitch: 6.43 in

2. Minimum ^{10}B loading in the Boral neutron absorbers: 0.0372 g/cm^2 in the MPC 68, and 0.01g/cm^2 in the MPC-68F.

1.5.2. Specifications Important for Thermal Performance

1.5.2.1 OVERPACK

The painted surface of the HI-STAR 100 OVERPACK must have an emissivity no less than 0.85.

Table 1.1-1
Fuel Assembly Limits

I. MPC MODEL: MPC-24

A. Allowable Contents

1. Uranium oxide, PWR INTACT FUEL ASSEMBLIES listed in Table 1.1-2 and meeting the following specifications:

a. Cladding Type:	Zircaloy (Zr) or Stainless Steel (SS) as specified in Table 1.1-2 for the applicable fuel assembly array/class
b. Initial Enrichment:	As specified in Table 1.1-2 for the applicable fuel assembly array/class.
c. Decay Heat Per Assembly:	
i. Zr Clad:	An assembly decay heat as specified in Table 1.1-4 for the applicable post-irradiation cooling time.
ii. SS Clad:	$\leq$ 575 Watts
d. Post-irradiation Cooling Time and Average Burnup Per Assembly:	
i. Zr Clad:	An assembly post-irradiation cooling time and average burnup as specified in Table 1.1-5.
ii. SS Clad:	An assembly post-irradiation cooling time $\geq$ 9 years and an average burnup $\leq$ 30,000 MWD/MTU. OR An assembly post-irradiation cooling time $\geq$ 15 years and an average burnup $\leq$ 40,000 MWD/MTU.

e.	Nominal Fuel Assembly Length:	≤ 176.8 inches
f.	Nominal Fuel Assembly Width:	≤ 8.54 inches
g.	Fuel Assembly Weight:	≤ 1,680 lbs

B. Quantity per MPC: Up to 24 fuel assemblies.

C. Fuel assemblies shall not contain control components.

D. DAMAGED FUEL ASSEMBLIES and FUEL DEBRIS are not authorized for loading into the MPC-24.

II. MPC MODEL: MPC-68

A. Allowable Contents

1. Uranium oxide, BWR INTACT FUEL ASSEMBLIES listed in Table 1.1-3, with or without Zircaloy channels, and meeting the following specifications:

a. Cladding Type:	Zircaloy (Zr) or Stainless Steel (SS) as specified in Table 1.1-3 for the applicable fuel assembly array/class.
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
c. Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
d. Decay Heat Per Assembly:	
i. Zr Clad:	An assembly decay heat as specified in Table 1.1-4 for the applicable post-irradiation cooling time, except for array/class 6x6A, 6x6C,and 8x8A fuel assemblies, which shall have a decay heat $\leq$ 115 Watts.
ii. SS Clad:	$\leq$ 95 Watts

e.	Post-irradiation Cooling Time and Average Burnup Per Assembly:	
	i. Zr Clad:	An assembly post-irradiation cooling time and average burnup as specified in Table 1.1-5, except for array/class 6x6A, 6x6C, and 8x8A fuel assemblies, which shall have a cooling time $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTU.
	ii. SS Clad:	An assembly cooling time after discharge $\geq$ 10 years and an average burnup $\leq$ 22,500 MWD/MTU.
f.	Nominal Fuel Assembly Length:	$\leq$ 176.2 inches
g.	Nominal Fuel Assembly Width:	$\leq$ 5.85 inches
h.	Fuel Assembly Weight:	$\leq$ 700 lbs, including channels

2. Uranium oxide, BWR DAMAGED FUEL ASSEMBLIES, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. BWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6A, 6x6C, 7x7A, or 8x8A, and meet the following specifications:

a. Cladding Type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
c. Initial Maximum Rod Enrichment:	As specified in Table 2.1-3 for the applicable fuel assembly array/class.
d. Decay Heat Per Assembly:	≤ 115 Watts
e. Post-irradiation Cooling Time and Average Burnup Per Assembly:	An assembly post-irradiation cooling time ≥ 18 years and an average burnup ≤ 30,000 MWD/MTU.
f. Nominal Fuel Assembly Length:	≤ 135.0 inches
g. Nominal Fuel Assembly Width:	≤ 4.70 inches
h. Fuel Assembly Weight:	≤ 400 lbs, including channels

3. Mixed oxide (MOX), BWR INTACT FUEL ASSEMBLIES, with or without Zircaloy channels. MOX BWR INTACT FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a. Cladding Type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
c. Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
d. Decay Heat Per Assembly:	≤ 115 Watts
e. Post-irradiation Cooling Time and Average Burnup Per Assembly:	An assembly post-irradiation cooling time ≥ 18 years and an average burnup ≤ 30,000 MWD/MTIHM.
f. Nominal Fuel Assembly Length:	≤ 135.0 inches
g. Nominal Fuel Assembly Width:	≤ 4.70 inches
h. Fuel Assembly Weight:	≤ 400 lbs, including channels

4. Mixed oxide (MOX), BWR DAMAGED FUEL ASSEMBLIES, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. MOX BWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a. Cladding Type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for array/class 6x6B.
c. Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for array/class 6x6B.
d. Decay Heat Per Assembly:	$\leq$ 115 Watts
e. Post-irradiation Cooling Time and Average Burnup Per Assembly:	An assembly post-irradiation cooling time $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTIHM.
f. Nominal Fuel Assembly Length:	$\leq$ 135.0 inches
g. Nominal Fuel Assembly Width	$\leq$ 4.70 inches
h. Fuel Assembly Weight:	$\leq$ 400 lbs, including channels

B. Quantity per MPC: Any combination of DAMAGED FUEL ASSEMBLIES in DAMAGED FUEL CONTAINERS and INTACT FUEL ASSEMBLIES UP TO A TOTAL OF 68.

C. Fuel assemblies with stainless steel channels are not authorized for loading in the MPC-68.

III. MPC MODEL: MPC-68F

A. Allowable Contents

1. Uranium oxide, BWR INTACT FUEL ASSEMBLIES, with or without Zircaloy channels. BWR INTACT FUEL ASSEMBLIES shall meet the criteria in Table 1.1-3 for fuel assembly array class 6x6A, 6x6C, 7x7A or 8x8A, and meet the following specifications:

a. Cladding Type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
c. Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
d. Decay Heat Per Assembly:	≤ 115 Watts.
e. Post-irradiation Cooling Time and Average Burnup Per Assembly:	An assembly post-irradiation cooling time ≥ 18 years and an average burnup ≤ 30,000 MWD/MTU.
f. Nominal Fuel Assembly Length:	≤ 176.2 inches
g. Nominal Fuel Assembly Width:	≤ 5.85 inches
h. Fuel Assembly Weight:	≤ 700 lbs, including channels

2. Uranium oxide, BWR DAMAGED FUEL ASSEMBLIES, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. BWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6A, 6x6C, 7x7A, or 8x8A, and meet the following specifications:

a. Cladding Type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
c. Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
d. Decay Heat Per Assembly:	≤ 115 Watts
e. Post-irradiation Cooling Time and Average Burnup Per Assembly:	A post-irradiation cooling time after discharge ≥ 18 years and an average burnup ≤ 30,000 MWD/MTU.
f. Nominal Fuel Assembly Length:	≤ 135.0 inches
g. Nominal Fuel Assembly Width:	≤ 4.70 inches
h. Fuel Assembly Weight:	≤ 400 lbs, including channels

3. Uranium oxide, BWR FUEL DEBRIS, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. The original fuel assemblies for the BWR FUEL DEBRIS shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6A, 6x6C, 7x7A, or 8x8A, and meet the following specifications:

a.	Cladding Type:	Zircaloy (Zr)
b.	Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable original fuel assembly array/class.
c.	Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for the applicable original fuel assembly array/class.
d.	Decay Heat Per DFC:	≤ 115 Watts
e.	Post-irradiation Cooling Time and Average Burnup Per Assembly:	A post-irradiation cooling time after discharge ≥ 18 years and an average burnup ≤ 30,000 MWD/MTU for the original fuel assembly.
f.	Nominal Original Fuel Assembly Length:	< 135.0 inches
g.	Nominal Original Fuel Assembly Width:	≤ 4.70 inches
h.	Fuel Debris Weight:	≤ 400 lbs, including channels

4. Mixed oxide (MOX), BWR INTACT FUEL ASSEMBLIES, with or without Zircaloy channels. MOX BWR INTACT FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a. Cladding Type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
c. Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
d. Decay Heat Per Assembly:	$\leq$ 115 Watts
e. Post-irradiation Cooling Time and Average Burnup Per Assembly:	An assembly post-irradiation cooling time after discharge $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTIHM.
f. Nominal Fuel Assembly Length:	$\leq$ 135.0 inches
g. Nominal Fuel Assembly Width:	$\leq$ 4.70 inches
h. Fuel Assembly Weight:	$\leq$ 400 lbs, including channels

5. Mixed oxide (MOX), BWR DAMAGED FUEL ASSEMBLIES, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. MOX BWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a.	Cladding Type:	Zircaloy (Zr)
b.	Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
c.	Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
d.	Decay Heat Per Assembly:	$\leq$ 115 Watts
e.	Post-irradiation Cooling Time and Average Burnup Per Assembly:	A post-irradiation cooling time after discharge $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTIHM.
f.	Nominal Fuel Assembly Length:	$\leq$ 135.0 inches
g.	Nominal Fuel Assembly Width:	$\leq$ 4.70 inches
h.	Fuel Assembly Weight:	$\leq$ 400 lbs, including channels

6. Mixed Oxide (MOX), BWR FUEL DEBRIS, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. The original fuel assemblies for the MOX BWR FUEL DEBRIS shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a.	Cladding Type:	Zircaloy (Zr)
b.	Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for original fuel assembly array/class 6x6B.
c.	Initial Maximum Rod Enrichment:	As specified in Table 1.1-3 for original fuel assembly array/class 6x6B.
d.	Decay Heat Per DFC:	$\leq$ 115 Watts
e.	Post-irradiation Cooling Time and Average Burnup Per Assembly:	A post-irradiation cooling time after discharge $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTIHM for the original fuel assembly.
f.	Nominal Original Fuel Assembly Length:	$\leq$ 135.0 inches
g.	Nominal Original Fuel Assembly Width:	$\leq$ 4.70 inches
h.	Fuel Debris Weight:	$\leq$ 400 lbs, including channels

B. Quantity per MPC:

Up to four (4) DFCs containing uranium oxide or MOX BWR FUEL DEBRIS. The remaining MPC-68F fuel storage locations may be filled with array/class 6x6A, 6x6B, 6x6C, 7x7A, and 8x8A fuel assemblies of the following type, as applicable:

a. Uranium oxide BWR INTACT FUEL ASSEMBLIES;

b. MOX BWR INTACT FUEL ASSEMBLIES;

c. Uranium oxide BWR DAMAGED FUEL ASSEMBLIES placed in DFCs; or

d. MOX BWR DAMAGED FUEL ASSEMBLIES placed in DFCs.

C. Fuel assemblies with stainless steel channels are not authorized for loading in the MPC-68F.

Table 1.1-2
PWR FUEL ASSEMBLY CHARACTERISTICS (note 1)

Fuel Assembly Array/Class	14x14A	14x14B	14x14C	14x14D	15x15A
Clad Material (note 2)	Zr	Zr	Zr	SS	Zr
Design Initial U (kg/assy.)	≤ 402	≤ 402	≤ 410	≤ 400	≤ 420
Initial Enrichment (wt % ^{235}U)	≤ 4.6	≤ 4.6	≤ 4.6	≤ 4.0	≤ 4.1
No. of Fuel Rods	179	179	176	180	204
Clad O.D. (in.)	≥ 0.400	≥ 0.417	≥ 0.440	≥ 0.422	≥ 0.418
Clad I.D. (in.)	≤ 0.3514	≤ 0.3734	≤ 0.3840	≤ 0.3890	≤ 0.3660
Pellet Dia. (in.)	≤ 0.3444	≤ 0.3659	≤ 0.3770	≤ 0.3835	≤ 0.3580
Fuel Rod Pitch (in.)	≤ 0.556	≤ 0.556	≤ 0.580	≤ 0.556	≤ 0.550
Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 144	≤ 150
No. of Guide Tubes	17	17	5(note 3)	16	21
Guide Tube Thickness (in.)	≥ 0.017	≥ 0.017	≥ 0.040	≥ 0.0145	≥ 0.0165

Table 1.1-2 (continued)
PWR FUEL ASSEMBLY CHARACTERISTICS (note 1)

Fuel Assembly Array/Class	15x15B	15x15C	15x15D	15x15E	15x15F
Clad Material (note 2)	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.)	≤ 464	≤ 464	≤ 475	≤ 475	≤ 475
Initial Enrichment (wt % ^{235}U)	≤ 4.1	≤ 4.1	≤ 4.1	≤ 4.1	≤ 4.1
No. of Fuel Rods	204	204	208	208	208
Clad O.D. (in.)	≥ 0.420	≥ 0.417	≥ 0.430	≥ 0.428	≥ 0.428
Clad I.D. (in.)	≤ 0.3736	≤ 0.3640	≤ 0.3800	≤ 0.3790	≤ 0.3820
Pellet Dia. (in.)	≤ 0.3671	≤ 0.3570	≤ 0.3735	≤ 0.3707	≤ 0.3742
Fuel Rod Pitch (in.)	≤ 0.563	≤ 0.563	≤ 0.568	≤ 0.568	≤ 0.568
Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Guide Tubes	21	21	17	17	17
Guide Tube Thickness (in.)	≥ 0.015	≥ 0.0165	≥ 0.0150	≥ 0.0140	≥ 0.0140

Table 1.1-2 (continued)
PWR FUEL ASSEMBLY CHARACTERISTICS (note 1)

Fuel Assembly Array/ Class	15x15G	16x16A	17x17A	17x17B	17x17C
Clad Material (note 2)	SS	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.)	≤ 420	≤ 430	≤ 450	≤ 464	≤ 460
Initial Enrichment (wt % ^{235}U)	≤ 4.0	≤ 4.6	≤ 4.0	≤ 4.0	≤ 4.0
No. of Fuel Rods	204	236	264	264	264
Clad O.D. (in.)	≥ 0.422	≥ 0.382	≥ 0.360	≥ 0.372	≥ 0.377
Clad I.D. (in.)	≤ 0.3890	≤ 0.3320	≤ 0.3150	≤ 0.3310	≤ 0.3330
Pellet Dia. (in.)	≤ 0.3825	≤ 0.3255	≤ 0.3088	≤ 0.3232	≤ 0.3252
Fuel Rod Pitch≤ (in.)	≤ 0.563	≤ 0.506	≤ 0.496	≤ 0.496	≤ 0.502
Active Fuel Length (in.)	≤ 144	≤ 150	≤ 150	≤ 150	≤ 150
No. of Guide Tubes	21	5 (note 3)	25	25	25
Guide Tube Thickness (in.)	≥ 0.0145	≥ 0.0400	≥ 0.016	≥ 0.014	≥ 0.020

Notes:
1. Initial Uranium weights and all dimensions are design nominal values. Actual uranium weights may be up to 2.0% higher, within the manufacturers tolerance. Maximum and minimum dimensions are specified to bound variations in design nominal values among fuel assemblies within a given array/class.
2. Zr designates cladding material made of Zirconium or Zirconium alloys.
3. Each guide tube replaces four fuel rods.

Table 1.1-3
BWR FUEL ASSEMBLY CHARACTERISTICS (note 1)

Fuel Assembly Array/Class	**6x6A**	**6x6B**	**6x6C**	**7x7A**	**7x7B**	**8x8A**
Clad Material (note 2)	Zr	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.)	≤ 108	≤ 108	≤ 108	≤ 100	≤ 195	≤ 120
Maximum PLANAR-AVERAGE INITIAL ENRICHMENT (wt.% ^{235}U)	≤ 2.7	≤ 2.7 for the UO_2 rods. See Note 3 for MOX rods	≤ 2.7	≤ 2.7	≤ 4.2	≤ 2.7
Initial Maximum Rod Enrichment (wt.% ^{235}U)	≤ 4.0	≤ 4.0	≤ 4.0	≤ 4.0	≤ 5.0	≤ 4.0
No. of Fuel Rods	36	36 (up to 9 MOX rods)	36	49	49	64
Clad O.D. (in.)	≥ 0.5550	≥ 0.5625	≥ 0.5630	≥ 0.4860	≥ 0.5630	≥ 0.4120
Clad I.D. (in.)	≤ 0.4945	≤ 0.4945	≤ 0.4990	≤ 0.4200	≤ 0.4990	≤ 0.3620
Pellet Dia. (in.)	≤ 0.4940	≤ 0.4820	≤ 0.4880	≤ 0.4110	≤ 0.4880	≤ 0.3580
Fuel Rod Pitch (in.)	≤ 0.694	≤ 0.694	≤ 0.740	≤ 0.631	≤ 0.738	≤ 0.523
Active Fuel Length (in.)	≤ 110	≤ 110	≤ 77.5	≤ 79	≤ 150	≤ 110
No. of Water Rods	0	0	0	0	0	0
Water Rod Thickness (in.)	N/A	N/A	N/A	N/A	N/A	N/A
Channel Thickness (in.)	≤ 0.060	≤ 0.060	≤ 0.060	≤ 0.060	≤ 0.120	≤ 0.100

Table 1.1-3 (continued)
BWR FUEL ASSEMBLY CHARACTERISTICS (note 1)

Fuel Assembly Array/Class	8x8B	8x8C	8x8D	8x8E	9x9A	9x9B
Clad Material (Note 2)	Zr	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.)	≤ 185	≤ 185	≤ 185	≤ 180	≤ 173	≤ 173
Maximum PLANAR-AVERAGE INITIAL ENRICHMENT (wt.% ^{235}U)	≤ 4.2	≤ 4.2	≤ 4.2	≤ 4.2	≤ 4.2	≤ 4.2
Initial Maximum Rod Enrichment (wt.% ^{235}U)	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0
No. of Fuel Rods	63	62	60	59	74/66 (Note 4)	72
Clad O.D. (in.)	≥ 0.4840	≥ 0.4830	≥ 0.4830	≥ 0.4930	≥ 0.4400	≥ 0.4330
Clad I.D. (in.)	≤ 0.4250	≤ 0.4250	≤ 0.4190	≤ 0.4250	≤ 0.3840	≤ 0.3810
Pellet Dia. (in.)	≤ 0.4160	≤ 0.4160	≤ 0.4110	≤ 0.4160	≤ 0.3760	≤ 0.3740
Fuel Rod Pitch (in.)	≤ 0.641	≤ 0.641	≤ 0.640	≤ 0.640	≤ 0.566	≤ 0.569
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Water Rods	1	2	1 - 4 (Note 6)	5	2	1 (Note 5)
Water Rod Thickness (in.)	≥ 0.034	> 0.00	> 0.00	≥ 0.034	> 0.00	> 0.00
Channel Thickness (in.)	≤ 0.120	≤ 0.120	≤ 0.120	≤ 0.100	≤ 0.120	≤ 0.120

Table 1.1-3 (continued)
BWR FUEL ASSEMBLY CHARACTERISTICS (note 1)

Fuel Assembly Array/Class	9x9C	9x9D	9x9E	9x9F	10x10A
Clad Material	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.)	≤ 173	≤ 170	≤ 170	≤ 170	≤ 182
Maximum PLANAR-AVERAGE INITIAL ENRICHMENT (wt.% ^{235}U)	≤ 4.2	≤ 4.2	≤ 4.2	≤ 4.2	≤ 4.2
Initial Maximum Rod Enrichment (wt.% ^{235}U)	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0
No. of Fuel Rods	80	79	76	76	92/78 (Note 7)
Clad O.D. (in.)	≥ 0.4230	≥ 0.4240	≥ 0.4170	≥ 0.4430	≥ 0.4040
Clad I.D. (in.)	≤ 0.3640	≤ 0.3640	≤ 0.3590	≤ 0.3810	≤ 0.3520
Pellet Dia. (in.)	≤ 0.3565	≤ 0.3565	≤ 0.3525	≤ 0.3745	≤ 0.3455
Fuel Rod Pitch (in.)	≤ 0.572	≤ 0.572	≤ 0.572	≤ 0.572	≤ 0.510
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Water Rods	1	2	5	5	2
Water Rod Thickness (in.)	> 0.020	≥ 0.0305	≥ 0.0305	≥ 0.0305	≥ 0.0300
Channel Thickness (in.)	≤ 0.100	≤ 0.100	≤ 0.100	≤ 0.100	≤ 0.120

Table 1.1-3 (continued)
BWR FUEL ASSEMBLY CHARACTERISTICS (note 1)

Fuel Assembly Array/Class	10x10B	10x10C	10x10D	10x10E
Clad Material (note 2)	Zr	Zr	SS	SS
Design Initial U (kg/assy.)	≤ 182	≤ 180	≤ 125	≤ 125
Maximum PLANAR-AVERAGE INITIAL ENRICHMENT (wt.% ^{235}U)	≤ 4.2	≤ 4.2	≤ 4.0	≤ 4.0
Initial Maximum Rod Enrichment (wt.% ^{235}U)	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0
No. of Fuel Rods	91/83 (note 8)	96	100	96
Clad O.D. (in.)	≥ 0.3957	≥ 0.3790	≥ 0.3960	≥ 0.3940
Clad I.D. (in.)	≤ 0.3480	≤ 0.3294	≤ 0.3560	≤ 0.3500
Pellet Dia. (in.)	≤ 0.3420	≤ 0.3224	≤ 0.3500	≤ 0.3430
Fuel Rod Pitch (in.)	≤ 0.510	≤ 0.488	≤ 0.565	≤ 0.557
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 83	≤ 83
No. of Water Rods	1 (Note 5)	5 (Note 9)	0	4
Water Rod Thickness (in.)	> 0.00	≥ 0.034	N/A	≥ 0.022
Channel Thickness (in.)	≤ 0.120	≤ 0.055	≤ 0.080	≤ 0.080

1. Initial uranium weights and all dimensions are design nominal values. Actual uranium weights may be up to 1.5% higher, within the manufacturer's tolerance. Maximum and minimum dimensions are specified to bound variations in design nominal values among fuel assemblies within a given array/class.
2. Zr designates cladding material made of Zirconium or Zirconium alloys.
3. ≤ 0.612 wt.% ^{235}U and ≤ 1.578 wt.% total fuel fissile plutonium (^{239}Pu and ^{241}Pu).
4. This assembly class contains 74 rods; 66 full length rods and 8 partial length rods.
5. Square, replacing nine fuel rods.
6. Variable
7. This assembly class contains 92 total fuel rods; 78 full length rods and 14 partial length rods.
8. This assembly class contains 91 total fuel rods; 83 full length rods and 8 partial length rods.
9. One diamond shaped water rod replacing the four center fuel rods and four rectangualr water rods dividing the assembly into four quadrants.

Table 1.1-4
FUEL ASSEMBLY COOLING AND DECAY HEAT GENERATION

Post-irradiation Cooling Time (years)	MPC-24 PWR Assembly Decay Heat (Watts)	MPC-68 BWR Assembly Decay Heat (Watts)
5	≤ 792	≤ 272
≤ 6	≤ 773	≤ 261
≤ 7	≤ 703	≤ 238
≤ 8	≤ 698	≤ 236
≤ 9	≤ 692	≤ 234
≤ 10	≤ 687	≤ 232
≤ 11	≤ 683	≤ 231
≤ 12	≤ 678	≤ 229
≤ 13	≤ 674	≤ 228
≤ 14	≤ 669	≤ 227
> 14	≤ 665	≤ 226

Table 1.1-5
FUEL ASSEMBLY COOLING AND AVERAGE BURNUP

Post-irradiation Cooling Time (years)	MPC-24 PWR Assembly Burnup (MWD/MTU)	MPC-68 BWR Assembly Burnup (MWD/MTU)
≥ 5	≤ 28,700	≤ 26,000
≥ 6	≤ 32,800	≤ 29,100
≥ 7	≤ 33,300	≤ 29,600
≥ 8	≤ 35,600	≤ 31,400
≥ 9	≤ 37,000	≤ 32,800
≥ 10	≤ 38,300	≤ 33,800
≥ 11	≤ 39,300	≤ 34,800
≥ 12	≤ 40,200	≤ 35,500
≥ 13	≤ 40,900	≤ 36,200
≥ 14	≤ 41,500	≤ 36,900
≥ 15	≤ 42,100	≤ 37,600

LIST OF ASME CODE EXCEPTIONS FOR HI-STAR 100 SYSTEM

Table 1.3-1

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
MPC	NB-1100	Statement of requirements for Code stamping of components.	MPC enclosure vessel 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.
MPC	NB-2000	Requires materials to be supplied by ASME-approved material supplier.	Materials will be supplied by Holtec approved suppliers with Certified Material Test Reports (CMTRs) in accordance with NB-2000 requirements.
MPC Lid and Closure Ring Welds	NB-4243	Full penetration welds required for Category C Joints (flat head to main shell per NB-3352.3)	MPC lid and closure ring are not full penetration welds. They are welded independently to provide a redundant seal. Additionally, a weld efficiency factor of 0.45 has been applied to the analyses of these welds.
MPC Closure Ring, Vent and Drain Cover Plate Welds	NB-5230	Radiographic (RT) or ultrasonic (UT) examination required.	Root and final liquid penetrant examination to be performed in accordance with NB-5245. The MPC vent and drain cover plate welds are leak tested. The closure ring provides independent redundant closure for vent and drain cover plates.

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
MPC Enclosure Vessel and Lid	NB-6111	All completed pressure retaining systems shall be pressure tested.	The MPC enclosure vessel is seal welded in the field following fuel assembly loading. The MPC enclosure vessel shall then be hydrostatically tested as defined in Chapter 9. Accessibility for leakage inspections preclude a Code compliant hydrostatic test. All MPC enclosure vessel welds (except the lid-to-shell and closure ring and vent/drain cover plate) are inspected by RT or UT. The MPC lid-to-shell root and final weld layers are PT examined and the entire weld is either UT examined or multilayer PT examined. The vent/drain cover plate weld is confirmed by leakage testing and liquid penetrant examination and the closure ring weld is confirmed by liquid penetrant examination. The inspection process, including findings, (indications) shall be made a permanent part of the certificate holder's records by video, photographic, or other means which provide an equivalent retrievable record of weld integrity. The video or photographic records should be taken during the final interpretation period described in ASME Section V, Article 6, T-676. The inspection of the weld must be performed by qualified personnel and shall meet the acceptance requirements of ASME Code Section III, NB-5350 for PT or NB-5332 for UT.

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
MPC Enclosure Vessel	NB-7000	Vessels are required to have overpressure protection.	No overpressure protection is provided. Function of MPC enclosure vessel is to contain radioactive contents under normal, off-normal, and accident conditions of storage. MPC vessel is designed to withstand maximum internal pressure considering 100% fuel rod failure and maximum accident temperatures.
MPC Enclosure Vessel	NB-8000	States requirements for nameplates, stamping and reports per NCA-8000.	HI-STAR 100 System to be marked and identified in accordance with 10CFR71 and 10CFR72 requirements. Code stamping is not required. QA data package to be in accordance with Holtec approved QA program.
Overpack Helium Retention Boundary	NB-1100	Statement of requirements for Code stamping of components.	Overpack helium retention boundary 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.
Overpack Helium Retention Boundary	NB-2000	Requires materials to be supplied by ASME approved Material Supplier.	Materials will be supplied by Holtec approved suppliers with CMTRs per NB-2000.
Overpack Helium Retention Boundary	NB-7000	Vessels are required to have overpressure protection.	No overpressure protection is provided. Function of overpack vessel is to contain helium contents under normal, off-normal, and accident conditions. Overpack vessel is designed to withstand maximum internal pressure and maximum accident temperatures.

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
Overpack Helium Retention Boundary	NB-8000	Statement of Requirements for nameplates, stamping and reports per NCA-8000.	HI-STAR 100 System to be marked and identified in accordance with 10CFR71 and 10CFR72 requirements. Code stamping is not required. QA data package to be in accordance with Holtec's approved QA program.
MPC Basket Assembly	NG-2000	Requires materials to be supplied by ASME approved Material Supplier.	Materials will be supplied by Holtec approved supplier with CMTRs in accordance with NG-2000 requirements.
MPC Basket Assembly	NG-8000	States requirements for nameplates, stamping and reports per NCA-8000.	The HI-STAR 100 System will be marked and identified in accordance with 10CFR71 and 10CFR72 requirements. No Code stamping is required. The MPC basket data package will be in conformance with Holtec's QA program.
Overpack Intermediate Shells	NF-4622	All welds, including repair welds, shall be post-weld heat treated (PWHT).	Intermediate shell-to-top flange welds and intermediate shell-to-bottom plate welds do not require PWHT. These welds attach non-pressure retaining parts to pressure retaining parts. The pressure retaining parts are > 7 inches thick. Localized PWHT will cause material away from the weld to experience elevated temperatures which will have an adverse effect on the material properties.
Overpack Helium Retention Boundary	NG-2000	Perform radiographic examination after post-weld heat treatment (PWHT)	Radiography of the helium retention boundary welds after PWHT is not required. All welds (including repairs) will have passed radiographic examination prior to PWHT of the entire containment boundary. Confirmatory radiographic examination after PWHT is not necessary because PWHT is not known to introduce new weld defects in nickel steels.

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
Overpack Intermediate Shells	NF-2000	Requires materials to be supplied by ASME approved Material Supplier.	Materials will be supplied by Holtec approved supplier with CMTRs in accordance with NF-2000 requirements.
Overpack Helium Retention Boundary	NB-2330	Defines the methods for determining the T_{NDT} for impact testing of materials.	T_{NDT} shall be defined in accordance with Regulatory Guides 7.11 and 7.12 for the helium retention boundary components.