



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

Telephone (856) 797-0900

Fax (856) 797-0909

November 14, 2003

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: USNRC Docket No. 72-1014 (TAC L23564)
HI-STORM 100 Certificate of Compliance 1014
HI-STORM 100 License Amendment Request 1014-2, Revision 2, Supplement 1

Reference: Holtec Meeting with NRC held on October 1, 2003

Dear Sir:

As discussed previously with the SFPO staff and management, this supplement to License Amendment Request 1014-2, Revision 2 provides additional information required to complete the NRC's review and development of the associated Safety Evaluation Report for HI-STORM CoC Amendment 2. Attached to this letter are the following documents:

1. Responses to NRC questions pertaining to the HI-STORM thermal analysis FLUENT model and commitments for in-situ validation testing (Holtec proprietary).
2. Holtec Report HI-2033054, Revision 2, which provides the detailed calculations supporting the responses contained in Attachment 1 (Holtec proprietary).
3. Affidavit pursuant to 10 CFR 2.790, applicable to Attachments 1 and 2.
4. Instructions and replacement pages for LAR 1014-2, Revision 2. These replacement pages include a proposed new CoC condition related to the in-situ thermal validation test and three editorial corrections to the LAR as follows:
 - a. Condition 5 of the CoC is modified to replace the word "safety" with the word "regulatory." This change is listed in the LAR Summary of Proposed Changes but was not previously noted in the proposed CoC changes.
 - b. A transposition error in the allowed burnups and cooling times for stainless steel-clad PWR fuel has been correct for the MPC-32 and MPC-32F in Section 2 of Appendix B to the CoC. These values were previously approved in CoC Amendment 1 and were not transposed properly in the proposed CoC changes to add damaged fuel to the MPC-32 and for the MPC-32F canister design.

LMSS01



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- c. FSAR Tables 2.1.17, 2.1.21 and 2.1.24 are modified to correct the burnups and cooling times for stainless steel-clad PWR fuel assemblies in the MPC-32 and MPC-32F and to correct the fuel assembly decay heat limit for the MPC-24 and -32F.

Please contact the undersigned if you require additional information.

Sincerely,

Brian Gutherman, P.E.
Manager, Licensing and Technical Services

Approval:

K.P. Singh, P.E., Ph.D.
President and CEO

Document ID: 5014503

Attachments: As Stated

cc: Mr. Christopher Regan, USNRC (w/attach.)
Holtec Groups 1, 2 and 4 (w/o attach.)
HUG Licensing Correspondence (w/o attach.)

AFFIDAVIT PURSUANT TO 10CFR2.790

I, Brian Gutherman, being duly sworn, depose and state as follows:

(1) I am Manager, Licensing and Technical Services of Holtec International and have reviewed the information described in paragraph (2) which is sought to be withheld, and am authorized to apply for its withholding.

(2) The information sought to be withheld is as follows:

- Attachment 1 to Holtec letter No. 5014503, entitled "Response to NRC Questions on LAR 1014-2 Thermal Model."
- Attachment 2 to Holtec letter No. 5014503, entitled Holtec Report No. HI-2033054, "Thermal Analysis Package for HI-STORM LAR 2 (NRC Docket 1014-2)," Revision 2

This information is considered proprietary to Holtec International as is appropriately annotated as such.

(3) In making this application for withholding of proprietary information of which it is the owner, Holtec International relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4) and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10CFR Part 9.17(a)(4), 2.790(a)(4), and 2.790(b)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

AFFIDAVIT PURSUANT TO 10CFR2.790

- (4) Some examples of categories of information which fit into the definition of proprietary information are:
- a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by Holtec's competitors without license from Holtec International constitutes a competitive economic advantage over other companies;
 - b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.
 - c. Information which reveals cost or price information, production, capacities, budget levels, or commercial strategies of Holtec International, its customers, or its suppliers;
 - d. Information which reveals aspects of past, present, or future Holtec International customer-funded development plans and programs of potential commercial value to Holtec International;
 - e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs 4.a, 4.b, 4.d, and 4.e, above.

- (5) The information sought to be withheld is being submitted to the NRC in confidence. The information (including that compiled from many sources) is of a sort customarily held in confidence by Holtec International, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by Holtec International. No public disclosure has been made, and it is not available in public sources. All

AFFIDAVIT PURSUANT TO 10CFR2.790

disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

- (6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within Holtec International is limited on a "need to know" basis.
- (7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his designee), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside Holtec International are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.
- (8) The information classified as proprietary was developed and compiled by Holtec International at a significant cost to Holtec International. This information is classified as proprietary because it contains detailed descriptions of analytical approaches and methodologies not available elsewhere. This information would provide other parties, including competitors, with information from Holtec International's technical database and the results of evaluations performed by Holtec International. A substantial effort has been expended by Holtec International to develop this information. Release of this information would improve a competitor's position because it would enable Holtec's competitor to copy our technology and offer it for sale in competition with our company, causing us financial injury.

AFFIDAVIT PURSUANT TO 10CFR2.790

- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to Holtec International's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of Holtec International's comprehensive spent fuel storage technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology, and includes development of the expertise to determine and apply the appropriate evaluation process.

The research, development, engineering, and analytical costs comprise a substantial investment of time and money by Holtec International.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

Holtec International's competitive advantage will be lost if its competitors are able to use the results of the Holtec International experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to Holtec International would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive Holtec International of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Document ID 5014503
Attachment 3


AFFIDAVIT PURSUANT TO 10CFR2.790

STATE OF NEW JERSEY)
)
COUNTY OF BURLINGTON) ss:


Mr. Brian Gutherman, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at Marlton, New Jersey, this 14th day of November, 2003.


Brian Gutherman
Holtec International

Subscribed and sworn before me this 14th day of November, 2003.


MARIA C. PEPE
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 25, 2005

INSTRUCTIONS FOR LAR 1014-2, REVISION 2, SUPPLEMENT 1

1. Insert the cover letter in front of LAR Volume 1
2. Remove Markup CoC (4 pages) and replace with enclosed modified Markup CoC (5 pages).
3. Remove Revised CoC and replace with enclosed modified Revised CoC.
4. Remove Mark-up CoC, Appendix B, page 2-31/32 and replace with enclosed page 2-31/32.
5. Remove Mark-up CoC, Appendix B, pages 2-43 through 2-46 and replace with enclosed pages 2-43 through 2-46.
6. Remove Revised CoC, Appendix B, page 2-31/32 and replace with enclosed page 2-31/32.
7. Remove Revised CoC, Appendix B, pages 2-43 through 2-46 and replace with enclosed pages 2-43 through 2-46.
8. Remove SAR page 2.1-33/34, Proposed Rev. 2B and replace with enclosed SAR page 2.1-33/34, Proposed Rev. 2B.
9. Remove SAR page 2.1-41/42, Proposed Rev. 2B and replace with enclosed SAR page 2.1-41/42, Proposed Rev. 2B.
10. Remove SAR page 2.1-47/48, Proposed Rev. 2B and replace with enclosed SAR page 2.1-47/48, Proposed Rev. 2B.



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Please contact the undersigned if you require additional information.

Sincerely,

Brian Gutherman, P.E.
Manager, Licensing and Technical Services

Approval:

K.P. Singh, P.E., Ph.D
President and CEO

Document ID: 5014503

Attachments: As Stated

cc: Mr. Christopher Regan, USNRC (w/attach.)
Holtec Groups 1, 2 and 4 (w/o attach.)
HUG Licensing Correspondence (w/o attach.)

**CERTIFICATE OF COMPLIANCE
FOR SPENT FUEL STORAGE CASKS**

Page 1 of 5

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.
1014	05/31/00	06/01/20	72-1014	42		USA/72-1014

Issued To: (Name/Address)

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

Safety Analysis Report Title

Holtec International Inc., Final Safety Analysis Report for the HI-STORM 100 Cask System
Docket No. 72-1014

CONDITIONS

This certificate is conditioned upon fulfilling the requirements of 10 CFR Part 72, as applicable, the attached Appendix A (Technical Specifications) and Appendix B - (Approved Contents and Design Features), and the conditions specified below:

1. CASK**a. Model No.: HI-STORM 100 Cask System**

The HI-STORM 100 Cask System (the cask) consists of the following components: (1) interchangeable multi-purpose canisters (MPCs), which contain the fuel; (2) a storage overpack (HI-STORM 400 or 400S), which contains the MPC during storage; and (3) a transfer cask (HI-TRAC), which contains the MPC during loading, unloading and transfer operations. The cask stores up to 32 pressurized water reactor (PWR), fuel assemblies or 68 boiling water reactor (BWR) fuel assemblies.

b. Description

The HI-STORM 100 Cask System is certified as described in the Final Safety Analysis Report (FSAR) and in the U. S. Nuclear Regulatory Commission's (NRC) Safety Evaluation Report (SER) accompanying the Certificate of Compliance. The cask comprises three discrete components: the MPCs, the HI-TRAC transfer cask, and the HI-STORM 400 or 400S storage overpack.

The MPC is the confinement system for the stored fuel. It is a welded, cylindrical canister with a honeycombed fuel basket, a baseplate, a lid, a closure ring, and the canister shell. It is made entirely of stainless steel except for the neutron absorbers and optional aluminum heat conduction elements (AHCEs), which are installed in some early-vintage MPCs. The canister shell, baseplate, lid, vent and drain port cover plates, and closure ring are the main confinement boundary components. The honeycombed basket, which is equipped with Boral neutron absorbers, provides criticality control.

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FOR SPENT FUEL STORAGE CASKS**
Supplemental Sheet

Certificate 1014

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1. b. Description (continued)

There are seven *eight* types of MPCs: the MPC-24, MPC-24E, MPC-24EF, MPC-32, MPC-32F, MPC-68, MPC-68F, and MPC-68FF. *The number suffix indicates the maximum number of fuel assemblies permitted to be loaded in the MPC. The MPG-24 and MPG-32 hold up to 24 and 32 PWR fuel assemblies, respectively, that must be intact. The MPG-24E holds up to 24 PWR fuel assemblies, up to four of which may be classified as damaged fuel assemblies. The MPG-24EF holds up to 24 PWR fuel assemblies, up to four of which may be classified as damaged fuel assemblies or in the form of fuel debris. The MPG-68 holds up to 68 BWR fuel assemblies that may be intact or damaged (i.e., with known or suspected cladding defects greater than hairline cracks or pinholes). The number of damaged fuel assemblies is limited to sixteen unless they are Dresden Unit 1 or Humboldt Bay fuel assemblies. The MPG-68F holds up to 68 Dresden Unit 1 or Humboldt Bay BWR fuel assemblies that may be intact, damaged, with up to four in the form of fuel debris (i.e., with known or suspected defects such as ruptured fuel rods, severed fuel rods, and loose fuel pellets). The MPG-68FF holds up to 68 BWR fuel assemblies, up to sixteen of which may be classified as damaged fuel or fuel debris. A maximum of eight fuel assemblies may be in the form of fuel debris. All fuel to be stored in the HI-STORM 100 System must comply with the limits specified in Appendix B to this GoG. All seven *eight* MPC models have the same external dimensions diameter.*

The HI-TRAC transfer cask provides shielding and structural protection of the MPC during loading, unloading, and movement of the MPC from the spent fuel pool to the storage overpack. The transfer cask is a multi-walled (carbon steel/lead/carbon steel) cylindrical vessel with a water jacket attached to the exterior. Two typesizes of HI-TRAC transfer casks are available: the 125 ton HI-TRAC and the 100 ton HI-TRAC. The weight designation is the maximum weight of a loaded transfer cask during any loading, unloading or transfer operation. Both transfer cask typesizes have identical cavity diameters. The 125 ton HI-TRAC transfer cask has thicker lead and water shielding and larger outer dimensions than the 100 ton HI-TRAC transfer cask.

The HI-STORM 100 or 100S storage overpack provides shielding and structural protection of the MPC during storage. The HI-STORM 100S is a shortened version *variation of the HI-STORM 100 overpack design that includes with a modified lid design incorporating which incorporates the air outlet ducts into the lid, allowing the overpack body to be shortened.* The overpack is a heavy-walled steel and concrete, cylindrical vessel. Its side wall consists of plain (un-reinforced) concrete that is enclosed between inner and outer carbon steel shells. The overpack has a *minimum of four* air inlets at the bottom and a *minimum of four* air outlets at the top to allow air to circulate naturally through the cavity to cool the MPC inside. The inner shell has channels attached to its interior surface to guide the MPC during insertion and removal, provide a flexible medium to absorb impact loads, and allow cooling air to circulate through the overpack. A loaded MPC is stored within the HI-STORM 100 or 100S storage overpack in a vertical orientation. The HI-STORM 100A is a variant of the HI-STORM 100 family and is outfitted with an extended baseplate and gussets to enable the overpack to be anchored to the concrete storage pad in high seismic applications. The HI-STORM 100A applies to both the standard (HI-STORM 100) and short (HI-STORM 100S) overpacks that are classified as the HI-STORM 100A and HI-STORM 100SA, respectively.

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 Chapter 8 of the FSAR.

3. ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

Written cask acceptance tests and maintenance program shall be prepared consistent with the technical basis described in Chapter 9 of the FSAR.

**CERTIFICATE OF COMPLIANCE
FOR SPENT FUEL STORAGE CASKS**
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Certificate 1014

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4. QUALITY ASSURANCE

Activities in the areas of design, purchase, 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.

5. HEAVY LOADS REQUIREMENTS

Each lift of an MPC, a HI-TRAC transfer cask, or a HI-STORM 100 or 100S overpack must be made in accordance to the existing heavy loads requirements and procedures of the licensed facility at which the lift is made. A plant-specific safety regulatory review (under 10 CFR 50.59 or 10 CFR 72.48, if applicable) is required to show operational compliance with existing plant specific heavy loads requirements. Lifting operations outside of structures governed by 10 CFR Part 50 must be in accordance with Section 5.5 of Appendix A and/or Sections 3.4.6 and Section 3.5 of Appendix B to this certificate, as applicable.

6. APPROVED CONTENTS

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

7. DESIGN FEATURES

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

8. 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.

9. SPECIAL REQUIREMENTS FOR FIRST SYSTEMS IN PLACE

The heat transfer characteristics of the cask system will be recorded by temperature measurements for the first HI-STORM Cask Systems (for each thermally unique MPC basket design - MPC-24/24E/24EF, MPC-32/32F, and MPC-68/68F/68FF) placed into service by any user with a heat load equal to or greater than 10 kW. An analysis shall be performed that demonstrates the temperature measurements validate the analytic methods and predicted thermal behavior described in Chapter 4 of the FSAR.

Validation tests shall be performed for each subsequent cask system that has a heat load that exceeds a previously validated heat load by more than 2 kW (e.g., if the initial test was conducted at 10 kW, then no additional testing is needed until the heat load exceeds 12 kW). No additional testing is required for a system after it has been tested at a heat load equal to or greater than 16 kW.

Letter reports summarizing the results of each validation test shall be submitted to the NRC in accordance with 10 CFR 72.4. Cask users may satisfy these requirements by referencing validation test reports submitted to the NRC by other cask users.

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10. MPC THERMAL TESTING

The heat transfer characteristics of the MPC shall be recorded by temperature measurements for the first HI-STORM Cask Systems (for each thermally unique MPC basket design - MPC-24/24E/24EF, MPC-32/32F, and MPC-68/68F/68FF) placed into service by any user with a heat load equal to or greater than 30 kW. MPC lid temperatures shall be measured to confirm that fuel cladding temperature is less than or equal to 752°F. Additional tests shall be performed for each subsequent MPC that has a heat load that exceeds a previously validated heat load by more than 2 kW (e.g., if the initial test was conducted at 30 kW, then no additional testing is needed until the heat load exceeds 32 kW). No additional testing is required for an MPC after it has been tested at a heat load equal to or greater than 36 kW.

101. PRE-OPERATIONAL TESTING AND TRAINING EXERCISE

A dry run training exercise of the loading, closure, handling, unloading, and transfer of the HI-STORM 100 Cask 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 MPC. 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 MPC and the transfer cask into the spent fuel pool.
- b. Preparation of the HI-STORM 100 Cask System for fuel loading.
- c. Selection and verification of specific fuel assemblies to ensure type conformance.
- d. Loading specific assemblies and placing assemblies into the MPC (using a dummy fuel assembly), including appropriate independent verification.
- e. Remote installation of the MPC lid and removal of the MPC and transfer cask from the spent fuel pool.
- f. MPC welding, NDE inspections, hydrostatic pressure testing, draining, moisture removal (by vacuum drying or forced helium dehydration, as applicable), and helium backfilling, and leakage testing. (A mockup may be used for this dry-run exercise.)
- g. Transfer cask upending/downending on the horizontal transfer trailer or other transfer device, as applicable to the site's cask handling arrangement.
- h. Transfer of the MPC from the transfer cask to the overpack.
- i. Placement of the HI-STORM 100 Cask System at the ISFSI.
- j. HI-STORM 100 Cask System unloading, including cooling fuel assemblies, flooding MPC cavity, removing MPC lid welds. (A mockup may be used for this dry-run exercise.)

**CERTIFICATE OF COMPLIANCE
FOR SPENT FUEL STORAGE CASKS**
Supplemental Sheet

Certificate 1014

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142. AUTHORIZATION

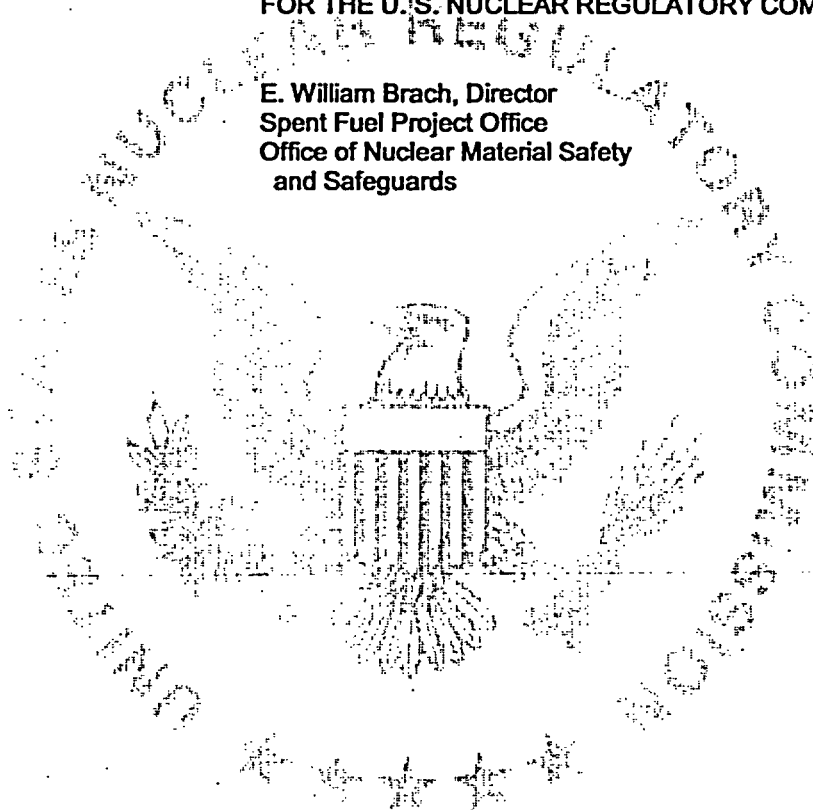
The HI-STORM 100 Cask System, which is authorized by this certificate, is hereby approved for general use by holders of 10 CFR Part 50 licenses for nuclear reactors at reactor sites under the general license issued pursuant to 10 CFR 72.210, subject to the conditions specified by 10 CFR 72.212, and the attached Appendix A and Appendix B. *All The HI-STORM 100 Cask Systems must may be fabricated and used in accordance with any approved amendment to CoC No. 1014 listed in 10 CFR 72.214. Each of the licensed HI-STORM 100 System components (i.e., the MPC, overpack, and transfer cask), if fabricated in accordance with different CoC amendments, may be used with one another provided the CoC does not specifically prohibit their use with each other, and a design compatibility assessment is performed by the CoC holder. Amendment No. 4; except that general licensees may use the HI-STORM 100 Cask Systems that were fabricated in accordance with the original CoC.*

FOR THE U. S. NUCLEAR REGULATORY COMMISSION

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
FOR SPENT FUEL STORAGE CASKS**

Page 1 of 4

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Certificate No.	Effective Date	Expiration Date	Docket Number	Amendment No.	Amendment Date	Package Identification No.
1014	05/31/00	06/01/20	72-1014	2		USA/72-1014

Issued To: (Name/Address)

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

Safety Analysis Report Title

Holtec International Final Safety Analysis Report for the HI-STORM 100 Cask System
Docket No. 72-1014

CONDITIONS

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b. Description

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The MPC is the confinement system for the stored fuel. It is a welded, cylindrical canister with a honeycombed fuel basket, a baseplate, a lid, a closure ring, and the canister shell. It is made entirely of stainless steel except for the neutron absorbers and aluminum heat conduction elements (AHCEs), which are installed in some early-vintage MPCs. The canister shell, baseplate, lid, vent and drain port cover plates, and closure ring are the main confinement boundary components. The honeycombed basket, which is equipped with neutron absorbers, provides criticality control.

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1. b. Description (continued)

There are eight types of MPCs: the MPC-24, MPC-24E, MPC-24EF, MPC-32, MPC-32F, MPC-68, MPC-68F, and MPC-68FF. The number suffix indicates the maximum number of fuel assemblies permitted to be loaded in the MPC. All eight MPC models have the same external diameter.

The HI-TRAC transfer cask provides shielding and structural protection of the MPC during loading, unloading, and movement of the MPC from the spent fuel pool to the storage overpack. The transfer cask is a multi-walled (carbon steel/lead/carbon steel) cylindrical vessel with a water jacket attached to the exterior. Two sizes of HI-TRAC transfer casks are available: the 125 ton-HI-TRAC and the 100 ton HI-TRAC. The weight designation is the maximum weight of a loaded transfer cask during any loading, unloading or transfer operation. Both transfer cask sizes have identical cavity diameters. The 125 ton HI-TRAC transfer cask has thicker lead and water shielding and larger outer dimensions than the 100 ton HI-TRAC transfer cask.

The HI-STORM 100 or 100S storage overpack provides shielding and structural protection of the MPC during storage. The HI-STORM 100S is a variation of the HI-STORM 100 overpack design that includes a modified lid which incorporates the air outlet ducts into the lid, allowing the overpack body to be shortened. The overpack is a heavy-walled steel and concrete, cylindrical vessel. Its side wall consists of plain (un-reinforced) concrete that is enclosed between inner and outer carbon steel shells. The overpack has a minimum of four air inlets at the bottom and a minimum of four air outlets at the top to allow air to circulate naturally through the cavity to cool the MPC inside. The inner shell has channels attached to its interior surface to guide the MPC during insertion and removal, provide a flexible medium to absorb impact loads, and allow cooling air to circulate through the overpack. A loaded MPC is stored within the HI-STORM 100 or 100S storage overpack in a vertical orientation. The HI-STORM 100A is a variant of the HI-STORM 100 family and is outfitted with an extended baseplate and gussets to enable the overpack to be anchored to the concrete storage pad in high seismic applications. The HI-STORM 100A applies to both the HI-STORM 100 and HI-STORM 100S overpacks that are classified as the HI-STORM 100A and HI-STORM 100SA, respectively.

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 Chapter 8 of the FSAR.

3. ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

Written cask acceptance tests and maintenance program shall be prepared consistent with the technical basis described in Chapter 9 of the FSAR.

4. QUALITY ASSURANCE

Activities in the areas of design, purchase, 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.

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5. HEAVY LOADS REQUIREMENTS

Each lift of an MPC, a HI-TRAC transfer cask, or a HI-STORM 100 or 100S overpack must be made in accordance to the existing heavy loads requirements and procedures of the licensed facility at which the lift is made. A plant-specific regulatory review (under 10 CFR 50.59 or 10 CFR 72.48, if applicable) is required to show operational compliance with existing plant specific heavy loads requirements. Lifting operations outside of structures governed by 10 CFR Part 50 must be in accordance with Section 5.5 of Appendix A and/or Sections 3.4.6 and Section 3.5 of Appendix B to this certificate, as applicable.

6. APPROVED CONTENTS

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

7. DESIGN FEATURES

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

8. 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.

9. SPECIAL REQUIREMENTS FOR FIRST SYSTEMS IN PLACE

The heat transfer characteristics of the cask system will be recorded by temperature measurements for the first HI-STORM Cask Systems (for each thermally unique MPC basket design - MPC-24/24E/24EF, MPC-32/32F, and MPC-68/68F/68FF) placed into service by any user with a heat load equal to or greater than 10 kW. An analysis shall be performed that demonstrates the temperature measurements validate the analytic methods and predicted thermal behavior described in Chapter 4 of the FSAR.

Validation tests shall be performed for each subsequent cask system that has a heat load that exceeds a previously validated heat load by more than 2 kW (e.g., if the initial test was conducted at 10 kW, then no additional testing is needed until the heat load exceeds 12 kW). No additional testing is required for a system after it has been tested at a heat load equal to or greater than 16 kW.

Letter reports summarizing the results of each validation test shall be submitted to the NRC in accordance with 10 CFR 72.4. Cask users may satisfy these requirements by referencing validation test reports submitted to the NRC by other cask users.

10. MPC THERMAL TESTING

The heat transfer characteristics of the MPC shall be recorded by temperature measurements for the first HI-STORM Cask Systems (for each thermally unique MPC basket design - MPC-24/24E/24EF, MPC-32/32F, and MPC-68/68F/68FF) placed into service by any user with a heat load equal to or greater than 30 kW. MPC lid temperatures shall be measured to confirm that fuel cladding temperature is less than or equal to 752°F. Additional tests shall be performed for each subsequent MPC that has a heat load that exceeds a previously validated heat load by more than 2 kW (e.g., if the initial test was conducted at 30 kW, then no additional testing is needed until the heat load exceeds 32 kW). No additional testing is required for an MPC after it has been tested at a heat load equal to or greater than 36 kW.

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11. PRE-OPERATIONAL TESTING AND TRAINING EXERCISE

A dry run training exercise of the loading, closure, handling, unloading, and transfer of the HI-STORM 100 Cask 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 MPC. 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 MPC and the transfer cask into the spent fuel pool.
- b. Preparation of the HI-STORM 100 Cask System for fuel loading.
- c. Selection and verification of specific fuel assemblies to ensure type conformance.
- d. Loading specific assemblies and placing assemblies into the MPC (using a dummy fuel assembly), including appropriate independent verification.
- e. Remote installation of the MPC lid and removal of the MPC and transfer cask from the spent fuel pool.
- f. MPC welding, NDE inspections, pressure testing, draining, moisture removal (by vacuum drying or forced helium dehydration, as applicable), and helium backfilling. (A mockup may be used for this dry-run exercise.)
- a. Transfer cask upending/downending on the horizontal transfer trailer or other transfer device, as applicable to the site's cask handling arrangement.
- h. Transfer of the MPC from the transfer cask to the overpack.
- i. Placement of the HI-STORM 100 Cask System at the ISFSI.
- j. HI-STORM 100 Cask System unloading, including cooling fuel assemblies, flooding MPC cavity, removing MPC lid welds. (A mockup may be used for this dry-run exercise.)

12. AUTHORIZATION

The HI-STORM 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. The HI-STORM 100 Cask System may be fabricated and used in accordance with any approved amendment to CoC No. 1014 listed in 10 CFR 72.214. Each of the licensed HI-STORM 100 System components (i.e., the MPC, overpack, and transfer cask), if fabricated in accordance with different CoC amendments, may be used with one another provided the CoC does not specifically prohibit their use with each other, and a design compatibility assessment is performed by the CoC holder.

FOR THE U. S. NUCLEAR REGULATORY COMMISSION

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

Attachments:

- 1. Appendix A
- 2. Appendix B

Table 2.1-1 (page 24 of 339)
Fuel Assembly Limits

V. MPC MODEL: MPC-32 (continued)

A. Allowable Contents (continued)

d. Decay Heat Per Assembly

i. Array/Classes 14x14D,
14x14E, and 15x15G ≤ 500 Watts

ii. All Other Array/Classes As specified in *Section 2.4. Tables 2-1-5
or 2-1-7.*

e. Fuel Assembly Length ≤ 176.8 inches (nominal design)

f. Fuel Assembly Width ≤ 8.54 inches (nominal design)

g. Fuel Assembly Weight $\leq 1,680$ lbs (including NON-FUEL
HARDWARE)

Table 2.1-1 (page 245 of 339)
Fuel Assembly Limits

V. MPC MODEL: MPC-32 (continued)

A. Allowable Contents (continued)

2. *Uranium oxide, PWR DAMAGED FUEL ASSEMBLIES, with or without NON-FUEL HARDWARE, placed in DAMAGED FUEL CONTAINERS. Uranium oxide PWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 2.1-2 and meet the following specifications (Note 1):*

- | | |
|---|---|
| <i>a. Cladding Type:</i> | <i>ZR or Stainless Steel (SS) as specified in Table 2.1-2 for the applicable fuel assembly array/class</i> |
| <i>b. Initial Enrichment:</i> | <i>As specified in Table 2.1-2 for the applicable fuel assembly array/class.</i> |
| <i>c. Post-irradiation Cooling Time and Average Burnup Per Assembly</i> | |
| <i>i. Array/Classes 14x14D, 14x14E, and 15x15G</i> | <i>Cooling time ≥ 9 years and an average burnup $\leq 30,000$ MWD/MTU or cooling time ≥ 20 years and an average burnup $\leq 40,000$ MWD/MTU.</i> |
| <i>ii. All Other Array/Classes</i> | <i>As specified in Section 2.4.</i> |
| <i>iii. NON-FUEL HARDWARE</i> | <i>As specified in Table 2.1-8.</i> |

*Table 2.1-1 (page 36 of 39)
Fuel Assembly Limits*

VIII. MPC MODEL: MPC-32F

A. Allowable Contents

- 1. Uranium oxide, PWR INTACT FUEL ASSEMBLIES listed in Table 2.1-2, with or without NON-FUEL HARDWARE and meeting the following specifications (Note 1):**

- | | |
|--|---|
| a. Cladding Type: | ZR or Stainless Steel (SS) as specified in Table 2.1-2 for the applicable fuel assembly array/class |
| b. Initial Enrichment: | As specified in Table 2.1-2 for the applicable fuel assembly array/class. |
| c. Post-irradiation Cooling Time and Average Burnup Per Assembly: | |
| i. Array/Classes 14x14D, 14x14E, and 15x15G | Cooling time ≥ 9 years and an average burnup $\leq 30,000$ MWD/MTU or cooling time ≥ 20 years and an average burnup $\leq 40,000$ MWD/MTU. |
| ii. All Other Array/Classes | As specified in Section 2.4. |
| iii. NON-FUEL HARDWARE | As specified in Table 2.1-8. |

Table 2.1-1 (page 37 of 39)
Fuel Assembly Limits

VIII. MPC MODEL: MPC-32F (cont'd)

A. Allowable Contents (cont'd)

d. Decay Heat Per Assembly

i. Array/Classes 14x14D, 14x14E, and 15x15G ≤ 500 Watts.

ii. All Other Array/Classes As specified in Section 2.4.

e. Fuel Assembly Length ≤ 176.8 inches (nominal design)

f. Fuel Assembly Width ≤ 8.54 inches (nominal design)

g. Fuel Assembly Weight $\leq 1,680$ lbs (including NON-FUEL
HARDWARE)

Table 2.1-1 (page 38 of 39)
Fuel Assembly Limits

VIII. MPC MODEL: MPC-32F (cont'd)

A. Allowable Contents (cont'd)

2. Uranium oxide, PWR DAMAGED FUEL ASSEMBLIES and FUEL DEBRIS, with or without NON-FUEL HARDWARE, placed in DAMAGED FUEL CONTAINERS. Uranium oxide PWR DAMAGED FUEL ASSEMBLIES and FUEL DEBRIS shall meet the criteria specified in Table 2.1-2 and meet the following specifications (Note 1):

a. Cladding Type: ZR or Stainless Steel (SS) as specified in Table 2.1-2 for the applicable fuel assembly array/class

b. Initial Enrichment: As specified in Table 2.1-2 for the applicable fuel assembly array/class.

c. Post-irradiation Cooling Time and Average Burnup Per Assembly:

i. Array/Classes 14x14D, 14x14E, and 15x15G Cooling time ≥ 9 years and an average burnup $\leq 30,000$ MWD/MTU or cooling time ≥ 20 years and an average burnup $\leq 40,000$ MWD/MTU.

ii. All Other Array/Classes As specified in Section 2.4.

iii. NON-FUEL HARDWARE As specified in Table 2.1-8.

Table 2.1-1 (page 39 of 39)
Fuel Assembly Limits

VIII. MPC MODEL: MPC-32F (cont'd)

A. Allowable Contents (cont'd)

d. Decay Heat Per Assembly

i. Array/Classes 14x14D, 14x14E, and 15x15G ≤ 500 Watts.

ii. All Other Array/Classes As specified in Section 2.4.

e. Fuel Assembly Length ≤ 176.8 inches (nominal design)

f. Fuel Assembly Width ≤ 8.54 inches (nominal design)

g. Fuel Assembly Weight $\leq 1,680$ lbs (including NON-FUEL
HARDWARE and DFC)

B. Quantity per MPC: Up to eight (8) DAMAGED FUEL ASSEMBLIES and/or FUEL DEBRIS in DAMAGED FUEL CONTAINERS, stored in fuel storage locations 1, 4, 5, 10, 23, 28, 29, and/or 32. The remaining MPC-32F fuel storage locations may be filled with PWR INTACT FUEL ASSEMBLIES meeting the applicable specifications.

C. Neutron Sources are not authorized for loading in the MPC-32F.

Note 1: Fuel assemblies containing BPRAs, TPDs, WABAs, water displacement guide tube plugs, orifice rod assemblies, or vibration suppressor inserts may be stored in any fuel cell location. Fuel assemblies containing CRAs, RCCAs, CEAs, or APSRs may only be loaded in fuel storage locations 13, 14, 19 and/or 20. These requirements are in addition to any other requirements specified for uniform or regionalized fuel loading.

Table 2.1-1 (page 24 of 39)
Fuel Assembly Limits

V. MPC MODEL: MPC-32 (continued)

A. Allowable Contents (continued)

d. Decay Heat Per Assembly

i. Array/Classes 14x14D,
14x14E, and 15x15G ≤ 500 Watts

ii. All Other Array/Classes As specified in Section 2.4.

e. Fuel Assembly Length ≤ 176.8 inches (nominal design)

f. Fuel Assembly Width ≤ 8.54 inches (nominal design)

g. Fuel Assembly Weight $\leq 1,680$ lbs (including NON-FUEL
HARDWARE)

Table 2.1-1 (page 25 of 39)
Fuel Assembly Limits

V. MPC MODEL: MPC-32 (continued)

A. Allowable Contents (continued)

2. Uranium oxide, PWR DAMAGED FUEL ASSEMBLIES, with or without NON-FUEL HARDWARE, placed in DAMAGED FUEL CONTAINERS. Uranium oxide PWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 2.1-2 and meet the following specifications (Note 1):

- | | |
|---|--|
| a. Cladding Type: | ZR or Stainless Steel (SS) as specified in Table 2.1-2 for the applicable fuel assembly array/class |
| b. Initial Enrichment: | As specified in Table 2.1-2 for the applicable fuel assembly array/class. |
| c. Post-irradiation Cooling Time and Average Burnup Per Assembly: | |
| i. Array/Classes 14x14D, 14x14E, and 15x15G | Cooling time \geq 9 years and an average burnup \leq 30,000 MWD/MTU or cooling time \geq 20 years and an average burnup \leq 40,000 MWD/MTU. |
| ii. All Other Array/Classes | As specified in Section 2.4. |
| iii. NON-FUEL HARDWARE | As specified in Table 2.1-8. |

Table 2.1-1 (page 36 of 39)
Fuel Assembly Limits

VIII. MPC MODEL: MPC-32F

A. Allowable Contents

1. Uranium oxide, PWR INTACT FUEL ASSEMBLIES listed in Table 2.1-2, with or without NON-FUEL HARDWARE and meeting the following specifications (Note 1):

- | | |
|---|--|
| a. Cladding Type: | ZR or Stainless Steel (SS) as specified in Table 2.1-2 for the applicable fuel assembly array/class |
| b. Initial Enrichment: | As specified in Table 2.1-2 for the applicable fuel assembly array/class. |
| c. Post-irradiation Cooling Time and Average Burnup Per Assembly: | |
| i. Array/Classes 14x14D, 14x14E, and 15x15G | Cooling time ≥ 9 years and an average burnup $\leq 30,000$ MWD/MTU or cooling time ≥ 20 years and an average burnup $\leq 40,000$ MWD/MTU. |
| ii. All Other Array/Classes | As specified in Section 2.4. |
| iii. NON-FUEL HARDWARE | As specified in Table 2.1-8. |

Table 2.1-1 (page 37 of 39)
Fuel Assembly Limits

VIII. MPC MODEL: MPC-32F (cont'd)

A. Allowable Contents (cont'd)

d. Decay Heat Per Assembly

i. Array/Classes 14x14D, 14x14E, and 15x15G ≤ 500 Watts.

ii. All Other Array/Classes As specified in Section 2.4.

e. Fuel Assembly Length ≤ 176.8 inches (nominal design)

f. Fuel Assembly Width ≤ 8.54 inches (nominal design)

g. Fuel Assembly Weight $\leq 1,680$ lbs (including NON-FUEL
HARDWARE)

Table 2.1-1 (page 38 of 39)
Fuel Assembly Limits

VIII. MPC MODEL: MPC-32F (cont'd)

A. Allowable Contents (cont'd)

2. Uranium oxide, PWR DAMAGED FUEL ASSEMBLIES and FUEL DEBRIS, with or without NON-FUEL HARDWARE, placed in DAMAGED FUEL CONTAINERS. Uranium oxide PWR DAMAGED FUEL ASSEMBLIES and FUEL DEBRIS shall meet the criteria specified in Table 2.1-2 and meet the following specifications (Note 1):

- | | |
|---|--|
| a. Cladding Type: | ZR or Stainless Steel (SS) as specified in Table 2.1-2 for the applicable fuel assembly array/class |
| b. Initial Enrichment: | As specified in Table 2.1-2 for the applicable fuel assembly array/class. |
| c. Post-irradiation Cooling Time and Average Burnup Per Assembly: | |
| i. Array/Classes 14x14D, 14x14E, and 15x15G | Cooling time ≥ 9 years and an average burnup $\leq 30,000$ MWD/MTU or cooling time ≥ 20 years and an average burnup $\leq 40,000$ MWD/MTU. |
| ii. All Other Array/Classes | As specified in Section 2.4. |
| iii. NON-FUEL HARDWARE | As specified in Table 2.1-8. |

Table 2.1-1 (page 39 of 39)
Fuel Assembly Limits

VIII. MPC MODEL: MPC-32F (cont'd)

A. Allowable Contents (cont'd)

d. Decay Heat Per Assembly

i. Array/Classes 14x14D, 14x14E, and 15x15G ≤ 500 Watts.

ii. All Other Array/Classes As specified in Section 2.3.

e. Fuel Assembly Length ≤ 176.8 inches (nominal design)

f. Fuel Assembly Width ≤ 8.54 inches (nominal design)

g. Fuel Assembly Weight $\leq 1,680$ lbs (including NON-FUEL HARDWARE and DFC)

B. Quantity per MPC: Up to eight (8) DAMAGED FUEL ASSEMBLIES and/or FUEL DEBRIS in DAMAGED FUEL CONTAINERS, stored in fuel storage locations 1, 4, 5, 10, 23, 28, 29, and/or 32. The remaining MPC-32F fuel storage locations may be filled with PWR INTACT FUEL ASSEMBLIES meeting the applicable specifications.

C. Neutron sources are not permitted for loading in the MPC-32F.

Note 1: Fuel assemblies containing BPRAs, TPDs, WABAs, water displacement guide tube plugs, orifice rod assemblies, or vibration suppressor inserts may be stored in any fuel cell location. Fuel assemblies containing CRAs, RCCAs, CEAs, or APSRs may only be loaded in fuel storage locations 13, 14, 19 and/or 20. These requirements are in addition to any other requirements specified for uniform or regionalized fuel loading.

Table 2.1-16

Soluble Boron Requirements for MPC-32 and MPC-32F Wet Loading and Unloading Operations

<i>Fuel Assembly Array/Class</i>	<i>All Intact Fuel Assemblies</i>		<i>One or More Damaged Fuel Assemblies or Fuel Debris</i>	
	<i>Initial Enrichment $\leq 4.1 \text{ wt. \% } ^{235}\text{U}$ (ppmb)</i>	<i>Initial Enrichment $\leq 5.0 \text{ wt. \% } ^{235}\text{U}$ (ppmb)</i>	<i>Initial Enrichment $\leq 4.1 \text{ wt. \% } ^{235}\text{U}$ (ppmb)</i>	<i>Initial Enrichment $\leq 5.0 \text{ wt. \% } ^{235}\text{U}$ (ppmb)</i>
<i>14x14A/B/C/D/E</i>	<i>1,300</i>	<i>1,900</i>	<i>1,500</i>	<i>2,300</i>
<i>15x15A/B/C/G</i>	<i>1,800</i>	<i>2,500</i>	<i>1,900</i>	<i>2,700</i>
<i>15x15D/E/F/H</i>	<i>1,900</i>	<i>2,600</i>	<i>2,100</i>	<i>2,900</i>
<i>16x16A</i>	<i>1,300</i>	<i>1,900</i>	<i>1,500</i>	<i>2,300</i>
<i>17x17A/B/C</i>	<i>1,900</i>	<i>2,600</i>	<i>2,100</i>	<i>2,900</i>

Table 2.1.17

LIMITS FOR MATERIAL TO BE STORED IN MPC-24

PARAMETER	VALUE
Fuel Type	Uranium oxide, PWR intact fuel assemblies meeting the limits in Table 2.1.3 for the applicable array/class
Cladding Type	ZR or Stainless Steel (SS) as specified in Table 2.1.3 for the applicable array/class
Maximum Initial Enrichment per Assembly	As specified in Table 2.1.3 for the applicable array/class
Post-irradiation Cooling Time and Average Burnup per Assembly	ZR clad: As specified in Section 2.1.9.1 SS clad: ≥ 8 years and $\leq 40,000$ MWD/MTU
Decay Heat Per Assembly	ZR clad: As specified in Section 2.1.9.1 SS clad: ≤ 710 Watts
Non-Fuel Hardware Burnup and Cooling Time	As specified in Table 2.1.25
Fuel Assembly Length	≤ 176.8 in. (nominal design)
Fuel Assembly Width	≤ 8.54 in. (nominal design)
Fuel Assembly Weight	$\leq 1,680$ lbs (including non-fuel hardware)
Other Limitations	<ul style="list-style-type: none"> Quantity is limited to up to 24 PWR intact fuel assemblies. Neutron sources, damaged fuel assemblies and fuel debris are not permitted for storage in MPC-24. BPRAs, TPDs, WABAs, water displacement guide tube plugs, orifice rod assemblies, and/or vibration suppressor inserts may be stored with fuel assemblies in any fuel cell location. CRAs, RCCAs, CEAs, and/or APSRs may be stored with fuel assemblies in fuel cell locations 9, 10, 15, and/or 16 Soluble boron requirements during wet loading and unloading are specified in Table 2.1.14.

Table 2.1.20 (cont'd)

LIMITS FOR MATERIAL TO BE STORED IN MPC-24E

PARAMETER	VALUE
<i>Other Limitations</i>	<ul style="list-style-type: none"> ▪ Quantity is limited to up to 24 PWR intact fuel assemblies or up to four (4) damaged fuel assemblies in DFCs may be stored in fuel storage locations 3, 6, 19, and/or 22. The remaining fuel storage locations may be filled with intact fuel assemblies. ▪ Fuel debris and neutron sources are not authorized for storage in the MPC-24E. ▪ BPRAs, TPDs, WABAs, water displacement guide tube plugs, orifice rod assemblies, and/or vibration suppressor inserts may be stored with fuel assemblies in any fuel cell location. ▪ CRAs, RCCAs, CEAs, and/or APSRs may be stored with fuel assemblies in fuel cell locations 9, 10, 15, and/or 16. ▪ Soluble boron requirements during wet loading and unloading are specified in Table 2.1.14.

Notes:

1. A fuel assembly must meet the requirements of any one column and the other limitations to be authorized for storage.

Table 2.1.21

LIMITS FOR MATERIAL TO BE STORED IN MPC-32

PARAMETER	VALUE (Note 1)	
Fuel Type	Uranium oxide, PWR intact fuel assemblies meeting the limits in Table 2.1.3 for the applicable fuel assembly array/class.	Uranium oxide, PWR damaged fuel assemblies meeting the limits in Table 2.1.3 for the applicable fuel assembly array/class.
Cladding Type	ZR or Stainless Steel (SS) assemblies as specified in Table 2.1.3 for the applicable array/class	ZR or Stainless Steel (SS) assemblies as specified in Table 2.1.3 for the applicable array/class
Maximum Initial Enrichment per Assembly	As specified in Table 2.1.3 for the applicable fuel assembly array/class	As specified in Table 2.1.3 for the applicable fuel assembly array/class
Post-irradiation Cooling Time and Average Burnup per Assembly	ZR clad: As specified in Section 2.1.9.1 SS clad: ≥ 9 years and $\leq 30,000$ MWD/MTU or ≥ 20 years and $\leq 40,000$ MWD/MTU	ZR clad: As specified in Section 2.1.9.1 SS clad: ≥ 9 years and $\leq 30,000$ MWD/MTU or ≥ 20 years and $\leq 40,000$ MWD/MTU
Decay Heat Per Assembly	ZR-clad: As specified in Section 2.1.9.1 SS-clad: ≤ 500 Watts	ZR-clad: As specified in Section 2.1.9.1 SS-clad: ≤ 500 Watts
Non-fuel hardware post-irradiation cooling time and burnup	As specified in Table 2.1.25	As specified in Table 2.1.25
Fuel Assembly Length	≤ 176.8 in. (nominal design)	≤ 176.8 in. (nominal design)
Fuel Assembly Width	≤ 8.54 in. (nominal design)	≤ 8.54 in. (nominal design)
Fuel Assembly Weight	$\leq 1,680$ lbs (including non-fuel hardware)	$\leq 1,680$ lbs (including DFC and non-fuel hardware)

Table 2.1.23 (cont'd)

LIMITS FOR MATERIAL TO BE STORED IN MPC-24EF

PARAMETER	VALUE
<i>Other Limitations</i>	<ul style="list-style-type: none"> ▪ <i>Quantity per MPC: up to 24 PWR intact fuel assemblies or up to four (4) damaged fuel assemblies and/or fuel classified as fuel debris in DFCs may be stored in fuel storage locations 3, 6, 19, and/or 22. The remaining fuel storage locations may be filled with intact fuel assemblies.</i> ▪ <i>Neutron sources are not authorized for storage in the MPC-24EF.</i> ▪ <i>BPRAs, TPDs, WABAs, water displacement guide tube plugs, orifice rod assemblies, and/or vibration suppressor inserts may be stored with fuel assemblies in any fuel cell location.</i> ▪ <i>CRAs, RCCAs, CEAs, and/or APSRs may be stored with fuel assemblies in fuel cell locations 9, 10, 15, and/or 16.</i> ▪ <i>Soluble boron requirements during wet loading and unloading are specified in Table 2.1.14.</i>

Notes:

1. *A fuel assembly must meet the requirements of any one column and the other limitations to be authorized for storage.*

Table 2.1.24

LIMITS FOR MATERIAL TO BE STORED IN MPC-32F

PARAMETER	VALUE (Note 1)	
Fuel Type	Uranium oxide, PWR intact fuel assemblies meeting the limits in Table 2.1.3 for the applicable fuel assembly array/class	Uranium oxide, PWR damaged fuel assemblies and fuel debris in DFCs meeting the limits in Table 2.1.3 for the applicable fuel assembly array/class
Cladding Type	ZR or Stainless Steel (SS) as specified in Table 2.1.3 for the applicable fuel assembly array/class	ZR or Stainless Steel (SS) as specified in Table 2.1.3 for the applicable fuel assembly array/class
Maximum Initial Enrichment per Assembly	As specified in Table 2.1.3	As specified in Table 2.1.3
Post-irradiation Cooling Time, Average Burnup, and Minimum Initial Enrichment per Assembly	ZR clad: As specified in Section 2.1.9.1 SS clad: ≥ 9 years and $\leq 30,000$ MWD/MTU or ≥ 20 years and $\leq 40,000$ MWD/MTU	ZR clad: As specified in Section 2.1.9.1 SS clad: ≥ 9 years and $\leq 30,000$ MWD/MTU or ≥ 20 years and $\leq 40,000$ MWD/MTU
Decay Heat Per Assembly	ZR clad: As specified in Section 2.1.9.1 SS clad: ≤ 500 Watts	ZR clad: As specified in Section 2.1.9.1 SS clad: ≤ 500 Watts
Non-fuel hardware post-irradiation Cooling Time and Burnup	As specified in Table 2.1.25	As specified in Table 2.1.25
Fuel Assembly Length	≤ 176.8 in. (nominal design)	≤ 176.8 in. (nominal design)
Fuel Assembly Width	≤ 8.54 in. (nominal design)	≤ 8.54 in. (nominal design)
Fuel Assembly Weight	$\leq 1,680$ lbs (including non-fuel hardware)	$\leq 1,680$ lbs (including DFC and non-fuel hardware)