Criticality

The MPC provides criticality control for all design basis normal, off-normal, and postulated accident conditions, as discussed in Section 6.1. The effective neutron multiplication factor is limited to $k_{eff} < 0.95$ for fresh (unirradiated) fuel with optimum water moderation and close reflection, including all biases, uncertainties, and manufacturing tolerances.

Criticality control is maintained by the geometric spacing of the fuel assemblies and the spatially distributed B-10 isotope in the Metamic-HT fuel basket, and for the PWR MPC model, the additional soluble boron in the MPC water or use of burnup credit. The minimum specified boron concentration in the purchasing specification for Metamic-HT must be met in every lot of the material manufactured. The guaranteed B-10 value in the neutron absorber, assured by the manufacturing process, is further reduced by 10% (90% credit is taken for the Metamic-HT) to accord with NUREG/CR-5661. No credit is taken for fuel burnup or integral poisons such as gadolinia in BWR fuel. For PWR fuel, the soluble boron concentration requirements or burnup requirements based on the initial enrichment of the fuel assemblies are delineated in Section 2.1 consistent with the criticality analysis described in Chapter 6.

Confinement

The MPC provides for confinement of all radioactive materials for all design basis normal, off-normal, and postulated accident conditions. As discussed in Section 7.1, the HI-STORM FW MPC design meets the guidance in Interim Staff Guidance (ISG)-18 so that leakage of radiological matter from the confinement boundary is non-credible. Therefore, no confinement dose analysis is required or performed. The confinement function of the MPC is verified through pressure testing, helium leak testing of the MPC shell, base plate, and lid material along with the shell to base plate and shell to shell seam welds, and a rigorous weld examination regimen executed in accordance with the acceptance test program in Chapter 10.

Operations

There are no radioactive effluents that result from storage or transfer operations. Effluents generated during MPC loading are handled by the plant's radioactive waste system and procedures.

Generic operating procedures for the HI-STORM FW System are provided in Chapter 9. Detailed operating procedures will be developed by the licensee using the information provided in Chapter 9 along with the site-specific requirements that comply with the 10CFR50 Technical Specifications for the plant, and the HI-STORM FW System Certificate of Compliance (CoC).

Acceptance Tests and Maintenance

The acceptance criteria and maintenance program to be applied to the MPC are described in Chapter 10. The operational controls and limits to be applied to the MPC are discussed in reasonably conservative dose rates. The reference assemblies given in Table 1.0.4 are the predominant assemblies used in the industry.

The design basis dose rates can be met by a variety of burnup levels and cooling times. Table 2.1.1 provides the acceptable ranges of burnup, enrichment and cooling time for all of the authorized fuel assembly array/classes. Table 2.1.5 and Figures 2.1.3 and 2.1.4 provide the axial distribution for the radiological source terms for PWR and BWR fuel assemblies based on the axial burnup distribution. The axial burnup distributions are representative of fuel assemblies with the design basis burnup levels considered. These distributions are used for analyses only, and do not provide a criteria for fuel assembly acceptability for storage in the HI-STORM FW System.

Non-fuel hardware, as defined in the Glossary, has been evaluated and is also authorized for storage in the PWR MPCs as specified in Table 2.1.1.

2.1.7 Criticality Parameters for Design Basis SNF

Criticality control during loading of the MPC-37 is achieved through either meeting the soluble boron limits in Table 2.1.6 OR verifying that the assemblies meet the minimum burnup requirements in Table 2.1.7.

For those spent fuel assemblies that need to meet the burnup requirements specified in Table 2.1.7, a burnup verification shall be performed in accordance with either Method A OR Method B described below.

Method A: Burnup Verification Through Quantitative Burnup Measurement

For each assembly in the MPC-37 where burnup credit is required, the minimum burnup is determined from the burnup requirement applicable to the loading configuration chosen for the cask (see Table 2.1.7). A measurement is then performed that confirms that the fuel assembly burnup exceeds this minimum burnup. The measurement technique may be calibrated to the reactor records for a representative set of assemblies. The assembly burnup value to be compared with the minimum required burnup should be the measured burnup value as adjusted by reducing the value by a combination of the uncertainties in the calibration method and the measurement itself.

Method B: Burnup Verification Through an Administrative Procedure and Qualitative Measurements

Depending on the location in the basket, assemblies loaded into a specific MPC-37 can either be fresh, or have to meet a single minimum burnup value. The assembly burnup value to be compared with the minimum required burnup should be the reactor record burnup value as adjusted by reducing the value by the uncertainties in the reactor record value. An administrative procedure shall be established that prescribes the following steps, which shall be performed for each cask loading:

- Based on a review of the reactor records, all assemblies in the spent fuel pool that have a burnup that is below the minimum required burnup of the loading curve for the cask to be loaded are identified.
- After the cask loading, but before the release for shipment of the cask, the presence and location of all those identified assemblies is verified, except for those assemblies that have been loaded as fresh assemblies into the cask.

Additionally, for all assemblies to be loaded that are required to meet a minimum burnup, a measurement shall be performed that verifies that the assembly is not a fresh assembly.

2.1.8 Summary of Authorized Contents

Tables 2.1.1 through 2.1.3 specify the limits for spent fuel and non-fuel hardware authorized for storage in the HI-STORM FW System. The limits in these tables are derived from the safety analyses described in the following chapters of this FSAR.

Table 2.1.1

MATERIAL TO BE STORED

PARAMETER	VALUE	
	MPC-37	MPC-89
Fuel Type	Uranium oxide undamaged fuel assemblies, damaged fuel assemblies, and fuel debris meeting the limits in Table 2.1.2 for the applicable array/class.	Uranium oxide undamaged fuel assemblies, damaged fuel assemblies, with or without channels, fuel debris meeting the limits in Table 2.1.3 for the applicable array/class.
Cladding Type	ZR (see Glossary for definition)	ZR (see Glossary for definition)
Maximum Initial Rod Enrichment	Depending on soluble boron levels or burnup credit and assembly array/class as specified in Table 2.1.6 and Table 2.1.7.	≤ 5.0 wt. % U-235
Post-irradiation cooling time and average burnup per assembly	Minimum Cooling Time: 3 years Maximum Assembly Average Burnup: 68.2 GWd/mtU	Minimum Cooling Time: 3 years Maximum Assembly Average Burnup: 65 GWd/mtU
Non-fuel hardware post-irradiation cooling time and burnup	Minimum Cooling Time: 3 years Maximum Burnup†: - BPRAs, WABAs and vibration suppressors: 60 GWd/mtU - TPDs, NSAs, APSRs, RCCAs, CRAs, CEAs, water displacement guide tube plugs and orifice rod assemblies: 630 GWd/mtU - ITTRs: not applicable	N/A
Decay heat per fuel storage location	Regionalized Loading: See Table 1.2.3	Regionalized Loading: See Table 1.2.4

† Burnups for non-fuel hardware are to be determined based on the burnup and uranium mass of the fuel assemblies in which the component was inserted during reactor operation. Burnup not applicable for ITTRs since installed post-irradiation.

Table 2.1.6

Soluble Boron Requirements for MPC-37 Wet Loading and Unloading Operations

Array/Class	**All Undamaged Fuel Assemblies**		**One or More Damaged Fuel Assemblies and/or Fuel Debris**	
	Maximum Initial Enrichment ≤ 4.0 wt% ^{235}U (ppmb)	Maximum Initial Enrichment 5.0 wt% ^{235}U (ppmb)	Maximum Initial Enrichment ≤ 4.0 wt% ^{235}U (ppmb)	Maximum Initial Enrichment 5.0 wt% ^{235}U (ppmb)
All 14x14 and 16x16	1,000	1,600	1,300	1,800
All 15x15 and 17x17	1,500	2,000	1,800	2,300

Note:
1. For maximum initial enrichments between 4.0 wt% and 5.0 wt% ^{235}U, the minimum soluble boron concentration may be determined by linear interpolation between the minimum soluble boron concentrations at 4.0 wt% and 5.0 wt% ^{235}U.
2. If burnup credit is used (as described in Section 2.1.7), these soluble boron requirements do not apply.

TABLE 2.1.7

POYNOMIAL FUNCTIONS FOR THE MINIMUM BURNUP AS A FUNCTION OF INITIAL ENRICHMENT

Assembly Classes	**Configuration**[**]	**Cooling Time, years**	**Minimum Burnup (GWd/mtU) as a Function of the Initial Enrichment (wt% ^{235}U)**
15x15B, C, D, E, F, H, I and 17x17A, B, C, D, E	Uniform	3.0	f(x) = -7.9224e-02 * x^3 -7.6419e-01 * x^2 +2.2411e+01 * x^1 -4.1183e+01
		7.0	f(x) = +1.3212e-02 * x^3 -1.6850e+00 * x^2 +2.4595e+01 * x^1 -4.2603e+01
	Regionalized	3.0	f(x) = +3.6976e-01 * x^3 -5.8233e+00 * x^2 +4.0599e+01 * x^1 -5.8346e+01
		7.0	f(x) = +3.3423e-01 * x^3 -5.1647e+00 * x^2 +3.6549e+01 * x^1 -5.2348e+01
16x16A, B, C	Uniform	3.0	f(x) = -1.0361e+00 * x^3 +1.1386e+01 * x^2 -2.9174e+01 * x^1 +2.0850e+01
		7.0	f(x) = -9.6572e-01 * x^3 +1.0484e+01 * x^2 -2.5982e+01 * x^1 +1.7515e+01
	Regionalized	3.0	f(x) = -2.1456e-01 * x^3 +2.4668e+00 * x^2 +2.1381e+00 * x^1 -1.2560e+01
		7.0	f(x) = -5.9154e-01 * x^3 +5.8403e+00 * x^2 -6.9339e+00 * x^1 -4.7951e+00
		Combined[††]	f(x) = -4.9680e-01 * x^3 +4.9471e+00 * x^2 -4.2373e+00 * x^1 -7.3936e+00

[**] Uniform configuration refers to Configuration 1 in Table 2.1.8. Regionalized configuration refers to Configuration 2, 3, and 4 in Table 2.1.8.
[††] The combined cooling time loading curve is applicable for fuel with above 3 years cooling time.

TABLE 2.1.8
BURNUP CREDIT CONFIGURATIONS

Configuration	Description
Configuration 1	Spent UNDAMAGED fuel assemblies are placed in all positions of the basket
Configuration 2	Fresh UNDAMAGED fuel assemblies are placed in locations 3-4, 3-5, 3-12, and 3-13 (see Figure 2.1.1); spent UNDAMAGED fuel assemblies are placed in the remaining positions
Configuration 3	Damaged Fuel Containers (DFCs) with spent DAMAGED fuel assemblies are placed in locations 3-1, 3-3, 3-4, 3-5, 3-6, 3-7, 3-10, 3-11, 3-12, 3-13, 3-14, and 3-16 (see Figure 2.1.1); spent UNDAMAGED fuel assemblies are placed in the remaining positions
Configuration 4	DFCs with fresh FUEL DEBRIS are placed in locations 3-1, 3-7, 3-10, and 3-16 with locations 2-1, 2-5, 2-8, and 2-12 (see Figure 2.1.1) empty; spent UNDAMAGED fuel assemblies are placed in the remaining positions

TABLE 2.2.14
List of ASME Code Alternatives for Multi-Purpose Canisters (MPCs)

MPC Enclosure Vessel	NB-4122	Implies that with the exception of studs, bolts, nuts and heat exchanger tubes, CMTRs must be traceable to a specific piece of material in a component.	MPCs are built in lots. Material traceability on raw materials to a heat number and corresponding CMTR is maintained by Holtec through markings on the raw material. Where material is cut or processed, markings are transferred accordingly to assure traceability. As materials are assembled into the lot of MPCs being manufactured, documentation is maintained to identify the heat numbers of materials being used for that item in the multiple MPCs being manufactured under that lot. A specific item within a specific MPC will have a number of heat numbers identified as possibly being used for the item in that particular MPC of which one or more of those heat numbers (and corresponding CMTRS) will have actually been used. All of the heat numbers identified will comply with the requirements for the particular item.
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.
MPC Closure Ring, Vent and Drain Cover Plate Welds	NB-5230	Radiographic (RT) or ultrasonic (UT) examination required.	Root (if more than one weld pass is required) and final liquid penetrant examination to be performed in accordance with NB-5245. The closure ring provides independent redundant closure for vent and drain cover plates. Vent and drain port cover plate welds are helium leakage tested.
MPC Lid to Shell Weld	NB-5230	Radiographic (RT) or ultrasonic (UT) examination required.	Only progressive liquid penetrant (PT) examination is permitted. PT examination will include the root and final weld layers and each approx. 3/8" of weld depth.
MPC Enclosure Vessel and Lid	NB-6111	All completed pressure retaining systems shall be pressure tested.	The MPC vessel is strength welded in the field following fuel assembly loading. Pressure tests (Hydrostatic or pneumatic) will not be performed because lack of accessibility for leakage inspections precludes a meaningful pressure retention capability test. The different models of MPCs available in the industry are not subject to pressure tests because of the dose to the crew, the proven ineffectiveness of the pressure tests to reveal any leaks and the

TABLE 2.2.14
List of ASME Code Alternatives for Multi-Purpose Canisters (MPCs)

			far more effective tests performed on the MPC confinement boundary, such as: All MPC enclosure vessel welds (except closure ring and vent/drain cover plate) are inspected by volumetric examination. All MPC shell and baseplate materials are UT tested. Finally, the MPC lid-to-shell weld shall be verified by progressive PT examination. PT must include the root and final layers and each approximately 3/8 inch of weld depth. The inspection results, including relevant findings (indications) shall be made a permanent part of the user's records by video, photographic, of other means which provide an equivalent 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 vent/drain cover plate and the closure ring welds are confirmed by liquid penetrant examination. The inspection of the weld must be performed by qualified personnel and shall meet the acceptance requirements of ASME Code Section III, NB-5350.
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.	The HI-STORM FW System is 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.

SUPPLEMENT 6.I

CRITICALITY EVALUATION OF MPC-37 WITH THE BURNUP CREDIT

6.I.0 INTRODUCTION

This supplement is solely focused on providing an evaluation of criticality safety of HI-STORM FW with MPC-37 using the burnup credit approach instead of the soluble boron credit approach, discussed in Section 6.1. The evaluation presented herein supplements those evaluations of HI-STORM FW system contained in the main part of Chapter 6 of this FSAR. The HI-STORM FW design structures and components, limiting fuel characteristics, analysis methodologies, modeling assumptions, etc. utilized in the safety evaluation are based on those used in the main body of Chapter 6, unless otherwise noted in the following sections. Specifically, the actinide and fission product burnup credit, based on the latest USNRC Interim Staff Guidance (ISG-8 Rev. 3), is used for the MPC-37 basket. The results of this evaluation demonstrate that the effective neutron multiplication factor (k_{eff}) of the HI-STORM FW system with MPC-37, including all biases and uncertainties evaluated with a 95% probability at the 95% confidence level, does not exceed 0.95 under all credible normal, off-normal, and accident conditions, which is in conformance with the principles established in 10CFR72.124 [6.I.0.1], NUREG-1536 [6.I.0.2], and NUREG-0800 Section 9.1.2 [6.I.0.3].

6.I.1 DISCUSSION AND RESULTS

6.I.1.1 Design Features

Criticality safety of HI-STORM FW with MPC-37 and burnup credit depends on the following principal design features:

- The inherent geometry of the fuel basket design within the MPC;
- The incorporation of permanent fixed neutron-absorbing material in the fuel basket structure. The baskets are completely manufactured from Metamic-HT, an aluminum and B_4C composite material. All assemblies are therefore completely surrounded by neutron absorbing material;
- An administrative limit on the maximum average enrichment for PWR fuel;
- An administrative limit on the minimum average assembly burnup for PWR fuel. The burnup credit methodology is described in detail in Appendix 6.I.B of this supplement, and implements an actinides and fission products approach; and

The number and permissible location of DFCs is provided in Figure 2.1.1 and the licensing drawing in Section 1.5, respectively. The following basket loading configurations are available for use in MPC-37 with the burnup credit approach:

- Configuration 1: Spent undamaged fuel assemblies are placed in all positions of the basket;
- Configuration 2: Fresh undamaged fuel assemblies are placed in one region (4 cells) at the periphery of the basket; spent undamaged fuel assemblies are placed in the remaining positions;
- Configuration 3: Damaged Fuel Containers (DFCs) with the spent damaged fuel assemblies are placed in one region (12 cells) at the periphery of the basket; spent undamaged fuel assemblies are placed in the remaining positions;
- Configuration 4: DFCs with fresh fuel debris are placed in one region (4 cells) at the periphery of the basket with the adjacent cells kept empty; spent undamaged fuel assemblies are placed in the remaining positions.

The basket loading configurations, discussed above, are graphically shown in Section 6.I.C.4.

Confirmation of the criticality safety of the HI-STORM FW system was accomplished with the three-dimensional Monte Carlo code MCNP5 [6.I.1.1]. K-factors for one-sided statistical tolerance limits with 95% probability at the 95% confidence level were obtained from the National Bureau of Standards (now NIST) Handbook 91 [6.I.1.2]. Benchmark calculations were made and summarized in Appendix 6.I.A to compare the primary code package (MCNP5) with experimental data, using critical experiments selected to encompass, insofar as practical, the design parameters of HI-STORM FW.

The design basis criticality safety calculations are performed for a single unreflected, internally flooded cask. The results of the calculations, conservatively evaluated for the worst combination of manufacturing tolerances (as identified in Section 6.3), and including the calculational bias, uncertainties, and calculational statistics, are listed in Table 6.I.1.1. For each fuel assembly class, Tables 6.I.1.1 lists the bounding maximum k_{eff} value, the associated maximum allowable enrichment, and the minimum required assembly average burnup. The unreflected cask condition is acceptable since this configuration is shown to yield results that are statistically equivalent to the results for the corresponding reflected cask (see Subparagraph 6.4.2.1.1). The maximum enrichment and minimum burnup acceptance criteria are defined in Chapter 2.

In summary, the evaluation presented in this supplement shows that the maximum k_{eff} value, including all applicable biases and uncertainties is below 0.95 for all normal, off-normal and accident conditions. This demonstrates that the HI-STORM FW system with MPC-37 and PWR burnup credit is in full compliance with the criticality requirements of 10CFR72 and NUREG-1536. The maximum k_{eff} value for misloading conditions is below the limit of 0.98 recommended in ISG-8 Rev. 3 (see Appendix 6.I.D).

[Remainder of Supplement Proprietary Information Withheld in Accordance with 10 CFR 2.390]

The cask loading and handling operations program shall ensure maximum emphasis to mitigate the potential load drop accidents by implementing measures to eliminate shortcomings in all aspects of the operation including the four aforementioned areas.

Each TAL will be subjected to a dimensional test in the shop using go/no-go gauges to ensure that the threads meet the dimensional requirements. As an alternative to the thread gauge test, the threads may be proof-tested using a torque test to simulate a load equal to three times the design load. Furthermore, the thread in the TAL shall be visually inspected in accordance with a written procedure to ensure absence of burrs, undercuts, and other stress raisers.

The acceptance testing of the TALS in the manner described above will provide adequate assurance against handling accidents.

10.1.2.2 Pressure Testing

10.1.2.2.1 HI-TRAC Transfer Cask Water Jacket

All HI-TRAC transfer cask water jackets shall be hydrostatically tested in accordance with written and approved procedures. The water jacket fill port will be used for filling the cavity with water and the vent port for venting the cavity. The approved test procedure shall clearly define the test equipment arrangement.

The hydrostatic test shall be performed after the water jacket has been welded together. The test pressure gage installed on the water jacket shall have an upper limit of approximately twice that of the test pressure. The hydrostatic test pressure shall be maintained for ten minutes. During this time period, the pressure gage shall not fall below the applicable minimum test pressure. At the end of ten minutes, and while the pressure is being maintained at the minimum pressure, weld joints shall be visually examined for leakage. If a leak is discovered, the cavity shall be emptied and an examination to determine the cause of the leakage shall be made. Repairs and retest shall be performed until the hydrostatic test criteria are met.

After completion of the hydrostatic testing, the water jacket exterior surfaces shall be visually examined for cracking or deformation. Evidence of cracking or deformation shall be cause for rejection, or repair and retest, as applicable. Unacceptable areas shall require repair and re-examination per the applicable ASME Code. The HI-TRAC water jacket hydrostatic test shall be repeated until all examinations are found to be acceptable.

Test results shall be documented. The documentation shall become part of the final quality documentation package.

10.1.2.2.2 DELETED

10.1.3 Materials Testing

The majority of materials used in the HI-TRAC transfer cask and a portion of the material in the HI-STORM overpack are ferritic steels. ASME Code, Section II and Section III require that certain materials be tested in order to assure that these materials are not subject to brittle fracture failures.

Materials of the HI-TRAC transfer cask and HI-STORM overpack, as required, shall be Charpy V-notch tested in accordance with ASME Section IIA and/or ASME Section III, Subsection NF, Articles NF-2300, and NF-2430. The materials to be tested are identified in Table 3.1.9 and applicable weld materials. Table 3.1.9 provides the test temperatures and test acceptance criteria to be used when performing the material testing specified above.

The concrete utilized in the construction of the HI-STORM overpack shall be mixed, poured, and tested as set down in Chapter 1.D of the HI-STORM 100 FSAR (Docket 72-1014) [10.1.6] in accordance with written and approved procedures. Testing shall verify the compressive strength and density meet design requirements. Tests required shall be performed at a frequency as defined in the applicable ACI code.

Qualification tests on Metamic-HT coupons drawn from production runs shall be performed in compliance with Table 10.1.6 requirements to ensure that the manufactured panels shall render their intended function. Testing shall be performed using written and approved procedures consistent with the test methods documented in Holtec's test report [10.1.7]. To ensure the above test requirements are met a sampling plan based on the MIL Standard 105E [10.1.8] is defined and incorporated in the Metamic-HT Manufacturing Manual's Shop Operating Procedure HTSOP-108.

Test results on all materials shall be documented and become part of the final quality documentation package.

10.1.4 Leakage Testing

Leakage testing shall be performed in accordance with written and approved procedures and the leakage test methods and procedures of ANSI N14.5 [10.1.5], as follows.

(i) Helium leakage testing of the shop manufactured MPC Enclosure Vessel (MPC shell to baseplate and shell to shell welds) has been performed on over 800 MPCs since the inception of the HI-STAR/HI-STORM manufacturing program in the late 1990s garnering a 100% acceptance record. Not a single defect in the MPC Confinement Boundary has been identified by the helium leak tests. (This record of zero defect discerned by the helium tests is wholly expected and reasonable in light of the fact that all pressure retaining material is ultrasonically tested and the configuration of the MPC confinement boundary does not present a helium migration path parallel to the surface of the plate stock where welding-induced delamination may create a capillary for leakage of helium.) Therefore, it is proposed to perform the helium leak test in the shop (unloaded MPC) using the statistical sampling method analogous to that adopted for Metamic-HT (Table 10.1.7). Referring to Table 10.1.7, 1% of the manufactured MPCs in the shop shall be helium leak tested (1 MPC for every 100 manufactured). In the unlikeliest of scenarios, if an MPC were to fail the helium leak test then it would be necessary to begin testing every MPC in the lot (defined as the set manufactured sequentially under the same Holtec Purchase Order to the shop), perform a root cause evaluation and adopt the corrective actions thus identified. The testing frequency will remain at 100% and revert to 1% only after 100 MPCs in the subsequent successive lots have passed the helium leak test.

(ii) Subsequent to fuel loading, the helium leakage test of the vent and drain port cover plate welds shall be performed. The acceptance criterion is "leaktight" as defined in ANSI N14.5. The helium leakage test of the vent and drain port cover plate welds shall be performed using a helium mass spectrometer leak detector (MSLD). If a leakage rate exceeding the acceptance criterion is detected, then the area of leakage shall be determined and the area repaired per ASME Code Section III, Subsection NB, Article NB-4450 requirements. Re-testing shall be performed until the leakage rate acceptance criterion is met.

Leakage testing of the field welded MPC lid-to-shell weld and closure ring welds are not required. Leak testing results for the MPC shall be documented and shall become part of the quality record documentation package.

Leakage testing of the vent and drain port cover plate welds shall be performed after welding of the cover plates and subsequent NDE. The description and procedures for these field leakage tests are provided in Chapter 9 of this FSAR and the acceptance criteria are defined in the Technical Specifications for the HI-STORM FW system.

10.1.5 Component Tests

10.1.5.1 Valves, Pressure Relief Devices, and Fluid Transport Devices

There are no fluid transport devices associated with the HI-STORM FW system. The only valve-like components in the HI-STORM FW system are the specially designed caps installed in the MPC lid for the drain and vent ports. These caps are recessed inside the MPC lid and covered by the fully-welded vent and drain port cover plates. No credit is taken for the caps' ability to confine helium or radioactivity. After completion of drying and backfill operations, the drain and vent port cover plates are welded in place on the MPC lid and are liquid penetrant examined and leakage tested to verify the MPC Confinement Boundary.

There are multiple pressure relief devices installed in the upper ledge surface of the HI-TRAC transfer cask water jacket. One is provided for venting air and water due to pressure build-up from thermal expansion of the water in the water jacket. The other relief devices are provided for venting of the neutron shield jacket fluid under hypothetical fire accident conditions in which the design pressure of the water jacket may be exceeded. The set pressures for the pressure relief devices are listed on the HI-TRAC VW drawings in Section 1.5.

10.1.5.2 Seals and Gaskets

There are no confinement seals or gaskets included in the HI-STORM FW system.

Table 10.1.1 (continued) MPC INSPECTION AND TEST ACCEPTANCE CRITERIA			
Function	**Fabrication**	**Pre-operation**	**Maintenance and Operations**
Structural	a) Assembly and welding of MPC components is performed per ASME Code Section IX and III, Subsection NB, as applicable. b) Materials analysis (steel, neutron absorber, etc.), is performed and records are kept in a manner commensurate with "important to safety" classifications.	a) None.	a) A multi-layer liquid penetrant (PT) examination of the MPC lid-to-shell weld is performed per ASME Section V, Article 2. Acceptance criteria for the examination are defined in Subsection 10.1.1, and in the Licensing Drawings. b) ASME Code NB-6000 pressure test is performed after MPC closure welding. Acceptance criteria are defined in the Code.
Leak Tests	a) Helium leakage testing of the,MPC shell to baseplate welds and MPC shell to shell welds is performed on the unloaded MPC, on a sampling basis as described in Section 10.1.4. Acceptance criterion is in accordance with "leaktight" definition in ANSI N14.5.	a) None.	a) Helium leakage testing is performed on the vent and drain port cover plates to MPC lid field welds. See Technical Specification for guidance on acceptance criteria.
Criticality Safety	a) The boron content is verified at the time of neutron absorber material manufacture. b) The installation of MPC cell panels is verified by inspection.	None.	None.
Shielding Integrity	a) Material compliance is verified through CMTRs. b) Dimensional verification of MPC lid thickness is performed.	None.	None.

BASES	
LCO	Compliance with this LCO ensures that the stored fuel will remain subcritical with a $k_{eff} \leq 0.95$ while water is in the MPC. LCOs 3.3.1.a provides the minimum concentration of soluble boron required in the MPC water for the MPC-37. The amount of soluble boron is dependent on the initial enrichment of the fuel assemblies to be loaded in the MPC. Fuel assemblies with an initial enrichment less than or equal to 4.0 wt. % U-235 require less soluble boron than those with initial enrichments greater than 4.0 wt. % U-235. For initial enrichments greater than 4.0 wt. % U-235 and up to 5.0 wt. % U-225, interpolation is permitted to determine the required minimum amount of soluble boron. All fuel assemblies loaded into the MPC-37 are limited by analysis to maximum enrichments of 5.0 wt. % U-235. The LCO also requires that the minimum soluble boron concentration for the most limiting fuel assembly array/class and classification to be stored in the same MPC be used. This means that the highest minimum soluble boron concentration limit for all fuel assemblies in the MPC applies in cases where fuel assembly array/classes are mixed in the same MPC. This ensures the assumptions pertaining to soluble boron used in the criticality analyses are preserved.
APPLICABILITY	The boron concentration LCO is applicable whenever an MPC-37 has at least one PWR fuel assembly in a storage location and water in the MPC. During LOADING OPERATIONS, the LCO is applicable immediately upon the loading of the first fuel assembly in the MPC. It remains applicable until the MPC is drained of water. During UNLOADING OPERATIONS, the LCO is applicable when the MPC is reflooded with water. Note that compliance with SR 3.0.4 assures that the water to be used to flood the MPC is of the correct boron concentration to ensure the LCO is satisfied upon entering the Applicability. A note has also been added to the APPLICABILITY that states that this LCO is not applicable if burnup credit is being utilized.

(continued)