of fissile material from those cells. DFI storage locations are limited to the same locations allowed for DFCs in the MPC-68M. The limiting design characteristics for damaged fuel assemblies and restrictions on the number and location of damaged fuel containers authorized for loading in each MPC model are provided in Section 2.1.9. Dresden Unit 1 fuel assemblies contained in Transnuclear-designed damaged fuel canisters and one Dresden Unit 1 thoria rod canister have been approved for storage directly in the HI-STORM 100 System without re-packaging (see Figures 2.1.2 and 2.1.2A).

MPC contents classified as fuel debris are required to be stored in DFCs. The basket designs for the standard and "F" model MPCs are identical. The lid and shell designs of the "F" models are unique in that the upper shell portion of the canister is thickened for additional strength needed to qualify as a secondary containment, which used to be required under hypothetical accident conditions of transportation under 10 CFR 71. Figure 2.1.9 shows the details of the differences between the standard and "F" model MPC shells. These details are common for both the PWR and BWR series MPC models.

2.1.3.1 Damaged Fuel Isolator

For the MPC-68M, if the damaged fuel assembly can be handled by normal means and its structural integrity is such that geometric rearrangement of fuel is not expected, then the device known as the Damaged Fuel Isolator (DFI) can be used in place of the DFC. Like the DFC, the DFI prevents the migration of fissile material in bulk or coarse particulate form from the nuclear fuel stored in its cellular storage cavity. The DFI can be used only if the fuel can be handled by normal means but is classified as damaged because of physical defect, viz., a breach in the fuel cladding or a structural failure in the grid strap assembly, etc., as explained in ISG-1. Damaged fuel stored utilizing the DFI may contain missing or partial fuel rods and/or fuel rods with known or suspected cladding defects greater than hairline cracks or pinhole leaks as long as the fuel assembly can be handled by normal means.

The DFI is made up of two end caps that, along with the four basket cell walls, comprise the fuel isolation space. The essential attributes of the DFI are:

1. The bottom cap is an open prismatic box with a flat baseplate which fits inside the storage cell space with a small clearance (for ease of installation). Once installed, the bottom of the DFI is flush with the MPC baseplate. The sidewalls of the bottom cap have perforations or wire mesh to permit transmigration of gases but not fuel fragments or gross particulates and is equipped with a permeable barrier against the storage cell walls for sequestration of coarse particulate matter. Figure 2.1.10 illustrates the features of the DFI end cap.
2. The top cap is anatomically similar to the bottom cap as illustrated in Figure 2.1.10. The height of the top DFI is sized dependent upon the fuel geometry. The top DFI shall extend far enough into the top of the basket cell such that if the fuel shifts upwards, the DFI top cap can contact the MPC lid and still maintain a particulate barrier within the basket cell. During installation, the top DFI will be pushed down on top of the fuel assembly until contact is made.

3. Both caps have engineered features to enable them to be remotely installed in any storage cell in which a fuel assembly needs to be isolated. Both caps are geometrically constrained to prevent their ejection from the storage cavity during a postulated accident event.
4. The design configuration of the DFI is common for all Light Water Reactor fuel.
5. The DFI is constructed entirely from stainless steel or nickel alloy suitable for use within the high temperature environment of the MPC. (see Table 2.2.6) Per Figure 2.1.10, the cap walls shall have perforation with a maximum size of 1mm. This allows flow through the walls while keeping gross particulate fissile material inside the basket cell.
6. The DFI includes perforated plates at the top and bottom to allow for flow through the basket cell while keeping gross particulate fissile material inside the basket cell.

2.1.4 Deleted

2.1.5 Structural Parameters for Design Basis SNF

The main physical parameters of an SNF assembly applicable to the structural evaluation are the fuel assembly length, envelope (cross sectional dimensions), and weight. These parameters, which define the mechanical and structural design, are specified in Section 2.1.9. The centers of gravity reported in Section 3.2 are based on the maximum fuel assembly weight. Upper and lower fuel spacers (as appropriate) maintain the axial position of the fuel assembly within the MPC basket and, therefore, the location of the center of gravity. The upper and lower fuel spacers are designed to withstand normal, off-normal, and accident conditions of storage. An axial clearance of approximately 2 to 2-1/2 inches is provided to account for the irradiation and thermal growth of the fuel assemblies. The suggested upper and lower fuel spacer lengths are listed in Tables 2.1.9 and 2.1.10. In order to qualify for storage in the MPC, the SNF must satisfy the physical parameters listed in Section 2.1.9.

2.1.6 Thermal Parameters for Design Basis SNF

The principal thermal design parameter for the stored fuel is the peak fuel cladding temperature, which is a function of the maximum heat generation rate per assembly and the decay heat removal capabilities of the HI-STORM 100 System. No attempt is made to link the maximum allowable decay heat per fuel assembly with burnup, enrichment, or cooling time. Rather, the decay heat per fuel assembly is adjusted to yield peak fuel cladding temperatures with an allowance for margin to the temperature limit.

To ensure the permissible fuel cladding temperature limits are not exceeded, Section 2.1.9 specifies the allowable decay heat per assembly for each MPC model. For both uniform and regionalized loading of moderate and high burnup fuel assemblies, the allowable decay heat per assembly is presented in Section 2.1.9.

Section 2.1.9 also includes separate cooling time, burnup, and decay heat limits for uniform fuel

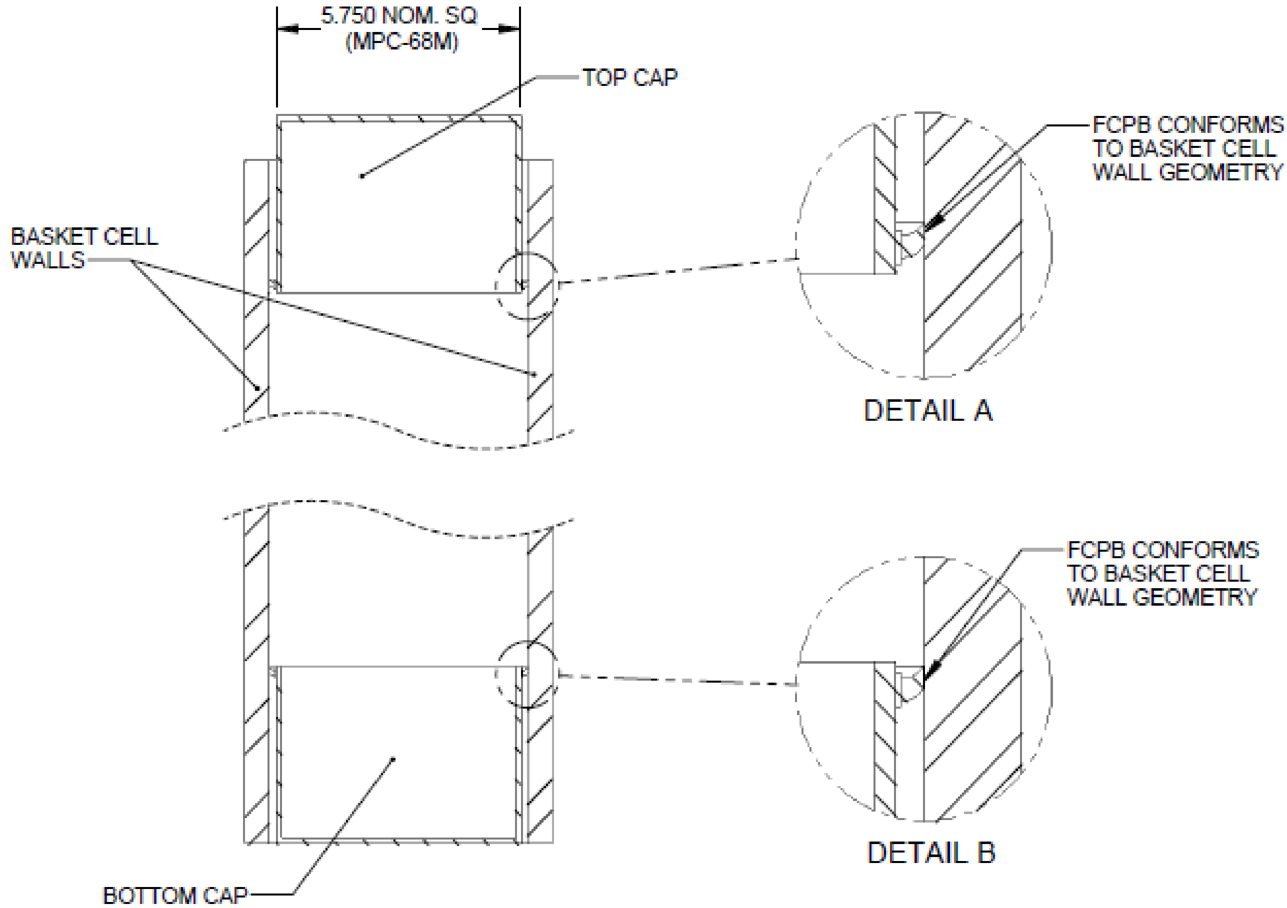

FIGURE 2.1.10 (CONTINUED): DAMAGED FUEL ISOLATOR IN BASKET CELL (TYPICAL)

TABLE 6.III.3.5 (continued)

COMPOSITION OF THE MAJOR COMPONENTS OF THE HI-STORM 100 PACKAGE WITH THE ENDF/B-VII LIBRARY

COMMON MATERIALS		
Nuclide	**MCNP ZAID [6.III.1.5]**	**Wt. Fraction**
LEAD, DENSITY 11.34 g/cm^3		
^{204}Pb	82204.70c	1.3781E-02
^{206}Pb	82206.70c	2.3955E-01
^{207}Pb	82207.70c	2.2074E-01
^{208}Pb	82208.70c	5.2592E-01
HOLTITE-A, DENSITY 1.61 g/cm^3		
^{10}B	5010.70c	1.410E-03
^{11}B	5011.70c	6.420E-03
^{27}Al	13027.70c	2.129E-01
^{1}H	1001.70c	5.920E-02
^{16}O	8016.70c	4.237E-01
C	6000.70c	2.766E-01
^{14}N	7014.70c	1.980E-02
STAINLESS STEEL, DENSITY 7.84 g/cm^3		
^{50}Cr	24050.70c	7.9050E-03
^{52}Cr	24052.70c	1.5853E-01
^{53}Cr	24053.70c	1.8322E-02
^{54}Cr	24054.70c	4.6467E-03
^{55}Mn	25055.70c	2.0010E-02
^{54}Fe	26054.70c	3.8983E-02
^{56}Fe	26056.70c	6.3458E-01
^{57}Fe	26057.70c	1.4917E-02
^{58}Fe	26058.70c	2.0200E-03
^{58}Ni	28058.70c	6.7198E-02
^{60}Ni	28060.70c	2.6776E-02
^{61}Ni	28061.70c	1.1834E-03
^{62}Ni	28062.70c	3.8348E-03
^{64}Ni	28064.70c	1.0082E-03

f. Remove the closure ring, vent and drain port cover plates and the MPC lid. Disconnect the drain line. Store these components in an approved plant storage location.

10. At the user's discretion, perform an MPC vent and drain port cover plate fit test and verify that the weld prep is in accordance with the approved fabrication drawings.

Note:
Fuel spacers are fuel-type specific. Not all fuel types require fuel spacers. Lower fuel spacers are set in the MPC cells manually. No restraining devices are used.

11. Install lower fuel spacers in the MPC (if necessary). See Figure 8.1.10. Install bottom DFI caps into predetermined locations of the MPC-68M as required by loading patterns.

12. Fill the MPC and annulus as follows:

a. Fill the annulus with plant demineralized water to just below the inflatable seal seating surface.

Caution:
Do not use any sharp tools or instruments to install the inflatable seal. Some air in the inflatable seal helps in the installation.

b. Manually insert the inflatable annulus seal around the MPC. See Figure 8.1.13.

c. Ensure that the seal is uniformly positioned in the annulus area.

d. Inflate the seal.

e. Visually inspect the seal to ensure that it is properly seated in the annulus. Deflate, adjust and inflate the seal as necessary. Replace the seal as necessary.

ALARA Note:
Bolt plugs installed, and/or waterproof tape over empty bolt holes, reduce the time required for decontamination.

13. At the user's discretion, install HI-TRAC top lid bolt plugs and/or apply waterproof tape over any empty bolt holes.

ALARA Note:
Keeping the water level below the top of the MPC prevents splashing during handling.

14. Fill the MPC with either demineralized water or spent fuel pool water to approximately 12 inches below the top of the MPC shell. Refer to Tables 2.1.14 and 2.1.16 for boron concentration requirements.

15. If necessary for plant crane capacity limitations, drain the water from the neutron shield jacket. See Tables 8.1.1 through 8.1.4 as applicable.

16. Place HI-TRAC in the spent fuel pool as follows:

2. Load the pre-selected fuel assemblies into the MPC in accordance with the approved fuel loading pattern.

3. Perform a post-loading visual verification of the assembly identification to confirm that the serial numbers match the approved fuel loading pattern.

4. Install top DFI caps into predetermined locations of the MPC-68M as required by loading plans.

8.1.5 MPC Closure

Note:
The user may elect to use the Lid Retention System (See Figure 8.1.15) to assist in the installation of the MPC lid and lift yoke, and to provide the means to secure the MPC lid in the event of a drop accident during loaded cask handling operations outside of the spent fuel pool. The user is responsible for evaluating the additional weight imposed on the cask, lift yoke, crane and floor prior to use. See Tables 8.1.1 through 8.1.4 as applicable. The following guidance describes installation of the MPC lid using the lift yoke. The MPC lid may also be installed separately. Depending on facility configuration, users may elect to perform MPC closure operations with the HI-TRAC partially submerged in the spent fuel pool. If opted, operations involving removal of the HI-TRAC from the spent fuel pool shall be sequenced accordingly.

1. Remove the HI-TRAC from the spent fuel pool as follows:

   a. Visually inspect the MPC lid rigging or Lid Retention System in accordance with site-approved rigging procedures. Attach the MPC lid to the lift yoke so that MPC lid, drain line and trunnions will be in relative alignment. Raise the MPC lid and adjust the rigging so the MPC lid hangs level as necessary.

   b. Install the drain line to the underside of the MPC lid. See Figure 8.1.17.

   c. Align the MPC lid and lift yoke so the drain line will be positioned in the MPC drain location and the cask trunnions will also engage. See Figure 8.1.11 and 8.1.17.

ALARA Note:
Pre-wetting the components that enter the spent fuel pool may reduce the amount of decontamination work to be performed later.

   d. Slowly lower the MPC lid into the pool and insert the drain line into the drain access location and visually verify that the drain line is correctly oriented. See Figure 8.1.12.

   e. Lower the MPC lid while monitoring for any hang-up of the drain line. If the drain line becomes kinked or disfigured for any reason, remove the MPC lid and replace the drain line.

m. Disconnect the drain line from the MPC lid.

n. Store the MPC lid components in an approved location. Disengage the lift yoke from MPC lid. Remove any upper fuel spacers using the same process as was used in the installation.

o. Disconnect the lid retention system if used.

8.3.4 MPC Unloading

1. Remove the spent fuel assemblies and top DFI caps as required in the MPC-68M, from the MPC using applicable site procedures.

2. Vacuum the cells of the MPC to remove any debris or corrosion products.

3. Inspect the open cells for presence of any remaining items. Remove them as appropriate.

8.3.5 Post-Unloading Operations

1. Remove HI-TRAC and the unloaded MPC from the spent fuel pool as follows:

a. Engage the lift yoke to the top trunnions.

b. Apply slight tension to the lift yoke and visually verify proper engagement of the lift yoke to the trunnions.

c. Raise HI-TRAC until HI-TRAC flange is at the surface of the spent fuel pool.

ALARA Warning:
Activated debris may have settled on the top face of HI-TRAC during fuel unloading.

d. Measure the dose rates at the top of HI-TRAC in accordance with plant radiological procedures and flush or wash the top surfaces to remove any highly-radioactive particles.

e. Raise the top of HI-TRAC and MPC to the level of the spent fuel pool deck.

f. Close the annulus overpressure system reservoir valve.

g. Using a water pump, lower the water level in the MPC approximately 12 inches to prevent splashing during cask movement.

ALARA Note:
To reduce contamination of HI-TRAC, the surfaces of HI-TRAC and lift yoke should be kept wet until decontamination can begin.

h. Remove HI-TRAC from the spent fuel pool while spraying the surfaces with plant demineralized water.

i. Disconnect the annulus overpressure system from the HI-TRAC via the quick disconnect.

j. Place HI-TRAC in the designated preparation area.

k. Disengage the lift yoke.