2.4 Burnup Credit

Criticality control during loading of the MPC-37 is achieved through either meeting the soluble boron limits in LCO 3.3.1 OR verifying that the assemblies meet the minimum burnup requirements in Table 2.4-1 and the in-core operating requirements in Table 2.4-3.

For those spent fuel assemblies that need to meet the burnup requirements specified in Table 2.4-1, 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 2.4-1). 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.
- An independent, third-party verification of the loading process, including the fuel selection process and generation of the fuel move instructions

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

TABLE 2.4-1

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

Assembly Classes	Configuration[1]	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 and <7.0	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 and <7.0	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 and <7.0	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 and <7.0~~ ~~≥7.0~~ Combined[2] (>3.0)	~~f(x) = -2.1456e-01 * x^3 +2.4668e+00 * x^2 +2.1381e+00 * x^1 -1.2560e+01~~ ~~f(x) = -5.9154e-01 * x^3 +5.8403e+00 * x^2 -6.9339e+00 * x^1 -4.7951e+00~~ f(x) = -4.9680e-01 * x^3 +4.9471e+00 * x^2 -4.2373e+00 * x^1 -7.3936e+00

[1] Uniform configuration refers to Configuration 1 in Table 2.4-2. Regionalized configuration refers to Configuration 2, 3, or 4 in Table 2-4-2.
[2] The combined cooling time loading curve bounds the loading curves at 3 and 7 years cooling times and it is applicable for fuel with above 3 years cooling time.

TABLE 2.4-3
IN-CORE OPERATING REQUIREMENTS

Assembly Type	**Specific Power (MW/mtU)**	**Moderator Temperature (K)**	**Fuel Temperature (K)**	**Soluble Boron (ppm)**
Bounding Values (for Design Basis Calculations)				
15x15D, E, F, H	≤ 47.36	≤ 604	≤ 1169	≤ 1000
15x15B, C (Note 1)	≤ 52.33	≤ 620	≤ 1219	≤ 1000
16x16A, B	≤ 51.90	≤ 608	≤ 1113	≤ 1000
17x17A, B, C, D, E	≤ 61.61	≤ 620	≤ 1181	≤ 1000

NOTES:

1. The same core operating parameters are assumed for the 15x15I and 16x16C fuel assembly types