

3.7 PLANT SYSTEMS

3.7.16 Spent Fuel Assembly Storage

- LCO 3.7.16 The combination of initial enrichment and burnup of each new or spent fuel assembly stored in the spent fuel pool storage racks shall be within the following configurations:
- a. Unrestricted storage of fuel meeting the criteria of Table 3.7.16-1; or
 - b. Restricted storage in accordance with Figure 3.7.16-1, of fuel which does not meet the criteria of Table 3.7.16-1; or
 - c. Restricted storage, in accordance with Figure 3.7.16-1, of MOX fuel assemblies as Restricted Fuel.

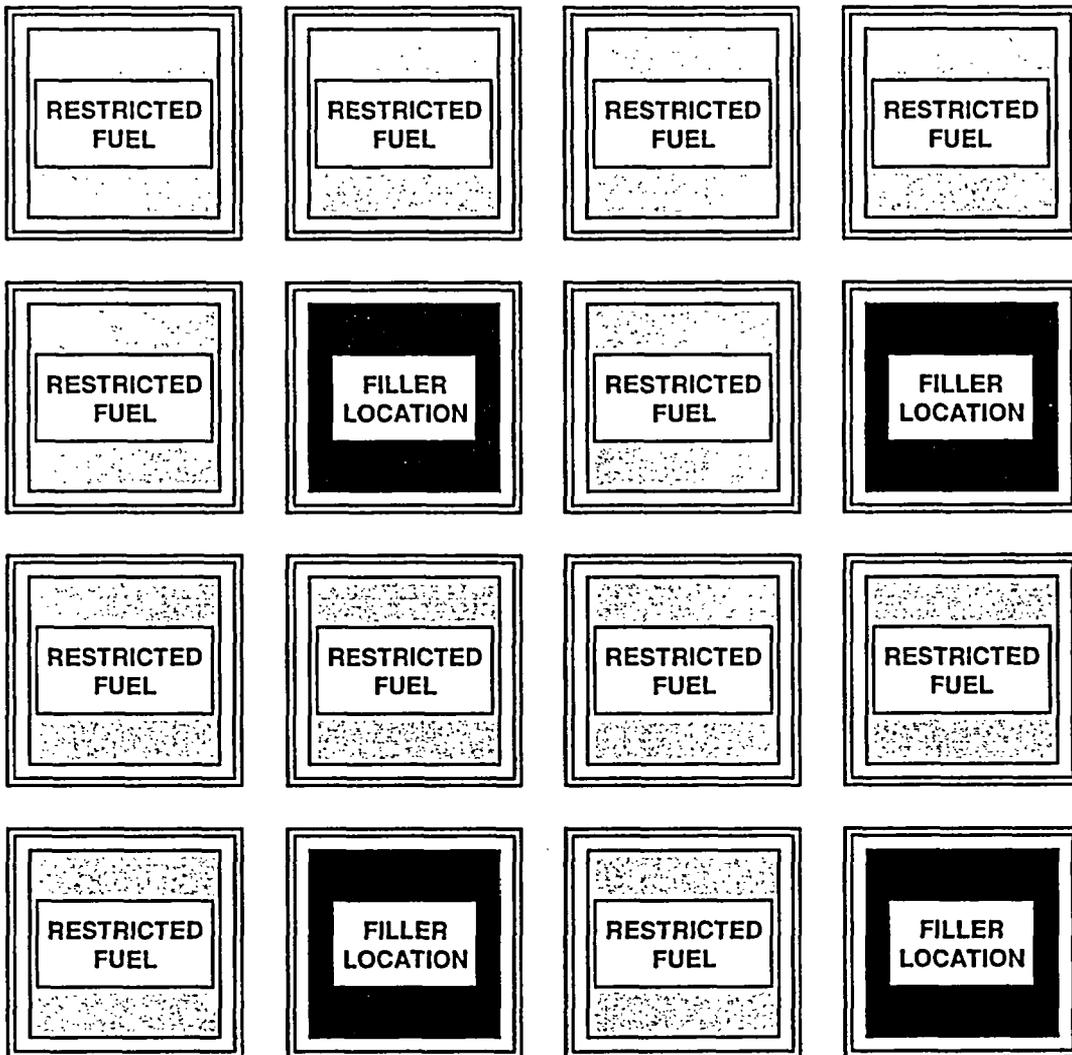
APPLICABILITY: Whenever any fuel assembly is stored in the spent fuel pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of the LCO not met.	A.1 -----NOTE----- LCO 3.0.3 is not applicable. ----- Initiate action to move the noncomplying fuel assembly to the correct location.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.16.1 Verify by administrative means the planned spent fuel pool location is acceptable for the fuel assembly being stored.	Prior to storing the fuel assembly in the spent fuel pool



Restricted Fuel: Fuel which: a) does not meet the requirements of Table 3.7.16-1 for Unrestricted Fuel; or b) is a mixed oxide fuel assembly with a maximum nominal fissile plutonium concentration of 4.15 weight percent and a maximum nominal U-235 enrichment of 0.35 weight percent. (Fuel defined for Unrestricted Storage in Table 3.7.16-1, or non-fuel components, or an empty location may be placed in restricted fuel locations as needed)

Filler Location: Either fuel which meets the minimum burnup requirements of Table 3.7.16-2, or an empty cell.

Boundary Condition: Any row bounded by an Unrestricted Storage Area shall contain a combination of restricted fuel assemblies and filler locations arranged such that no restricted fuel assemblies are adjacent to each other. Example: In the figure above, row 1 or column 1 can not be adjacent to an Unrestricted Storage Area, but row 4 or column 4 can be.

Figure 3.7.16-1
Required 3 out of 4 Loading Pattern for Restricted Storage

4.0 DESIGN FEATURES

4.1 Site Location

Catawba Nuclear Station is located in the north central portion of South Carolina approximately six miles north of Rock Hill and adjacent to Lake Wylie. The station center is located at latitude 35 degrees, 3 minutes, 5 seconds north and longitude 81 degrees, 4 minutes, 10 seconds west. The corresponding Universal Transverse Mercator Coordinates are E 493, 660 and N 3, 878, 558, zone 17.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 193 fuel assemblies. Each assembly shall consist of a matrix of either ZIRLO™ or Zircalloy fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO₂) as fuel material.* Limited substitutions of ZIRLO™, zirconium alloy, or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

* A maximum of four lead assemblies containing mixed oxide fuel and M5™ cladding may be inserted into the Unit 1 or Unit 2 reactor core.

4.2.2 Control Rod Assemblies

The reactor core shall contain 53 control rod assemblies. The control material shall be silver indium cadmium and boron carbide as approved by the NRC.

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

(continued)

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

- a. Fuel assemblies having a maximum nominal U-235 enrichment of 5.0 weight percent or mixed oxide fuel assemblies having a maximum nominal fissile plutonium concentration up to 4.15 weight percent and a maximum nominal U-235 enrichment of 0.35 weight percent;
- b. $k_{\text{eff}} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR; and
- c. A nominal 13.5 inch center to center distance between fuel assemblies placed in the fuel storage racks.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

- a. Fuel assemblies having a maximum nominal U-235 enrichment of 5.0 weight percent;
- b. $k_{\text{eff}} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR;
- c. $k_{\text{eff}} \leq 0.98$ if moderated by aqueous foam, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR; and
- d. A nominal 21 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.2 Drainage

The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 596 ft.

4.3.3 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1418 fuel assemblies.

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

12. DPC-NE-2008-P-A, "Fuel Mechanical Reload Analysis Methodology Using TACO3" (DPC Proprietary).
13. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code" (W Proprietary).
14. DPC-NE-2009-P-A, "Westinghouse Fuel Transition Report" (DPC Proprietary).
15. WCAP-12945-P-A, Volume 1 and Volumes 2-5, "Code Qualification Document for Best-Estimate Loss of Coolant Analysis" (W Proprietary).
16. DPC-NE-1005P-A, "Duke Power Nuclear Design Methodology Using CASMO-4/SIMULATE-3 MOX," (DPC Proprietary).
17. BAW-10231P-A, "COPERNIC Fuel Rod Design Computer Code," (Framatome ANP Proprietary).

The COLR will contain the complete identification for each of the Technical Specifications referenced topical reports used to prepare the COLR (i.e., report number, title, revision number, report date or NRC SER date, and any supplements).

- c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.
- d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

5.6.6 Ventilation Systems Heater Report

When a report is required by LCO 3.6.10, "Annulus Ventilation System (AVS)," LCO 3.7.10, "Control Room Area Ventilation System (CRAVS)," LCO 3.7.12, "Auxiliary Building Filtered Ventilation Exhaust System (ABFVES)," LCO 3.7.13, "Fuel Handling Ventilation Exhaust System (FHVES)," or LCO 3.9.3, "Containment Penetrations," a report shall be submitted within the following 30 days. The report shall outline the reason for the inoperability and the planned actions to return the systems to OPERABLE status.

(continued)

B 3.7 PLANT SYSTEMS

B 3.7.16 Spent Fuel Assembly Storage

BASES

BACKGROUND

The spent fuel storage rack (Ref. 1) is limited to a capacity of 1418 fuel assemblies. The spent fuel storage rack is designed to accommodate fuel with a maximum nominal enrichment of 5.0 wt% U-235 (maximum tolerance of ± 0.05 wt%) which have accumulated minimum burnups greater than or equal to the minimum qualifying burnups in Table 3.7.16-1. The storage rack can also accommodate mixed oxide fuel assemblies with a maximum nominal fissile plutonium concentration up to 4.15 weight percent (maximum tolerance of ± 0.075 weight percent fissile Pu) and a maximum nominal Uranium-235 enrichment of 0.35 weight percent. The mixed oxide fuel assembly design is radially zoned with fuel rods at three different plutonium concentrations. The nominal fissile plutonium concentration limit is the weighted average for the entire fuel assembly. Fuel assemblies not meeting the criteria of Table 3.7.16-1 shall be stored in accordance with Figure 3.7.16-1.

The water in the spent fuel pool normally contains soluble boron, which results in large subcriticality margins under actual operating conditions. However, the NRC guidelines, based upon the accident condition in which all soluble poison is assumed to have been lost, specify that the limiting k_{eff} of 0.95 be evaluated in the absence of soluble boron. Hence, the design of the spent fuel storage racks is based on the use of unborated water, which maintains the spent fuel pool in a subcritical condition during normal operation when fully loaded. The double contingency principle discussed in ANSI N-16.1-1975 and the April 1978 NRC letter (Ref. 2) allows credit for soluble boron under other abnormal or accident conditions, since only a single accident need be considered at one time. For example, the most severe accident scenario is associated with the accidental misloading of a fuel assembly. This could potentially increase the reactivity of the spent fuel pool. To mitigate these postulated criticality related accidents, boron is dissolved in the pool water. Safe operation of the spent fuel pool storage rack with no movement of assemblies may therefore be achieved by controlling the location of each assembly in accordance with the accompanying LCO. Prior to movement of an assembly, it is necessary to perform SR 3.7.15.1.

BASES

APPLICABLE SAFETY ANALYSES The hypothetical accidents can only take place during or as a result of the movement of an assembly (Ref. 3). For these accident occurrences, the presence of soluble boron in the spent fuel pool (controlled by LCO 3.7.15, "Spent Fuel Pool Boron Concentration") prevents criticality in the spent fuel pool storage racks. By closely controlling the movement of each assembly and by checking the location of each assembly after movement, the time period for potential accidents may be limited to a small fraction of the total operating time. During the remaining time period with no potential for accidents, the operation may be under the auspices of the accompanying LCO.

The configuration of fuel assemblies in the spent fuel pool satisfies Criterion 2 of 10 CFR 50.36 (Ref. 4).

LCO The restrictions on the placement of fuel assemblies within the spent fuel pool, in accordance with Table 3.7.16-1, in the accompanying LCO, ensures the k_{eff} of the spent fuel pool will always remain < 0.95 , assuming the pool to be flooded with unborated water. Fuel assemblies not meeting the criteria of Table 3.7.16-1 shall be stored in accordance with Figure 3.7.16-1 and Table 3.7.16-2.

APPLICABILITY This LCO applies whenever any fuel assembly is stored in the spent fuel pool.

ACTIONS A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the configuration of fuel assemblies stored in the spent fuel pool is not in accordance with the LCO, the immediate action is to initiate action to make the necessary fuel assembly movement(s) to bring the configuration into compliance.

If unable to move irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not be applicable. If unable to move irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the action is independent of reactor operation. Therefore, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.7.16.1

This SR verifies by administrative means that the fuel assembly is in accordance with the configurations specified in the accompanying LCO.

REFERENCES

1. UFSAR, Section 9.1.2.
2. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A).
3. UFSAR, Section 15.7.4.
4. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).