License and CoC Amendments for PWR Fuel Affected by Stress Corrosion Cracking in the Top Nozzle Bulge Joints

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Objectives

- Provide Industry's position on when Part 72 and 71 license/CoC amendments are required for storage and transportation of spent fuel assemblies susceptible to top nozzle bulge joint corrosion
- Summarize information in 8/27/10 white paper submitted to NRC
- Provide sufficient information (with second presentation) for NRC to determine their position on the issue



Introduction

- Certain older Westinghouse fuel assemblies are susceptible to stress corrosion cracking (SCC) at the bulge joints near the top nozzle
- An event at North Anna in 2001 confirmed that, if severe enough, the SCC could result in the top nozzle separating from the assembly when lifted
 - NRC Information Notice 2002-09



PWR Fuel Assembly Top Region



Fuel Assembly Bulge Joint Detail



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Background

Fuel assemblies susceptible to top nozzle SCC were loaded into storage casks at McGuire (and elsewhere) over many years

NRC letter to Duke Energy, August 2008:

 Systems containing modified, SSC susceptible fuel assemblies loaded for storage are not transportable until an analysis demonstrating the assemblies meet Part 71 requirements is reviewed and approved by the NRC.



Problem Statement

- The Duke letter created some confusion in the industry among licensees and CoC holders.
 - Industry seeks clarification, for the susceptible fuel assemblies (modified or not), whether or not licensing action is required under Parts 72 and 71.
 - It is unclear what the specific technical aspects that must be addressed in any analyses and evaluations are, and what form they should take to meet NRC's expectations.



Industry Proposal

- White paper submitted to NRC 8/27/10
- Four variants of susceptible fuel assemblies
- Total of eight conditions across 72/71
- Proposes position and a basis for when amendments are required in Part 72/71
- Applicable condition(s) will be governed by an analysis or evaluation (A/E) showing Part 72/71 and cask/package fuel-specific and systemrelated functions are met, to classify the assemblies as undamaged



Variants

1. Unmodified fuel assemblies moved with a standard tool

2. Unmodified fuel assemblies moved with a tool (e.g., thimble grip tool)

3. Assemblies modified with guide tube anchors or similar devices



4. Assemblies modified with instrument tube tie rods (ITTRs) or similar device

Part 50 In-Pool Requirements

Variants 1 and 2 are unmodified assemblies that are moved using normal means

- Variants 3 and 4 are modified fuel assemblies that can be moved using normal means. Modifications prevent top nozzle separation during lifting
 - 50.59 review required



Part 72 Amendments

- Involves specific licenses and CoCs
- Regulatory criteria to determine if a Part 72
 license/CoC amendment is required:
 - 1. The license/CoC requires a change based on the information currently in the license/CoC
 OR

 - 2. A 72.48 evaluation of the change, test, or experiment yields a "yes" answer to one or more of the 8 questions in §72.48(c)



Part 72 Approach

- Applicable variants require A/E to determine if all Part 72 fuel-specific and system-related functions are met without canning the assembly
 - If yes, that variant is undamaged for Part 72
- A/E documented and subject to NRC inspection
- Variants 3 and 4 receive a 72.48 review to determine if an FSAR change is needed to include that hardware.

Part 72 A/E Criteria

- Confinement
- Configuration

 Potential geometry, orientation, and/or basket deformation, or other physical changes evaluated for impact on structural, thermal, shielding, and criticality safety analyses

Retrievability

Prevention of gross cladding rupture



Part 72 Analysis/Evaluations

- Must show that, under all normal, off-normal, and accident conditions, each variant:
 - Confinement and configuration criteria are met
 - Will not result in gross rupture of fuel cladding
- Must show that, under all normal and off-normal conditions each variant results in a retrievable fuel assembly by normal means
- For accidents, fuel recovery but not retrievability (ISG-3)



Part 72 Cask Contents

- No detailed definitions for cask contents in SRP or other guidance
- Anchors and ITTRs (or similar devices)
 - Not irradiated in reactor
 - Insignificant or no impact on criticality, shielding, confinement, structural, thermal
 - Not cask contents in the context of the storage license/CoC



Part 72 Summary

- No direct regulatory driver for license or CoC amendment for any of the 4 variants
- If A/Es are successful, all 4 variants can be classified as undamaged fuel for storage
- Anchors and ITTRs are not CoC contents
- 72.48 process used to determine if an FSAR change is required for anchors or ITTRs
- A/E documented and subject to NRC inspection



Part 71 Amendments

- Only CoCs affected, not licenses
- CoC amendment needed if the CoC needs to be changed
- Part 71 CoCs reference a specific revision of the transport SAR
- Part 71 lacks a mechanism to modify the Part 71 SAR referenced in the CoC without prior NRC approval (no "71.48" process)
- If the SAR requires changes, a CoC amendment is needed



Part 71 Approach

Applicable variants require A/E to determine whether all Part 71 fuel-specific and system-related functions are met without canning

 If yes, that variant is undamaged for Part 71

 A/E documented and subject to NRC inspection



Part 71 A/E Criteria

- Containment integrity
- Configuration

 Potential geometry, orientation, and/or basket deformation, or other changes evaluated for impact on structural, thermal, shielding, and criticality safety analyses



Part 71 Analysis/Evaluations

- Must show that, under all normal and accident conditions of transportation, for each variant:
 - Meets containment and configuration criteria



Part 71 Package Contents

- No detailed definitions for package contents in SRP or other guidance.
- Anchors and ITTRs (or similar devices)
 - Not irradiated in reactor
 - Insignificant or no impact on criticality, shielding, containment, structural, thermal
 - Not package contents in the context of the transport CoC



Part 71 Summary

- Without a "71.48" process for modifying the Part 71 SAR, if the SAR is affected, a CoC amendment is required even if the CoC itself does not require revision
- Licensees are responsible for performing the appropriate A/E and classifying the fuel for transportation
- A/E documented and made available for NRC inspection



Conclusions

- Industry is responsible for classifying fuel assemblies for storage and transportation (ISG-1)
- Classification must be based on documented A/E verifying regulatory and cask/package design requirements are met
- A/E will be documented and available for NRC inspection
- To determine need for amendment, use appropriate regulatory process
- Fuel placed into storage should be known to be transportable when loaded

