



August 4, 1999
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United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Braidwood Station, Unit 1
Facility Operating License No. NPF-72
NRC Docket No. STN 50-456

Subject: Notification of Application of Best Estimate Loss of Coolant
Accident Interim Methodology for Resolution of the Fuel Rod
Internal Pressure Issue

- References:
- (1) Letter OG-97-118 from T. V. Green, (Westinghouse Owner's Group), to U.S. NRC, "Transmittal of Responses to NRC Request for Additional Information on the Fuel Rod Internal Pressure Issue," dated November 12, 1997
 - (2) NRC Memorandum from C. M. Craig, (U.S. NRC) to T. Essig, (U.S. NRC), "Summary of Meeting with Westinghouse Owner's Group (WOG) to discuss issues related to 10 CFR 50.46," dated January 15, 1998
 - (3) NRC Memorandum from E. Y. Wang, (U.S. NRC), to T. H. Essig, (U.S. NRC), "Meeting Summary of May 5, 1998 Westinghouse Electric Corporation Regarding Fuel Rod Internal Pressure and Other Fuel-Related Activities," dated May 29, 1998
 - (4) U.S. NRC Information Notice 98-29, "Predicted Increase in Fuel Rod Cladding Oxidation," dated August 3, 1998

This letter is being submitted to inform the NRC that Commonwealth Edison (ComEd) Company plans to demonstrate compliance with 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors" requirements, for fuel that is predicted to experience fuel pellet to fuel rod cladding gap reopening, during Braidwood Station, Unit 1 Cycle 8 (i.e., the current operating cycle) using the Westinghouse Electric Company (WEC) computer code HOTSPOT.

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The HOTSPOT code is used in conjunction with the WCOBRA/TRAC computer code for plants that utilize Best Estimate (Loss of Coolant Accident) LOCA methods. ComEd has not yet received NRC review and approval to use Best Estimate LOCA methods; however, based on discussions held between Westinghouse and the NRC, as documented in References 2,3, and 4, ComEd considers that this is the most appropriate method for showing compliance with 10 CFR 50.46 requirements given the potential for fuel pellet to fuel rod cladding gap reopening.

Background Summary

WEC's fuel performance computer code, "Performance Analysis and Design (PAD)," is a NRC approved methodology that has been in use since the 1970's. In early 1996, Westinghouse discovered that the fuel rod internal pressure buildup due to helium release from Integral Fuel Burnable Absorbers (IFBA) was higher than previously modeled. In late 1996, Westinghouse completed development of a new corrosion model for Zircaloy-4 cladding material to address the higher levels of corrosion being measured in the field on high duty fuel rods.

After incorporation of the new corrosion model into the PAD code, PAD indicated that the higher levels of corrosion are causing elevated fuel cladding temperature at end of life conditions, and consequently, higher outward clad creep rates and reduced pressure margin to the no gap re-opening criteria. This criteria is found in the NRC's Safety Evaluation Report, J. F. Stolz, NRC, to T. M. Anderson, Westinghouse, dated May 19, 1999 for WCAP-8963, "Safety Analysis for the Revised Fuel Rod Internal Pressure Design Basis," dated May 19, 1978. The specific Westinghouse analysis acceptance criteria in question states that, "an approved fuel performance code must be used to show that the fuel-to-cladding gap does not open."

Chronology

In October 1997, WEC notified the NRC that when the effects of the increased corrosion predicted by the revised Zircaloy-4 corrosion model are incorporated into the NRC-approved version of the PAD code, gap re-opening may be predicted for the high duty IFBA rods in many cores. Current fuel design criteria approved by the NRC specify that no gap re-opening is allowed. PAD is the NRC approved code that WEC uses to demonstrate fuel design limits.

In response to the WEC notification, Byron and Braidwood Stations performed an operability assessment that documented that there was reasonable assurance that the 10 CFR 50.46 criteria was met for all four operating units. Cycle specific evaluations for the operating cycles and subsequent cycles confirmed acceptability of the 10 CFR 50.46 criteria.

WEC developed an "interim" methodology for addressing fuel with gap re-opening. The Westinghouse Owners Group (WOG) supports this "interim" methodology. This methodology was presented to the NRC on November 6, 1997 (Reference 1). The methodology demonstrates that a plant safety analysis will remain bounding and that all of the 10 CFR 50.46 requirements would be met for plants that the PAD code indicated gap re-opening. The NRC agreed with this methodology, provided the 10 CFR 50.46 oxidation criteria could be met on a plant specific basis.

The NRC published this concurrence in the meeting minutes of the November 1997 meeting (Reference 2). In the meeting minutes, the NRC states, "The staff concluded that licensees using Westinghouse fuel are in present compliance with 10 CFR 50.46 requirements and that the overall plan provided licensees a means to demonstrate continued compliance with both the reporting and analytical requirements of 10 CFR 50.46."

WEC met with the NRC on May 5, 1998 to provide an update on the status of the rod internal pressure issue. WEC informed the NRC that use of the interim methodology would continue until the PAD code 10.0 was revised. The NRC agreed with this approach and issued an internal memo confirming their position (i.e., Reference 3). This memo notes that, "for some fuel already in reactor cores, it may be possible that the revised PAD model might still predict some gap reopening. If this were to occur, Westinghouse will demonstrate that these assemblies will continue to meet all safety limits as well as 10 CFR 50.46 oxidation limits, for operating as well as future cycles, using the methodology that has already been presented to the NRC for gap reopening analysis. The staff agrees that this is an appropriate way to proceed."

The NRC issued Information Notice (IN) 98-29, "Predicted Increase in Fuel Rod Cladding Oxidation," on August 3, 1998 (i.e., Reference 4). The IN documented that during the November 6, 1997 meeting with the WOG and NRC, "the WOG stated that it would provide a list of affected plants, the projected dates when each might become vulnerable to potential non-compliance, and details of its plans to address the issue. The WOG also stated that each affected plant would take appropriate individual actions in terms of reporting pursuant to 10 CFR 50.46(a)(3)ii before the plant reached its projected date of vulnerability." In conclusion, the IN states that, "the NRC staff found that this approach was adequate to address in the near term the specific problems reported by Westinghouse and that plants with Westinghouse IFBA fuel could continue to operate in compliance with 10 CFR 50.46."

On January 6, 1999, ComEd representatives met with the NRC Reactor Systems Branch Chief to discuss the fuel rod gap reopening issue for Braidwood Station, Unit 1, Cycle 8. In this meeting, Mr. T. Collins of the NRC indicated that the issue could be addressed by performing a plant specific analysis to show that 10 CFR 50.46 criteria are met as noted in IN 98-29 (i.e., Reference 4). Mr. Collins also stated that for fuel cycles in progress, such as Braidwood Station, Unit 1, Cycle 8, the core would not have to be reanalyzed using the new PAD code after it receives NRC approval.

Braidwood Station, Unit 1, Cycle 8 Specific Analysis

The PAD code predicts that a limited number of fuel assemblies in the Braidwood Station, Unit 1, Cycle 8 core will experience gap reopening. The fuel assemblies in question are predicted to experience gap reopening at approximately 15,000 MWD/MTU burnup. This burnup is projected to occur in November 1999. At the time of the Braidwood Station, Unit 1, Cycle 8 reload, the original PAD code implementation schedule would have allowed WEC to re-evaluate the Braidwood Station, Unit 1, Cycle 8 core with the new revised PAD code in order to show acceptability of the no gap re-opening criteria. The current PAD implementation schedule will preclude the use of PAD for evaluation of Braidwood Station, Unit 1, Cycle 8; however, based on the ComEd/NRC meeting in January 1999, a PAD code evaluation would not be necessary.

WEC has performed an analysis for ComEd consistent with the WEC interim methodology (i.e., Reference 1) for addressing fuel with gap re-opening. This analysis has shown that Braidwood Station, Unit 1, Cycle 8 is in full compliance with the 10 CFR 50.46 criteria. Specifically, the Braidwood Station, Unit 1, Cycle 8 initial LOCA oxidation is 11.42 % and is within the interim methodology acceptance criteria of 12.00%. The final LOCA oxidation is 16.4% and is within the 10 CFR 50.46 acceptance criteria of 17%. The "Analysis of Record Small Break LOCA Peak Clad Temperature" remains unchanged at 1695 °F. The "Analysis of Record Large Break LOCA Peak Clad Temperature" remains unchanged at 2100 °F.

All reload design values are within the acceptance criteria or are conservative with respect to a generic bounding analysis with the exception of the "Rod Internal Pressure Analysis - Gap Opening" criteria.

The oxidation calculations for Braidwood Station, Unit 1, Cycle 8 fuel were calculated in accordance with Reference 1 using WCOBRA/TRAC and HOTSPOT. Westinghouse stated in Reference 1, "The use of the WCOBRA/TRAC and HOTSPOT analysis approach to assess the effects of gap re-opening for plants analyzed with Appendix K methods is considered by Westinghouse to be a reasonable and acceptable method for assessing compliance with 10 CFR 50.46, provided that the time-at-temperature of the WCOBRA/TRAC reference transient bounds that of the Appendix K transient and the Baker-Just model is used." The NRC has acknowledged this approach in References 2, 3 and 4.

Because Braidwood Station is an Appendix K plant, and based on the meeting between ComEd and the NRC in January 1999, ComEd considers that it is appropriate to notify the NRC of this application of WEC Best Estimate LOCA codes.

Conclusion

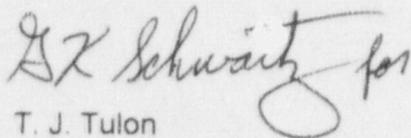
ComEd plans to demonstrate compliance with 10 CFR 50.46 requirements for fuel that is predicted to have a re-opened fuel pellet to fuel rod cladding gap for Braidwood Station, Unit 1, Cycle 8 (i.e., the current operating cycle) using WEC Best Estimate LOCA codes.

ComEd has not obtained NRC concurrence to use Best Estimate LOCA methods; however, based on discussions held between Westinghouse and the NRC, as documented in References 2, 3 and 4, ComEd considers that this is the most appropriate method for showing compliance with a re-opened fuel pellet to fuel rod cladding gap.

August 4, 1999
U.S. Nuclear Regulatory Commission
Page 5 of 5

If you have any further questions regarding this matter, please contact Mr. T. W. Simpkin
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Respectfully,

A handwritten signature in cursive script, appearing to read "T. J. Tulon for".

T. J. Tulon
Site Vice President
Braidwood Station

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Braidwood Station