Working Together to Economically Provide Reliable and Safe Electrical Power

March 5, 2001
OG-01-1805

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Subject: Submittal of Topical Report BAW-10179P, Rev. 4. Safety Criteria and Methodology for Acceptable Cycle Reload Analyses, March 2001

Gentlemen:

Enclosed are twelve (12) copies of Topical Report BAW-10179P, Rev. 4, Safety Criteria and Methodology for Acceptable Cycle Reload Analyses. This report is being revised to incorporate additional topical reports that have been approved by the NRC since the safety evaluation report (SER) for BAW-10179P, Rev. 3 was issued.

BAW-10179P provides the criteria and methodology for determining cycle specific limits and setpoints that are included in the Core Operating Limits Reports (COLR) for the B&W 177-fuel assembly class of plants that are participants in this B&W Owners Group project. The report serves as the approved methodology that is referenced in the COLR portion of the Administrative Controls of the plant Technical Specifications.

This revision comprises a list of references that have been approved since the approval of BAW-10179P, Rev. 3. Five new topical reports are being added with this revision and an appendix is provided for each of them. These appendices are brief summaries of each topical and include the conditions and limitations for the applicability of each.

The references in BAW-10179P, Rev. 4 do not require any additional review by the NRC because they are already approved and accepted versions for them have been published. Since no review is required, the NRC is requested to issue an SER for BAW-10179P, Rev. 4 by June 30, 2001. The B&W Owners Group members will then reference Revision 4 as the current approved version of BAW-10179P.

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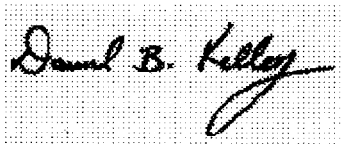
TOIO

Revision 4 will be referenced in the Core Operating Limits Reports and no changes to the plants' Technical Specifications will be required.

Very truly yours,



D. B. Kelley, Chairman
B&W Owners Group
Core Performance Committee

c: S. N. Bailey, NRC

BAW-10179P, Rev. 4
March 2001

SAFETY CRITERIA AND METHODOLOGY FOR ACCEPTABLE CYCLE RELOAD ANALYSES

THE B&W OWNERS GROUP

CORE PERFORMANCE COMMITTEE

FRAMATOME ANP

BAW-10179P, Rev.4
March 2001

SAFETY CRITERIA AND METHODOLOGY FOR ACCEPTABLE CYCLE RELOAD ANALYSES

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SAFETY CRITERIA AND METHODOLOGY FOR ACCEPTABLE CYCLE RELOAD ANALYSES

CONTENTS

Appendix A

Additional NRC Approved Documents

The following NRC approved topical reports were incorporated in BAW-10179P-A, Revision 1. These reports have received approval subsequent to the submittal of BAW-10179P-A and describe methodologies that replace or augment methodologies described in that report. Appendices B through G provide brief descriptions of each of the reports listed below.

1. BAW-2149-A, "Evaluation of Replacement Rods in BWFC Fuel Assemblies", B&W Fuel Company, Lynchburg, Virginia, September 1993.

2. BAW-10156-A, Rev. 1, "LYNXT Core Transient Thermal-Hydraulic Program", B&W Fuel Company, Lynchburg, Virginia, August 1993.

3. BAW-10187P-A, "Statistical Core Design for B&W-Designed 177 FA Plants", B&W Fuel Company, Lynchburg, Virginia, March 1994.

4. BAW-10184P-A, "GDTACO, Urania-Gadolinia Thermal Analysis Code", B&W Fuel Company, Lynchburg, Virginia, February 1995.

5. BAW-10183P-A, "Fuel Rod Gas Pressure Criterion (FRGPC)", B&W Fuel Company, Lynchburg, Virginia, July 1995.

6. Letter from Robert C. Jones to J. H. Taylor Concerning Fuel Rod Power History Uncertainty with TACO3, October 18, 1995.

Additional Documents Approved by NRC to be Included in Revision 2 of BAW-10179P-A

The following NRC approved documents are being incorporated in BAW-10179P, Revision 2. These documents describe methodologies that replace or augment methodologies described in the initial issue and Revision 1 of BAW-10179P-A. Appendices H through K provide brief descriptions of each of the documents listed below.

7. BAW-10084P-A, Rev. 3, Program to Determine In-Reactor Performance of BWFC Fuel Cladding Creep Collapse, B&W Fuel Company, Lynchburg, Virginia, August 1995.

8. BAW-10186P-A, Extended Burnup Evaluation, Framatome Cogema Fuels, Lynchburg, Virginia, June 1997.

9. Letter from R.C. Jones to J.H. Taylor Extending Burnup Limit for TACO3, January 11, 1996.

10. Letter from R.C. Jones to J.H. Taylor Accepting Revised Measurement Uncertainty for Control Rod Worth Calculations, January 26, 1996.

11. BAW-10199P-A, The BWU Critical Heat Flux Correlations, Framatome Cogema Fuels, Lynchburg, Virginia, August 1996.

12. Letter from David B. Matthews to J. H. Taylor, "Safety Evaluation of the Babcock & wilcox Owners Group Submittal Relating to Assumptions in the B&W ECCS Analysis," August 20. 1997.

Additional Documents Approved by NRC to be Included in Revision 3 of BAW-10179P-A

The following NRC approved documents are being incorporated in BAW-10179P, Revision 3. These documents describe methodologies that replace or augment methodologies described in the initial issue and Revisions 1 and 2 of BAW-10179P-A. Appendices N and O provide brief descriptions of each of the documents listed below.

13. BAW-10192PA, BWNT Loss of Coolant Accident Evaluation Model for Once-Through Steam Generator Plants, June 1998.

14. BAW-10221P-A, NEMO-K A Kinetics Solution in NEMO, September 1998.

Additional Documents Approved by NRC to be Included in Revision 4 of BAW-10179P-A

The following NRC approved documents are being incorporated in BAW-10179P, Revision 4. These documents describe methodologies that replace or augment methodologies described in the initial issue and Revisions 1, 2, and 3 of BAW-10179P-A. Appendices P, Q, R, S, and T provide brief descriptions of each of the documents listed below.

15. BAW-10133P-A, Rev. 1, Addendum 1 and Addendum 2 - Addendum 1 and Addendum 2 to Mark-C Fuel Assembly LOCA-Seismic Analyses, November 2000.

16. BAW-10199P-A, Addendum 1 - The BWU Critical Heat Flux Correlations, December 2000.

17. BAW-10227P-A - Evaluation of Advanced Cladding and Structural Material (M5™) in PWR Reactor Fuel, February 2000.

18. BAW-10228P-A - SCIENCE, December 2000.

19. BAW-10229P-A, Mark-B11 Fuel Assembly Design Report, April 2000.

Appendix P

Addendum 1 and Addendum 2 to Mark-C Fuel Assembly LOCA-Seismic Analyses - BAW-10133P-A, Rev. 1, Addendum 1 and Addendum 2

Addendum 1 of BAW-10133P-A, Rev. 1 provides changes to the modeling of the spacer grids and the modeling of the hydrodynamic coupling. Addendum 2 provides the justification of higher damping values in fuel assembly seismic and LOCA models. As a consequence of these changes more realistic analysis results will be obtained that will allow the design of optimized products. The NRC concludes that both addenda are acceptable for incorporation into the overall methodology for seismic and LOCA applications.

Appendix Q

The BWU Critical Heat Flux Correlations - BAW-10199P-A, Addendum 1

BAW-10199P-A, Addendum 1 justifies the application of the BWU-Z CHF correlation to fuel assemblies with the Mark-B11 spacer grid design. The BWU-Z CHF correlation is approved for all types of cell geometries. The table below provides the approved MDNBR limits and range for the BWU-Z CHF correlation for fuel with Mark-B11 spacer grids.

Pressure	400 - 2465 psia
Mass velocity	0.36 - 3.55 Mlbm/hr-ft^2
Equilibrium quality at CHF	Up to 0.74
Design limit DNBR	1.183 for P > 1000 psia 1.20 for 700 psia < P < 1000 psia 1.59 for 400 psia < P < 700 psia

Appendix R

Evaluation of Advanced Cladding and Structural Material (M5™) in PWR Reactor Fuel - BAW-10227P-A

BAW-10227P-A provides the justification for use of the alloy M5™ to replace Zircaloy-4 in the construction of fuel assembly components such as fuel rod cladding, guide tubes, and spacer grids. M5™ was developed by Framatome in France and is being implemented on a wide scale in Europe. M5™ provides improvements that include less corrosion, lower hydrogen pickup, decreased axial growth, and lower diametral creep. These improvements provide increased operating margin to the approved fuel rod average burnup limit of 62 GWd/mtU for the Mark-B fuel designs.

Appendix S

SCIENCE - BAW-10228P-A

BAW-10228P-A describes the SCIENCE nuclear code package and its application to fuel cycle design and licensing. SCIENCE is an integrated system of codes that may be used to perform the nuclear analysis of PWR cores. It comprises a set of core physics tools based on two-dimensional lattice calculations and three-dimensional core calculations and data manipulation codes.

The use of SCIENCE is subject to the following limitations:

1. The SCIENCE code package shall be applied in such a manner that predicted results are within the ranges of the validation criteria and measurement uncertainties presented in Tables 5-1 and 5-2, respectively, of BAW-10228P-A.

2. Fuel designs to which the SCIENCE code package will be applied shall be within the validation bases of BAW-10228P-A. The bases of BAW-10228P-A are considered valid for the following conditions:

   - 15x15 or 17x17 UO_2 fuel designs.
   - ^{235}U enrichments less than or equal to a maximum of 5.0 w/o.
   - Gadolinia loadings less than or equal to 8.3 w/o (nominal 8.0 w/o).

3. The following uncertainties shall be applied to the SCIENCE code package results:

   - Maximum pin peaking uncertainty of 3.8 percent.
   - Maximum pellet uncertainty of 4.8 percent.
   - Total rod worth uncertainty of 10 percent.
   - Bank rod worth uncertainty of 15 percent.

4. The SCIENCE code package shall only be used for PWR licensing analyses by FCF unless approved by the NRC for use by other organizations.

Appendix T

Mark-B11 Fuel Assembly Design Report - BAW-10229P-A

BAW-10229P-A provides the licensing bases for the Mark-B11 fuel assembly design. The Mark-B11 fuel is the most recent addition to the Framatome ANP fuel product line. The Mark-B11 fuel design features smaller diameter fuel rods to reduce uranium requirements and mixing vane grids to provide superior thermal performance. The Mark-B11 also incorporates an improved spacer grid restraint system.

The NRC staff has found the Mark-B11 fuel to be acceptable to a rod average burnup of 62 GWd/mtU. The NRC also requires that the following plant-specific analyses be performed by licensees incorporating the Mark-B11 fuel design:

1. cladding oxidation,
2. rod internal pressure,
3. overheating of cladding, and
4. ECCS related analyses.

Framatome ANP has confirmed that these issues will be addressed on a plant-specific basis for each reload application.