PART A

EXECUTIVE SUMMARY

SAFETY EVALUATION NUMBER:(1) SE 97085

DOCUMENT EVALUATED:(2) Burnup Extension Program

BRIEF DESCRIPTION OF CHANGE, TEST OR EXPERIMENT:(3)

The proposed change involves an experiment (high burnup demonstration) not described in the UFSAR. The 220 fuel pins in a single Batch J assembly at the center of the core in this experiment are expected to accumulate one-pin (axially integrated) burnups up to 66,200 MWd/MTU at EOC-9.

REASON FOR CHANGE, TEST OR EXPERIMENT: (4)

The purpose of the continued irradiation of a single Batch J assembly in Cycle 9 is to demonstrate acceptable corrosion resistance of the current standard ABB CENO low-tin Zircaloy-4 fuel pin cladding (OPTIN) at Waterford 3 to at least 63,000 MWd/MTU for fuel management considerations. At the end of Cycle 9, the information gained from this special test/experiment on the Batch J assembly will be used to support the development of an ABB CENO topical report demonstrating the acceptability of higher burnup fuel..

SAFETY EVALUATION SUMMARY AND CONCLUSIONS:(5)

Operation of up to 220 fuel pins in a single assembly beyond 60,000 MWd/MTU exceeds a one-pin burnup design limit of Appendix 4.3A.3.1.3 of the UFSAR. The extension of burnup for this test assembly has been explicitly included in the core calculations performed in support of the reload safety analysis of Cycle 9 using methods approved by the NRC. Additional explicit evaluations of CEA ejection, the fuel mishandling accident, and fuel performance for the lead Batch J assembly at the highest one-pin burnup anticipated indicates no licensing limits will be exceeded. No changes are required to the UFSAR or the Technical Specifications for a temporary experimental extension of the burnup design limit for a single test fuel assembly for Cycle 9. Also attached is background information provided by ABB.

LICENSING BASIS AND OTHER DOCUMENTS REVIEWED:(6)

The review considered the UFSAR, Technical Specifications, reload safety evaluations, and fuel design and performance evaluations performed specifically for the lead Batch J assembly for Cycle 9.

Signatures

	NAME (PRINT)	Signature/Date
Preparer:(10)	Dennis Barr	[signature] 4/16/97
Reviewer:(11)	Abid Rustaey	[signature] ABID-RUSTAEY 4/16/97
Supervisor:(12)	Jerry Holman	J B Holman 4/16/97

UFSAR CHANGE REQUIF.ED? (7) ☐ YES ■ NO

RADIOACTIVE WASTE SYSTEMS ADDITIONAL SAFETY EVALUATION ATTACHED? (8) ☐ YES ■ NO

ENVIRONMENTAL IMPACT EVALUATION ATTACHED? (9) ☐ YES ■ NO

PART B

SAFETY EVALUATION QUESTIONS[13]

B1) Does the proposed change or activity increase the probability of occurrence of an accident previously evaluated in the SAR?
A. List accidents in the SAR that may be caused by or affected by the proposed change or activity or justify that there is no effect.
B. For each accident, discuss the effect of the proposed change or activity on the likelihood of the accident occurring.

☐ Yes
■ No

BASIS:

The proposed change represented by the continued operation of up to 220 fuel pins in a single test fuel assembly that may achieve burnups in the range of 61,980 to 66,200 MWd/MTU does not increase the probability of occurrence of an accident previously evaluated in the UFSAR. Since the experiment does not involve any changes to current equipment, operating procedures, technical specifications or COLR limits, the proposed extended burnup experiment does not increase the probability of occurrence of a previously evaluated accident. Fuel is not a direct cause of an accident evaluated in the UFSAR.

B2) Does the proposed change or activity increase the consequences of an accident previously evaluated in the SAR?
A. List accidents in the SAR that may have radiological release consequences altered by the proposed change or activity, or justify that no accidents are affected.
B. For each accident, discuss the effect of the proposed change or activity on the radiological release consequences. Include the effect of the proposed change or activity on mitigating system performance and analysis assumptions credited in the accident analysis.
C. If applicable, provide the results of a new analysis that accounts for the proposed change or activity.

☐ Yes
■ No

BASIS:

The lead Batch J fuel assembly has been explicitly included in the core calculations performed in support of the reload safety analysis for Cycle 9. Additional CEA ejection and fuel mishandling accident analyses were performed specifically for this lead assembly to assure that current limits will not be exceeded.

In addition, explicit evaluations have been performed on the impact of postulated accidents on the performance of the extended burnup assembly itself. In this regard two accidents were considered: The reactivity insertion accident (RIA) event (specifically CEA Ejection) and the Spent Fuel Assembly Handling Accident. In both of these cases the impact of increased fuel assembly burnup were investigated to verify that the consequences of these accidents do not exceed those previously considered in the UFSAR.

B3) Does the proposed change or activity increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the SAR? ☐ Yes ■ No

A. Identify the equipment important to safety that could be affected by the proposed change or activity, or justify why no equipment important to safety is affected.

B. Discuss the effect the proposed change or activity may have on equipment important to safety. Include a determination of whether the likelihood of malfunction will increase.

BASIS:

The design and performance of fuel pins and shim pins were evaluated up to the peak one-pin burnups anticipated for Cycle 9 to assure acceptable fuel pin cladding and fuel assembly performance.

The fuel pin cladding is the primary barrier to the release of fission products from the fuel pellets to the primary coolant. Cladding lifetime issues such as waterside oxide thickness have been addressed.

Maximum oxide thickness measurement data have been collected at other CE designed 16x16 reactors for the identical Zircaloy-4 cladding type and dimensions used in this Batch J assembly, up to one-pin actual burnups of 65,900 MWd/MTU. This burnup experience is within 300 MWd/MTU of the peak one-pin burnup of 66,200 MWd/MTU used for the Cycle 9 safety analysis at Waterford 3 (the actual burnup at Waterford 3 will be less than the 66,200 MWd/MTU safety analysis limit).

The Batch J assembly will be placed at the center of the core beneath CEDM Number 01, which is part of CEA Regulating Group 2 and CEA Sub-Group 19. This rod is scrammable. Reference 9 provides an evaluation of the potential for delayed CEA insertion times at CE-designed plants at high burnups. This evaluation demonstrated that no burnup dependencies have been observed for CEA drops in any CE plant design. The evaluation further concludes that the potential for CEA insertion problems at high burnups is not significant and that fuel management restrictions are not required on the placement of high burnup fuel assemblies under CEAs. Reference 9 was submitted to the NRC for information by Reference 10.

B4) Does the proposed change or activity increase the consequences of a malfunction of equipment important to safety previously evaluated in the SAR? ☐ Yes ■ No

A. List the accidents for which the equipment important to safety in 3A above is required to perform a safety function.
B. For each accident, discuss how the consequences may be different if the equipment in 3A above were to malfunction.

BASIS:

The failure of any of the 220 fuel pins at Waterford 3 is not expected, based on the successful irradiation of 15 fuel pins to one-pin maximum burnups up to 65,900 MWd/MTU at another 16x16 CE plant, as reported by References 11 and 12, which is within 300 MWd/MTU of the peak one-pin burnup of 66,200 MWd/MTU used for the Cycle 9 safety analysis at Waterford 3 (the actual burnup at Waterford 3 will be less than the 66,200 MWd/MTU safety analysis limit). If additional fuel pin failures do occur for an unforeseen reason, they would occur over a long period of time permitting appropriate corrective actions. Technical Specification 3.4.7 limits operation with the specific activity above the setpoint stated in the Technical Specification.

B5) Does the proposed change or activity create the possibility of an accident of a different type than previously evaluated in the SAR? ☐ Yes ■ No

A. Discuss new system interactions or connections that did not previously exist.
B. Discuss how these new system interactions or connections could or could not create a new accident.

BASIS:

Since the proposed extended burnup experiment involving a single fuel assembly does not involve any changes to current equipment, operating procedures, technical specifications, or COLR limits, this experiment does not create the possibility of an accident of a different type than previously evaluated in the SAR. Waterside corrosion induced fuel failures or failures due to an unforeseen mechanism of an additional 220 fuel pins expected to achieve one-pin burnups up to 66,200 MWd/MTU would not be considered an accident, because the failures would occur over a sufficiently long period of time such that increased coolant activity would be detected and appropriate corrective actions as stated in Technical Specification 3.4.7 will be taken to mitigate any undesirable consequences. The proposed center assembly was evaluated in the normal reload safety analysis and was found to meet all design limits as described in the Reload Analysis Report, Reference 13.

B6) Does the proposed change or activity create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the SAR? ☐ Yes ■ No

A. Discuss new system interactions or connections that did not previously exist.

BASIS:

The failure of the fuel pin cladding is not expected based on experience at another plant that achieved burnups within 300 MWd/MTU of the Cycle 9 high burnup demonstration. If additional fuel pin failures do occur for an unforeseen reason, they would occur over a long period of time permitting appropriate corrective actions as stated in Technical Specification 3.4.7. See the attached supporting information.

B7) Does the proposed change or activity reduce the margin of safety as defined in the bases for any technical specification or the appropriate safety analysis?

☐ Yes
■ No

A. If the change is to a protective boundary, discuss how the boundary is affected.
B. Identify the margins of safety (related to boundary performance) that may be affected by the proposed change or activity.
C. Discuss how the accident response, as affected by the proposed change or activity, relates to the appropriate acceptance limits.
D. If applicable, provide the results of an analysis that accounts for the proposed change or activity and shows the impact on margin of safety.

BASIS:

The extension of burnup for this test assembly has been explicitly included in the core calculations performed in support of the reload safety analysis of Cycle 9 using methods approved by the NRC. Additional explicit evaluations of CEA ejection, the fuel mishandling accident, and fuel performance for the lead Batch J assembly at the highest one-pin burnup anticipated indicates no licensing limits will be exceeded.

PART C[14]

RADIOACTIVE WASTE SYSTEMS MODIFICATION & UNPLANNED RELEASE APPLICABILITY REVIEW

IF THE FOLLOWING QUESTION IS ANSWERED "YES," THEN A RADIOACTIVE WASTE SYSTEMS ADDITIONAL SAFETY EVALUATION (ATTACHMENT VI) MUST BE COMPLETED AND ATTACHED TO THIS FORM. ATTACHMENT VIII MAY BE USED IN ANSWERING THIS QUESTION.

Does the proposed change or activity represent:

C1) A change to a radioactive waste system or a potential to cause an uncontrolled, unplanned, or unmonitored release?

☐ Yes
■ No

PART D[15]

ENVIRONMENTAL EVALUATION APPLICABILITY REVIEW

IF THE FOLLOWING QUESTION IS ANSWERED "YES," THEN AN ENVIRONMENTAL IMPACT EVALUATION (ATTACHMENT VII) MUST BE COMPLETED AND ATTACHED TO THIS FORM. ATTACHMENT IX MAY BE USED IN ANSWERING THIS QUESTION.

Does the proposed change or activity represent:

D1) A change to the Environmental Protection Plan, or a change that may affect the environment?

☐ Yes
■ No

Background

A single Batch J fuel assembly that was irradiated in Cycles 7 and 8 will be placed at the center core location in Cycle 9 for a third cycle to demonstrate acceptable performance, including corrosion resistance of the current standard ABB CENO low-tin Zircaloy-4 fuel pin cladding, to fuel assembly one-pin (axially integrated) burnups up to 66,200 MWd/MTU. This peak one-pin burnup is based on safety analysis assumptions of 510 EFPD at EOC-8 and 531 EFPD at EOC-9 from Reference 1. For this safety analysis case, the fuel assembly one-pin minimum burnup is 61,980 MWd/MTU and the fuel assembly average burnup is 64,340 MWd/MTU. These Cycle 8 and 9 assumptions bound the safety analyses results for the anticipated Cycle 8 and Cycle 9 shutdown windows (including 480 EFPD at EOC-8 and 549 EFPD at EOC-9).

This Batch J fuel assembly will be selected from the four-fold symmetric set that includes Assemblies LAJ202, LAJ206, LAJ207 and LAJ233, as identified in Reference 1. Each of these four fuel assemblies contains 168 fuel pins with 4.05 wt% U-235 nominal initial enrichment, 52 fuel pins with 3.65 wt% U-235 nominal initial enrichment, and 16 boron carbide shim pins with 0.024 grams boron-10 per inch loading. All of the urania fuel pins and alumina-oxide boron-carbide shim pins were fabricated using the current standard ABB CENO Zircaloy-4 cladding (OPTIN) with tin content in the lower range of the ASTM specification for Zircaloy-4. This cladding was fabricated using an optimized process for improved resistance to waterside corrosion in an irradiation environment.

The fuel one-pin burnups for this Batch J fuel assembly range from 45,140 to 48,900 MWd/MTU at EOC-8, based on a Cycle 8 length of 510 EFPD for the safety analysis. The fuel assembly average burnup at EOC-8 for this safety analysis case is 47,380 MWd/MTU.

Since the 220 total Batch J fuel pins are expected to operate with fuel one-pin burnups in excess of the design limit of 60,000 MWd/MTU specified in Appendix 4.3A.3.1.3 of the UFSAR, a 10CFR50.59 evaluation has been performed in order to determine if unreviewed safety questions exist or changes in the Technical Specifications are required. The use of the 60,000 MWd/MTU limit at Waterford 3 is supported and approved by the generic high burnup topical report of Reference 2 for 16x16 fuel. This approved methodology is deemed to remain technically sound and appropriate for a burnup extension of a single test assembly up to at least 67,000 MWd/MTU. As described below, a prior successful high burnup demonstration of 15 fuel rods of the same 16x16 design at another CE designed plant supports this conclusion.

The requirements for fuel pin testing and surveillance are addressed in Section 4.2.1.5 of the UFSAR. The inclusion of the 220 fuel pins in a single Batch J assembly in Cycle 9 may be considered a complementary (non-mandatory) experiment whose purpose is to demonstrate acceptable corrosion resistance of the current fuel pin Zircaloy-4 cladding type to higher burnups as described above.

Prior to insertion into the core for Cycle 9, the Batch J assembly will be inspected consistent with UFSAR Section 4.2 surveillance requirements. The visual inspection shall consist of viewing the top and sides of the assembly using an underwater TV camera. This inspection will include special attention to any gross problems involving cladding defects, spacer grid damage and any other structural abnormalities as directed by the UFSAR.

The proposed change does not make any changes to any of the procedures that are described in Section 13.5 of the UFSAR. Also, no changes are necessary to any surveillance testing requirements as described in the Waterford 3 Technical Specifications.

As described below, there are no unreviewed safety questions, and a change to the Technical Specifications is not required for a temporary extension of the burnup design limit for a single test fuel assembly for Cycle 9. The core reload analysis of Reference 13 and the additional safety analyses and fuel design and performance analyses of References 3, 4, 6, 7 and 8, which were done specifically to support extending the burnup of the Batch J center assembly, were evaluated and are shown to provide acceptable results.

B1. ***Does the proposed change or activity increase the probability of occurrence of an accident previously evaluated in the SAR (UFSAR)?***

No. The proposed change represented by the continued operation of up to 220 fuel pins in a single test fuel assembly that may achieve burnups in the range of 61,980 to 66,200 MWd/MTU does not increase the probability of occurrence of an accident previously evaluated in the UFSAR. Since the experiment does not involve any changes to current equipment, operating procedures, technical specifications or COLR limits, the proposed extended burnup experiment does not increase the probability of occurrence of a previously evaluated accident.

B2. ***Does the proposed change or activity increase the consequences of an accident previously evaluated in the SAR (UFSAR) ?***

No. Engineering evaluations have shown that the proposed extended burnup experiment does not increase the consequences of an accident previously evaluated in the SAR.

The extended burnup assembly has been explicitly included in the core calculations performed in support of the reload safety analysis for Cycle 9 in Reference 13. These calculations and the associated evaluations have demonstrated that there is no significant impact on core behavior nor increase in overall accident consequences due to the presence of the extended burnup assembly in the Cycle 9 core.

In addition, explicit evaluations have been performed on the impact of postulated accidents on the performance of the extended burnup assembly itself. In this regard two accidents were considered: The reactivity insertion accident (RIA) event (specifically CEA Ejection) and the Spent Fuel Assembly Handling Accident. In both of these cases the impact of increased fuel assembly burnup were investigated to verify that the consequences of these accidents do not exceed those previously considered in the UFSAR.

With respect to potential RIA issues at high burnup, the CEA Ejection Event analysis was reviewed in Reference 3 to determine the impact of failure for these 220 high burnup fuel pins on the number of fuel failures predicted by these events. The predicted number of failed fuel pins reported in DNB in the UFSAR for the CEA Ejection Event is 9.12% of the fuel pins in the core. CEA Ejection scenarios analyzed for Cycle 9 of Waterford 3 calculate less than 9.12% failed fuel in DNB, which includes the 220 Batch J fuel pins, representing less than 0.45% of the total fuel pins in the core that are conservatively assumed as fuel failures. Thus the total fuel failures will remain less than the docketed value. For conservatism, the current UFSAR CEA Ejection radiological doses (UFSAR Table 15.4-33) are based upon the isotope properties in UFSAR Table 15B-1, which result in more adverse radiological doses than the currently accepted ICRP isotope properties in UFSAR Table 15B-2. Therefore, the postulated failure of these Batch J fuel pins will not result in consequences more adverse than previously presented in the UFSAR.

The possible impact of the high burnup assembly on the fuel mishandling accident results reported in the UFSAR have been evaluated in Reference 4. The dominate term contributing to the thyroid and whole-body dose comes from the I-131 activity. Since I-131 has a relatively short half life, its activity saturates quickly at full power conditions and is therefore not very sensitive to higher assembly burnups. The results indicate that the expected consequences of a handling accident with this assembly have been conservatively analyzed in the UFSAR which assumes 173% of the bundle average power opposed to 60% maximum relative pin power for assemblies with burnups greater than 54,000 MWD/T, and that the consequences would be much less than the allowed dose limits provided in Chapter 15.7.4 of NUREG-0800, Reference 5.

B3. ***Does the proposed change or activity increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the SAR (UFSAR)?***

No. The probability of a malfunction of equipment important to safety is not increased.

The fuel pin cladding is the primary barrier to the release of fission products from the fuel pellets to the primary coolant. Cladding lifetime issues such as waterside oxide thickness have been addressed.

Maximum oxide thickness measurement data have been collected at other CE designed 16x16 reactors for the identical Zircaloy-4 cladding type and dimensions used in this Batch J assembly, up to one-pin actual burnups of 65,900 MWd/MTU. This burnup experience is within 300 MWd/MTU of the peak one-pin burnup of 66,200 MWd/MTU used for the Cycle 9 safety analysis at Waterford 3 (the actual burnup at Waterford 3 will be less than the 66,200 MWd/MTU safety analysis limit).

The 16x16 oxide measurement data were used in Reference 6 to evaluate the waterside corrosion behavior for this Zircaloy-4 cladding type, which is the current standard cladding used for all ABB CENO PWR fuel deliveries. From this evaluation, the maximum oxide thickness for these 220 fuel pins is predicted to be less than 120 microns at EOC-9 at the 99.5% (+3σ) level. Reference 2 indicates an oxide thickness of up to 120 microns is acceptable to maintain sufficient thermal and mechanical performance of the Batch J fuel pin cladding material.

The mechanical performance of the cladding for the fuel pins and the shim pins, considering allowable cladding stresses, strains, fatigue and cladding collapse, was evaluated in Reference 7 and found to be acceptable and, with the exception of the one-pin burnup, within design limits. Furthermore, analyses of shoulder gap and assembly length in Reference 7 show acceptable margin for operation throughout Cycle 9.

A fuel performance calculation in Reference 8 shows that predicted results for fuel pin internal pressures, fuel temperatures, and power to fuel centerline melting for these 220 fuel pins are bounded by the results calculated for the rest of the core.

The Batch J assembly will be placed at the center of the core beneath CEDM Number 01, which is part of CEA Regulating Group 2 and CEA Sub-Group 19. This rod is scrammable. Reference 9 provides an evaluation of the potential for delayed CEA insertion times at CE-designed plants at high burnups. This evaluation demonstrated that no burnup dependencies have been observed for CEA drops in any CE plant design. The evaluation further concludes that the potential for CEA insertion problems at high burnups is not significant and that fuel management restrictions are not required on the placement of high burnup fuel assemblies under CEAs. Reference 9 was submitted to the NRC for information by Reference 10.

B4. ***Does the proposed change or activity increase the consequences of a malfunction of equipment important to safety previously evaluated in the SAR?***

No. The consequences of a malfunction of equipment important to safety are not increased. Failures attributable to cladding corrosion of any or all of the 220 Batch J fuel pins, while not expected, would occur over a sufficiently long period of time such that increased coolant activity would be detected and appropriate corrective actions taken to mitigate any undesirable consequences.

The failure of any of the 220 fuel pins at Waterford 3 is not expected, based on the successful irradiation of 15 fuel pins to one-pin maximum burnups up to 65,900 MWd/MTU at another 16x16 CE plant, as reported by References 11 and 12, which is within 300 MWd/MTU of the peak one-pin burnup of 66,200 MWd/MTU used for the Cycle 9 safety analysis at Waterford 3 (the actual burnup at Waterford 3 will be less than the 66,200 MWd/MTU safety analysis limit).

These 15 fuel pins were fabricated using the same Zircaloy-4 cladding material type and 16x16 wall dimensions as the Waterford 3 pins and experienced higher reactor coolant temperatures than will be experienced at Waterford 3 during Cycle 9. None of the 15 fuel pins were found to be failed at discharge based on ultrasonic inspection, and all of the 15 fuel pins exhibited acceptable corrosion performance based on poolside eddy current measurements, including no evidence of oxide spalling.

B5. ***Does the proposed change or activity create the possibility of an accident of a different type than previously evaluated in the SAR (UFSAR)?***

No. Since the proposed extended burnup experiment involving a single fuel assembly does not involve any changes to current equipment, operating procedures, technical specifications, or COLR limits, this experiment does not create the possibility of an accident of a different type than previously evaluated in the SAR. Waterside corrosion induced fuel failures or failures due to an unforeseen mechanism of an additional 220 fuel pins expected to achieve one-pin burnups up to 66,200 MWd/MTU would not be considered an accident, because the failures would occur over a sufficiently long period of time such that increased coolant activity would be detected and appropriate corrective actions taken to mitigate any undesirable consequences.

B6. ***Does the proposed change or activity create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the SAR (UFSAR)?***

No. Since the proposed extended burnup experiment involving a single fuel assembly does not involve any changes to current equipment, operating procedures, technical specifications, or COLR limits, this experiment does not create the possibility of a malfunction of equipment important to safety of a different type than previously evaluated in the SAR.

Applications of safety and mechanical design limits to fuel pins at one-pin burnups up to 60,000 MWd/MTU have been reviewed and approved by the NRC on a generic basis for 16x16 ABB CE fuel. This approved methodology is deemed to remain technically sound and appropriate for small burnup extensions up to at least 67,000 MWd/MTU. No significant deviation in behavior is expected from that supported up to 60,000 MWd/MTU, as demonstrated by the successful irradiation of 15 fuel pins to approximately the same high burnup at another 16x16 CE plant.

Applications of these safety and design limits to fuel pins to one-pin burnups approaching 66,200 MWd/MTU have not been proposed to, nor been reviewed by the NRC. However, any corrosion-induced fuel pin cladding failures or other failures due to an unforeseen mechanism in the 220 fuel pins that are expected to achieve one-pin burnups up to 66,200 MWd/MTU would be expected to occur over a sufficiently long period of time that increased coolant activity would be detected and appropriate corrective actions taken to mitigate any undesirable consequences.

B7. ***Does the proposed change or activity reduce the margin of safety as defined in the bases for any technical specification or the appropriate safety analysis?***

No. The margin of safety as defined in the basis for any Technical Specification is not reduced. The proposed change does not impact the current Technical Specifications. The supplemental safety evaluations of References 3, 4, 6, 7 and 8 indicate that no Cycle 9 licensing limits are exceeded. Also, there are no fuel pin burnup limits listed in the Technical Specifications.

The proposed irradiation of 220 fuel pins to one-pin burnups approaching 66,200 MWd/MTU does not result in any reduction in the margin between core operating parameters and the safety limits prescribed in the Waterford 3 Operating License, even if all 220 of these fuel pins were assumed to fail.

Consequently, the bases for any Technical Specifications that are related to assuring that these limits are not violated remain unchanged.

References

1.a. A-WS-FE-0169, Rev. 00, "Waterford 3 Cycle 9 Physics Data for High Burnup Assembly," December 16, 1996.

1.b. A-WS-FE-0169, Rev. 01, "Waterford 3 Cycle 9 Physics Data for High Burnup Assembly," February 12, 1997.

2. CEN-386-P-A, "Verification of the Acceptability of a 1-Pin Burnup Limit of 60 MWD/kg for Combustion Engineering 16x16 PWR Fuel," August 1992.

3. WS-FE-0186, Rev. 00, "CEA Ejection Evaluation for Lead Fuel Assembly for Burnup up to 65 K," March 26, 1997.

4. WS-FE-0188, Rev. 00, "Waterford Unit 3 Cycle 9 Fuel Mishandling Accident for High Burnup Assemblies," March 21, 1997.

5. NUREG-0800, Chapter 15.7.4, "Radiological Consequences of a Fuel Handling Accident," July 1981.

6. A-WF-FE-0212, Rev. 00, "Waterford 3 Cycle 9 Lead Fuel Assembly Corrosion Analysis," March 20, 1997.

7. A-WF-FMDE-004, Rev. 00, "Waterford 3, Cycle 9 Lead Test Assembly - Mechanical Design Evaluation," March 25, 1997.

8. A-WF-FE-0149, Rev. 00, "Waterford 3 Cycle 9 Batch and High Burnup Test Assembly Fuel Performance Analysis," February 14, 1997.

9. CE NPSD-1049-P, Rev. 01, "Potential for Delayed CEA Insertion Times at C-E Designed Plants - Final Report CEOG Task 931," June 1996.

10. CEOG-96-417, Letter D. F. Pilmer (CEOG) to R. C. Jones (NRC), "CEA Insertion Time Experience and Evaluation," October 17, 1996.

11. CE NPSD-818-P, Rev. 00, "Palo Verde Nuclear Generating Station - Unit 1 End-of-Cycle 6 Diagnostic Fuel Examination Report," December 1996.

12. M-PV1-FMDE-97-001, Rev. 00, "Maximum Oxide Thickness Data for Palo Verde 1 Batch D Fuel Rods with Low Tin Zr-4 Cladding," January 24, 1997.

13. *L-97-013, "Waterford 3 Cycle 9 Final Reload Analysis Report," March 31, 1997.*