

FEB 16 1982

Docket No. 50-13

Mr. A. F. Olsen
License Administrator
Babcock & Wilcox Company
Lynchburg Research Center
P. O. Box 1260
Lynchburg, Virginia 24505



Dear Mr. Olsen:

Subject: Correction to Amendment No. 11

On May 30, 1980, NRC issued Amendment No. 11 to Facility Operating License Co. CX-10. Upon reviewing the file we noted a discrepancy in the numbering system used in the license. This has now been corrected as follows:

- (1) the section indicated in Amendment No. 11 Part A is changed to Part 4.g and each subsection numbered accordingly (4.g.1, 4.g.2, 4.g.3); and
- (2) the section indicated as Part B is changed to 4.h.

Sincerely,

ORIGINAL SIGNED BY:

James R. Miller, Chief
Standardization and Special
Projects Branch
Division of Licensing

Enclosure:
As stated

cc: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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- (1) the section indicated in Amendment No. 11 Part A is changed to Part 4.g and each subsection numbered accordingly (4.g.1, 4.g.2, 4.g.3); and
- (2) the section indicated as Part B is changed to 4.h.

Sincerely,

A handwritten signature in dark ink, appearing to read "James R. Miller", is written over a large, light-colored, stylized graphic that resembles a large "X" or a signature flourish.

James R. Miller, Chief
Standardization and Special
Projects Branch
Division of Licensing

Enclosure:
As stated

cc: See next page

Babcock & Wilcox Company

cc w/enclosure(s):

Executive Secretary of
Campbell County
Rustburg, Virginia 24588

Mr. J. B. Jackson, Jr.
Commonwealth of Virginia
Council of the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555



Docket No. 50-13

MAY 30 1980

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Posted
Amend. 11
to CX-10

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Mr. A. F. Olsen, License
Administrator
Babcock & Wilcox Company
Lynchburg Research Center
Post Office Box 1260
Lynchburg, VA 24505

Dear Mr. Olsen:

The Commission has issued the enclosed Amendment No. 11 to Facility License No. CX-10 in response to your requests dated October 18, 1979, December 3, 1979, and April 11, 1980.

This amendment widens the allowed range of non-moderator to moderator (M/W) volume ratios from the previous range between 0.7 and 1.2 to a new range between 0.7 and 9.7. This change will allow the performance of benchmark critical experiments in support of the Department of Energy's program in Light Water Reactor spent fuel pin storage. This amendment becomes effective as of the date of its issuance.

A copy of the related Safety Evaluation is also enclosed.

Sincerely,

OFFICIAL SIGNED BY:
JAMES R. MILLER

James R. Miller, Chief
Standardization and Special Projects
Branch
Division of Licensing
Office of Nuclear Reactor Regulation

Enclosures:

1. Amendment No. 11
2. Safety Evaluation

cc/w/ enclosures:
See next page

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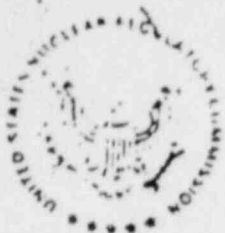
Babcock & Wilcox Company

cc w/enclosure(s):

Executive Secretary of
Campbell County
Rustburg, Virginia 24588

cc w/enclosure(s) and incoming
dtd.: 10/18/79, 12/03/79 and 04/11/80.

Mr. J. B. Jackson, Jr.
Commonwealth of Virginia
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

THE BABCOCK & WILCOX COMPANY

DOCKET NO. 50-13

CRITICAL EXPERIMENT FACILITY

AMENDMENT TO FACILITY LICENSE

Amendment No. 11
License No. CX-10

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by the Babcock & Wilcox Company (the licensee) dated October 18, 1979, as supplemented by additional information dated December 3, 1979 and April 11, 1980, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public;
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied; and
 - F. Publication of notice of this amendment is not required since it does not involve a significant hazards consideration nor amendment of a license of the type described in 10 CFR Section 2.106(a)(2).
2. Accordingly, Facility License No. CX-10 is hereby further amended by adding the following items:
 - A. In addition to the activities previously authorized by the Commission by License No. CX-10, as amended, the licensee is authorized, as requested by its application for license amendment dated October 18, 1979, as supplemented by additional information dated December 3,

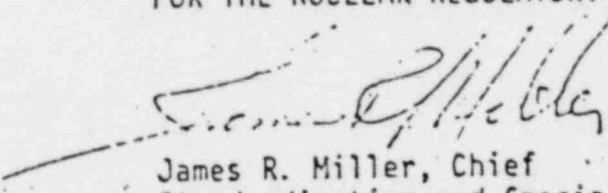
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1979 and April 11, 1980 (hereinafter referred to as the application), to conduct certain experiments using light and heavy water mixtures as moderator at power levels up to one kilowatt thermal in its Spectral Shift Control Reactor Critical Experiment Facility ("the facility") situated in Bay No. 2 in its Critical Experiment Laboratory located near Lynchburg, Virginia.

The experiments shall be conducted in accordance with the procedures and subject to the limitations in License No. CX-10, as amended, in the application for license amendment and the following additional conditions:

- 1) The licensee shall conduct critical experiments consisting of tightly packed fuel rod clusters in various arrays using 2.46% enriched UO_2 in aluminum clad rods.
 - 2) Non-moderator to moderator volume ratios [M/W] shall vary from 0.7 to 9.7 for the respective arrays as indicated in the application.
 - 3) The fuel assembly for each experiment shall consist of 25 full clusters in a 5 x 5 array as described in the application.
- B. The licensee shall submit a written report to the Commission following completion of the program that describes and compares the measured results of various criticality experiments with the calculated and extrapolated values described in the application.
3. This amendment becomes effective as of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION


James R. Miller, Chief
Standardization and Special Projects
Branch
Division of Licensing
Office of Nuclear Reactor Regulation

Date of Issuance:
May 30, 1980



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Safety Evaluation by the Office of Nuclear Reactor Regulation
Supporting Amendment No. 11 to Facility License No. CX-10
Babcock and Wilcox Company
Docket No. 50-13

Introduction

During the past few years, the Babcock and Wilcox Company (B&W) has conducted critical experiments for the Department of Energy's (DOE) program to provide benchmark experiments for criticality calculations of stored Light Water Reactor (LWR) fuel assemblies. DOE has extended the scope of this program at B&W in order to provide benchmark experiments for tightly packed fuel pin storage.

These experiments are of importance to DOE because with the decrease in likelihood of fuel reprocessing, a tightly packed array of pins represents an attractive method of increasing utilization of present storage space. Although critical experiments representing higher and lower non-moderator to moderator (M/W) volume ratios exist, the lack of suitable benchmarks in the range of the proposed B&W experiments requires conservatism in the present calculational methods.

Since the M/W ratio of this high density fuel condition is outside the previous range of ratios allowed by the B&W license, B&W requested by letters of October 18, 1979, December 3, 1979, April 11, 1980 and April 30, 1980, a widening of the allowed range from 0.7-1.2 to "between 0.7 and 9.7." This change would constitute Amendment No. 11 to license CX-10.

Discussion and Evaluation

The proposed experiments will be conducted in the CX-10 facility in the Critical Experiment Laboratory Building located at the B&W Research Center on the James River near Lynchburg, Virginia.

The proposed experiments would utilize previously approved fuel pins of 2.46% enriched UO_2 fuel pellets clad in aluminum. These pins would be arranged in three different pitches in about 7" square assemblies. The three pitches, representing in order the driest to wettest configurations, are: triangular pitch equal to the fuel pin diameter, square pitch equal to the fuel pin diameter, and square pitch equal to 1.158 times the fuel pin diameter. Twenty-five assemblies in a 5x5 array will be assembled in the core tank and brought critical. Moderator spaces of various sizes will be left between boxes to achieve criticality and to allow passage of boron safety blades. The moderator and reflector used will be light water, with or without boric acid addition as necessary to achieve criticality at accept-

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able moderator height with all four safety blades fully withdrawn. Reactivity control during operation will be provided by adjustment of moderator height; in the range of normal operating heights, a change of one centimeter is worth a few cents in reactivity. Moderator boron content adjustment can be made between runs. The CX-10 facility is licensed to operate no higher than 1000 watts.

The mechanical assembly of the cores will be of the type used in previous experiments to assure integrity in the core, although individual hardware items will be specially fabricated. Top and bottom end fittings will be used in all three cluster types; intermediate restraint will be provided by aluminum straps in the close packed clusters or by grids in the loose packed cluster. A base plate will position the clusters at the bottom and the tops will be fastened together by tie-plates attached to contiguous clusters. The core will be braced against the wall of the 9' diameter tank. This tank was used from the earliest experiments until the advent of the spectral shift (D_2O) measurements when a 5' diameter tank was installed within it; the small tank and its associated hardware will be removed for the proposed measurements in order to accommodate the larger cores.

Potential accidents from operation at excessive power, mechanical rearrangement of modules or pins or accidental flooding of a dry core can be considered using the same rationale as was used in Reference (1); the designs and procedures provide ample margin.

Due to license limits on the worth of an individual safety blade, the reactivity addition of the continuous rod withdrawal accident is limited to 0.05%/sec; this accident is highly unlikely and the addition rate is less than that for the addition of incorrect moderator discussed below.

Although also highly unlikely, addition of pure water to an assembly which requires boron for reactivity suppression is the maximum credible accident. KENO IV was used to calculate the expected maximum reactivity for the three types of clusters in the planned range of module separation distances: the most reactive core was determined to be the loose-packed array with modules separated by 0.7 inch. KENO has been used by B&W with the 123-group XSDRN cross section set to calculate more than 30 experimental configurations ranging from very wet assemblies to dry metal spheres. Because none of the benchmarks lies in the M/W range of the proposed experiments (hence the justification for the program), the largest difference between KENO and experiment, namely 1.9%, was added to the calculated excess of the loose-packed core. For the postulated accident condition of addition of pure

water to this assembly, the critical height is about 11 inches. The rate of reactivity addition for continued fill after criticality is calculated from an experimentally determined relationship including a 10.7% factor for the uncertainty in β and in the fitting of the experimental data. The peak-to-average (PTA) power ratio needed in the point kinetics calculation was calculated as a pin-to-pin times an assembly-to-assembly factor; about 15% conservatism was added to the calculated value. Also of significance in the kinetics calculation is the fuel temperature coefficient of reactivity. NITAWL was used to perform the resonance processing needed in this calculation. B&W has determined that NITAWL-calculated resonance integrals match experimentally determined integrals of both Hellstrand and Pettus to about 1.5%; however a 10% reduction in the calculated fuel temperature coefficient was assumed for conservatism. The effect of this last conservatism was evaluated not for the loose-packed core, but for the triangular pitch core with assemblies separated by 1.5 inches. However, by assuming separability and additivity, the effect was included in the calculation of peak clad temperature for the worst case condition in discussions with B&W.

The calculated peak clad temperature for the maximum credible accident in the worst case core was 832°F, well below the approximately 1200°F melting temperature for the aluminum clad, and also below the 1050°F calculated for the maximum credible accident in a past critical experiment program.

Environmental Considerations

We have determined that this amendment will not result in any significant environmental impact and that it does not constitute a major Commission action significantly affecting the quality of the human environment. We have also determined that this action is not one of those covered by 10 CFR § 51.5(a) or (b). Having made these determinations, we have further concluded that, pursuant to 10 CFR § 51.5(d)(4), an environmental impact statement or environmental impact appraisal and negative declaration need not be prepared in connection with issuance of this amendment.

Conclusion

The staff has concluded that B&W has used qualified methods and input data in their calculations and has included adequate conservatism in the results to allow for the lack of suitable benchmark experiments. The staff further concludes that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in safety margin, the amendment does not involve a significant safety consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Reference

1. B&W-1211, "Spectral Shift Control Reactor Basic Physics Program, Critical Experiment Hazard Evaluation," R. H. Clark, T. C. Engelder, B&W Co., September 1960.