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 50-316 Donald C. Cook Nuclear Power Plant, Unit 2, Indiana & 05000316
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 ALEXICH, M. P. Indiana & Michigan Electric Co.
 RECIP. NAME RECIPIENT AFFILIATION
 DENTON, H. R. Office of Nuclear Reactor Regulation, Director (post 851125)

SUBJECT: Submits description of condition involving post-LOCA long-term core cooling boron requirements that may be of interest to other operators of Westinghouse PWRs. Westinghouse HC Walls 860821 ltr re situation encl.

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INDIANA & MICHIGAN ELECTRIC COMPANY

P.O. BOX 16631
COLUMBUS, OHIO 43216

November 17, 1986
AEP:NRC:1008

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
POST-LOCA LONG-TERM CORE COOLING
BORON REQUIREMENTS

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

This letter describes a condition involving post-LOCA long-term core cooling boron requirements which was applicable to the Donald C. Cook Nuclear Plant Units 1 and 2. The letter is being submitted because the situation may be of interest to other operators of Westinghouse pressurized water reactors.

By letter dated August 21, 1986 (attached), Westinghouse Electric Corporation (Westinghouse) recommended that we evaluate the boron concentration which would exist in the containment sump following a LOCA to ensure that it was sufficient to maintain the reactor in a subcritical state. The Westinghouse letter suggested that the Technical Specification requirements for Refueling Water Storage Tank (RWST) and Accumulator boron concentration were based on typical 12-month cycle core designs, and under some circumstances may not be sufficient because of the recent trend towards longer cycle life, increased fuel enrichment, and positive moderator temperature coefficients below 70% of full power.

Evaluations were performed by the American Electric Power Service Corporation (AEPSC) using a methodology based on the "Recommended Action" section found on pages 2 and 3 of the attached Westinghouse letter. The evaluations were performed assuming the minimum allowable T/S boron concentrations for the ice bed, RWST, accumulators, and Spray Additive Tank. These evaluations showed that all of the D. C. Cook Unit 1 and 2 cycles (including the present) would have had a sufficient boron concentration in the sump post-LOCA to maintain subcriticality, with the exception of Unit 2 Cycle 3. However, when actual plant data for ice bed and tank boron concentrations were considered, it was determined that this cycle also would have had sufficient boron to ensure subcriticality post-LOCA. All of the evaluations performed considered the effects of depletion of Boron-10 which was described in our letter AEP:NRC:1011, dated October 8, 1986.

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Because Unit 2 Cycle 3 had the potential for a post-LOCA boron shortfall, Westinghouse was asked to evaluate whether the issue would be reportable under the requirements of 10 CFR 21. By letter dated September 17, 1986, Westinghouse advised AEPSC that they did not consider the issue reportable per 10 CFR 21, since actual plant data showed that a post-LOCA boron shortfall would not have existed. Although Westinghouse concluded the issue was not reportable under the requirements of 10 CFR 21, we have chosen to inform you of it since it may be of interest to other licensees. This issue was discussed previously with your staff and the NRC Region III staff.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,



M. P. Alexich
Vice President

RBK
11/17/86

cm

Attachment

cc: John E. Dolan
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Bruchmann
G. Charnoff
NRC Resident Inspector - Bridgman

ATTACHMENT TO AEP:NRC:1008

WESTINGHOUSE ELECTRIC CORPORATION LETTER

DATED AUGUST 21, 1986

AUG 23 1986

Westinghouse
Electric Corporation

Power Systems

Box 355
Pittsburgh Pennsylvania 15230-0355

August 21, 1986
AEP-86-665

Mr. W. G. Smith, Plant Manager
D. C. Cook Nuclear Plant
Indiana and Michigan Electric Company
P. O. Box 458
Bridgman, Michigan 49106

Dear Mr. Smith:

American Electric Power Service Corporation
D. C. Cook Units 1 and 2
POST-LOCA LONG-TERM
CORE COOLING BORON REQUIREMENT

Background Information

10CFR50.46 "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" paragraph (b) item (5) sets forth requirements for Long-Term Cooling. During the development and subsequent NRC review of the Westinghouse ECCS model, credit for the shutdown provided by the control rods (RCCs) for breaks greater than 3.0 ft² (i.e., large breaks) was not taken and this assumption is part of the current licensing basis for Westinghouse PWRs. As a result, the Westinghouse licensing position is that "... the ECCS water has enough boron concentration to maintain the core shutdown" (WCAP-8339, Westinghouse Proprietary Class 3, "Westinghouse Emergency Core Cooling System Evaluation Model - Summary", Pg. 4-22, June 1974).² In order to take credit for control rods for breaks larger than 3.0 ft² specific NRC approval would be needed for any Westinghouse designed PWR regardless of fuel vendor or ECCS evaluation model used to perform the required Appendix K analysis.

The traditional boron concentrations of 2000 ppm for the RWST and 1900-2000 ppm for the cold leg accumulators have provided, with margin, boron concentrations capable of keeping the core subcritical (K_{eff} less than 1.0) assuming All Rods Out (ARO) for typical 12 month cycle core designs. The recent trend to longer cycle life, increased fuel enrichment necessary to support a longer cycle life, and the introduction of a positive moderator temperature coefficient at power levels below 70% has resulted in the need to

reexamine the boron concentrations necessary to demonstrate that the reactor core remains subcritical, post-LOCA, ARO. This is required regardless of the fuel design or the fuel vendor. This LOCA licensing commitment applies to all Westinghouse designed PWRs.

Recommended Action

The boron concentration (C_B) required to keep the core subcritical (K_{eff} less than 1.0), All control Rods Out (ARO), no xenon (NOXE), for the most reactive time in core life, with an assumed post-LOCA core/fluid temperature in the range of 68-212°F, should be determined. Then a detailed calculation to determine the RCS/containment sump post-LOCA boron concentration will be needed to demonstrate that the core remains subcritical following a LOCA of 3.0 ft² or greater. This calculation must consider the initial pre-LOCA boron concentrations for the RWST, Cold Leg Accumulators, Pre-Trip RCS Hot Full Power (HFP) boron concentration (including appropriate assumptions for xenon) and the concentrations of any other source of water that may eventually reside in the containment sump (i.e., Spray Additive Tank, Boron Injection Tank, water residing in piping associated with the suction and injection of the ECCS, CVCS, containment spray system, and switchover of the ECCS). Additionally, the assumption for containment spray actuation and operation as it affects the delivery of RWST water subsequent to SI switchover from the injection phase to the cold leg recirculation phase must be considered. A review of all tanks residing in either the containment, auxiliary building or outside should be conducted to determine if any tank can reasonably be hypothesized to deliver its contents following a LOCA. Westinghouse plants utilizing ice condensor containments must account for the ice melt and the associated boron concentration of the ice bed.

Once all sources of water and their associated pre-LOCA boron concentrations have been determined, the mass average boron concentration of the mixture must be calculated. The result of the mass average boron concentration must show a post-LOCA boron concentration greater than the core C_B , in order to demonstrate that the condition of K_{eff} is less than 1.0, ARO, NOXE, most reactive time in life, 68-212°F, will be met. If the post-LOCA mass average boron concentration does not exceed the core C_B requirement then to demonstrate that the core will be subcritical the RWST and Cold Leg Accumulator minimum Tech-Spec boron concentrations must be increased or the core must be redesigned to reduce the core C_B . Increases in the maximum allowable Tech-Spec values of the RWST and Accumulator boron concentrations may require a new calculation to determine the hot leg recirculation switchover time necessary to preclude boron precipitation following a LOCA.

August 21, 1986
Page 3

This time is provided in Emergency Operating Procedures to ensure operator action. In the event that Tech-Spec changes for the boron concentrations of the RWST and Accumulators are needed, then the post-LOCA sump pH should be evaluated.

Additional Guidance and Information

A preliminary review of currently operating Westinghouse cores performed by Westinghouse has found that these cores satisfy the long-term post-LOCA core cooling requirement. Future reload safety evaluations provided by Westinghouse in support of reloads for which Westinghouse performs the safety evaluation will determine if the post-LOCA long-term core cooling requirement is satisfied by the current plant Technical Specifications covering boron concentrations. Should Technical Specification changes become necessary for cores supplied by Westinghouse, Westinghouse will advise the affected utility of the necessary changes.

Westinghouse plants not currently utilizing Westinghouse fuel or utilities which perform their own reload safety evaluations should consider developing internal procedures for tracking boron requirements to demonstrate that the reactor core remains subcritical following a hypothetical large break LOCA. Also, a provision for maintaining an appropriate hot leg recirculation switchover time should also be considered.

Sincerely,



H. C. Walls, Manager
Mid-America Region
Projects Department

HT/1886R

cc: M. P. Alexich
W. G. Smith
M. J. Parvin
J. Feinstein WOG Rep.

V. Vandeburg
J. Waleko W
C. Swist W

November 12, 1986

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ACRS (10)

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DOCKET NO(S): 50-315

Mr. John Dolan, Vice President
Indiana and Michigan Electric Company
c/o American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43216

SUBJECT: D. C. Cook Nuclear Plant, Units No. 1

The following documents concerning our review of the subject facility are transmitted for your information.

- ☐ Notice of Receipt of Application, dated _____.
- ☐ Draft/Final Environmental Statement, dated _____.
- ☐ Notice of Availability of Draft/Final Environmental Statement, dated _____.
- ☐ Safety Evaluation Report, or Supplement No. _____ dated _____.
- ☐ Environmental Assessment and Finding of No Significant Impact, dated _____.
- ☐ Notice of Consideration of Issuance of Facility Operating License or Amendment to Facility Operating License, dated _____.
- ☒ Bi-Weekly Notice; Applications and Amendments to Operating Licenses Involving No Significant Hazards Considerations, dated Nov. 5, 1986 [see page(s)] 40279.
- ☐ Exemption, dated _____.
- ☐ Construction Permit No. CPPR-_____, Amendment No. _____ dated _____.
- ☐ Facility Operating License No. _____, Amendment No. _____ dated _____.
- ☐ Order Extending Construction Completion Date, dated _____.
- ☐ Monthly Operating Report for _____ transmitted by letter dated _____.
- ☐ Annual/Semi-Annual Report- _____
_____ transmitted by letter dated _____.

Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc: See next page

OFFICE	PWR#4/DPWR-A	PWR#4/DPWR-A			
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DATE	11/12/86	11/12/86			

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