



ATTACHMENT B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

January 14, 1977

Honorable Marcus A. Rowden
Chairman
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: REPORT ON DONALD C. COOK NUCLEAR PLANT UNIT NO. 1

Dear Mr. Rowden:

During its 201st meeting, January 6-8, 1977, the Advisory Committee on Reactor Safeguards completed its review of the proposal to replace, during the first refueling of the Donald C. Cook Nuclear Plant Unit No. 1, 65 of the original Westinghouse Electric Corporation fuel assemblies with Exxon Nuclear Company (ENC) fuel assemblies and to operate the resulting core to produce rated reactor power of 3250 MWt. The Committee has previously discussed this plant in its reports of December 13, 1968, October 17, 1973, and March 11, 1976. A Subcommittee meeting to consider the current proposal was held in Washington, D. C., on December 22, 1976. During its review, the Committee had the benefit of discussions with representatives of Indiana and Michigan Power Company, American Electric Power Service Corporation, ENC, and the Nuclear Regulatory Commission (NRC) Staff. The Committee also had the benefit of the documents listed.

The NRC Staff has concluded that the design of the ENC fuel assemblies proposed for Donald C. Cook Nuclear Plant Unit No. 1 Cycle 2 is similar to that supplied by ENC for other pressurized water reactors (PWRs). The NRC Staff has indicated that its review of ENC fuel design analytical methods is not yet complete but that the review has progressed sufficiently to indicate that the methods are adequate for application to Donald C. Cook Nuclear Plant Unit No. 1 Core 2. Approximately 1000 fuel bundles manufactured by ENC are in PWRs and in boiling water reactors with burnups ranging from first cycle to 25,000 megawatt-days per metric ton of uranium. Performance of these assemblies has been good.

Primarily because of the low back pressure produced by the ice-condenser type containment following a loss-of-coolant accident, the peaking factor required to satisfy the emergency core cooling system (ECCS) Acceptance Criteria of 10 CFR 50.46 is unusually low. The ENC analysis satisfied the ECCS Acceptance Criteria of 10 CFR 50.46 with an assumed peaking factor of 1.95 at rated power. The Licensee proposes a peaking factor

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January 14, 1977

Technical Specification limit of 1.95 at rated power for Cycle 2. The Licensee proposes continued use of the axial power distribution monitoring system (APDMS) for determining conformance. Experience with APDMS during Cycle 1 operation at Donald C. Cook Nuclear Plant Unit No. 1 and in other reactors indicates this system can provide an appropriate measurement of the core power distribution.

Although sufficient information and analyses exist to predict the performance of the Westinghouse fuel at the beginning of Cycle 2, further analyses may be appropriate with regard to both fuel pellet-clad interaction and fission gas release rate, with operation near the end of the cycle. The Committee wishes to be kept informed.

During Cycle 1 operation, one or two fingers broke off a control rod during rod drop timing tests. The Licensee and Westinghouse Electric Corporation have concluded that the observed failure is not indicative of generic failures and will not adversely affect reactor control rod scram times. The NRC Staff is requiring further examination and analyses by the Licensee. The ACRS wishes to be kept informed.

The ACRS believes that, subject to the foregoing and to matters discussed in its report of March 11, 1976, the Donald C. Cook Nuclear Plant Unit No. 1 can be operated with the proposed reload core up to the design power of 3250 MWt, under the proposed operating and monitoring conditions, without undue risk to the health and safety of the public.

Sincerely yours,



M. Bender
Chairman

Additional Comments by Members David Okrent and Milton Plesset

In connection with the March 11, 1976 report on Donald C. Cook Nuclear Plant Unit No. 1, we made additional comments which included the following:

"First, while there may be merit in the proposed changes in the Westinghouse evaluation model, we believe further examination is warranted of several factors, including the scaling of experiments, the scatter in data, and the possible influence of super-plasticity on clad behavior during postulated loss-of-coolant accidents. Our reluctance to endorse these changes is also due, in large part, to signs of a continued process of cutting into the conservatism built into the original evaluation models, without a concomitant build-up in our basic understanding or predictive ability for the overall LOCA-ECCS process. In this situation there are limits beyond which the use of best estimate heat transfer coefficients, etc., is no longer appropriate.

"Second, even with application of the revised Westinghouse evaluation model which has been judged acceptable by the NRC Staff, Donald C. Cook Nuclear Plant Unit No. 1 requires a LOCA - limited maximum peaking factor (F_0) of 1.98 (plus the margin for bowing) at rated power. While this is somewhat higher than the F_0 which can be expected at steady operation for the rest of the first fuel cycle for Donald C. Cook Nuclear Plant Unit No. 1, it still represents a very large reduction in the margin that has been available for most plants between LOCA - limited F_0 and that value which would be present most of the time. This margin has been eroded until it is a small fraction of its earlier values. Furthermore, if we accept this low F_0 value for Donald C. Cook Nuclear Plant Unit No. 1, a precedent will be set by means of which all PWR's will be able to reduce what was a substantial safety margin only a few years ago. This previously available substantial safety margin could cover many of the existing uncertainties in the analysis of LOCA-ECCS. The uncertainty aspect is highlighted by the less than perfect record obtained by the experts in their pre-prediction of various separate effects experiments, by the recognized difficulties in a calculation from first principles, by the current unavailability of experiments to test all relevant effects, and by the lack of a meaningful test of Westinghouse predictive capability with experiment.

"Third, the ACRS has in the past been reluctant to accept proposed operation of reactors with F_0 's less than 2.2. In part, such caution arose from the knowledge that, with a more flattened power distribution, a much larger fraction of the fuel elements would be at or near peak temperatures, given a LOCA, and therefore potentially vulnerable to an "anomaly" in ECCS function (such as some three-dimensional flow effect or excessive steam generator leakage)."

We find that these comments apply equally to the proposed operation with Exxon Nuclear Company (ENC) fuel. We believe that the proposed new ENC ECCS evaluation model is subject to considerable uncertainty, particularly with regard to flow blockage effects, the choice of FLECHT heat transfer coefficients, and steam cooling.

More importantly, as we suggested on March 11, 1976, the NRC Staff has continued to follow a legalistic approach in its interpretation of 10 CFR 50, Appendix K, accepting so-called best-estimate parameters and models in areas where conservatism is not explicitly required. Since March 1976, a significant number of operating PWRs have been granted authority to operate with peaking factors even less than 1.98; for example, Surry Units 1 and 2 were granted approved peaking factors of 1.80 and 1.82, respectively, on August 27, 1976.

January 14, 1977

In view of the current state of knowledge, we do not believe that the path currently being followed by the NRC Staff is prudent, and we recommend that the Nuclear Regulatory Commission reexamine 10 CFR 50, Appendix K, including its actual implementation in evaluation models.

For Donald C. Cook Nuclear Plant Unit No. 1, we still believe that operation with the present design of fuel assemblies and ECCS, should be limited to about 92% of rated power.

References:

1. Revision 1 to Nuclear Reactor Regulation (NRR) Safety Evaluation Report on the Exxon Nuclear Company (ENC) WREM-Based Generic PWR-ECCS Evaluation Model Update ENC-WREM-II, dated January 5, 1977
2. Letter, Indiana and Michigan Power Company (I and M) to NRR, dated December 17, 1976, concerning reactor vessel overpressurization events
3. NRR Report to the ACRS on Donald C. Cook Nuclear Plant Unit No. 1, dated December 14, 1976
4. Letter, I and M to NRR, dated December 13, 1976, concerning proposed changes to Technical Specifications on power distribution limits and surveillance requirements
5. Letter, ENC to NRR, dated November 30, 1976, forwarding information concerning the ECCS analyses
6. Letter, I and M to NRR, dated November 23, 1976, concerning modifications being made to valve control circuits and procedures
7. Letter, I and M to NRR, dated November 23, 1976, forwarding responses to NRR questions concerning a permit to operate at full power during Cycle 2
8. Letter, ENC to NRR, dated November 19, 1976, forwarding XN-76-35 Supplement 1, "Assumptions Used in the Plant Transient Analysis for the Donald C. Cook Unit 1 Nuclear Plant"
9. Letter, I and M to NRR, dated November 17, 1976, forwarding XN-76-35, "Donald C. Cook Unit 1 LOCA Analyses Using the ENC WREM-Based PWR ECCS Evaluation Model (ENC-WREM-II)"
10. Letter, I and M to NRR, dated November 17, 1976, forwarding the results of analyses of the effect of degraded grid voltage on the operability of safety-related equipment
11. Letter, I and M to NRR, dated November 11, 1976, concerning the loose-parts monitoring system
12. Letter, I and M to NRR, dated November 5, 1976, forwarding answers to NRR questions on the reload license application
13. Letter, American Electric Power Service Corporation to the Office of Inspection and Enforcement, dated October 29, 1976, forwarding a supplement to the Startup Test Report
14. Letter, I and M to NRR, dated October 27, 1976, concerning fire protection considerations

References Cont'd

15. Letter, I and M to NRR, dated October 19, 1976, concerning susceptibility to reactor vessel overpressurization events
16. Letter, I and M to NRR, dated October 1, 1976, forwarding answers to NRR questions on ENC reports XN-76-25 and XN-75-39
17. Letter, I and M to NRR, dated October 1, 1976, forwarding the report, "Long Term Evaluation of the Ice Condenser System Results of the July 1976 and September 1976 Ice Weighing Programs"
18. Letter, I and M to NRR, dated August 27, 1976, concerning the evaluation of the adequacy of the reactor pressure vessel supports
19. Letter, I and M to NRR, dated August 26, 1976, forwarding XN-76-36, "Exxon Nuclear Company WREM-Based Generic PWR ECCS Evaluation Model (ENC-WREM-II)"
20. Letter, ENC to NRR, dated August 20, 1976, forwarding XN-76-35, "Plant Transient Analysis for the Donald C. Cook Unit 1 Nuclear Power Plant"
21. Letter, I and M to NRR, dated July 30, 1976, forwarding the report, "Long Term Evaluation of the Ice Condenser System - Results of the January 1976 and April 1976 Ice Weighing Programs"
22. Letter, I and M to NRR, dated July 20, 1976, concerning request to operate at full power during Cycle 2
23. Letter, ENC to NRR, dated July 19, 1976, forwarding XN-76-25, "Donald C. Cook Unit 1 Cycle 2 Reload Fuel Licensing Data Submittal"