

OCT 26 1977

For your information, we have attached a copy of the IE Circular and the General Electric Company's letter discussed above. Thank you for your interest in this matter and feel free to contact me should you have additional questions.

Sincerely,

Original Signed By
E. G. Case

Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation

Enclosures:

- 1. IE Circular 77-7
- 2. GE letter dtd. 9/19/77

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OCT 26 1977

Mr. T. K. DeBoer, Director
Technological Development Programs
State of New York Energy Office
Swan Street Building, Core 1 - 2nd Floor
Empire State Plaza
Albany, New York 12223

Dear Mr. DeBoer:

This is in response to your letter of May 31, 1977 concerning the high rate of power increase (short periods) experienced at the Dresden Unit No. 2 and Monticello boiling water reactor facilities. We appreciate and share your interest in these events. Although neither of the events involved violation of a technical specification limit, fuel damage, or personnel radiation exposure, we have initiated measures to minimize the possibility that similar events will occur in the future.

Our interest in these events parallels yours and involves both the short reactor periods, which were the result of unusually high control rod notch worths, and the potential effects of high control rod worths on boiling water reactor accident analyses.

We have concluded that the available redundant reactor trip capability during startup provides safe termination of power excursions of the type encountered at Dresden Unit No. 2 and Monticello independent of action by the operator. Nevertheless, we believe that the operator should be able to control power changes resulting from allowed control rod movements; and, therefore, we have recommended to boiling water reactor licensees, via IE Circular 77-7, measures to avoid short reactor periods and are continuing to investigate means of limiting the differential worth of control rods to prevent the recurrence of short reactor periods. Specifically, we have contacted the General Electric Company, the BWR vendor, and have been advised that new procedures have been issued to owners of operating BWRs which result in reduced control rod notch worths. While we are continuing to review this issue, we expect that the new control rod withdrawal procedures should reduce control rod notch worths as well as total control rod worths.

We will continue to evaluate, on a generic basis, the issue of rod withdrawal sequences to confirm that the sequences used at BWRs will allow proper operator control of reactivity changes and that potential dropped rod worths are within acceptable limits.

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- 2 -

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Additionally, we are evaluating, on a generic basis, the issue of rod withdrawal sequences to confirm that the sequences resulting from the IE circular will allow proper operator control of reactivity changes and that potential dropped rod worths are within acceptable limits.

Thank you for your interest in this matter and feel free to contact me should you have additional questions.

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Office of Nuclear Reactor Regulation

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Mr. T. K. DeBoer

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Date: April 12, 1977

SHORT PERIOD DURING REACTOR STARTUP

DESCRIPTION OF CIRCUMSTANCES:

Recent events of concern to the NRC occurred at the Monticello and Dresden BWRs involving inadvertent high reactivity insertions causing short periods during reactor startup.

At Dresden Unit No. 2 on December 28, 1976 during a reactor startup following a scram from unrelated causes about 9 hours earlier, a rod withdrawal of one notch resulted in a rapid power rise associated with a reactor period of about one second and caused an Intermediate Range Monitor (IRM) Hi-Hi flux scram. The IRM was on its most sensitive scale. The moderator was essentially without voids and the reactor water temperature was 336F. A similar event occurred at this facility on August 17, 1972.

At Monticello on February 23, 1977, following a reactor scram about 10 hours earlier from unrelated causes, a reactor period of about one second was experienced during startup before the reactor tripped on IRM Hi-Hi flux. The IRM was on its most sensitive scale and the short period resulted from the withdrawal of a control rod one notch. The reactor moderator had few voids and the water temperature was 480F.

The two most recent events were similar in the following respects:

1. Prior to the earlier, unrelated scram, both plants had been operating at or near full power with axial flux peaking in the bottom portion of the core.
2. The time from the earlier scrams to the subsequent startups maximized the xenon concentrations in the core.
3. High worth rod locations were similar and both plants were using the same generic control rod pattern (identified as B1).
4. Prior to the IRM scram at both facilities, dramatic indications of high notch worth had been seen with rod withdrawals resulting in periods ranging from 10 to 30 seconds, which were terminated by reinsertion of the rod.

Date: April 12, 1977

Review of the events showed that all of the systems including the reactor protection system functioned as required. Analyses indicate that the combination of essentially no voids in the moderator and high xenon concentration accounted for the conditions that resulted in the control rod notch acquiring an unusually high differential reactivity worth which approximated one-half percent delta K/K at Monticello. This excessive worth of rod notch was the result of essentially no voids in the moderator and peak xenon conditions which necessitated the withdrawal of significantly more control rods than is normally required to reach criticality. The resultant flux distribution at criticality magnified the normal axial peaking at the top of the core due to the heavy xenon concentrations at the bottom. Additionally, the radial contribution to flux peaking was enhanced due to the withdrawal of peripheral rods.

A review of NRC records showed that after the earlier event at Dresden Unit No. 2 on August 17, 1972, corrective measures were taken for the subsequent startup consisting of notchwise withdrawal of the group of rods. This corrective action was taken only for that operating cycle.

Evaluation of these events indicates that essentially trouble-free startups can be accomplished by avoiding the peak xenon with no moderator voids condition or possibly by the use of a rod pattern developed for these particular conditions.

These events indicate a need for all licensees of operating BWRs to review their startup procedures and practices to assure that their operating staff has adequate information to perform reactor startups avoiding such short periods in the event that the above-described conditions of peak xenon with no moderator voids exist at the time of startup. Operators should be made aware that extremely high rod notch worths can be encountered under these conditions. The procedures should include requirements for a thorough assessment following the occurrence of a short period before any further rod withdrawals are made. These considerations should be included in the operator training and requalification training programs.

No written response to this Circular is required. If you need additional information regarding this matter contact the Director of the cognizant NRC Regional Office.