

SAFETY EVALUATION BY THE RESEARCH & POWER REACTOR SAFETY BRANCH

DIVISION OF REACTOR LICENSING

NORTHERN STATES POWER COMPANY

PATHFINDER ATOMIC POWER PLANT

DOCKET NO. 50-130

LOW COUNT RATE STARTUP SPECIFICATION

CHANGE NO. 8

*Superseded
Kataxi for
info only.*

Introduction

By application dated March 14, 1966, the Northern States Power Company (NSP) requested a change in the Technical Specifications of License No. DPR-11. The change would allow startup of the Pathfinder reactor with a minimum startup count rate of 1/3 counts per second (cps) under certain conditions. We have designated this request Proposed Change No. 8.

Evaluation

The Technical Specifications presently require a minimum count rate of 2 cps prior to startup. However, due to the extended time required in the approach to operation of the reactor and its nuclear superheater, the antimony-beryllium source will decay to the extent that it will not be capable of providing a count rate of 2 cps due to neutrons measured by the out-of-vessel source range detectors. NSP is proposing to conduct reactor startup with the count rate as low as 1/3 cps providing special procedures, incorporated into the Technical Specifications by this change, are in effect. NSP reports that when the count rate is 1/3 cps, the source power is sufficient at 1×10^{-8} percent of full power. Thus, even when there is a substantial neutron population in the core, the neutron attenuation due to the 32 inches of water in the reflector region results in a low count rate at the detectors. No startup without a source will be performed.

NSP reports that the proposed low count rate startup may be necessary at various times throughout the life of the plant; specifically, after extended outage and after periods of low power operation. We agree that the proposed startup is acceptable from a safety standpoint based on our review of the special procedures and safety precautions which are discussed below.

(1) A source range, key-switch type bypass will permit rod withdrawal with less than a 2 cps count rate. Use of a key switch will allow better control by supervisors than would a jumper. A qualified staff engineer will be present in the control room during the approach to critical. The bypass will also allow control rod latching and unlatching which is necessary in the event that in-core detectors must be used to correlate rod position with core reactivity prior to a low count rate startup. Other specially supervised tests allowed by the Technical Specifications may also require use of this bypass. We have reviewed the proposed wiring of this bypass circuit and believe it is adequate and that the proposed use of the bypass is acceptable.

(2) A low count rate startup will only be performed on a core for which the correlation of rod position and core reactivity is known. Additionally, rod withdrawal will be in accordance with the specific rod program used to correlate the core reactivity.

(3) If any change in the core reactivity or the rod withdrawal program has occurred since the correlation of rod position versus core reactivity, or if more than four months have elapsed since shutdown, the correlation must be redetermined. If necessary, in-vessel detectors may be used for this new correlation, which will provide a minimum count rate of 2 cps. We believe the restrictions of this paragraph and (2) above will assure that the operator has an accurate knowledge of the core reactivity during all phases of the startup operation.

(4) Whenever the low count rate approach is being used, the noise level of the three source range detectors and associated instrumentation will be demonstrated to be less than 1 cps prior to startup. Thus, it will be assured that the detector is providing neutronic information from the core.

(5) The approach to criticality will be done in reactivity insertion increments approved by the Operations Committee and Safety Committee. After each increment there will be at least a 2 minute wait before addition of the next increment is initiated. Therefore, if by error the multiplication is increasing at a more rapid rate than predicted, it would be detected before further reactivity has been added to the core. The neutron count rate will always be at least 2 cps when the core reactivity reaches a calculated k-effective of 0.995. Multiplication versus rod position will be plotted and enough counts will be taken on a scaler at each increment to obtain 10 percent statistics until the core reactivity is 0.98 when statistics will be required to be better than 3 percent thereafter. Any significant deviation from the correlated data during startup will require an immediate reactor shutdown until the cause of the discrepancy is determined. We believe these limitations will assure a conservative approach to low count rate reactor startup.

(6) During this type of startup the instrumentation will provide all normal scram protection including single coincidence short period scram in the startup range and level trip in the intermediate range. Thus, automatic protection is available through the source power range which is capable of terminating any transient condition prior to reactor damage.

Accident Analysis

Change No. 5 to the Technical Specifications allowed reactivity insertions at rates up to 25 cents per second for both boiler only and full core testing. The startup accident provided in support of this change indicated that with a ramp reactivity addition of 50 cents per second initiated at power levels 1 Mw(t) or lower, there was no fuel damage in either the boiler or superheater region of the core. We understand that the maximum rate of addition during low count rate startup would be approximately 12 cents per second. On the basis of previous analysis we believe that even if the operator were to continuously add reactivity at the maximum rate during a low count rate startup, there would be no fuel damage and consequently there would be no hazard to the public.

Technical Specifications

To implement Change No. 8 the following changes to the Technical Specifications (Appendix A) of License No. DPR-11 should be made:

- (1) Add the following to Section 6.1.8(a):

"This interlock may be bypassed manually with the use of a key switch to:

- (1) permit control rod latching and unlatching as approved by the Operations Committee.
- (2) permit use of low count rate procedure or other supervised tests approved by the Operations Committee and in accordance with these Technical Specifications."

- (2) Add the following to Section 7.6.2(d):

"In the event that the source strength is insufficient to produce a count rate of 2 cps due to neutrons on the out-of-vessel detectors in the startup channels, approach to criticality may be accomplished provided the count rate is greater than 1/3 cps due to neutrons and the following conditions are adhered to:

- (1) Prior approval of all procedures and methods of analysis for the specific startup shall be obtained from the Operations Committee and the Safety Committee.
- (2) A qualified staff engineer shall be present in the control room during startup.
- (3) No changes which could significantly affect reactivity shall have been made to any of the core components or to the core configuration since core reactivity was last correlated with rod position. The specific rod withdrawal sequence used in the correlation shall be used for this type of startup.
- (4) If changes which affect reactivity have been made to the core or any of its components, or the rod withdrawal sequence is changed, or more than 4 months have elapsed since shutdown new correlating data shall be obtained. If in-vessel detectors are used, they shall provide a minimum count rate of 2 cps.
- (5) The noise level of the detectors and associated electronics shall be less than 1 cps.

- (6) No reactivity increment shall exceed $1/3$ the extrapolated amount to critical. There shall be at least a 2 minute wait before addition of the next increment is initiated. Plots of multiplication versus rod position shall be made; and enough counts shall be taken after each increment on a scaler to provide 10 percent statistics until the core reactivity is 0.98, and to provide 3 percent statistics thereafter. The count rate shall exceed 2 cps when the core reactivity is 0.995. After the count rate exceeds 2 cps normal startup procedures may be used.
- (7) Single coincidence in the startup channel short period scram circuit shall be provided.
- (8) Any significant deviation from the correlated data during startup shall require an immediate reactor shutdown until the cause of the discrepancy is determined."

Conclusion

Based on our review of the information submitted, we have concluded that the low count rate startup procedure specified in Change No. 8 does not present significant hazards considerations not described or implicit in the hazards summary report, and there is reasonable assurance that the health and safety of the public will not be endangered.

Original signed by:
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Date: APR 29 1966