

SAFETY EVALUATION BY THE RESEARCH AND POWER REACTOR SAFETY BRANCH

DIVISION OF REACTOR LICENSING

IN THE MATTER OF

NORTHERN STATES POWER COMPANY

PATHFINDER ATOMIC POWER PLANT

DOCKET NO. 50-130

PROPOSED CHANGE NO. 12

*Superseded  
retain for  
info only.*

Introduction

On August 16, 1966, and August 18, 1966, Northern States Power Company requested authorization of two changes in the Technical Specifications of Provisional Operating License No. DPR-11, pursuant to the provisions of Section 50.59 of the Commission's regulations. These requests would permit (1) reactor cooling rates in excess of 200°F/hr (Change No. 11 dated May 10, 1966 authorized such rates up to 40% power) during the power escalation program up to full power, and (2) use of the reactor noise analysis technique in lieu of the rod oscillator technique to evaluate the stability of the Pathfinder reactor. These changes have been requested to allow certain tests which could result in rapid cooldown during the startup program and to minimize disturbances to the vessel and core which occur as a result of the rod oscillator tests. We have designated these requests Proposed Change No. 12.

Discussion

Section 8.0 of the Technical Specifications, which was added by Change No. 11, stipulates that a cooldown rate of 200°F/hr may be exceeded during testing of the emergency condenser and during initial power escalation up to 40% power. The licensee is now requesting temporary authorization to exceed the cooldown rate during the initial power escalation up to full power. The licensee has submitted justification for a permanent change in the Technical Specifications which will be considered by the staff at a later date.

Since the cooldown rate could exceed acceptable rates under certain conditions of scram and manual pressure control if the blowdown were initiated at power levels above 40% power, the licensee has made changes to the circuitry of the main steam isolation valve, the power-actuated safety valve, and the bypass valve. These changes essentially provide for automatic closure of the main steam isolation valve whenever reactor pressure drops to the low-pressure scram set-point. This action would reduce the blowdown rate to that allowed by the bypass valve and thus the cooldown would be limited to an acceptable rate. We have reviewed the changes made to the system and have determined that they do not affect safe operation of the reactor. We believe that, on the basis of the Safety Evaluation attached to Change No. 11, the previously

allowed cooldown limits (which are not altered by this change) remain acceptable. Starting cooldown from a higher power level does not affect acceptability of the previously authorized rates.

The licensee also proposes to change Section 7.5.3.6 of the Technical Specifications which requires that the stability evaluation be based on the result of rod oscillator tests. The licensee proposes to substitute the reactor noise analysis method to accomplish stability evaluation of the plant. Use of the noise analysis technique would eliminate removal of the vessel head, demister, holddown mechanism, and some of the instrumented superheater fuel assemblies now required to allow for placement and removal of the oscillator rod.

We have evaluated this request to determine that the proposed noise analysis, coupled with dynamics tests performed at each power step, will provide all necessary information to enable prediction of an unstable condition in the reactor. In particular, we have determined the following:

(1) Previous experience with many boiling-water reactors where both rod oscillator and noise analysis techniques were used has indicated that good correlation between the two techniques exists and therefore the noise analysis should provide a sufficient means for predicting instability in this application.

(2) Although the phase shift and break frequency of the reactor response cannot be accurately determined using this method, we believe that since the system response to perturbations such as inlet cooling temperature changes, rapid rod movement, various scrams and trips, etc., will be measured for each power step, the ability to predict reactor instability is reasonably assured.

(3) We understand that the noise from two detectors will be analyzed and that they will be located in the superheater region near the interface of the inside of the boiler region. One will be positioned near the top of the core and one near the bottom. These locations were chosen to provide assurance that the response obtained will be representative of both the boiler and superheater regions at two different locations along the axis. We believe that the proposed placement of the detectors will provide meaningful information.

(4) To protect against an instability which might occur, even though it had not been predicted, the licensee will have the high power level scram setpoints and steam temperature scram setpoints set slightly above the limit for each particular power step during the power escalation. Thus, if a power oscillation were to begin, rapid reactor shutdown would occur prior to core damage.

Extensive theoretical calculations have been performed for the multiregion Pathfinder core which indicate that instabilities should not occur until power levels exceed the maximum allowable level by a large amount. Measured data at power levels up to 40% have shown no anomalies with the predicted behavior. On this basis, and the discussion in paragraphs (1) - (4) above, we believe that the noise analysis technique may be substituted for the rod oscillator method without decreasing the ability to predict the onset of reactor instability.

Accordingly, we believe the Technical Specifications of Provisional Operating License No. DPR-11 should be changed as follows:

- (1) Change Section 8.0 to read:

"During testing of the emergency condenser and during the startup program, and with the superheater drained, the controlled cooling rate of the reactor may exceed 200°F per hour under the following conditions:

- (a) A temperature reduction not to exceed 50°F may occur at higher rates during any half-hour period in which the overall temperature variation does not exceed 100°F, or
- (b) During performance testing of the emergency condenser cooling at higher rates may occur during a single 20 minute period occurring within any given hour. The cooling shall not exceed 80°F during this 20 minute period, and the number of such tests to be performed under this temporary authorization shall not exceed five."

- (2) Change Section 7.5.3.6 to read:

"7.5.3.6 Stability Evaluation

Transfer function measurements shall be made at zero power (less than 5 mw), and subsequently may be made at higher power levels, to evaluate reactor stability. An oscillator rod, if used, shall be calibrated at several angular positions to assure that peak-to-peak worth does not exceed 10 cents in the configuration used for transfer function measurements. The range of investigation may extend from 0.01 to about 12 cycles per second. Evaluation of reactor stability shall be made at initial power escalation steps (as specified in 7.5.3 above), before proceeding to the higher power steps. Such evaluation and extrapolation of stability shall be based on analysis of reactor power noise (noise transfer function) or analysis of transfer function measurements made with the oscillator rod mechanism."

Conclusion

We have concluded that Proposed Change No. 12 does not present significant hazards considerations not described or implicit in the Final Hazards Summary Report, and that there is reasonable assurance that the health and safety of the public will not be endangered.

*Original signed by:  
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