UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 37 TO FACILITY OPERATING LICENSE NO. DPR-42

AND AMENDMENT NO. 31 TO FACILITY OPERATING LICENSE NO. DPR-60

NORTHERN STATES POWER COMPANY

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-282 AND 50-306

Introduction

By letter dated January 10, 1978[1] supplemented on March 15, 1979[3], Northern States Power Company (the licensee) submitted a proposed amendment to the Technical Specifications for Prairie Island Nuclear Generating Plant, Units 1 and 2. The amendment changes the surveillance frequencies of the nuclear instrumentation system low power level reactor trip functions. The licensee has provided an analysis for our review indicating that the proposed change would not degrade safe operation of the plant.

In addition, we have corrected T' to read 567.3°F in 2.3.A.2.d on page TS 2.3-1. In amendment requests dated November 4, 1976 and January 4, 1977 T' was proposed by the licensee to be 566.1°F. A January 28, 1977 licensee withdrew that request and requested that T' remain at 567.3°F. T' was inadvertently changed to 566.1°F in Amendments 28 and 22 issued March 28, 1978. Since the plant normally operates at around 560°F, that error was of no safety significance. It is appropriate at this time to revert to the original value of 567.3°F in the Technical Specifications.

The effect of the requested change in surveillance frequencies would be to require functional testing of the nuclear source and intermediate range power level monitoring instrumentation channels prior to each startup following a shutdown which lasts longer than two days, provided the functional testing has not been performed in the previous 30 days. The present specification requires the functional test prior to each startup if not done the previous week.

Background

Functional testing of a channel consists of electrical simulation of a signal as close as practicable to the channel sensor. The level of the simulated signal is varied such that the operability and setpoints of the various bistables are checked. Thus, "functional testing" should not be confused with "calibration." Functional testing is a check of the electronic analog and logic sections of the channel.

Source Range Channels

The source range channels are used by the operator to monitor neutron flux levels and rates of increase during reactor startup. The two channels also operate an alarm and a trip in a one-out-of-two logic. The analyses of the startup accidents do not take credit for this trip, but instead conservatively assume failure of both source range channels, both intermediate range channels, and two of the four power range channels. With such high redundancy, an extended functional test interval would be acceptable if trip failure were the only concern. However, the functional test also includes a checkout of the analog circuitry, which in addition to outright failure, is subject to drift.

The Technical Specifications require that the source range neutron flux reactor trip setpoint be $\leq 10^6$ counts per second (CPS). This is the limit of the range of allowable values: if the setpoint were discovered above this value, it would constitute a Technical Specification violation. Unlike the Standard Technical Specifications[2], the Prairie Island Technical Specifications do not specify a target value for the operator. It is the responsibility of the licensee to specify values in his procedures which have sufficient margin to the 10^6 CPS limit to allow for instrument drift. The licensee stated[3] that current practice is to set the trip setpoint at 10^5 CPS. The source range channels read out on a logarithmic scale, so the margin is not as large as it would first appear.

The licensee has stated[3] that in the past five years, the RMS deviation observed has been equivalent to 4000 CPS in a six month period, with a maximum deviation equivalent to 5000 CPS. This implies that in an eighteen month fuel cycle, 95% of the time the actual setpoint will be $\leq 1.20 \times 10^5$ CPS, which (on a log scale) is less than 1/3 of the margin to the Technical Specification limit. This is acceptable.

The alarm setpoint drift need not be considered here because the only direct safety function of the alarm is to warn plant personnel of positive reactivity insertions during core alterations. This is a shutdown function which is not addressed by the particular specification under consideration.

Finally, the indicating function to the operator during startup, which is used to calculate periods and other relative rather than absolute observations, should not be impaired by a 20% drift, particularly since the operator has access to both channels. Therefore, we find the longer test interval to be acceptable.

Intermediate Range Channels

In addition to indicating neutron flux levels to the operator during startup, the intermediate range channels feed the P-6 permissive, a rod stop, and a trip through a one-out-of-two logic. The trip is backed up by the source and power range trips, as discussed previously. Once again, an extended functional test interval would be acceptable based only on trip failure considerations. However, the analog circuitry testing must also be considered.

The Technical Specifications require that the intermediate range neutron flux reactor trip setpoint be less than or equal to the equivalent of 40% of rated core thermal power (not detector current). This is in contrast to the source range trip setpoint, which is stated directly in terms of detector output (counts per second). Thus, there are two contributions to intermediate range setpoint drift: deviations in the channel circuitry and changes in the relationship between neutron flux at the detector and core thermal power. The licensee has stated previously that total setpoint drift can be as high as 7% over a fuel cycle[4]. The functional test will check the channel circuitry contribution only. No check of detector-flux-to-power ratio is required by the Technical Specification, although data taken later in the startup sequence can be used to determine whether a violation has taken place. The licensee uses 30% of rated thermal power as a target value, thus allowing 10% margin to the 40% rated thermal power limit in the Technical Specifications.

The licensee has stated[3] that the RMS instrument deviation in an average seven and one-half month period has been equivalent to 1.3% power. For an eighteen month refueling cycle, this would correspond to 3.12% power RMS, or 5.13% power for a one-sided 95% probability. This would imply that the 7% maximum total drift would be increased to 8.7%. This is still less than the 10% margin to the Technical Specification limit. Moreover, the sole purpose of this 10% margin is to allow for this drift. Other uncertainties are accounted for elsewhere. Therefore, we find a refueling outage interval to be acceptable for functional tests of the intermediate range trip function.

The intermediate range rod stop is not a Technical Specification requirement. Its sole function is to prevent inadvertent trips during startup, and is not required for safety. Therefore, it will not be considered further.

The P-6 permissive allows manual blocking of the source range trip, and de-energizing of the source range channels to present detector burnout only when the reactor neutron flux as indicated by the intermediate range channels is above the P-6 setpoint. (Re-instatement of the source range channels is automatic when the intermediate range signal drops below the setpoint.) The purpose of the P-6 permissive is to ensure that the intermediate range channels are on scale before the source range channels are shut off. The Technical Specifications do not address the P-6 permissive directly, but instead require the source range trip to be active whenever the intermediate range detector signal is less than 10^{-10} amperes. (This assures at least one decade of source range to intermediate range overlap.) Thus, the P-6 permissive is a hard-wired backup to the operator's manual action. Downward drifts of the P-6 setpoint would not necessarily lead to a Technical Specification violation. Because of this, and because it is expected that the instrument drift rate of the P-6 setpoint will be of the same order as the other bistables, we find the longer functional test interval to be acceptable for the P-6 circuitry.

Finally, the indicating functions of the intermediate range channels to the operator during startup could drift up to 8.7% instead of 7% in terms of core thermal power. This is not a sufficient increase to cause a problem with range overlap, nor would it impair the ability of the operator to safely maneuver the reactor. Therefore, the longer functional test interval is acceptable for the indicating functions.

Summary

All safety requirements of the source and intermediate range channels have been examined, and in no case will the longer functional test interval significantly affect the reliability of the channels' required safety functions. Therefore, we find the proposed Technical Specification change to be acceptable.

Environmental Consideration

We have determined that the amendments do not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendments involve an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of these amendments.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendments do not involve a significant increase in the probability or consequences of accidents previously considered and do not involve a significant decrease in a safety margin, the amendments do not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Date: August 2, 1979

References

1. Letter, L. O. Mayer (NSP) to Director of Nuclear Reactor Regulation (NRC) dated January 10, 1978, enclosing Request for Amendment to Operating License No. DPR-42 and DPR-60, dated January 10, 1978 by L. J. Wachter (NSP).

2. "Standard Technical Specifications for Westinghouse Pressurized Water Reactors," NUREG-0452, June 15, 1978.

3. Lette , '. O. Mayer (NSP) to Director of Nuclear Reactor Regulation (NRC) dated March 15, 1979.

4. Letter, L. O. Mayer (NSP) to D. K. Davis (NRC) dated August 10, 1977.