UNITED STATES ATOMIC ENERGY COMMISSION

SAFETY EVALUATION BY THE DIRECTORATE OF LICENSING

NORTHERN STATES POWER COMPANY

DOCKET NO. 50-263

Northern States Power Company (NSP), by letter dated September 13, 1973, has proposed to change the Technical Specifications of Provisional Operating License No. DPR-22 to permit operation of the Monticello Nuclear Power Plant with the four safety valve set points at 1240 psig instead of two at 1210 and two at 1220 psig and to require four safety valves where three of four installed valves were required previously. We have reviewed the proposed Technical Specifications changes and the safety analysis provided as attachments to the NSP letter.

According to the Final Safety Analysis Report (FSAR), three of four relief valves and two of four safety valves (ref. 1) provided sufficient capacity to guard against excessive pressure due to turbine trip without bypass, conservatively assuming reactor scram from a high flux signal instead of from the turbine valve trip signal. NSP in a later assessment (ref. 2) of relief and safety valve performance changed the basis for steam safety valve capacity determinations to simultaneous closure of all MSIVs assuming delayed reactor scram due to high neutron flux signal because this transient is more severe. For this transient, the peak steam pressure was calculated to be 1283 psig using the scram reactivity curve corresponding to an exposure threshold of 2250 MWD/STU (ref. 3). We accepted the revised basis for calculating safety valve requirements and changed the Technical Specifications (ref. 4) to show the revised pressure peak assuming three relief and two safety valves operated as designed following MSIV closure with delayed reactor scram due to high neutron flux.

Slower relief valve opening times (ref. 5) caused a reduction in the exposure threshold from 2250 to 2000 MWD/STU and prompted examination of the advantages that could be gained by setting safety valves at 1240 psig to allow an increase in transient peak pressure while maintaining the 25 psi GE design margin to the safety valve set point (ref. 6 and 7).

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According to the reanalysis of safety valve performance attached to the September 13, 1973 NSP letter, the overpressure peak for closure of all four MSIVs, assuming delayed reactor scram from the high flux signal and a new end-of-cycle (EOC) scram reactivity curve, the maximum vessel pressure (at the bottom of the pressure vessel) is 1308 psig or 67 psi below the maximum overpressure design limit of 1375 psig. However, the basis for the calculation was changed to require that all four safety/relief valves and four safety valves open. In the previous analysis, only three safety/relief and two safety valves were required. Therefore, the severity of the transients using the fuel exposure threshold at 2000 MWD/STU and EOC are not directly comparable. Inquiry brought the telephone response by NSP that the following combinations of safety/relief and safety valves had been evaluated at 100% power with 0.8 second relief valve response times and delayed flux scram after simultaneous closure (within 3 seconds) of all MSIVs:

1. 4 safety/relief valves and 0 safety valves
2. 3 safety/relief valves and 2 safety valves
3. 2 safety/relief valves and 4 safety valves

and the margin to 1375 psig design limit remains greater than 25 psi. The margin to the pressure design limit has, therefore, been reduced from 92 psi to approximately 25 psi under similar circumstances. We have concluded that this margin, with allowance for reliability considerations, is acceptable and the safety valves may, therefore, be set at 1240 psig instead of 1210 and 1220 psig. We note that both valve types, i.e., the pilot-operated safety/relief valve and the spring-loaded safety valve are pressure actuated (self-actuated) and are not dependent on any other source of power to prevent overpressure.

We understand that sensitivity calculations are currently being performed by NSP to determine the peak transient pressure effect of increasing the safety/relief valve set pressure to 1090 psig (from 1080) so that allowance can be made for set point drift or variations. Pending completion of this study and the analysis for the remainder of fuel cycle 2, however, Monticello operations should continue to be conservatively restricted by requiring the same core control rod inventory attained at 1200 MWD/STU specified by NSP prior to the September 29, 1973 shutdown. (Shutdown to modify relief valve response time and the increase in the safety valve set points.)

On the basis of our evaluation, we have concluded that the increase in safety valve set point and the requirement for all four safety valves to be in service does not present an unreviewed safety consideration or significant hazards consideration and there is reasonable assurance that the health and safety of the public will not be endangered by operation of the reactor with the safety valve set points increased by 20 psi for two valves and 30 psi for the remaining two safety valves. The Technical Specifications should therefore be changed as proposed.

/s/

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/s/ John F. Stolz for

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Form AEC-318 (Rev. 9-53) AECM 0240 GPO 943-16-81455-1 443-678

REFERENCES

1. FSAR - page 4-4.4

   "The required safety valve steam flow capacity is determined by analyzing the pressure rise accompanying the main steam flow stoppage resulting from a turbine trip initiated with the reactor at 1670 MWt. The analysis assumes no steam bypass system flow, no turbine valve trip scram but a reactor scram from indirect means (high flux). The relief and safety valve capacity is assured to total 50% (35% relief and 15% safety of the full power steam generator rate). This capacity corresponds to assuming that three of the four relief/safety valves (35.4%) and two of the four safety valves (18.5%) operated."

2. NSP letter to AEC dated February 13, 1973, transmitting "Results of Transient Reanalysis for Monticello Nuclear Generating Plant with End-of-Cycle Core Dynamic Characteristics". A significant change in the shape of the scram reactivity curve could occur by the end of fuel cycle 2 (see Figure 1 - the new analysis curve is sometimes referred to as curve B).

   Page 4 - "It should be noted that the original FSAR analysis used for the safety valve sizing transient was the turbine trip without bypass (identical to instantaneous loss of condenser vacuum transient) with flux scram. However, it was determined with later plants that the main steam line isolation with flux scram could be more severe." Hence this analysis is used in checking safety valve adequacy.

   Page 5 - Relief Valve Adequacy Transient

   "A scram signal is initiated at the same time a turbine trip occurs by position switches on the turbine stop valves. This transient causes a rapid pressure increase in the reactor pressure vessel. Primary system relief valves are provided to remove sufficient energy from the reactor to prevent safety valves from lifting." Using improved control rod scram times (Figure 2) and four relief valves (three required previously) the peak pressure in the steam line at the safety valve location was calculated to be 1183 psig and since the lowest safety valve set point is 1210 psig, the GE design margin between peak preassure and the safety valve set point of 25 psi is maintained.

Page 5 and 6 - Safety Valve Adequacy

Figure 4 shows the transient resulting from closure of all 4 MSIVs within 3 seconds wherein 3 of the 4 relief/safety valves open (32% of main steam generation rate) and only 2 of the 4 safety valves (18% of main steam generation rate). Neutron flux reaches the scram level at about 1.8 seconds, initiating reactor shutdown. The assumed safety valve capacity (Target Rock plus spring safety capacities) keeps the peak vessel pressure 92 psi below the peak allowable ASME overpressure of 1375 psig. "Therefore, the relief valves plus spring safety valves provide adequate protection against excessive overpressurization of the nuclear system process barrier with a large margin because of the reduced capacities assumed for this analysis."

3. NSP letter to AEC dated June 1, 1973 - Request to change the Technical Specifications to require four operable relief valves instead of three, and slightly shorter control rod scram times in accordance with the analysis presented in the attachment to NSP letter dated February 13, 1973 (reference 2 above). "Preliminary calculations show that the new analyses present the most limiting conditions expected during the first 2250 MWD/STU exposure increment of cycle two."

4. AEC approval letter (Change No. 8) dated July 2, 1973, to require four relief valves instead of three as previously required and slightly faster scram times than previously specified in accordance with NSP change request dated June 1, 1973 (reference 3 above) for reactor operation at rated power out to 2250 MWD/STU.

"We are continuing our evaluation of the shape changes in the scram reactivity curve and the necessity for more restrictive technical specifications but agree that the technical specification changes you have proposed should be made now."

5. NSP letter to AEC dated August 1, 1973 - "Observed Relief Valve Opening Times Different than those Assumed in the Transient Analysis".

General Electric reports that results of Target Rock relief valve performance tests show a delay in initial opening time of about 0.8 second rather than 0.2 second as reported in the Monticello FSAR.

6. NSP letter to AEC dated August 21, 1973 - "Planned Reactor Operation from 2000 MWD/T to the End of Cycle 2".

   Page 2 - "Relief valve modifications will reduce peak vessel pressure following transients for the end of cycle 2 as well as subsequent cycles. Safety valve setting increases will maintain or improve the margin between vessel pressure and valve set points" (following turbine trip without steam bypass).

7. AEC Memo to File dated September 13, 1973.

   We will consider a change to the Technical Specifications to increase safety valve set point from 1210-1220 psig to 1240 psig. Our final conclusions, in this regard, are dependent on additional analysis for the period beyond 2000 MWD/T to be provided by NSP.

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