



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
SUPPORTING INSTALLATION OF RECIRCULATION PUMP TRIP MODIFICATION

NORTHERN STATES POWER COMPANY  
MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

INTRODUCTION

By letter dated September 15, 1976, Northern States Power Company (NSP) forwarded a General Electric Company report entitled "Evaluation of Anticipated Transients Without Scram for the Monticello Nuclear Generating Plant" (NEDO-25016), September 1976. This report described a Recirculation Pump Trip (RPT) modification which NSP committed to install at Monticello. This evaluation presents the results of our review of the proposed RPT modification, which is considered a short-term solution to the anticipated transient without scram, ATWS. Evaluation of the long-term program, which addresses all the WASH-1270 requirements and considers the need for additional modifications, will be accomplished for Monticello and other WASH-1270 Class C plants at a later date.

DISCUSSION AND EVALUATION

During the course of review of the ATWS long-term program, General Electric determined, and we have concurred, that a recirculation pump trip can significantly limit the consequences of an ATWS event. By tripping the two recirculation pumps in the event of high reactor vessel pressure or low vessel water level, an increase in the moderator voids in the reactor core will occur. The resultant negative reactivity substantially reduces the power and pressure surges that might otherwise occur as a result of the most limiting transient, closure of all Main Steam Isolation Valves. At the beginning of an ATWS event, when the recirculation pumps are signalled to trip, the operator will receive an alarm signal indicating that an ATWS has occurred, thus allowing him additional time to perform the required manual actions.

Since normal scram is assumed to be unavailable for reducing the reactor power and since the transient event is one in which power reduction is necessary, another method of reducing power is needed for the first 15 seconds of the event. The method proposed involves tripping of the recirculation pumps, which is accomplished by tripping the field circuit breaker of both recirculation pump motor generators. This causes a quick reduction in reactor coolant flow, thus decreasing the power for the first 15 seconds until the ATWS rod injection (ARI)\* can shutdown the reactor.

The automatic actuation of the recirculation pump trip will initiate when either the reactor water level or reactor pressure reaches the ATWS set-point. The logic delay for trip which includes dynamic response of the sensors, logic, action of the breakers and collapse of the generator field is approximately 0.53 seconds.

Because RPT will significantly mitigate the consequences of an ATWS event, we have determined its installation is acceptable.

#### Recirculation Pump Trip Logic

The inputs to the ATWS logic are taken from the reactor vessel water level and reactor vessel pressure sensors. The process trips that are input to the ATWS logic are reactor water level low-low trip and a high reactor pressure trip not to exceed 1150 psig. The pressure and level sensors are mounted on local racks in the reactor building. The logic for RPT uses relays which are mounted in the Emergency Core Cooling System divisional cabinets and are remote from the control benchboards. Reset and manual actuation switches are mounted on the reactor operating benchboards. The generator field breaker of the recirculation pump motor generator will be opened for an RPT.

Upon receipt of a manual actuation signal, reactor water level low-low trip signal, or a reactor high pressure trip signal, the logic will seal in and hold the trip until the reset switch is depressed. All trip units, which are powered by 125V DC, including the final ATWS logic, operate in the de-energized state. The final drive relays within the ATWS logic become energized when an ATWS variable is exceeded and result in a trip.

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\*NSP is not proposing to install ARI at this time, pending completion of its review of the on-going reliability study of the present reactor protection system.

An ATWS trip will result in the opening of the generator field breaker of both recirculation pump motor generators. To provide for redundancy, it is necessary to add a second trip coil to the field breakers. The logic relay contacts that trip the field breakers are closed for an ATWS trip and open during normal plant operation. The trip logic to each breaker is two-out-of-two or two-out-of-two in which contacts 'A' and 'C' or contacts 'B' and 'D' must close to trip the breaker.

Conclusions based upon our review of this ATWS logic are presented in the following paragraphs:

#### Testability

The ATWS logic will be tested by tripping one process sensor and observing the neon lights in parallel with the trip actuation contact change in brilliance. This will verify that the contact being tested is closed and that the trip coil is drawing some current which verifies that the coil is not open-circuited. This testing will be performed periodically, based on technical specification requirements which will be imposed at the time the proposed modifications are completed. When the plant is shutdown, the logic will be fully tested by tripping the field breaker. The setpoints of all the trip units will be tested and verified for trip accuracy periodically based on technical specification requirements.

Because the operability of the ATWS system can be tested while in service and verified when the reactor is shutdown, we have concluded that RPT testability is acceptable.

#### Diversity

The diversity between the ATWS logic and reactor protection system (RPS) logic has been achieved primarily through the functional application of the logic elements and the location of the logic elements. When common elements are used, the application in relation to the trip status is diverse; however, some logic elements are the same, such as trip units, pressure transmitter, pressure switches, relays, power supplies, wires and terminal boards.

The ATWS system, which is powered by 125V DC, is located in the ECCS cabinets while the RPS system, which is powered by 115V AC, is located in the RPS cabinets. The ATWS system logic contacts during operation are open with a de-energized end-diverse-status, while the RPS logic contacts are closed during operation with an energized end-diverse-status. The ATWS logic is a "two-out-of-two or two-out-of-two" logic, while the RPS scram logic is one-out-of-two twice.

We have determined that the diversity of this system, based on the above factors, is acceptable.

#### CONCLUSION

Based on our review of the information provided by NSP, as discussed above, we find the proposed modification of the automatic recirculation pump trip acceptable on the basis that: (1) RPT significantly limits the consequences of an ATWS event and as such, enhances plant safety; and (2) RPT is diverse from the current RPS and is testable in service. We have further concluded that there is reasonable assurance that the proposed RPT modification can be accomplished without endangering the health and safety of the public.

Date: February 23, 1977