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Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. Cecil O. Thomas, Chief
Standardization and Special Projects Branch

Reference: Docket 50-186
University of Missouri Research Reactor
License R-103

Subject: Report as required by Technical Specification 6.1.h(2) concerning reactor operation with incorrect trip settings on a nuclear instrumentation power range monitor.

Introduction

On February 20, 1985 with the reactor operating at a steady state power of 9.7 MW, the nuclear instrumentation channel 6 power range monitor indication dropped from an indicated power of 104% to 92%. The same magnitude of power reduction (12%) was reflected on the Channel 6 chart recorder as well. The reduced channel 6 indication was noted at 0202, at which time the power indicated on channel 6 returned to 104%. The chart recorder showed the duration of the reduced power indication to be 17 minutes, from 0145 to 0202. During the 17 minutes with the lower indicated power, the rod run-in and scram trip points for channel 6 would have occurred at an actual power level of 121% and 126% respectively. Therefore the reactor was not operating in compliance with Technical Specification 3.3a and 3.4c which require a maximum scram of 125% and a maximum rod run-in of 115%.

Analysis

MURR has six nuclear instrumentation channels for monitoring reactor power and period. Channels 4, 5, and 6 have high power trips set to provide a rod run-in at 115% and a scram at 120% of full power. These are set to comply with Technical Specifications 3.3a and 3.4c which require three channels of nuclear instrumentation to provide a scram and rod run-in at a maximum of 125% and 115% of full power respectively. These three channels also have a 75% down scale trip giving an annunciator alarm. This provides an audible and visual alarm when one of the three channels is below 75% of full power.

Channel 4, 5, and 6 are maintained to indicate between 95% and 105% when at full power. Full power is having an average steady state power between 9.5 MW and 10 MW as indicated on our total power meter. The total power meter is an on-line calorimetric of the energy being removed by the pool and primary coolant systems. The total power meter is checked hourly against a manual calorimetric of the secondary coolant system which removes the heat of the primary and pool coolant systems.

At 0202 on February 20, 1985, the on-duty operator noticed that the console meter for channel 6 was indicating 92%, which was 12% lower than it had been indicating. As he looked to check the other channel 6 indications, they all returned to their previous 104% indication. It could be determined from the channel 6 chart record that it had been indicating 92% for 17 minutes. During the 17 minutes, with the indicated power level of 92%, the actual power by heat balance was 9.7 megawatts. This implies that the trip set points of 115% for a rod run-in and 120% for a scram on channel 6 would have corresponded to a rod run-in at 121% and a scram at 126% of 10 MW. Therefore, for 17 minutes, the reactor was not in compliance with Technical Specifications 3.3a and 3.4c. However, the redundant power range channels 4 and 5 would have caused a rod run-in and/or scram at the desired set points. Therefore the safety system would have performed its intended function. It should be noted that the high power rod run-in is not part of the safety system and only serves to introduce a shim blade insertion on a reactor transient before the safety system is actuated.

The cause of the power indication reduction on channel 6 was investigated on the following maintenance period and again on the maintenance day, March 7. Electronics technicians performed drawer checks of channel 6 power range and simulated the power level at the time of the problem to determine if vibrating or touching specific components could cause a temporary indication decrease. The problem could not be reproduced.

Corrective Action

The problem immediately corrected itself after being observed. Other corrective actions will be taken with respect to this event. The circumstances that allowed the channel 6 indication to be 12% lower for 17 minutes without corrective action (and the nonconservative trip points this implies) have been reviewed with all licensed personnel. The 75% down scale alarm on power range instruments will be changed to a 95% down scale alarm. This will prevent operation with indicated power levels less than 95% without being observed.

The actual cause of the temporary channel 6 reduced indication problem is yet to be determined. Further investigation of this channel will be conducted to attempt to determine the cause.

Sincerely,

J. C. McKibben
Reactor Manager

Endorsement:
Reviewed and Approved

D. A. Alger
Associate Director

xc: U. S. Nuclear Regulatory Commission
c/o Document Management Branch

James Keppler, Director
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Reactor Advisory Committee

Reactor Safety Subcommittee