UNIVERSITY OF MISSOURI

Research Reactor Facility

Research Park
Columbia, Missouri 65211
Telephone (314) 882-4211

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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 an inoperable rod run-in function on a nuclear instrumentation power range monitor.

Introduction

On July 18, 1985, during performance of the Nuclear Instrumentation front panel checks prior to a reactor startup, the rod run-in trip function for power range monitor #5 was found to be inoperable. Technical Specification 3.4.c requires that a rod run-in function be operable for each power range monitor at 115% of full power maximum for reactor operation. All other Nuclear Instrument trip functions were found to be operable.

Analysis

MURR has six nuclear instrumentation channels for monitoring reactor power and period. Channels 4, 5 and 6 have high power trip settings to provide a rod run-in at 115% and a scram at 120% of full power. These setpoints are verified prior to each reactor startup as part of a full power startup checksheet.

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While performing these Nuclear Instrumentation setpoint verifications on July 18, 1985, the reactor operator determined that the rod run-in function for power range monitor #5 was inoperable. The reactor had operated from 0848 on July 16, 1985 until 0708 on July 18, 1985 (a period of 46 hours and 20 minutes) when the reactor was shutdown for a scheduled refueling. It was during the performance of the full power checksheet following this refueling shutdown that the rod run-in function for Channel 5 was found to be inoperable. This rod run-in trip setting had been checked previously as part of a full power startup checksheet on July 16, 1985. The Channel 5 rod run-in function was operable at that time and its trip point was verified to be 114.5% of full power.

The exact time that the Channel 5 rod run-in trip unit failed is unknown. Therefore, one may conclude that the reactor operated up to 46 hours and 20 minutes with the Channel 5 power range rod run-in function inoperable. This would have resulted in reactor operation deviating from Technical Specification 3.4.c, which requires that a rod run-in function be operable for each power range channel at 115% of full power maximum for reactor operation.

The trip settings for the reactor scram on Channels 4, 5 and 6 and the rod run-in trip settings for Channels 4 and 6 were verified to be correct at the time the Channel 5 rod run-in function was found to be inoperable. These redundant power range channel functions would have caused a rod run-in and/or scram at the desired setpoints. 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 activated.

Corrective Action

The trip unit module that provides the Channel 5 rod run-in function (G.E. model 194X382G1) was replaced by electronics technicians. The Channel 5 power range drawer was then calibration checked and the trip function was tested and verified to be operable.

The failed trip unit was bench tested as per the technical manual by the electronics technicians to determine the exact cause of failure. The test results were inconclusive, however, because the trip unit operated properly each time it was tested. The voltage checkpoints outlined in the technical manual were also checked and found to be correct. The problem may have been caused by a loose pin connection between the NI drawer and the trip unit module. This would have prevented an actual or test signal input to the differential amplifier in the first stage of the trip unit in the operate or test mode. When this actual or test signal exceeds the reference input to the differential amplifier, a trip signal output results. The absence of this trip output is what resulted in the Channel 5 rod run-in being inoperative.

A review of the electronics log shows this to be the first failure of this type in the G.E. 194X382G1 trip unit in eighteen years of operations. All other spares were tested to ensure they met technical manual specifications and to determine if there was evidence of a generic failure. All units met technical manual specifications.

The nuclear instrument trip units are exercised as part of the startup checksheet for full power operation for each startup. With our present operating schedule, this results in a check of their operability at least weekly. We will monitor these trip units closely during the next several months, for indications of similar problems, being particularly conscious of module pin engagement to the N.I. drawer connector board.

Sincerely,

Walter A. Meyer, Jr.
Acting Reactor Manager

Endorsement:
Reviewed and Approved

D. M. Alger
Associate Director

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

James Keppler, Regional Administrator
US NRC, Region III

Reactor Advisory Committee

Reactor Safety Subcommittee