



Research Reactor Center

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US Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Docket No. 50-186
The Curators of the University of Missouri
License No. R-103

The attached document provides the Missouri University Research Reactor (MURR) Licensee Event Report (LER) regarding a valve mis-positioning event that was discovered on January 16, 2004, which resulted in a deviation from MURR Technical Specification 3.10.b. This report is submitted in accordance with Technical Specification 6.1.h (2).

Please contact Les Foyto, Reactor Manager at 573-882-5276 if you have questions regarding this report.

Sincerely,

Ralph A. Butler, P.E.
Director

DIANE PURCELL
Notary Public - State of Missouri
County of Boone
My Commission Expires Jan. 31, 2006

RAB:dcp

Enc.

xc: Mr. Alexander Adams, Jr., US NRC
Mr. Craig Bassett, US NRC Region II
Dr. James S. Coleman, Vice Provost of Research, University of Missouri
Reactor Advisory Committee
Reactor Safety Subcommittee

IE22

Licensee Event Report No. 04-01 – January 16, 2004
University of Missouri Research Reactor

Introduction

On January 16, 2004, with the reactor operating at 10 MW, the control room operators observed no discernable increase in pressurizer liquid level with the primary coolant charging pump operating. The charging pump had automatically started in response to a pressurizer low liquid level signal generated by level controller 936. The low liquid level condition was a result of normal operating system losses. After observing no level increase for approximately 3 minutes, the reactor was immediately shutdown and the coolant charging pump was manually secured. Upon investigation, coolant charging pump suction valve 515C was found to be in the shut position; thereby isolating the charging pump from its suction source of makeup water. Pressurizer liquid level and pressure were within their normal operating ranges at the time of shutdown.

The coolant charging pump delivers makeup water to the primary coolant system via the pressurizer from makeup water storage tank T-300. In accordance with Technical Specification 3.10.b, “the reactor shall not be operated unless the reactor makeup water system is operable and connected to a source of at least 2,000 gallons of primary grade water.” The basis for this Specification is to provide “an adequate supply of primary grade water for makeup during all modes of operation.” With valve 515C in the shut position, the reactor makeup water system was in a degraded state and not considered operable.

Description of the Reactor Makeup Water System

The Reactor Makeup Water System is not specifically defined or described in the Technical Specifications or in the Hazards Summary Report. The intent of Specification 3.10.b would imply that the system consists of a pressurizer tank, a positive displacement pump (coolant charging pump P533), automatic control valves, a primary grade water supply, and associated piping, valves, and instrumentation. These components are shown on MURR Drawing No. 2325, “Pressurizer/Nitrogen System,” which is attached as page 5 to this document. The coolant charging pump is labeled as Level Control Pump P533 on this drawing. The purpose of the nitrogen supply system is to automatically supply nitrogen gas to the pressurizer to ensure that pressure in the primary coolant system is maintained within the Limiting Safety System Settings (LSSs) for 10 MW operation.

Pressurizer liquid level is maintained within a normal operating band of 7 inches below centerline (-7) to 4 inches above centerline (+4). This is accomplished by the addition of water with coolant charging pump P533 if the level is low, and draining water to the drain collection system if the level is high. If liquid level decreases to approximately -6

inches, level controller 936 initiates a signal to automatically open pump discharge valve 527B and start coolant charging pump P533. The pump will continue to run until liquid level is approximately +1 inches. At this time the pump will stop and valve 527B will close. At a design flow rate capacity of 50 gpm, the coolant charging pump will run for approximately 1 minute. If pressurizer liquid level continues to decrease to -11 inches, level controller 935 will initiate a "Pressurizer Water Lo Level" annunciator alarm alerting the operators to the abnormal condition. Should pressurizer liquid level lower to -13 inches, level controller 935 will initiate a reactor scram by opening a contact (K28-2) in the process input string to E3B of the Reactor Safety System Non-Coincidence Logic Units, thereby interrupting power to the control blade electromagnets. In addition, a "Pressurizer Lo Level Scram" annunciator alarm is initiated and the surge line isolation valve 527C closes to prevent an introduction of nitrogen gas into the primary coolant system.

Event description

On Friday, January 16, 2004, at 0925 with the reactor operating at 10 MW in the automatic control mode, the control room operators observed that the coolant charging pump had automatically started as required by system demand. Since reactor startup on Monday of the same week, pressurizer liquid level had decreased from -1 to -6 inches (approximately 38 gallons in 91 hours). Note: This water is collected and reused in the system. This amount of level decrease is typical of system losses due to coolant sampling and pump seal leakage. After observing no notable increase in pressurizer liquid level for approximately 3 minutes, the reactor was shutdown and the coolant charging pump was manually secured. Upon investigation, coolant charging pump suction valve 515C was found to be in the shut position; thereby isolating the charging pump from its source of makeup water.

Background

On Monday, January 12, 2004, the reactor was shutdown at 0100 for scheduled refueling and maintenance. One of the scheduled maintenance tasks that was performed that day was Preventative Maintenance Item No. R2-A3. This maintenance task consists of bench testing coolant charging pump discharge relief valve 557A at its set point of 150 psig. The first step of the maintenance procedure is to shut coolant charging pump suction valve 515C thereby isolating the relief valve from the system. Relief valve 557A is then removed and installed on a pressure test stand where the set point is verified to be within specification. After completion of the test, the relief valve is then reinstalled and valve 515C is reopened. All of these steps were performed as required by procedure with the exception of reopening valve 515C. The person conducting the maintenance procedure had informed a Senior Reactor Operator that R2-A3 had been completed and thus it was logged in the control room logbook as such. Later that day a reactor startup was performed and at 1433 the reactor was operating at 10 MW.

Safety Analysis

Operation with valve 515C in the shut position did not present a safety hazard to the reactor or any reactor coolant system. The reactor makeup water system is not part of the reactor safety system nor is it a facility design feature that is assumed to be operational in any accident analysis or reactor emergency procedure. The system provides a means for the addition of primary grade water that is lost during normal operation of the reactor through coolant sampling, pump seal leakage, etc. The system is not designed to provide makeup water for the protection against any significant leaks in the primary coolant system.

Furthermore, should a significant primary coolant system leak develop, a reactor scram would be initiated by low system pressure. Pressure sensors 944A and 944B would also cause the primary coolant pumps to stop and primary coolant isolation valves 507A and 507B to close. Closure of these valves would isolate the pressurizer and reactor water makeup system from the reactor pressure vessel and core.

Corrective Actions

When it appeared that a Limiting Condition for Operation regarding a reactor auxiliary system was not satisfied with respect to the reactor makeup water system (Technical Specification 3.10.b), the reactor was immediately shutdown.

After discovering valve 515C in the shut position, a valve line-up checksheet was performed of the pressurizer system to ensure that no other valves were out-of-position. Although the maintenance procedure clearly states to reopen valve 515C after relief valve 557A has been reinstalled, it was not done. Preventing component mis-positioning events is a significant management challenge at nuclear facilities. These events have been given much attention by nuclear utilities, the NRC, and the Institute of Nuclear Power Operations (INPO). One of the main causes of mis-positioning events is inadequate attention to detail, which can also be attributed as the root cause to this event.

A Standing Order was issued prior to reactor startup that requires valve line-up checksheets to be performed on all systems as part of equipment post maintenance testing. This includes all activities controlled by Compliance Procedures, Preventative Maintenance Procedures, Modification Records, and any Corrective Maintenance Procedure or Sequence. Valve line-up checksheets provide independent verification in that one operator initially confirms correct valve position and then a second operator independently verifies this position. The Standing Order will remain in effect until all compliance and preventative maintenance procedures, and AP-RR-015, "Work Control Procedure," have been reviewed and revised to include valve line-up checksheets as part of post maintenance testing.

A visual inspection and an operational capacity test of the coolant charging pump indicated that no damage had occurred to the pump while it was operating with its suction valve closed. The reactor was refueled and returned to 10 MW operation with Reactor Manager's approval at 1405, January 16, 2004.

This event has been entered into the MURR Corrective Action Program as CAP 04-0006 and any additional improvements or corrective actions will be considered. At a minimum, all operators will be coached on the need for flawless attention to detail when changing or verifying the position or state of a component. The importance of following procedure, regardless of how many times they may have performed it, will also be stressed.

If additional information is desired please call me at 573-882-5276.

A handwritten signature in black ink, appearing to read "Les Foyto". The signature is stylized with a large initial "L" and a long, sweeping tail.

Les Foyto
Reactor Manager
University of Missouri Research Reactor

