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May 1, 2002

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 University of Missouri Research Reactor event report for a valve mis-positioning event that was discovered on April 4, 2002. The mis-positioned valve resulted in a variance from technical specification 3.10.b. This report is submitted in accordance with Technical Specification 6.1.h (2).

Please contact Paul Hobbs, Reactor Manager at 573-882-5264 if you have questions regarding this report.

Sincerely

Ralph A. Butler
Interim Director

RAB:dcp

Enc.

xc: Mr. Alexander Adams, Jr., US NRC
Mr. Craig Bassett, NRC Region II
Dr. Robert Hall, Interim Vice-Provost
Reactor Advisory Committee
Reactor Safety Committee

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

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Attachment
US Nuclear Regulatory Commission
May 1, 2002

**Event Report 02-02 – April 4, 2002**
**University of Missouri Research Reactor**

Introduction

At 1533 on April 4, 2002, during normal operating activities, Control Room Operators observed that there was some fluctuation but no discernable rise in the water level of the pressurizer when the charging pump was running. The pump had started automatically in response to a normal makeup signal. It was quickly discovered that the pump's 1-inch recirculation valve, 528, was open allowing the water to return to storage tank T-300 rather than flow to the pressurizer. Pressurizer level was within its normal range and the reactor was operating at 10 MW, steady state, at the time of this discovery.

The charging pump delivers makeup water to the pressurizer from 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 of this Technical Specification is to provide for "an adequate supply of primary grade water for makeup during all modes of operation."

With valve 528 open, the reactor makeup water system was in a degraded state.

**Description of the reactor makeup 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 Technical Specification 3.10.b would imply that the reactor makeup water system consists of the positive displacement charging pump, P 533, and its associated piping. These components are shown on drawing number 156 in the MURR Control Room Print Book. P 533 is labeled as the Level Control Pump on this drawing.

Pressurizer level is maintained in a normal operating range of –7 inches to +4 inches. To maintain level in this range pump P533 may be started and stopped manually, or in the automatic mode it is started at –6.5 inches and stops when level reaches +3/4 inches. The pump's discharge valve 527B opens and closes automatically in conjunction with the pump starting and stopping. For testing purposes there is a normally closed 1-inch recirculation valve, 528, on the discharge of the pump. This valve allows water to be discharged back to the storage tank T-300.

When operating, the pump draws demineralized water from storage tank T-300 and delivers this water to the pressurizer through the pump's discharge valve 527B. This tank is used to contain the 2,000 gallons of primary grade water required by Technical Specification 3.10.b. This volume requirement was met at the time of this event.

The pressurizer is normally maintained at 85 psia using nitrogen. At this pressure and with valve 528 open a significant portion of the charging pump's discharge would flow back to the storage tank instead of to the pressurizer.

## Event description

On Thursday, April 4, 2002 with the reactor operating at 10 MW in the automatic control mode, operators observed that the charging pump had started but that pressurizer level was not increasing as it normally does. An Operator stated that the level indication fluctuated some.

Another operator went to the entrance of the mechanical equipment room to investigate and reported to the control room that the charging pump was running very noisily. An operator in the control room secured the pump. At this time the reactor was also shutdown.

Investigation of the charging pump and piping revealed that the pump's normally closed recirculation valve, 528, was open.

*Background*

On Monday, April 1, 2002 a number of maintenance activities were performed on valves and other components associated with the pressurizer and charging pump. The work instructions and tagout for this maintenance specified that this valve be open. Following the maintenance, and before starting up the reactor, the pressurizer valve lineup was performed. The valve lineup checksheet specified that valve 528 be closed. The operator who performed the valve lineup had initialed that the valve was closed. This operator believes that he verified the valve closed.

Following the maintenance and mechanical restoration of the system, the charging pump was used in a normal manner to return the drained pressurizer to its normal water level. This demonstrated to the operators that the system functioned normally following the maintenance. However, when this activity was performed the pressurizer had not yet been pressurized with nitrogen. In the depressurized condition, the piping to the pressurizer was the flow-path of least resistance. Following pressurization, the recirculation path to T 300 was the path of least resistance.

## Safety Analysis

Leaving valve 528 open did not present a hazard to the reactor or reactor coolant system.

Neither the pressurizer nor the charging pump are part of any safety system nor are they required in any accident analysis or emergency procedure.

In the event of a system leak in excess of the 50 GPM capacity of the charging pump, the reactor coolant loops would be isolated by closure of valves 507 A and B if pressure

decreased to 63 psi. A reactor scram is initiated by this low pressure signal and on a low pressurizer water level at 13 inches below centerline.

When isolated by closure of valves 507 A and B, the pressurizer and makeup system are no longer connected to the reactor.

In the event of a leak or rupture of tank T 300 or its piping with normally closed valve 528 open, check valve 516 on the discharge of the charging pump would prevent pressurizer and primary coolant inventory from being lost.

**Root Cause Determination**

An Event Review Team was convened to gather facts regarding this event.

Contributing Factors

1. The work instructions used on the April 1st maintenance activities specified a restored position of open and this position was carried over to the tagout restoration lineup. A valve lineup that specified the normal position, closed, was performed after the tagout was cleared. This lineup was performed as a prerequisite in procedure OP-RO-410, Primary Coolant System.

2. Inadequate attention to detail.

3. The identification tag on valve 528 is small and difficult to read in the poorly lit area.

4. Poor lighting at the valve location.

Preventing component mispositioning 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). The causes of mis-positioning events are numerous and include the items listed above as contributing factors.

**Corrective actions**

1. The pressurizer valve lineup was re-performed and independently verified by a second operator. No other component was found to be mispositioned.

2. The Reactor Manager issued a Standing Order requiring all tagout and valve lineup activities be independently verified by a second operator.

3. Revise tagout forms and procedure lineup checklists to include spaces for Independent Verification initials.

4. Discussed Nuclear Power Reactor valve mispositioning events with Dr. Gary Hughes,

Supervising Engineer, QA, Independent Technical Review, Callaway Plant.

5. Evaluated valve identification tags. Ordered new, easier to read identification tags. These will be installed upon receipt or when operating conditions permit access to the valves.

7. Reactor Manager coached crews on the need for flawless attention to detail when changing or verifying the position or state of a component.

This event is entered into the MURR Corrective Action Program as CAP 02-0022.

If additional information is desired please call me at 573-882-5264

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University of Missouri Research Reactor