



Research Reactor Center

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April 1, 2005

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

REFERENCE: Docket Number 50-186
University of Missouri - Columbia Research Reactor
Amended Facility License R-103

SUBJECT: Licensee Event Report

The attached document provides the Missouri University Research Reactor (MURR) Licensee Event Report (LER) for an airlock door malfunction that occurred on March 10, 2005, which resulted in a deviation from MURR Technical Specification 3.5.a. 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

RAB/djr

Enclosure

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

CHRISTINE M. ERRANTE
Notary Public - State of Missouri
County of Boone
My Commission Expires Apr. 14, 2007



LE22
A020

Licensee Event Report No. 05-01 – March 10, 2005
University of Missouri Research Reactor

Introduction

On March 10, 2005, with the reactor operating at 10 MW, a failure of the reactor containment building inner airlock door air supply control valve resulted in a loss of air pressure to its sealing gasket. This condition was reported to the console operator who placed the rod control Master Control Switch in the "Off" position. This action immediately scrammed the reactor and placed the reactor in a secured condition. Failure of the personnel airlock door to provide an adequate seal resulted in a deviation from Technical Specification 3.5.a; one of two Limiting Conditions for Operation regarding containment integrity.

Technical Specification 3.5.a requires that containment integrity be maintained at all times except when the reactor is secured, and irradiated fuel with a decay time less than sixty days is not being handled. One of the six conditions for reactor containment integrity to exist is "The personnel airlock door operable." This implies that one of the two personnel airlock doors must be fully closed with its gasket inflated, thus providing a satisfactory seal.

Description of Personnel Airlock Door System

The physical description of the reactor containment building personnel airlock doors is considered sensitive information from a security perspective. This information is kept onsite and is available to the U.S. Nuclear Regulatory Commission for inspection and review. The following information describes the airlock door interlock circuitry.

The airlock door control circuit is designed and interlocked to ensure that one door is always closed and sealed. The interlock consists of a relay logic circuit, which detects both door open and closed positions from a rotary limit switch assembly, as well as seal inflation pressure for each door. A three-way, dual solenoid-pilot valve controls the air supply pressure to the door-sealing gasket. The solenoids are normally de-energized and only momentarily energize to either inflate or deflate the door-sealing gasket. A latching mechanism keeps the three-way valve in either the pressurized or vent position after the solenoid de-energizes. The logic circuit enables one door to open only if the other door indicates closed and sealed.

When a door is in the fully closed position, the rotary limit switch energizes the closing solenoid, which aligns the three-way valve to inflate a gasket mounted in the door facing, thus sealing the door. The three-way valve then remains in the "latched" position, as depicted on page 4, after the solenoid de-energizes. When a door is in the fully open position, the rotary limit switch energizes the opening solenoid, which aligns the three-way valve to vent the sealing gasket to atmosphere. The three-way valve then remains in the "unlatched" position after the solenoid de-energizes. The purpose of using a dual solenoid is to prevent the three-way valve from getting out of phase. The position of the three-way valve will not change if the same solenoid is energized twice in succession (the opposite solenoid must be energized to reverse the valve).

Additionally, the reactor containment building is maintained at a slightly negative pressure with respect to the surrounding laboratory building. This ensures that the direction of airflow is into the containment building should a leak develop in the building structure.

Event Description

On Thursday, March 10, 2005, at 14:13, a control room operator was exiting the reactor containment building through the personnel airlock. The operator noted that the inner airlock door sealing gasket pressure gauge was reading 0 psig with the door shut. With the assistance of another operator, it was determined that the inner airlock door gasket inflated as intended when the door reached the "closed" position, but then immediately deflated after the cycle was complete (the door remained closed). Additionally, the sound of air flowing past the gasket seal could be heard. The operator immediately informed the control room of the condition and the reactor was shutdown and secured by 14:15.

Upon investigation, it was determined that the inner airlock door three-way, dual solenoid-pilot valve had not remained in the "latched" position following the door closing cycle. Once the closing solenoid de-energized, the three-way valve returned to the "unlatched" position, thereby venting air pressure from the sealing gasket resulting in a loss of containment integrity. The three-way valve bonnet and dual solenoid-pilot control assembly were replaced. The door was then cycled five times to verify proper adjustment and operability.

Safety Analysis

The basis for Technical Specification 3.5.a is to ensure that the reactor containment building can be isolated at all times except when plant conditions are such that the probability of release of radioactivity is negligible. When the personnel airlock door system malfunctioned, resulting in a deviation from the Limiting Conditions for Operation, a reactor scram was immediately performed to make negligible the already low probability of release of radioactivity while operating the reactor.

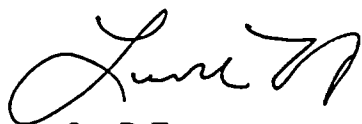
Corrective Actions

When the Limiting Condition for Operation regarding containment integrity was not satisfied with respect to the personnel airlock doors (Technical Specification 3.4.a), the reactor was immediately scrammed and placed in the secured condition. This is the fastest way to restore Technical Specification compliance. The three-way valve bonnet and dual solenoid-pilot control assembly were replaced. The personnel airlock was placed back into service and tested before being determined operable. The reactor was refueled and returned to 10 MW operation with Reactor Manager's approval at 21:35, March 10, 2005.

Attachment
U.S. Nuclear Regulatory Commission
April 1, 2005

This event has been entered into the MURR Corrective Action Program as CAP 05-0021 and any additional improvements or corrective actions will be considered. This type of airlock door failure had never previously occurred at MURR. The removed air control valve was disassembled and the exact cause of the valve failing to remain in the "latched" position could not be determined. Some of the possible causes include a loss in magnetic field strength of the control solenoid, undetectable wear of the latching mechanism or wear debris or dirt which prevented the valve from latching. Although sufficient spare valves and solenoids do exist for the foreseeable future, this particular vendor no longer supports this style valve. The facility's engineering staff is researching a possible future replacement for this valve.

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



Les P. Foyto
Reactor Manager
University of Missouri Research Reactor

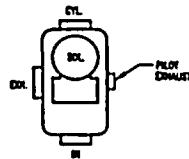
Containment Airlock Door Three-Way, Dual Solenoid-Pilot Valve

IMPULSE VALVES With JIC Solenoids THREE-WAY SOLENOID-PILOT

Current is required only momentarily to change positions of the Impulse Valve.

Dual Solenoid: To prevent valve from getting out of phase in automatic systems, the position of the valve will not be changed if the same solenoid is energized twice in succession (the opposite solenoid must be energized to reverse the valve).

If circuit requires that current be applied continuously, the ambient temperature should not exceed 100°F.



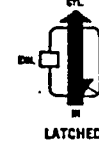
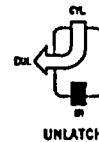
INTERNAL PILOT SUPPLY

The pressure supply to operate the pilot section is directed through internal channels leading from the main line pressure inlet.

The pilot valve exhausts into the subbase independent of the main valve exhaust. **CAUTION! NEVER PLUG OR RESTRICT PILOT EXHAUST**

SUBBASE MOUNTED AIR 15 to 150 PSI 2-1134J SERIES

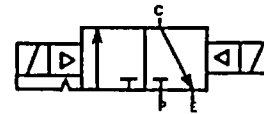
FLOW PATTERNS OF THREE-WAY VALVES (viewed from solenoid end)



Seal Deflated

Seal Inflated

ASA SYMBOL



VALVE CHARACTERISTICS AND ORDERING DATA:

IMPORTANT — When ordering please specify: Size, Ordering Number, Pressure Range, Voltage, and Frequency.

Pipe Size (NPT)	Cv Factor	Press. Range	Ordering Number	Approx. Ship. Weight (Lbs.)
1/4"	1.80	15-150	2-113422J	5
3/8"	2.88	15-150	2-113432J	5
1/2"	5.04	15-150	2-113452J	5 1/4
3/4"	8.08	15-150	2-113462J	6 1/4

STANDARD VOLTAGES: 115, 230 or 460 AC, 60 cycles;
 110, 220 AC, 50 cycles;
 12, 24, 28 and 115 DC

For other voltages and/or frequencies, consult Factory.

SPECIAL MODIFICATIONS

Available where quantity warrants.
 Consult factory for price and delivery.

- Subbase with bottom & side outlets.
- A.N.D. porting.
- Speed control valves installed in exhaust ports.
- Explosion proof solenoid enclosure.
- Seals other than standard Buna N.
- Class H coils.

POWER CONSUMPTION (At 20°C)

'Mach-2' Three-Way Pilot Valve

