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September 30, 1994

Director of Nuclear Reactor Regulation  
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Mail Station P1-37  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

REFERENCE: Docket No. 50-186  
University of Missouri Research Reactor  
License R-103

SUBJECT: Report as required by Technical Specification 6.1.h(2) regarding Personnel  
Airlock Door Failure

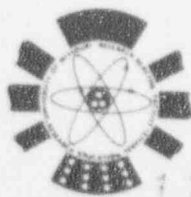
### INTRODUCTION

On September 2, 1994, at 2332, with the reactor operating at 10 MW, a failure of the inner airlock door drive system allowed both inner and outer airlock doors to be open at the same time. The failure was promptly reported to the control room and the operator immediately scrammed the reactor. The reactor was secured by 2333.

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. For reactor containment integrity to exist one of the personnel airlock doors must be closed with the gasket inflated. The reactor was operated out of compliance with this Limiting Condition for Operation for approximately one minute.

### DESCRIPTION

The personnel airlock doors at the second level of the reactor building are part of the containment system described in the Original Hazards Summary Report, Section 3.0. The airlock consists of two electric power driven steel doors and an intervening vestibule. Each door is suspended by trolleys from an overhead rail and is driven open or closed by means of a chain drive powered by an electric motor operating through a gear reducer. The control system for the two airlock doors is designed and interlocked to ensure that one door is always sealed. The interlock consists of a relay logic circuit which detects door "closed" position from a separate rotary limit switch assembly (see Fig. 1) for each door, as well as seal inflation pressure for each door. When a door is driven closed a microswitch in the limit switch assembly actuates an air valve to inflate a gasket which seals against the door. This logic circuit enables one door to open only if the other door indicates closed and sealed.



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At 2332, September 2, 1994, an experimenter exited the containment building through the personnel airlock doors. The inner airlock door began to shut when the drive chain became detached from the door. The drive chain attaches to the door through a threaded coupling into a shock absorber, and the coupling became unthreaded. This allowed the chain to continue to drive the sprocket ("south sprocket") that also drives the rotary limit switch assembly.

The rotary limit switch assembly continued to drive to the point where the door "closed" relay contacts made up and the inner door seal inflated. The inner door then electronically appeared to be closed and sealed and the airlock door interlock satisfied. This enabled the outer airlock door to sequence open causing a momentary loss of containment.

When this occurred the control room operators recognized an abnormal sound from the door sequence and the Shift Supervisor investigated immediately. The experimenter called the control room at the same time to report the failure and the reactor was shutdown and secured by 2333.

#### ANALYSIS

The basis for Technical Specification 3.5.a under Limiting Conditions for Operation is to ensure that the containment building can be isolated at all times except when the plant conditions are such that the probability of release of radioactivity is negligible. When the airlock doors malfunctioned, deviating 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. This was the first failure of this type experienced with the personnel airlock door drive system at MURR.

Review and evaluation of the semi-annual preventive maintenance inspection procedure for the airlock door drive system (BC1-S2) indicated that the procedure is adequately detailed to find and correct detectable problems with the drive system. This preventive maintenance procedure had been completed on August 1, 1994, and no apparent problems were found.

Analysis of the failure indicated that the degree of thread engagement into the coupling could not be detected by either the semiannual preventive maintenance inspection done by reactor operators, or by the daily mechanical routine inspection done by the machine shop staff. Based on this evaluation, the engineering staff decided to modify the threaded coupling to include a 1/8" roll pin to prevent the coupling from unthreading (see Fig. 2).

While evaluating the safety significance of this event, we recognized that our Limiting Conditions for Operation for containment integrity in MURR Technical Specifications do not include Action requirements (similar to Specification 3.0.2 of power plant Standard Technical Specifications) that would allow implementation of an Action requirement (in this case, a prompt shutdown) within a specified time interval as constituting compliance with the specification. Technically, the second a failure occurs we are in non-compliance.

Review of ANSI/ANS-15.1, American National Standard for Development of Technical Specifications for Research Reactors, recommends submission of a special report (Licensee Event Report) for "operation in violation of limiting conditions for operation established in the technical specifications unless prompt remedial action is taken" (Section 6.6.2.c(ii)).

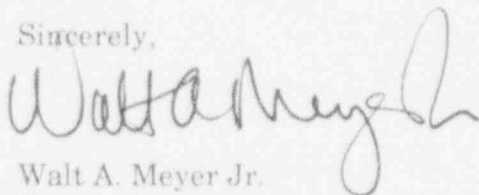
MURR staff will perform a safety analysis to support a request for change to T.S. 3.5.a in order to establish a reasonable time to take remedial action and still meet compliance with Technical Specifications. This will alleviate the generation of a Licensee Event Report for conditions which do not represent a safety concern for the reactor or the public.

### CORRECTIVE ACTION

When the Limiting Condition for Operation of the personnel airlock doors with regard to containment integrity (T.S. 3.5.a) was not met, the reactor was immediately scrammed and secured. This was the fastest way to put the reactor into Technical Specification compliance. The airlock door drive system was repaired and placed back in service at 0222, September 3, 1994. The reactor was refueled and returned to operation at 0544 September 3, 1994.

During the next maintenance shutdown, September 6, 1994, the modification described earlier was made to all four couplings associated with the airlock door system.

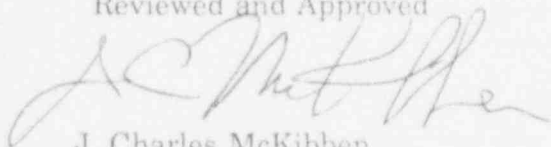
Sincerely,




Walt A. Meyer Jr.  
Reactor Manager

### ENDORSEMENT:

Reviewed and Approved



J. Charles McKibben  
Associate Director

 9/30/94  
CHRISTINE M. ERRANTE  
NOTARY PUBLIC STATE OF MISSOURI  
BOONE COUNTY  
MY COMMISSION EXP. APR. 14, 1995

Attachments: Figures 1 and 2

xc: Mr. Alexander Adams, Jr., USNRC  
Regional Administrator, NRC, Region III  
Dr. John P. McCormick, Interim Vice Provost for Research  
and Graduate School Dean, UMC  
Reactor Advisory Committee  
Reactor Safety Subcommittee

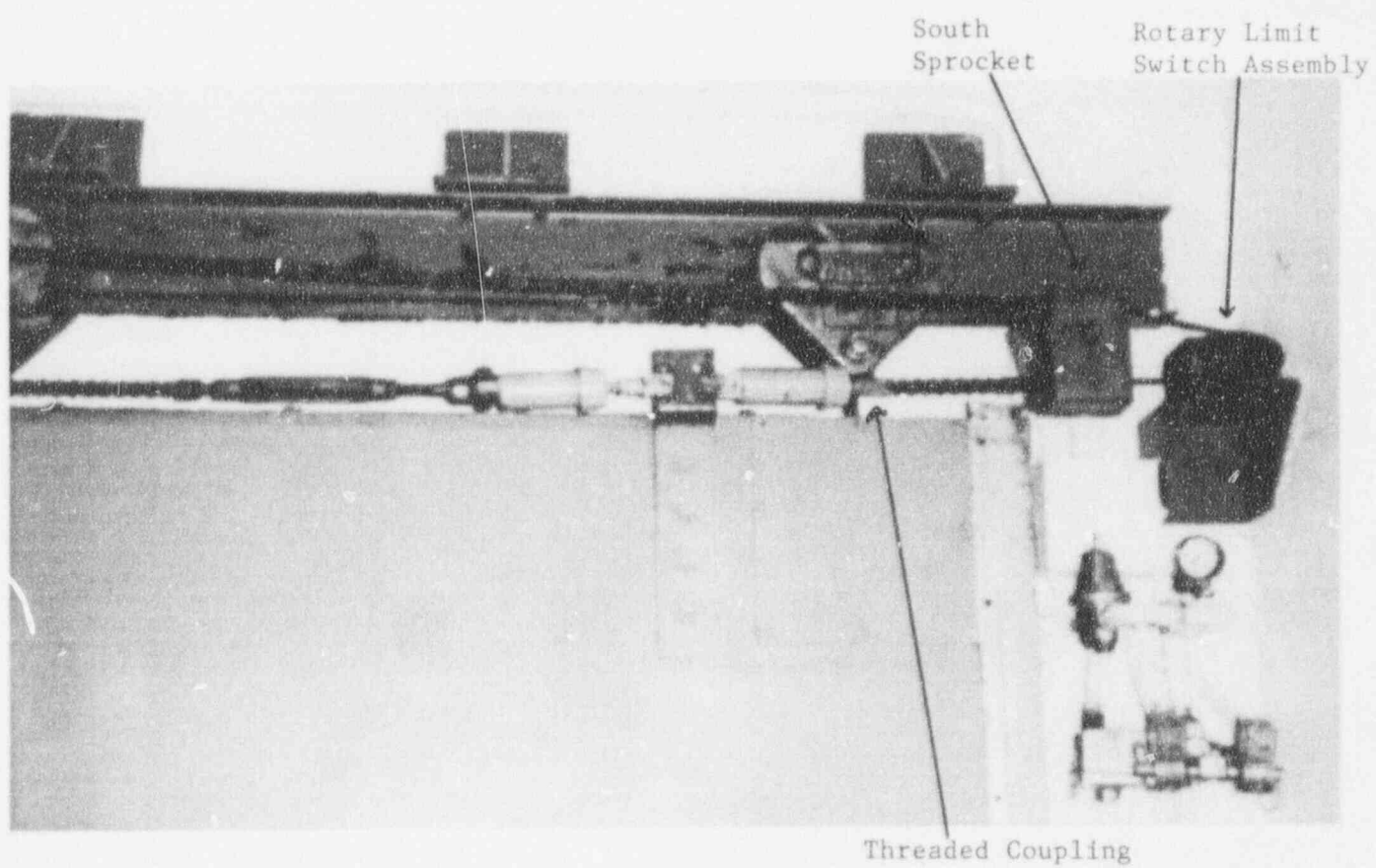
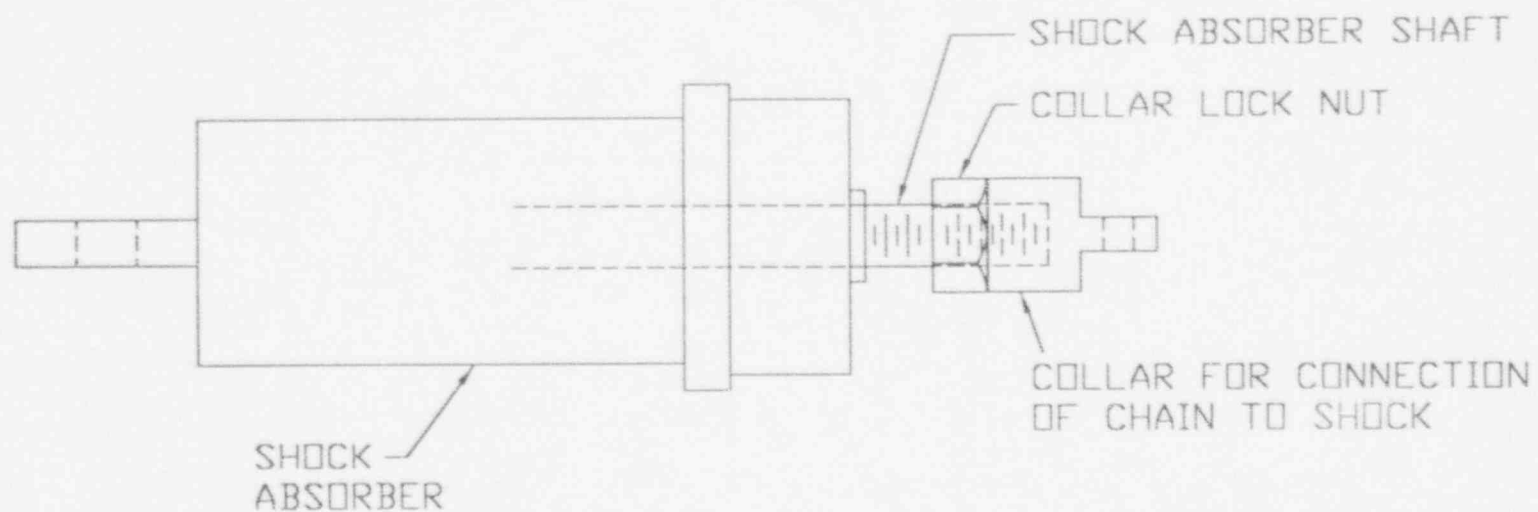
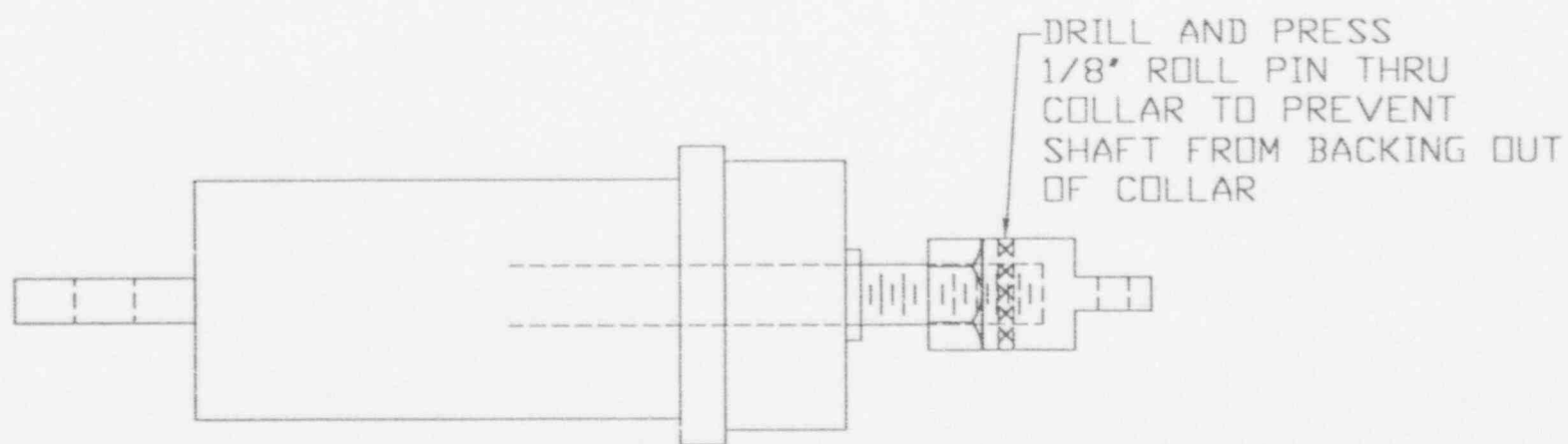


Figure 1. Inner Personnel Airlock Door Drive Chain



AIR LOCK DOOR SHOCK ABSORBER - BEFORE MODIFICATION



AIR LOCK DOOR SHOCK ABSORBER - AFTER MODIFICATION