

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) **JAMES A. FITZPATRICK NUCLEAR POWER PLANT** DOCKET NUMBER (2) **0 8 0 0 0 3 3 3 1** PAGE (3) **1** OF (4) **0 7**

TITLE (5) **Nine Air Operated Containment Isolation Valves Exhibit Operational Deficiencies Due to Packing Problems & Iron Build-Up in Reactor Building Closed Loop Cooling System**

EVENT DATE (6)			LER NUMBER (8)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (9)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME		DOCKET NUMBER (8)
09	18	89	89	015	01	11	07	89			0 8 0 0 0
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50. (Check one or more of the following) (11)											

OPERATING MODE (10) H	20.400(a)	20.400(a)	20.700(a)(1)(i)	73.71(b)
POWER LEVEL (10) 0.00	20.400(a)(1)(ii)	20.400(a)(1)	20.700(a)(1)(ii)	73.71(c)
	20.400(a)(1)(iii)	20.400(a)(2)	20.700(a)(2)(i)	OTHER (Specify in Abstract below and in Text, NRC Form 899A)
	20.400(a)(1)(iv)	20.700(a)(2)(ii)	20.700(a)(2)(ii)(A)	
	20.400(a)(1)(v)	20.700(a)(2)(iii)	20.700(a)(2)(ii)(B)	
	20.400(a)(1)(vi)	20.700(a)(2)(iv)	20.700(a)(2)(iii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME **Hamilton C. Fish** TELEPHONE NUMBER **3 1 5 3 4 9 - 6 0 1 3**

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC
X	CC	ISV	H035	Y					

SUPPLEMENTAL REPORT EXPECTED (14) YES (If yes, complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15) MONTH DAY YEAR

ABSTRACT (Limit to 1000 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

IIIS Codes are in []
 Revised Report - Previous Report Sent October 18, 1989

On September 18, 1989 during a scheduled outage and performance of a scheduled ASME, Section XI In-Service Test, two of nine remote manually operated diaphragm air operated containment isolation valves [ISV] on the reactor building closed loop cooling water system [CC] failed the acceptance criteria for valve closing time. One valve would not close except by manual operation. Another valve closing time exceeded the criteria by 0.4 seconds or 3.6 percent. Subsequent outage operations revealed common problems with the seven valves which initially passed the closing time test. Valves appeared to be binding due principally to the buildup of iron oxide sludge in the valve operating internals although there is some indication that the original packing may have contributed to the problem.

Corrective action: Disassembled and cleaned all nine valves and changed packing from seven ring Grafoil to live loaded five ring type on five valves. Three other valves had previously been changed to this type of packing in 1988. Long-term corrective action will flush system to reduce iron oxide buildup and investigate possible changes to internal valve trim which is less susceptible to corrosion product accumulation. The packing on the remaining valve will be changed during the next refueling outage.

LERs with common elements: 88-005, 88-009, and 86-003.

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TEXT (If more space is required, use additional NRC Form 305A's) (17)

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Revised Report - Previous Report Sent on October 18, 1989

Description

The plant was shutdown for a planned maintenance outage. During the outage deficiencies were discovered in the operation or internal condition of each of the nine containment isolation valves [ISV] of the Reactor Building Closed Loop Cooling water system (RBCLCW) [CC]. The valves are air diaphragm operated with piston in-cage valve internals. The sizes are one 1-1/2 inch, one 6-inch, and seven 4-inch valves.

The stroke closing time of all nine valves was measured on September 18, 1989 during the scheduled performance of ASME Section XI In-Service Testing (IST) Surveillance Test ST-1R, "Reactor Building Closed Loop Cooling Containment Isolation AOV Exercise". The closing times for seven of the valves were within the IST limits. The stroke time for valve 15AOV-130B of 11.81 seconds exceeded the maximum permitted closing time of 11.4 seconds by 0.41 second or 3.6 percent. Also, observation of the valve stem showed an erratic sticking motion. The operating mechanism for valve 15AOV-131A could be closed only by manual operation of the valve handwheel. The stroke time for valve 15AOV-131B was within the IST limits. However, visual observation of the valve stem travel revealed an erratic sticking motion. The position indicating limit switch for valve 15AOV-130A required adjustment.

Subsequent to the IST, a modification was in progress to replace the existing air supply to the valve operators with a nitrogen supply. This modification required closing the valves as a part of the protective tagging procedure. On September 29th and 30th, two valves, 15AOV-132B and 15AOV-133B, would not close for tag-out although they had previously passed the stroke time test ten days before.

On October 4th, as part of the system valve line-up, in preparation for plant start-up, additional sticking problems were found with several of the valves. Plant management directed that the remaining four valves in the system be disassembled, examined, and retested. At this time the pistons for the four remaining valves, 15AOV-130A, 15AOV-132A, 15AOV-133A, and 15AOV-134A, while previously demonstrated to be operable under air pressure, were found by mechanics to be sufficiently fouled by corrosion products that they were not able to be moved by hand in the valve cage.

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Cause

There are four contributing conditions which, because they existed concurrently, jointly may have contributed to excessive resistance to motion of the valve stem or the piston inside of the cage assembly:

- o Valve stem packing
- o Corrosion product (iron oxide) build-up
- o Inappropriate selection of valve trim for valve application
- o Infrequent (outage only) cycling of valves closed and open

1. Packing

The valves were originally supplied with seven rings of Grafoil packing. Inspection of the valve stems found a film of Grafoil packing material adhering to the exposed surface. Based on this description, the valve vendor (by telephone) suggested that the rings may be shearing on the surface in contact with the valve stem. These observations indicate that packing problems may be one contributor to the observed slow, erratic, or sticking motion (or lack of motion) of the valve stems.

2. Corrosion Products

All of the valves were disassembled for inspection. All exhibited an excessive accumulation of a black corrosion product sludge (magnetite iron oxide Fe-3 O-4) on internal surfaces and in critical crevices of the operating parts such as the close clearance space between the piston and cage.

The corrosion product build-up was sufficiently extensive that the pistons on four of the valves could not be removed from the valve cage by hand. Although the three valves which had previously (1988) had live load packing installed all passed the initial IST, two of them subsequently stuck during valve line-up. Upon disassembly all three were found to have pistons frozen in place. Because of this, corrosion product build-up is believed to be the principal contributor to the problem.

The water in the RBCLCW system is demineralized. No chemical treatment is added. Given the quantity of carbon steel pipe and fittings in the system, the generation of iron oxide is expected. It is not known at this time whether the quantity of iron oxide is excessive. A corrosion evaluation of the plant closed loop cooling system is in progress. This is expected to provide additional information on this subject.

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3. Valve Type and Trim

Remote operated containment isolation valves for the RBCLCW system were not part of the original design configuration of the plant. The valves were installed as an upgrade modification in 1983 to provide remote containment isolation operation capability. To meet a commitment installation deadline, the selection of valves was necessarily limited to those available on a short lead time. It appears that the internal trim option in these valves was not optimal for this application and may be more appropriate to a flow control application than to a full open to full closed isolation application. This particular trim option appears to be inherently more susceptible to accumulation of corrosion products and to fouling than a full flow isolation valve would be.

4. Cycling

These valves are cycled only during plant shutdown because there is an inherent risk of recirculation pump trip, containment temperature and pressure transients, and a scram resulting from failure of the valves in a closed position. This infrequent cycling, together with the original packing system and valve trim, permits build-up of corrosion products and contributes to possible sticking in the packing gland and at the piston interface with the valve cage.

Analysis

These nine valves were not installed as part of the original plant design in 1975. In response to the NRC, they were installed as a modification in 1983 to meet 10 CFR 50 Appendix A General Design Criteria 54 and 57. The valves are not included in the current plant Technical Specifications. They are included in a proposed amendment to the specifications which was submitted to the NRC on May 31, 1989 as JPTS-84-005. They are listed in Table 7.3-1 of the updated Final Safety Analysis Report (FSAR). As such, they are part of the revised design basis of the plant.

The safety function of the valves is to provide a remote manual method to selectively close and isolate individual sections of the RBCLCW system to isolate identified contamination pathways from primary containment to the environment if they occur during postulated design basis accidents. These valves fail open. By procedure, these valves will be closed only if there is an indication of piping failure in the RBCLCW system or activation of ESW system coincident with increased drywell pressure. These valves do not receive isolation signals for automatic closure. Remote manual operation of the valves requires a licensed operator to obtain a key and rotate manual keylock switches on

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a back control panel. Further, these valves are accessible in the reactor building and may be closed manually by use of a handwheel. Therefore, neither the FSAR nor the proposed Technical Specifications specify a maximum closing time for these valves.

While the valves may have been inoperable by remote control, the valves were never inoperable by local manual handwheel. They could have always performed their safety function to be selectively closed.

Nevertheless, because of the number of valves of a common type in one system which exhibited common problems indicative of a potential to fail, this event is reported as a "condition that was outside the design basis of the plant" in accordance with 10 CFR 50.73(a)(2)(ii).

The potential loss of ability to remotely close these valves does not by itself result in adverse safety consequences. To properly assess the safety consequences it is first necessary to postulate a scenario in which the following events occur simultaneously:

- o Loss of coolant accident without the concept of leak before break (and therefore lack of pressure rise above RBCLCW pressure in containment) accepted in 52FR41288 of October 27, 1987.
- o High energy pipe break in spite of the augmented 100% in-service inspection of weld locations during each inspection interval.
- o Pipe whip at the location of, and with sufficient force to, produce a double ended severing of (or a missile which severs) RBCLCW pipe in spite of the AEC conclusions that ". . . the applicant has provided adequate measures to protect against the occurrence and consequences of missiles and pipe whip." in U.S. Atomic Energy Commission Safety Evaluation Report of November 1972, Section 5.2.2.
- o And then operators are unable to remotely or locally manually close the single individual isolation valve for the particular section of pipe which was severed. (The valve which fails to operate remotely must also coincidentally be the isolation valve for the particular section of pipe which was severed.)

To determine the significance, it is necessary to combine the mathematical probabilities of each of these four events occurring within one scenario. As stated in NYPA letter JAFP-89-0689 of September 21, 1989 to the NRC, "The leakage paths postulated . . . are highly improbable. . . and . . . this is an incredible scenario."

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Corrective Action

Immediate: All nine valves were disassembled. The pistons and cage trim were cleaned and polished. The accumulated black iron oxide sludge, magnetite, was removed from the internal valve body. The existing seven ring Grafoil packing was replaced with five ring live loaded packing on five valves. The packing had previously been replaced in 1988 on three other valves. The valves were tested for satisfactory performance prior to returning the system to service.

Long-term:

- Two valves will be disassembled and inspected during the next scheduled outage approximately six months from now (March 1990).
- The remaining valve will be repacked during the next scheduled refueling outage to ensure consistency between the valves.
- The RBCLCW system will be flushed during the next outage to attempt to remove some of the accumulated iron oxide.
- The plant engineering group will investigate the suitability of alternate styles of internal trim designed for the application assigned to these valves.
- Periodic cycling of the valves during operations was considered and rejected due to operational restraints.

The other corrective actions, in conjunction with required cycling during shutdown conditions, should ensure continued operability.

Additional Information

Failed Component Identification:

Valve Manufacturer: ITT Grinnell Valve-Hammel Dahl

Model Number: V500

Size: 1-1/2", 4", 6"

Pressure Rating: 1-1/2" - 600 psig
4" and 6" - 150 psigStroke: 6" - 2-1/4"
4" - 1-1/2"
1-1/2" - 1-1/8"Number of Valves: 1 - 6"
1 - 1-1/2"
7 - 4"

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LERs with common elements:

- 88-005 05/25/88 Emergency Service Water Check Valves Blocked by Sludge Accumulation
- 88-009 10/21/88 Unit Coolers and Check Valves for ECCS Equipment Fouled by Mud and Silt
- 86-003 03/12/86 Containment Isolation Valve Inoperable Due to Motor Operator Failure

Revision 1 corrects format and editorial discrepancies and revises the "Analysis" section and the description of the effect of corrosion product build-up on valve operability.