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SUBJECT: LER 90-002-00:on 900110,MSIV inoperability due to condensate accumulation on vent side of operating piston.
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February 9, 1990

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90-002-00

Sincerely,

A. A. Blind

A.A. Blind
Plant Manager

AAB:clw

Attachment

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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
D. C. Cook Plant - Unit 2	0 5 0 0 0 3 1 6	1 OF 1 0

TITLE (4) Main Steam Isolation Valve Inoperability - Due to Condensate Accumulation on Vent Side of Operating Piston

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 1	1 0	9 0	9 0	0 0 2	0 0	0 2	0 9	9 0	Cook Plant - Unit 1	0 5 0 0 0 3 1 5
										0 5 0 0 0

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)				
3	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)	
POWER LEVEL (10) 0 0 0	20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)	
	20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)	
	20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)		
	20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)		
	20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
J. B. Droste - Technical Engineering Superintendent	AREA CODE 6 1 6 4 6 5 - 5 9 0 1

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
B	S B	V T V	X 9 9 9	Y							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On January 8, 1990 with Unit 2 in Mode 3 (Hot Standby) surveillance testing of the Main Steam Isolation Valves (MSIV's) was conducted. Two MSIV's exhibited a closing time in excess of the Technical Specification 3.7.1.5 limit of five seconds. This condition is believed to have existed during power operation. Additional MSIV testing on January 9, and 10, 1990 confirmed that excessive condensation was collecting on the vent side of the MSIV operating piston. When the dump valves were opened to vent-off steam from the MSIV operating piston, the accumulated condensate would flash to steam and result in increased MSIV closure times. Following an effort to blow out the MSIV condensate drain tubes, a series of tests were performed at various time intervals to determine if the condensate problem had been resolved and verify MSIV operability. With the failure of 2-MRV-220 on January 11, 1990, at 0916 hours, it was evident that the condensate problem was still present. All MSIV's were declared inoperable and an Unusual Event was declared. A cooldown to Mode 5 (Cold Shutdown) was started.

Repair activities included disassembly of the MSIV's to enlarge the condensate drain tube port and the equalizing steam nipple. Additional insulation was placed on the MSIV's, vent piping and valves.

CONDITIONS PRIOR TO OCCURRENCE

Unit 2 in Mode 3 (Hot Standby).

DESCRIPTION OF EVENT

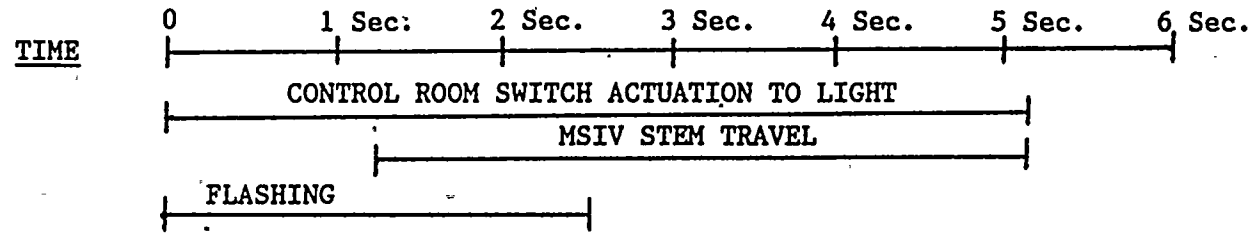
On January 8, 1990, surveillance testing of the Main Steam Isolation Valves (MSIV's) (EIIS/SB-ISV) was conducted. Two of the MSIV's exhibited a closing time in excess of the Technical Specification 3.7.1.5 limit of five seconds.

Following each MSIV failure, the MSIV was declared inoperable and immediately retested. In both cases the retest demonstrated the valve closed within the Technical Specification time limit and the MSIV was declared operable.

Additional tests were conducted on January 9, 1990. A substantial amount of water was observed to flash out of the dump valve (EIIS/SB-VTV) vent stacks during the first test of each MSIV. Three MSIV's exhibited a closing time in excess of the Technical Specification 3.7.1.5 limit of five seconds. Following each MSIV failure, the MSIV was declared inoperable and retested. In each case the retest demonstrated the valve closed within the Technical Specification time limit and the MSIV's were declared operable. (See attached test table).

The January 9, 1990 testing verified that enough condensation could accumulate on the vent side of the piston within a 24 hour period to render the valve inoperable. Unit 2 was held in Mode 3 to further diagnose the root cause of this issue.

On January 10, 1990, a series of diagnostic tests were performed to determine the extent that condensate within the MSIV operating cylinder volume could affect MSIV stroke time. A strip chart was used to record pressure within the volume as a function of time. Closure time was measured in the control room, measuring the time from the dump valve switch actuation until the MSIV valve light indicated the valve was closed. MSIV stem travel time was measured locally. The following time line is similar to each MSIV tested and represents typical circumstances experienced by all MSIV's.



Local observation verified substantial quantities of water and steam being discharged from the vent stack from T=0 until MSIV stem travel began.

Two of the MSIV's exhibited a closing time in excess of the Technical Specification 3.7.1.5 limit of five seconds. Following each MSIV failure, the MSIV was declared inoperable and retested. In each case the retest was an acceptable value and the MSIV was declared operable (see attached test table).

The Action Requirements of Technical Specification 3.7.1.5 were fulfilled at all times for Modes 2 and 3. When an MSIV failure occurred, an immediate retest demonstrated that the valve was operable. On January 10, 1990, it was realized that the failures which occurred on January 8, 1990, were believed to have existed during power operation. Notification to the NRC was made on January 10, 1990, reporting that we were outside the plants' design bases on January 8, 1990. At the time this notification was made, the MISV's were operable per Technical Specification Action Requirements for Modes 2 and 3 operation. The MSIV's were operable since the testing resulted in expelling the condensate from the vent side of the valve's operating piston. The MSIV's would remain operable as long as the valves were cycled frequently enough to prevent excessive amounts of condensate from collecting on top of the operating piston.

The MSIV testing confirmed that the slower main steam stop valve stroke times were symptoms of an unacceptable quantity of condensate accumulating in the upper valve volume. When a dump valve is opened the condensate flashes to steam this causes increased venting time due to delaying the development of sufficient Delta-P across the MSIV piston, to close the MSIV's. A logical hypothesis was formulated that condensate was not draining down into the lower volume through the drain tube (see attached drawings) fast enough to prevent accumulation in the upper volume. Acting under the premise that this flow path was in some way restricted, possibly due to mineral deposits plating out on the inside diameter of the drain tube, it was decided to attempt to blow-out this drain tube.

A process was devised to remove (blow-out) any possible restrictions located within each MSIV drain tubes. This was accomplished by maintaining the MSIV in its closed position and for approximately one hour with the dump valves open. In doing so, main steam was capable of forcing its way past the parallel closure disc, through the drain tube into the upper volume, and exhausted out the vent stack. It was hoped that this exhausted steam would be of sufficient velocity to carry away any restrictive material.

Additional testing was performed to determine if the maintenance action was successful and ensure MSIV operability. This series of tests had staggered test intervals to ensure MSIV operability was maintained. On January 11, 1990, at 0916 hours, 2-MRV-220 exceeded the allowed closing time. An Unusual Event was declared as all four (4) MSIV's were declared inoperable causing a Technical Specification 3.0.3 shutdown. This was classified as a One-Hour Reportable Event and NRC notification was made at 0930 hours. A cooldown to Mode 5 (Cold Shutdown) was commenced.

CAUSE OF EVENT

Investigation revealed that the failure of the MSIV's was caused by excessive condensate accumulation on the vent side of the MSIV operating piston. The excessive condensate accumulation was a result of the following contributing factors:

1. Insulation Less than Current Design

   Insulation on MSIV, the vent piping and associated valves was less than current design specifications. The insufficient insulation resulted in increased condensation rates in the MSIV.

2. Dump Valve Seat Leakage

   The quantity of condensate that can collect is related to the mass of saturated steam permitted to enter the upper equalizing steam volume. When steam is allowed to escape this volume, it will be replaced by additional saturated steam which increases the Delta-P and prevents drainage.

3. MSIV Actuator Design

   The combined effects of one and two above resulted in increased condensation rates, developing greater Delta-P across the operating piston than assumed by design during normal operation (MSIV's in steady-state open position). The rate at which condensate can flow down from the upper volume through the drain tube is limited by the diameter of the drain tube port holes. Condensate will accumulate within the upper equalizing volume if it cannot be drained faster than it forms. If the steam nipple is insufficiently sized, a Delta-P will exist across the piston restricting condensate drainage.

ANALYSIS OF EVENT

In addition to Technical Specification 3.7.1.5, slow MSIV closure times affect Technical Specification items 3.3.2.1, Table 3.3-5, 5.h (High Steam Line Flow - Low Low Tavg), 6.h (Steam Line Pressure Low), and 7.c (Containment Pressure-High High). These items use the valve closure time as part of their overall time response requirement. Examination of surveillance data for these items show that item 7.c, steam line isolation on high-high containment pressure in seven seconds, would not be met. This was reported to the NRC on January 10, 1990, under the provisions of 10 CFR 50.72.b.1.ii.B as a condition that was outside of the plant's design basis.

The investigation of this problem has identified that the slower closure times were caused by water accumulation on the top of the steam piston. With water present, the piston movement is slowed as the water flashes to steam during the venting process. The water accumulation occurs over time and is also affected by the leakage past the MSIV dump valves. Once the water is removed from the top of the piston, as would occur during a valve test, a retest conducted immediately thereafter would indicate normal valve actuation times.

As water would accumulate during operation, there is evidence that the condition may have existed prior to the surveillance. Thus, it is probable that Technical Specification 4.7.1.5.1 was not met.

Westinghouse has evaluated the consequences of increasing all applicable Technical Specification response times by three seconds, and they have concluded that the FSAR acceptance criteria are met using the longer response times. The mass and energy releases for an outside of containment steam line break were compared with the current FSAR values, and the environmental qualification of the equipment in the affected locations has not been compromised. Thus, there has been no significant degradation of plant safety as a result of the increased MSIV closure times.

Since Unit 1 has the same type of valve, an evaluation was also performed concerning the impact on Unit 1. The evaluation concluded that the MSIV's on Unit 1 are considered to be operable and fully supportive of the Chapter 14 accident analyses. At the last surveillances, all Technical Specifications applicable to steam line isolation were met, and the historical data indicate no pattern of closure time deterioration. Further, the recent Westinghouse analysis shows that sufficient margin exists with MSIV closure time such that plant safety is not compromised if the system response time is increased by three seconds. Thus, the recent events associated with the Unit 2 MSIV's do not cause undue concern with respect to the continued safe operation of

Unit 1. This conclusion is also based on the belief that the present performance of the Unit 1 MSIV's do not result in the probability or consequences of an accident being increased, any new type of accident being created, and any Technical Specification margin of safety being reduced.

CORRECTIVE ACTIONS

Upon reaching Mode 5, all four MSIV's were disassembled and a visual examination performed. These examinations revealed that the drain tubes had not experienced any physical degradation that could have restricted the condensate flow path. All dimensions were verified. Electric ITE de France (EDF) was contacted concerning their approach at resolving similar circumstances. EDF provided their investigation findings and valve design modifications. We implemented the EDF recommendations.

After all available sources of information were technically evaluated, it was determined that all Unit 2 MSIV's would be modified via Minor Modification 2-MM-079. Under this modification the diameter of drain tube port holes would be increased from 1/8" (0.125") to 5mm (0.197") and the diameter of the equalizing steam nipple would be increased from 1/8" (0.125") to 10mm (0.394"). Two performance related functions would be improved in this manner.

1. Increasing the size of the drain tube port holes provides a larger area to improve condensate flow through the actuator piston.

2. Increasing the size of the equalizing steam nipple will provide a less restrictive path for steam to pass up through the piston to maintain equilibrium and prevent steam from passing through the drain tube and inhibit drainage.

It was also discovered at this time that the insulation on the MSIV, vent piping and associated valves was less than the current design specification requirements. This contributed to a larger variance in temperature (Delta-T) resulting in more heat transfer and increasing the condensation rate.

After completing all modifications and reassembling the MSIV's, Special Procedure 2-THP.SP.MM-079 was used to verify operability. This procedure included a series of test cycles for all MSIV's at different intervals with the appropriate instrumentation required to measure and record all applicable performance variables, specifically the rate of pressure drop in the vent line.

The acceptance criteria used within 2-THP.SP.MM-079 was twofold. First, each full closure stroke time must be within 5 seconds in accordance with Technical Specification 3.7.1.5. Second, the rate of pressure drop in the vent line must not change as the test interval is extended to 24 hours. This second criteria was used to verify no additional condensate had accumulated within the upper steam volume that could lengthen stroke time and delay stem travel upon flashing to steam during the venting process.

All stroke tests performed in accordance with 2-THP.SP.MM-079, except the first test on MRV-210, provided acceptable results and verified the generic condensate issue had been resolved. The initial test performed on MRV-210 failed. The corresponding rate of pressure drop in the vent line signature verified significant quantities of condensate still present. Investigation revealed that Train B Dump Valve MRV-212 was not seating properly permitting a significant amount of steam to be exhausted out the vent stack. Under these circumstances, additional steam was brought into the upper volume with condensate collecting at a rate faster than could be drained. MRV-212 was repaired and subsequent closure tests completed on MRV-210 verified that this isolated incident had been resolved. All MSIV's were returned to an operable status and Unit 2 returned to power operation.

As stated in the analysis, we do not expect to encounter similar difficulties with the Unit 1 MSIV's. However, we are currently adding insulation to the Unit 1 MSIV's, vent lines and valves to enhance the MSIV operating conditions.

FAILED COMPONENT IDENTIFICATION

Component ID: Main Steam Isolation Valves
2-MRV-210, 2-MRV-220, 2-MRV-240

Manufacturer: Hopkinsons - Ferranti

Model: 2379 W

PREVIOUS SIMILAR EVENTS

050-316/83-57

MAIN STEAM ISOLATION VALVE TEST TABLE

January 8, 1990 Testing

VALVE	INITIAL CLOSING TIME (SEC)	RETEST (SEC)
2-MRV-210	5.94	3.01
2-MRV-240	5.18	1.95

January 9, 1990 Testing

2-MRV-210	5.07	2.83
2-MRV-220	5.60	2.28
2-MRV-240	5.05	2.21

January 10, 1990 Testing

2-MRV-210	5.78	3.08
2-MRV-220	5.73	2.55

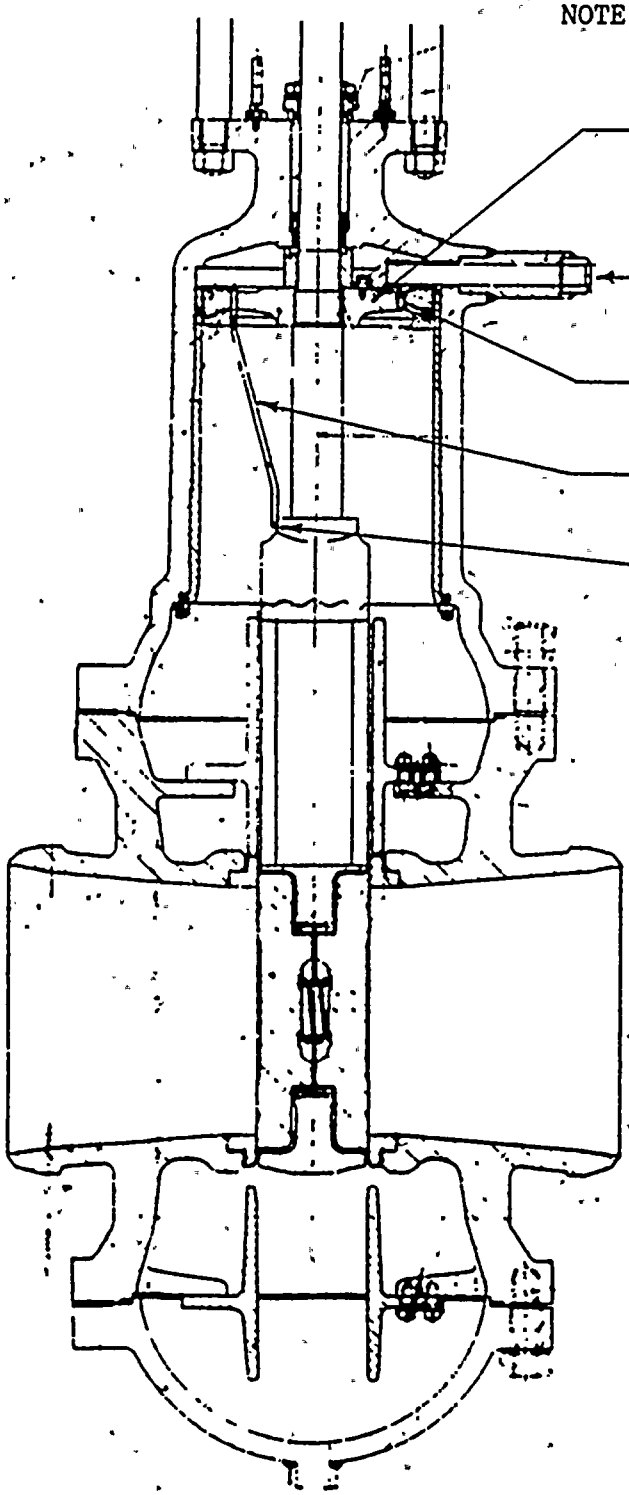
January 11, 1990 Testing

2-MRV-220	5.26	No Retest Performed

NOTE: During the test program 2-MRV-230 closing times were high, but did not exceed the Technical Specification Limit of five Seconds.

MAIN STEAM ISOLATION VALVE

NOTE: VALVE SHOWN IN CLOSED POSITION



VALVE MODIFICATIONS

CONDENSATE DRAIN PORT

INITIALLY - 0.125"

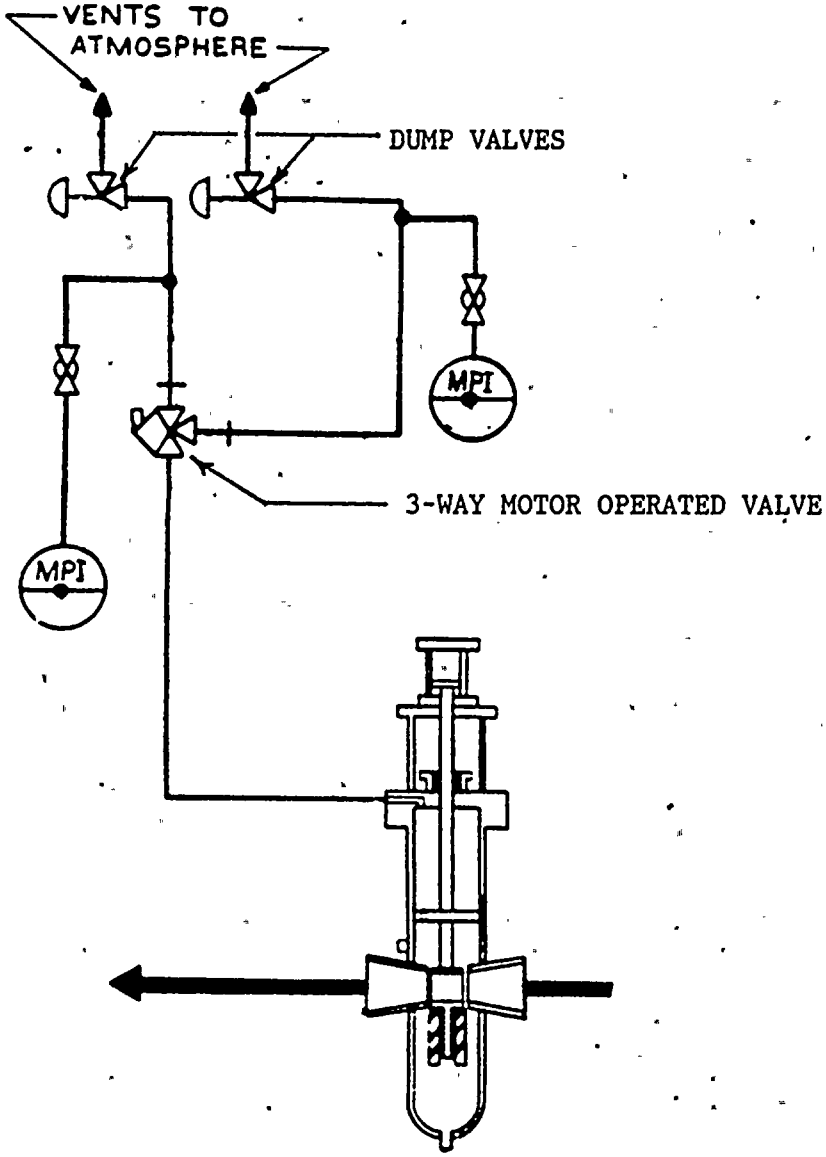
MODIFIED TO -0.197" (5MM)

STEAM NIPPLE

INITIALLY - 0.125"

MODIFIED TO 0.394" (10MM)

MAIN STEAM ISOLATION VALVE VENT PIPING



MSIV