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October 3, 1995
C311-95-2389

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

Dear Sir:

Subject: Three Mile Island Nuclear Station Unit I, (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
LER 95-002-00

This letter transmits Licensee Event Report (LER) No. 95-002-00 concerning an event on September 8, 1995 when during pre-11R outage testing conducted concurrent with plant shutdown, control rod insertion times for seven control rods exceeded the 1.66 second limit specified in Technical Specification 4.7.1.1.

This LER is being submitted pursuant to 10 CFR 50.73. NRC Form 366 contains an abstract which provides a brief description of the event. For a complete understanding of the event, refer to the text of the report provided on Form 366A.

Sincerely,

J. Knubel

Vice President & Director, TMI

WGH

Attachment
cc: Administrator, Region I
TMI Senior Resident Inspector
TMI-1 Senior Project Manager
File 94105

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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
THREE MILE ISLAND, UNIT 1	05000-289	1 OF 5

TITLE (4)

CONTROL ROD TRIP INSERTION TIMES EXCEED TS SECTION 4.7.1.1 LIMITS

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 NAME	DOCKET NUMBER
										05000
09	08	95	95	-- 002 --	00	10	03	95	FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
		20.2201(b)	20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
POWER LEVEL (10)	0%	20.2203(a)(1)	20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iv)	50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
W. G. HEYSEK, TMI LICENSING ENGINEER	717-948-8191

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
AC	AB	AA	D150	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 15 single-spaced typewritten lines) (16)

On September 8, 1995 during pre 11R testing conducted concurrent with plant shutdown, control rod trip insertion times were obtained in accordance with Surveillance Procedure 1303-11.1. Seven control rods [AB/AA]* exceeded the trip insertion time limit of 1.66 seconds from fully withdrawn to 3/4 insertion as specified in the TMI-1 Technical Specifications. The reactor was placed in cold shutdown for the 11R outage and 27 CRDMs and their thermal barriers were removed. Inspection showed crud deposition in the area of the thermal barrier ball check valves that restricted movement of the balls and in the lead screw guide bushing. These results further confirm the deposits as the cause of the slow rod insertion times.

The 27 thermal barriers were replaced with new open flow path thermal barriers. These barriers are dimensionally similar to those used to replace the four barriers in June 1994; in that they have larger clearances in the region of the ball check valves, however the open flow path barriers are different in that one of the four check valve balls was eliminated. The trip insertion times for all rods will be verified to be restored to less than 1.66 seconds prior to startup.

The event is being reported per 10 CFR 50.73(a)(2)(i)(b).

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
THREE MILE ISLAND, UNIT 1	05000-289	95	-- 002 --	00	2 OF 5

TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

I. PLANT OPERATING CONDITIONS BEFORE THE EVENT

The plant was at hot shutdown at the time of the event.

II. STATUS OF STRUCTURES, COMPONENTS OR SYSTEMS THAT WERE INOPERABLE AT THE START OF THE EVENT AND THAT CONTRIBUTED TO THE EVENT.

No systems, structures or components were out-of-service that contributed to this event.

III. EVENT DESCRIPTION

On September 8, 1995 during plant shutdown for the 11R outage, control rod trip insertion time testing found that seven control rods exceeded the Technical Specification (TS) 4.7.1.1 trip time of 1.66 seconds from fully withdrawn to 3/4 insertion. The out of specification control rod core locations and respective trip times in seconds were B-10, 1.83; O-5, 1.79; M-13, 2.16; O-7, 2.25; G-11, 2.05; H-8, 2.16; and E-5, 1.74. Cooldown for Refueling Outage 11R continued, and the trip insertion time data was utilized to make the final selection of CRDMs for thermal barrier replacement during the outage.

The event was discovered during pre 11R testing described in the Control Rod Drive Long Range Plan, letter C311-94-2125 dated September 29, 1994.

The cause for trip insertion times exceeding the TS limit is accumulation of corrosion deposits in the CRDM thermal barrier ball check valves and the lead screw guide bushing. The corrosion deposits tend to block the four check valves in the thermal barrier and reduce the clearance in the lead screw guide bushing. The blocked check valves and reduced clearance hydraulically slows the descent of the control rod and leadscrew. Deposits have caused increased trip insertion times on other B&W reactors with Type A CRDMs.

Of the seven rods which exceeded the 1.66 second trip insertion time TS limit during the September 1995 test, four of the rods also exceeded the limit on March 17, 1994. They were within the limit during the June 1, 1994 test. The remaining three CRDMs at core locations G-11, H-8 and E-5 had not previously exceeded the TS limit but had increased trip insertion times in March and the June 1994 test.

Four thermal barriers were replaced in June 1994 because of increased trip insertion times. During the September 1995 test, the four rods with the new thermal barriers had trip insertion times of 1.35 seconds or less. Time differences between the test in "new condition" on June 9, 1994 and the September 8, 1995 test are within normal variability for testing and do not show degradation.

The remaining rods generally show some increase in trip insertion times from the June 1, 1994 test to the September 1995 test. This indicates some continued degradation.

IV. COMPONENT FAILURE DATA

Shim Control Rod Drive Mechanism, Royal Industries model 120J255

V. AUTOMATIC OR MANUAL INITIATED SAFETY SYSTEM RESPONSES

There were no safety system actuations associated with this event.

VI. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THE EVENT

The safety consequences for the event are minimal since the acceptance criteria for all accidents are met with the as-found trip insertion times. An analysis performed for Cycle 11 (Evaluation of Safety Consequences for a Three Second Control Rod Trip Insertion Time for Cycle 11, Safety Evaluation #115403-010 Rev. 0) assumed all rods would have trip insertion times of 3.0 seconds. The analysis found that the acceptance criteria are met for all Final Safety Analysis Report Chapter 14 accidents. Procedures administratively control the overpower trip setpoint to a reduced value during startup and shutdown for added conservatism.

VII. PREVIOUS EVENTS OF A SIMILAR NATURE

LER 94-002, March 1994, Control Rod Drop Times Exceed TS Section 4.7.1.1 Limits and LER 94-004, June 1, 1994, Control Rod Drop Times

VIII. CORRECTIVE ACTIONS

Analyses have found that the differential pressure available for opening the check valve during a trip is a few inches of water. The small clearance in combination with the low opening force make the check valve subject to sticking. As a result, an open flow path thermal barrier was developed which is less susceptible to the condition. These thermal barriers have an open passage in lieu of one of the four ball check valves. They have been installed on a total of 27 CRDMs: 20 as a preventive measure.

The seven CRDMs with trip insertion times exceeding 1.66 seconds during this event have had their thermal barriers replaced with the open flow path thermal barrier design during the 11R outage. Seventeen others were selected on the basis of increased trip insertion times and three were replaced when the CRDM was removed to replace flange gaskets due to indication of flange leakage.

As stated in the Long Range Plan, 12 thermal barriers were scheduled for replacement during 11R with a contingency plan of replacing up to 24 thermal barriers. Six of the seven rods that failed the trip insertion test were among the group originally selected for thermal barrier replacement. The seventh (E-5) had a trip time of 1.49 seconds in March 1994 and 1.42 seconds in June 1994.

Based on the September 1995 test results and previous data, it was decided to increase the 11R outage thermal barrier replacement scope by 12 barriers. A total of 27 were

replaced: 12 in the original scope, 12 because of the increase in scope and 3 during replacement of CRDM gaskets.

Trip insertion testing following 11R will verify acceptable trip insertion times for all control rods prior to startup. The results of the test will be provided to the NRC Resident Inspector.

Actions described in the Long range plan have been implemented as follows:

1. The cycle design uses a lower beginning of cycle boron concentration and a revised lithium limit of 3 ppm that will enable maintaining a hot pH in the RCS of $\geq$ 6.9 from the beginning of the fuel cycle. The expectation is that this will help reduce the corrosion products available for deposition.

2. Plant operating procedures during RCS fill have been revised to raise the lithium concentration of the reactor coolant prior to fill of the CRDM housings (adding lithium prior to fill will improve chemistry conditions in the CRDM housing since the exchange of coolant between the CRDM and bulk RCS is limited).

3. The increased distance of travel during Control Rod exercise remains in effect to minimize deposit buildup in the gap between the lead screw and the thermal barrier bushing. Control Rod exercise will continue to be performed every two weeks.

Trip insertion times collected by the plant process computer will be evaluated if a trip occurs during Cycle 11. If any rod is found to exceed the trip insertion time limit, the NRC Resident will be promptly notified and, if required (more than one rod exceeds the limit) a 10 CFR 50.73 report will be made.

The deposition of corrosion products is not limited to those control rods that have experienced trip insertion times in excess of the TS limit. However, none of the remaining 30 rods have ever failed the trip insertion time limit. Replacement of an additional 16 thermal barriers on CRDMs that have not previously exceeded TS limits reduces the likelihood of future occurrence. If ball check valve blockage occurs in some of the remaining CRDMs, the practice of increased travel during rod exercising is expected to maintain the trip insertion times within 3.0 seconds. No trip insertion time in excess of 3.0 seconds has been experienced due to the corrosion deposits. Procedures are in effect to continue the practice of requiring increased travel during rod exercise. A conservative analysis, (Evaluation of Safety Consequences for a Three Second Control Rod Trip Insertion Time for Cycle 11, Safety Evaluation #115403-010 Rev. 0), was performed that determined that trip insertion times up to 3.0 seconds for all 61 rods could be accommodated without exceeding accident acceptance criteria for Cycle 11.

After 11R, thirty trippable CRDMs will still have original design thermal barriers. Eight of these thirty CRDMs have always been Group 7 rods, which have not shown deterioration based on trip insertion time performance and do not demonstrate the crud deposition based on 10R disassembly/inspection and the 11R leadscrew inspections.

TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Although all have significant margin to the TS limit, many have slight degradation in trip insertion times. Future planning will address installation of open flow path thermal barriers (or other suitable corrective action) on all non-Group 7 CRDMs by 13R. Trip insertion time testing of CRDMs at or near the end of Cycle 11 will determine the 12R maintenance scope. This schedule is consistent with Long Range Plan commitments.

* The Energy Industry Identification System (EIIS), System Identification (SI) and Component Function Identification (CFI) Codes are included in brackets, "[SI/CFI]", where applicable, as required by 10 CFR 50.73(b)(2)(ii)(F).