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An Exelon/British Energy Company

December 18, 2003
5928-03-20247

10 CFR 50.73

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

THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)
OPERATING LICENSE NO. DPR-50
DOCKET NO. 50-289

SUBJECT: LICENSEE EVENT REPORT (LER) NO. 2003-003-00
"REACTOR COOLANT SYSTEM PRESSURE BOUNDARY LEAKAGE DUE TO DEGRADATION OF AN ALLOY 600 PRESSURIZER HEATER BUNDLE DIAPHRAGM PLATE"

Attached please find Licensee Event Report (LER) 50-289/2003-003-00. This LER reports the discovery and corrective actions taken as a result of Reactor Coolant System pressure boundary leakage due to degradation of an Alloy 600 Pressurizer Heater Bundle Diaphragm Plate. For a complete description of the evaluated condition, refer to the text of the report provided on Forms 366 and 366A.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(i)(B) and 10 CFR 50.73(a)(2)(ii)(A). For this event, the overall safety significance was minimal and there was no impact on the health and safety of the public. For additional information regarding this LER contact Adam Miller of TMI Unit 1 Regulatory Assurance at (717) 948-8128.

Sincerely,

George Gellrich

George H. Gellrich
Plant Manager

GHG/awm

ATTACHMENT: List of Regulatory Commitments

cc: TMI Senior Resident Inspector
Administrator, Region I
TMI-1 Senior Project Manager
File No. 03068

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SUMMARY OF AMERGEN ENERGY CO. L.L.C. COMMITMENTS

The following table identifies commitments made in this document by AmerGen Energy Co. L.L.C. (AmerGen). Any other actions discussed in the submittal represent intended or planned actions by AmerGen. They are described to the NRC for the NRC's information and are not regulatory commitments.

COMMITMENT	COMMITTED DATE OR "OUTAGE"
No regulatory commitments are being made in this submittal.	

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION

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	05000289	1 OF 4

TITLE (4)

REACTOR COOLANT SYSTEM PRESSURE BOUNDARY LEAKAGE DUE TO DEGRADATION OF AN ALLOY 600 PRESSURIZER HEATER BUNDLE DIAPHRAGM PLATE

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
11	04	2003	2003	- 003 -	00	12	18	2003	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N
POWER LEVEL (10)	000

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)
	20.2203(a)(1)		20.2203(a)(3)(i)	X	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)
Adam W.Miller of TMI-1 Regulatory Assurance	(717) 948-8128

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	AB	HTR	B015	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 November 4, 2003, at approximately 10 AM, during the TMI Unit One 15th (T1R15) refueling outage, an inspection of the Pressurizer Heater Bundle (PHB) was completed. This inspection identified a primary system leak at the lower Pressurizer Heater Bundle Diaphragm Plate. Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.1.6.4 does not allow any leakage through a nonisolable RCS strength boundary. Therefore, the discovery of leakage from the PHB Diaphragm Plate was considered a degradation of a principal safety barrier. Three Mile Island Unit One was already in Refueling Shutdown and the conditions of the LCO were already satisfied. The identified condition existed during plant operation and is being reported under 10CFR50.73(a)(2)(i)(B), and 10CFR50.73(a)(2)(ii)(A). This condition does not represent a reduction in the public health and safety. The cause of the leakage was attributed to primary water stress corrosion cracking (PWSCC) of the Alloy 600 PHB Diaphragm Plate. Subsequent VT-2 examinations of the two other pressurizer heater bundles revealed no indication of leakage.

The lower Pressurizer Heater Bundle Assembly including the PHB Cover Plate was replaced with a new heater bundle assembly. This new PHB Diaphragm Plate is constructed of Type 304 austenitic stainless steel. The new PHB Diaphragm Plate was seal welded to the pressurizer using Alloy 52 weld material.

A previous PWSCC condition was reported in LER 50-289/2001-002-00.

1. REPORTING REQUIREMENT (S):

This LER is being submitted pursuant to 10CFR50.73(a)(2)(i)(B), and 10CFR50.73(a)(2)(ii)(A).

On November 4, 2003, at approximately 10AM, during the TMI Unit One 15th (T1R15) refueling outage, an inspection of the Pressurizer Heater Bundle (PHB) *[AB/PZR HTR] was completed. This inspection identified a primary system leak at the lower Pressurizer Heater Bundle Diaphragm Plate. Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.1.6.4 does not allow any leakage through a nonisolable RCS strength boundary. Therefore, the discovery of leakage from the PHB Diaphragm Plate was considered a degradation of a principal safety barrier. Three Mile Island Unit One was already in Refueling Shutdown and the conditions of the LCO were already satisfied.

The initial indication of a potential Reactor Coolant System (RCS) leak was boric acid residue located between the PHB Diaphragm Plate and the PHB Cover Plate. Following disassembly of the PHB Cover Plate and performance of NDE, it was determined that the leak pathway was through the edge of the PHB Diaphragm Plate.

On November 4, 2003 at 15:50 EST, TMI Unit One made prompt notification of the event to the Nuclear Regulatory Commission (NRC) via the emergency notification system (EN# 40296).

2. DESCRIPTION OF STRUCTURE (S), SYSTEM (S) AND COMPONENT (S):

The pressurizer heaters are used to control the pressure of the RCS. There are three heater bundles. Each heater bundle has 39 heater elements. The heaters are attached by welding to the PHB Diaphragm Plate. The two-inch thick PHB Diaphragm Plate was manufactured from Alloy 600, and was designed to be inserted into the pressurizer opening. The pressurizer opening is a stainless steel 308L clad surface over the ASME SA 508 Class 1 base metal forging. Once inserted into the pressurizer opening, the PHB Diaphragm Plate projects 0.25 inches above the pressurizer shell surface. The PHB Diaphragm Plate was attached to the pressurizer shell with an alloy 82 weld. The PHB Cover Plate (SA 533 Grade B) is installed over the PHB Diaphragm Plate and is connected to the pressurizer with sixteen 2-inch studs (SA 320 L 43). The PHB Cover Plate had a seating diameter of 20.50 inches, which rests on the 20.73-inch diameter diaphragm plate. The PHB Cover Plate and studs are designed to take the full pressure loads; and the weld of the PHB Diaphragm Plate to the pressurizer is designed as a seal weld.

3. INITIAL PLANT CONDITIONS:

On November 4, 2003, TMI Unit 1 was in Refueling Shutdown (T1R15). There were no structures, systems, or components that were inoperable at the time of discovery that contributed to this condition.

4. EVENT DESCRIPTION:

During the TMI Unit One T1R15 Refueling Outage, boric acid residue was found at the lower pressurizer heater bundle. After removal of the insulation and PHB Cover Plate, boric acid residue was removed to allow for a detailed inspection of the area. The inspection was performed using both Visual (VT-2) and Dye Penetrant (PT) techniques.

The inspection found six indications. Three were located at approximately the "8 o'clock position" and the other three at the "2 o'clock position." Four of the indications were surface indications not associated with a

throughwall leak. Progressive grinding and PT inspection identified two throughwall cracks, indicating a leak path through the PHB Diaphragm Plate.

All 360 degrees of the PHB Diaphragm Plate seal weld area were inspected with no other findings. The individual heater bundle area was observed during PHB Cover Plate removal and no evidence of leakage was found. The two other pressurizer heater bundles were visually inspected without removal of the PHB Cover Plate with no boric acid deposits found.

There were no significant operational issues noted over the last operating cycle associated with the pressurizer heaters.

This event was reported as a non-emergency [8-hour] in accordance with 10 CFR 50.72(b)(3)(ii)(A).

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The pressurizer is an integral part of the RCS pressure boundary. The pressurizer serves the following functions: (a) establishes and maintains RCS pressure; (b) provides a surge volume for limiting pressure excursions; and, (c) provides a water reserve to accommodate reactor coolant temperature/density changes during operation. The primary safety function provided by the pressurizer is to maintain RCS pressure boundary integrity.

The cracking of the Alloy 600 PHB Diaphragm Plate at Three Mile Island Unit One has been attributed to primary water stress corrosion cracking (PWSCC). It was not considered an immediate significant threat to the structural integrity of the RCS boundary or pressurizer due to the low leakage rate and slow crack growth. Industry experience with PWSCC of Alloy 600 components, and pressurizer heater bundle leakage, has shown that leakage rates are low and crack growth rates are relatively slow.

There were no releases from the plant due to the subject leak. The leakage from the heater bundle had no impact on the health and safety of the public.

There were no failures that rendered a train of a safety system inoperable and no failures of components with multiple functions were involved.

The condition would not have prevented the fulfillment of the safety function, and the condition did not result in a safety system functional failure as defined by 10CFR50.73(a)(2)(v).

6. CAUSE OF THE EVENT:

An investigation of this event was conducted in accordance with the TMI Unit 1 Condition Reporting program. PWSCC was determined to be the most likely cause of the PHB Diaphragm Plate leakage, resulting in cracking of the Alloy 600 material. PWSCC is a degradation mechanism that requires three conditions for initiation, all of which were present at the heater bundle: (1) a susceptible material, (2) a high residual state of stress, and (3) an aggressive environment. The PHB Diaphragm Plate was manufactured from Alloy 600, an alloy that is known to be susceptible to PWSCC. PWSCC-induced failures in industry have occurred in a number of Alloy 600 components, including pressurizer heaters, pressurizer nozzles, and steam generator tubes. Welding induces high residual stresses, and the diaphragm plate-to-pressurizer seal weld is a location where these residual stresses were present. The environment within the pressurizer is sufficiently aggressive to induce PWSCC: the pressurizer normally operates at a temperature of approximately 650 degrees Fahrenheit, which is above the

temperature threshold where PWSCC may initiate.

As described above, industry data demonstrates that PWSCC cracks typically become evident through small leaks prior to significant degradation of the pressure boundary.

7. CORRECTIVE ACTIONS:

The defects in the PHB Diaphragm Plate were at two locations. The seal weld metal and PHB Diaphragm Plate were progressively ground and PT examined until no further evidence of cracking was found. An initial weld repair consisted of redepositing a seal weld over the areas of the PHB Diaphragm Plate that were removed by the aforementioned grinding. On November 23, 2003 during post maintenance testing (PMT) of the repaired seal weld at normal operating pressure and temperature, leakage was observed from the repaired seal weld area. The plant was returned to Cold Shutdown conditions to perform additional repair(s).

Subsequently, the lower Pressurizer Heater Bundle Assembly including the PHB Cover Plate was replaced with a new heater bundle assembly. This new PHB Diaphragm Plate is constructed of Type 304 austenitic stainless steel, which is resistant to PWSCC. The new PHB Diaphragm Plate was seal welded to the pressurizer using Alloy 52 weld material which is known to be highly resistant to PWSCC.

Successful post maintenance testing of the new PHB Assembly at normal operating pressure and temperature has demonstrated the acceptability of the installation.

8. PREVIOUS SIMILAR EVENTS:

A similar previous condition was reported in LER 50-289/2001-002-00 where the Reactor Vessel Upper Head Nozzle Penetrations were found to have evidence of leakage (boric acid residue). Similarly, these conditions were attributed to PWSCC and the nozzles were repaired using more corrosion resistant materials. The Reactor Vessel Upper Head was replaced this past outage, T1R15, using PWSCC resistant materials.

* 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).