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10CFR50.73

September 19, 1995
Docket No. 50-353
License No. NPF-85

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

SUBJECT: Licensee Event Report
Limerick Generating Station - Unit 2

This LER reports a Unit 2 reactor SCRAM, an automatic Reactor Protection System actuation, resulting from a high reactor vessel pressure signal. The cause of this event was a malfunctioning relay associated with the main turbine Electrohydraulic Control system.

Reference:	Docket No. 50-353
Report Number:	2-95-010
Revision Number:	00
Event Date:	August 20, 1995
Report Date:	September 19, 1995
Facility:	Limerick Generating Station P.O. Box 2300, Sanatoga, PA 19464-2300

This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv).

Very truly yours,

Robert W. Boyce

DMS:cah

cc: T. T. Martin, Administrator Region I, USNRC
N. S. Perry, USNRC Senior Resident Inspector, LGS

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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)
Limerick Generating Station, Unit 2	05000 353	1 OF 5

TITLE (4) Reactor SCRAM resulting from a High Reactor Vessel Pressure Signal Caused by a Malfunctioning Relay Associated with the Electrohydraulic Control System.

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
08	20	95	95	-- 010 --	0	09	19	95	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)	100		20.402(b)		20.405(c)	X	50.73(a)(2)(iv)		73.71(b)
			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
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
			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 (Include Area Code)
J. L. Kantner - Manager, Experience Assessment, LGS	(610) 718-3400

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

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 08/20/95, an automatic Unit 2 reactor SCRAM occurred, a Reactor Protection System actuation, from a high reactor vessel pressure signal resulting from main turbine control valve closures. Subsequent to the reactor SCRAM the main turbine tripped on high reactor pressure vessel (RPV) water level. Following the main turbine trip, the rapid pressure change from the turbine stop valve closure resulted in a pressure wave traveling through the RPV causing a "ringing" in the wide range RPV water level instrumentation. This caused various Engineered Safety Feature actuations to occur. The RPS functioned as designed by automatically shutting down the reactor on high RPV pressure. The RPV water level 'ringing' and the resultant instrumentation spike were consistent with the results of previous events. The cause of the turbine valve oscillations was concluded to be high impedance across the normally closed (NC) contacts of relay KT106 (Agastat TDPU, Model 2112-D-H116YE), causing an energized relay coil downstream of the KT106 relay to drop out momentarily. The KT106 relay boards for the Units 1 and 2 Electrohydraulic Control systems were replaced, modifications were made to wire the spare sets of NC contacts in parallel with the original contacts, and preventative maintenance for the KT106 relay boards will be evaluated.

Unit Conditions Prior to the Event:

Unit 2 was in Operational Condition (OPCON) 1 (Power Operation) at 100% power level. There were no systems, components, or structures out of service which contributed to this event.

Description of the Event:

On August 20, 1995, an automatic Unit 2 reactor SCRAM occurred, a Reactor Protection System (RPS, EIIS:JC) actuation, from a high reactor vessel pressure signal. Subsequent to the reactor SCRAM the main turbine (EIIS:TRB) tripped on high reactor pressure vessel (RPV, EIIS:RPV) water level at +54 inches instrument level. A description of this event is as follows:

On August 20, 1995, at approximately 1520 hours, the Unit 2 main turbine bypass valves started to open and slowly oscillate. Investigation by Operations personnel revealed that the turbine control valves (TCV) had closed slightly and the bypass valves had opened as required to maintain RPV pressure. Suspecting that the valve motion may be related to changes in reactor power, Operations personnel entered Operational Transient (OT) Procedure OT-104 "Unexplained Reactivity Insertion," and began to reduce power. As power was reduced, the TCV positions stabilized with all bypass valves closed. With plant conditions stable at 50% power, operations personnel continued assessing the plant conditions and possible causes for the valve movements. At 1602:20 hours, TCV demand decreased to zero (i.e., the TCVs were signaled to go full closed) and all nine (9) bypass valves fully opened. As Operations personnel took actions to manually SCRAM the reactor, an automatic SCRAM on high RPV pressure occurred at 1602:26 hours. At 1602:32 hours, six seconds following the reactor SCRAM, the TCVs reopened and the bypass valves closed to 50% capacity, thereby decreasing RPV pressure. The resultant RPV water level swell caused a main turbine trip on high RPV water level (i.e., +54 inches level). Following the main turbine trip and subsequent closure of the turbine stop valves and TCVs, RPV pressure increased. The rapid pressure change from the turbine stop valve closure resulted in a pressure wave traveling through the vessel causing a "ringing" in the wide range RPV water level instrumentation. This resulted in Engineered Safety Feature (ESF) actuations due to a sensed RPV water level of less than -129 inches on the Wide Range Level B channel instruments. The following systems received

initiation signals, however, no system injections occurred due to the short duration of the signals.

- 'A' and 'C' Residual Heat Removal (RHR) subsystems
- 'A' and 'C' Core Spray (CS) subsystems
- Reactor Core Isolation Cooling (RCIC) system
- Electrical load sheds on the Division I and III Safeguard Busses

Actual RPV level reached a minimum of -5 inches during the transient.

Throughout the event the bypass valves functioned properly in response to changes in RPV pressure. Following the main turbine trip, RPV pressure was stabilized and controlled by the bypass valves. Operations personnel stabilized and controlled RPV water level by restarting a reactor feedwater pump.

With the RPV power, pressure and water level stabilized, operations personnel reset the initiation and isolation signals and secured the RHR, CS and RCIC pumps which were running on minimum recirculation flows. The load shed trips were then reset for the electrical loads on the Division I and III Safeguard Busses. Operations personnel then continued with a normal plant shutdown.

A four-hour notification was made to the NRC at 1602 hours on August 20, 1995, in accordance with the requirements of 10CFR50.72(b)(2)(ii) since this event involved automatic RPS and ESF actuations. This report is submitted in accordance with the requirements of 10CFR50.73(a)(2)(iv).

Analysis of the Event:

The RPS functioned as designed by automatically shutting down the reactor on high RPV pressure. Operations personnel successfully controlled the plant shutdown using the appropriate plant procedures. No RPV main steam relief valves lifted, and no Emergency Core Cooling Systems injected into the RPV as a result of the event. The ESF actuations functioned as designed in response to the sensed low RPV water level signal. There was no release of radioactive materials to the environment as a result of this event.

The RPV water level 'ringing' and the resultant instrumentation spike experienced during the main turbine trip were consistent with the results of previous events on Units 1 and 2 when the existing plant conditions were taken into account. The spurious initiation signals received by the affected systems were a result of the RPV water level instrumentation spike. All affected systems remained operable throughout this event. This reactor SCRAM or 'level ringing' event is bounded by the existing transient analysis for the Limerick Generating Station (LGS).

Cause of the Event:

The most probable cause of the main turbine valve oscillations was determined to be high impedance across the normally closed (NC) contacts of relay KT106 (Agastat TDPU, Model 2112-D-H116YE), causing an energized relay coil downstream of the KT106 relay to drop out momentarily, resulting in the TCV closures. The KT106 relay is a normally de-energized relay that provides permissive through NC contacts that allow the TCVs to open via relays downstream of KT106. Upon receipt of a turbine trip the KT106 energizes, opening the NC contacts and removing power from downstream relays causing the TCVs to close. Turbine bypass valves responded as expected to the increase in RPV pressure from the closing of the TCVs. The suspected failure of the KT106 relay was discussed with the General Electric (GE) Company Power Generation Group, who confirmed that the failure of the KT106 relay has resulted in similar EHC system malfunctions at other BWR plants.

The low RPV level ESF actuation signal was caused by wide range RPV level instrument reference leg 'ringing'. Ringing occurs in response to the pressure wave created by main turbine valve closures. The pressure wave is transmitted through the RPV inventory. Voids in the RPV water inventory slow the propagation of the pressure wave to the variable leg of the wide range level instruments. This results in a pressure variation between the reference leg and variable leg of the level sensing instruments.

Previous 'ringing' events involved a main turbine trip from high power. In this event, the TCVs opened following the reactor SCRAM, resulting in increased void formation. This increased voiding resulted in a significantly lower sensed RPV level than observed in previous events.

Corrective Actions:

The KT106 relay boards for the Unit 1 and Unit 2 EHC systems were replaced with new boards, and modifications were made on both units to wire the spare sets of NC contacts in parallel with the original contacts to increase reliability. The preventative maintenance tasks for the KT106 relay boards will be evaluated. The subject Unit 2 KT106 relay board was sent to a PECO Energy Company lab for destructive failure analysis. This analysis revealed the presence of carbon scoring on the NC relay contacts which is consistent with previous industry experience.

Previous Similar Occurrences:

LGS LER 2-93-001 reported a similar event which resulted in a Unit 2 SCRAM in January 1993. An investigation by Station Engineering and GE personnel was unable to identify the root cause of this previous event. Also, at that time, GE was not aware of the KT106 relay failure mode or of the connection to similar industry events. As a result, the KT106 relay had not been identified as a possible suspect. Based upon the similarity of the EHC system response, as well as additional recent industry experience, we conclude that the cause of the previous event may have been a similar failure of the KT106 relay.