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January 24, 1991

Docket No. 50-352
 License No. NPF-39

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

SUBJECT: Licensee Event Report
Limerick Generating Station - Unit 1

This LER reports a condition prohibited by Technical Specifications in that certain electrical equipment required for Unit 1 operation was found not to be dynamically qualified. In addition, this LER reports a single condition that caused at least one independent channel to become inoperable in multiple systems.

Reference: Docket No. 50-352
 Report Number: 88-019
 Revision Number: 02
 Event Date: May 6, 1988
 Report Date: January 24, 1991
 Facility: Limerick Generating Station
 P.O. Box A, Sanatoga, PA 19464

This revised LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(i)(B) and 50.73(a)(2)(vii)(C) and (D). Additionally, this revised LER is being submitted to provide a summary conclusion of the Root Cause Analysis performed to determine if there are any generic concerns related to the cause of this condition. Changes are indicated by revision bar markers in the right hand margin. The original LER was submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(i)(B).

Very truly yours,

WGS:rgs

cc: T. I. Martin, Administrator, Region I, USNRC
 T. J. Kenny, USNRC Senior Resident Inspector, LGS

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Limerick Generating Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 3 5 2	PAGE (3) 1 OF 0 9
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TITLE (4) **Locking springs on Agastat Relays that did not have complete dynamic qualification certification.**

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 5	0 6	8 8	8 8	0 1 9	0 2	0 1	2 4	9 1		0 5 0 0 0
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OPERATING MODE (9) 1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50. (Check one or more of the following) (11)				
POWER LEVEL (10) 0 9 0	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(e)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)	OTHER (Specify in Abstract below and in Text, NRC Form 308A)
	<input type="checkbox"/> 20.406(a)(1)(i)	<input type="checkbox"/> 50.36(e)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(e)	
	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(e)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(vi)		
	<input type="checkbox"/> 20.406(a)(1)(iii)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)		
	<input type="checkbox"/> 20.40F(5)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)		
<input type="checkbox"/> 20.406(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)			

LICENSEE CONTACT FOR THIS LER (12)		TELEPHONE NUMBER
NAME G. J. Madsen, Regulatory Engineer, Limerick Generating Station		AREA CODE 2 1 5
		3 2 7 - 1 2 0 1 0

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO				

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

On May 6, 1988, a Unit 1 inspection discovered 19 Agastat relays with missing/unsecured locking springs. Additionally, on May 10 a 1988 an inspection of similar relays in safety-related ventilation control cabinets was performed and 4 relay locking bands were found improperly installed. Due to the degradation of the relays' dynamic qualification, Technical Specifications (TS) Actuation Instrumentation minimum OPERABLE channel requirements for various safety-related systems were not met. Additionally, other TS systems would have been impacted. This is considered to be due to inadvertent dislodging of the locking springs during work activities in relay cabinets. On June 15, 1989, the adequacy of properly secured locking springs was questioned. During the construction testing phase of Unit 1, a component upgrade was performed. The new configuration's (new style relays retained by locking springs) dynamic qualification was not formally addressed during the modification review. This rendered the dynamic qualification of the relays indeterminate affecting most of the systems in TS. The old and new style relays are essentially identical in fit, form, and function. Therefore, the dynamic qualification requirements, with the exception of certification, were judged to be met. The locking springs that retained the new style relays were replaced with locking bands satisfying the dynamic qualification requirements. A Root Cause Analysis was performed and concluded that there were no generic implications associated with this condition.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Limerick Generating Station, Unit 1	0500035288	88	019	02	02	OF	09

TEXT (If more space is required, use additional NRC Form 300A-1 (17))

Plant Conditions Prior to the Event:

Operating Mode: 1 (Power Operation)

Reactor Power: 90%

Description of the Event:

A) 19 Relay Event

On May 6, 1988, during a Quality Control inspection of various electrical cabinets in the Auxiliary Equipment Room, locking springs on 17 Agastat relays were discovered missing or unsecured.

At 2045 hours the licensed shift supervision and senior staff were notified and actions to restore the locking springs were initiated. By 2300 all 17 locking springs were secured. During the restoration, further inspection of safety-related relay cabinets in the Auxiliary Equipment Room identified 2 additional unfastened locking springs which were immediately secured.

On May 10 and May 12, 1988 an inspection of similar relays in safety-related ventilation control cabinets throughout the plant was performed and 4 relay locking bands were found improperly installed. The locking mechanism for the ventilation relays prevents inadvertent dislodging of the device. The installation of the four locking bands was immediately corrected.

On May 13, 1988 an on-site evaluation was completed that determined the potential impact on plant systems on the assumption that the locking clips were required to maintain dynamic qualification of the affected relays. The condition of the locking springs might have degraded the dynamic qualification of the relays such that the minimum OPERABLE channel requirements of the Technical Specifications (TS) would not have been met for a single channel of Reactor Core Isolation Cooling (RCIC), a single channel of a Core Spray Subsystem (CSS), two logic channels of High Pressure Coolant Injection (HPCI) system, and a single channel of the four Low Pressure Coolant Injection (LPCI) subsystems.

During a subsequent independent evaluation, the systems identified on May 13 were confirmed and additional areas of impact on plant systems were identified. These additional areas are comprised of six (6) Primary Containment isolation valves, one of two trains of the Post Accident Sampling System (PASS), water supplied from the Control Rod Drive System (CRD) Reactor Recirculation Pump seal purge lines, the "B" Post Loss of Coolant Accident (LOCA) Hydrogen Recombiner, the Main Steam Line drain valves, the "B" train of Standby Gas Treatment System (SGTS), and the Reactor Protection System (RPS).

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Limerick Generating Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 3 5 2	LER NUMBER (6)			PAGE (3)		
		YEAR 8 8	SEQUENTIAL NUMBER 0 1 9	REVISION NUMBER 0 2			
					0 3	OF 0 9	

TEXT IF more space is required, use additional NRC Form 306A (1) (1)

The inoperable channels were not placed in the tripped condition within 1 hour nor were the associated systems declared inoperable as required by the TS Action Statements. Additionally, the 1 hour action required by TS Section 3.0.3 was not initiated. The above actions were not taken on May 13 because the situation had already been corrected. The actions were not taken on May 6 due to the detailed analysis required to determine the impact of the specific relays on instrument channel operability.

B) Dynamic Certification Issue

As a result of this condition in December 1988, and subsequent evaluations, an additional concern was confirmed on June 15, 1989. During an evaluation to determine operability of the 19 relays with missing or unsecured locking springs, the dynamic qualification adequacy of properly secured locking springs on currently installed relays was questioned. Dynamic qualification exists for two sets of relays and restraining devices. The first is an old style relay (Agastat GP) with a locking spring. The second is a new style relay (Agastat EGP) with a locking band. During the construction testing phase of Unit 1, in 1984, a component upgrade was performed, due to a reliability concern, that replaced the old style relays with the new style. The locking springs were reused to secure the new style relays. Since the old and new style relays are identical in function, essentially identical in size and mass, and the locking springs fit securely, the Nuclear Steam Supply System (NSSS) supplier and the Philadelphia Electric Company (PECO) judged that the dynamic qualification requirements were satisfied. However a formal analysis or test was not performed to substantiate this judgement. We concluded on June 15, 1989, that most of the systems in TS should have been declared inoperable. As with the 19 previously mentioned relays, the appropriate actions required by TS were not taken in the required time resulting in a condition prohibited by TS.

In conclusion, the conditions described above are being reported in accordance with 10CFR50.73(a)(2)(i)(B) due to not taking the appropriate actions required by TS in the required time period. Additionally, the conditions described above are being reported in accordance with 10CFR50.73(a)(2)(vii)(C) and (D) in that a single condition caused at least one independent channel to become inoperable in multiple systems designed to control the release of radioactive material or mitigate the consequences of an accident.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Limerick Generating Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 3 5 2	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		8 8	— 0 1 9	— 0 2	0 4	OF	0 9

TEXT (If more space is required, use additional NRC Form 365A's) (17)

Consequences of the Event:

A) 19 Relay Evaluation

There were no adverse consequences, and no release of radiation occurred as a result of the 19 relays being inadequately secured.

An evaluation was performed and determined that the relay restraint integrity is required to maintain relay dynamic qualification. The following systems might have been adversely affected during a seismic/hydrodynamic (earthquake/steam line break) event.

<u>System</u>	<u>Potential Impact</u>
"C" Residual Heat Removal (RHR)	Loss of capability to automatically initiate on low reactor pressure coincident with high drywell pressure
"D"-RHR	Loss of capability to automatically initiate on low reactor pressure coincident with high drywell pressure
"D"-CSS	Loss of capability to automatically initiate on low reactor pressure coincident with high drywell pressure
HPCI	(a) Loss of one of two high drywell pressure initiation capability. (b) Loss of high turbine exhaust diaphragm pressure isolation capability. (c) Loss of one of two low reactor pressure turbine trip signal capability. (d) HPCI turbine exhaust line vacuum breaker inboard isolation valve and HPCI injection valve to core spray (45% flow) would not have operated.
RCIC	Loss of one of two reactor level 2 initiation signal capability.
Main Steam Isolation Valve - Leakage Control System (MSIV-LCS)	The inboard suction valve to the "D" Main Steam Line Inboard MSIV-LCS subsystem would not have opened. This would make the "D" Main Steam Line Inboard MSIV-LCS inoperable.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)																
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER																	
		0	5	0	0	0	3	5	2	8	8	-	0	1	9	-	0	2	0	5	OF

TEXT (if more space is required, use additional NRC Form 366A's) (7)

Nuclear Steam Supply Shutoff System (NSSSS) Five normally closed Primary Containment isolation valves (the "B" Containment Hydrogen Recombiner inlet and outlet isolation valves, Drywell Nitrogen Makeup Line isolation valve, HPCI injection valve to Core Spray, and the inboard suction valve to the "D" Main Steam Line Inboard MSIV-LCS subsystem) would have lost their ability to automatically close. One normally open Primary Containment isolation valve (HPCI turbine exhaust line vacuum breaker inboard isolation valve would have lost its ability to automatically close.

Reactor Enclosure Recirculation System (RERS) Loss of one of two trains of RERS.

Post Accident Sampling System (PASS) One train of PASS for Drywell and Suppression Pool would isolate.

CRD Water supplied from CRD to the Reactor Recirculation Pump seal purge lines would isolate.

Post LOCA Recombiners The "B" Post LOCA Recombiner would receive a trip signal.

The following systems would have performed their safety function(s) in response to a seismic event as a result of the 19 relays being inadequately secured without a valid initiation signal.

NSSSS Main Steam Line drain to both the Main Condenser and normal Radiological Waste would isolate.

SGTS Train "B" would start up drawing a suction on the Refueling Floor, Unit 1 side.

RPS A Reactor Scram would occur initiated by invalid Low Reactor Water Level III signals.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Limerick Generating Station, Unit 1	05000352	88	019	02	06	OF	09

TEXT IF more space is required, use additional NRC Form 306A's (17)

B) Evaluation of Dynamic Certification issue

There were no adverse consequences, and no release of radiation occurred as a result of the dynamically uncertified new style relays since a seismic event did not occur. Both the NSSS supplier and PECO have concluded that the old and new style relays are essentially identical in form, fit and function, therefore the dynamic qualification requirements were judged to be met. However, no documented qualification existed for the installed configuration of new style relay with a locking spring as a restraining device. If this configuration would have failed during a seismic/hydrodynamic event, virtually all safety related systems would have been adversely impacted due to the extent with which this configuration was used.

Cause of the Event:

A) 19 Relay Event

The cause of the 19 missing or unsecured relay locking springs is considered to be inadvertent dislodging of the locking springs during work activities in the associated relay cabinets.

B) Dynamic Certification Issue

A detailed Root Cause Analysis (RCA) was performed and concluded that indeterminate dynamic qualification resulted from procedure non-compliance, procedural deficiencies, informal work practices and the extraordinary efforts expended due in part to perceived or actual pressures to meet scheduled completion of critical work.

The indeterminate dynamic qualification of the new style relays retained by the locking springs was the result of an oversight on the part of PECO in the modification review cycle of panel design specifications against the materials intended for installation. The relays installed in the Power Generation Control Center (PGCC) were installed during the Unit 1 construction testing phase prior to receipt of the Low Power Operating License (October 26, 1984) with the approval of the NSSS supplier, under Field Deviation Disposition Request (FDDR) HH1-3099. This FDDR approved relay installation but material environmental and dynamic qualification was the responsibility of PECO. The assumption that the component qualification of the new style relays would be done by PECO was documented by letter dated March 21, 1984, from PECO to the NSSSS supplier. Subsequent to this letter, the proper environmental qualification requirements were performed; however, the dynamic qualification of this component was not formally addressed by PECO. Therefore, at the time of installation, no dynamic testing or analysis was performed on the new style relay using the old locking

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Limerick Generating Station, Unit 1	DOCKET NUMBER (2) 0500035288	LER NUMBER (6)			PAGE (3) 07 OF 09
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
		88	019	02	

TEXT (If more space is required, use additional NRC Form 366A's) (17)

spring, thus rendering the dynamic qualification of the installed configuration as indeterminate.

In addition, the installation of these relays failed to comply with either the A/E or the PECO modification procedures in effect at the time. This is due to the multiple modification procedures in use prior to receipt of the Low Power Operating License and the failures of plant staff supervision to ensure proper material selection for the modification.

Corrective Actions:

19 Relay Event

The 17 initially identified locking springs were reinstalled within four hours of notification of the operating shift. The additional 2 locking springs found dislodged during the restoration inspection were reinstalled immediately upon discovery. The four locking bands found improperly installed during the subsequent inspection of the ventilation cabinets were immediately installed correctly. Subsequent reinspection has verified all locking springs have remained secured.

Additionally, a surveillance test was written to inspect the locking springs on safety-related relays until the locking springs could be replaced by the locking bands. This surveillance test was performed on January 30, 1989. During this test all locking springs inspected were properly installed on their relays.

B) Dynamic Certification Issue

During the Unit 1 Second Refueling Outage, which began January 13, 1989, locking springs that retained the new style relays installed in safety-related applications were replaced with locking bands. This alteration placed the new style relays restrained by locking bands in accordance with dynamic qualification requirements. Currently, all upgraded relays installed in safety-related applications meet all environmental and dynamic qualification requirements.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Limerick Generating Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 3 5 2 8 8	LER NUMBER (4)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		8 8	0 1 9	0 2	0 8	OF 0 9

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Actions Taken to Prevent Recurrence:

A) 19 Relay Event

A memo has been written and acted upon which required work group supervision to advise those persons working in the affected cabinets to exhibit care to avoid dislodging the locking springs.

Additionally, the surveillance test which was written and performed to periodically inspect relays will no longer be performed since all relays installed in safety-related applications have been upgraded to meet environmental and dynamic qualification requirements (i.e. replaced locking springs with locking bands).

B) Dynamic Certification Issue

As a corrective action for the original oversight in the modification review that occurred during the construction of Unit 1, upon receipt of the Unit 1 Low Power Operating License, Administrative Procedure A-14, "Procedure for Control of Plant Modifications," was placed in effect and adequately provided instruction and control throughout the modification process. This procedure addresses the modification review process and involves the independent review of several specialized work groups, supervision and management. Plant Management has determined that the current modification process is adequate and provides the proper instruction to attain the appropriate independent reviews. An analysis was performed by August 31, 1989, and determined that further investigation into the modification process that was in effect during the period prior to receipt of the Unit 1 Low Power Operating License was not required.

In addition, management's expectations of quality work regarding procedure compliance and modifications has been communicated to appropriate personnel. To determine whether other instances of inadequate design reviews exist, sampling programs were initiated. Specific types of documents utilized in design and installation were sampled to determine if any instances indicated inadequate design reviews. These sampling programs concluded that no generic concerns exist in this area.

In conclusion, further investigation into the generic concern of the adequacy of design reviews of plant changes is not necessary since, 1) there is reasonable confidence that the root causes of the Agastat relay replacement did not result in other plant alterations that lacked proper design reviews and, 2) adequate procedure controls and communication of quality expectations are currently in place to prevent recurrence.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Limerick Generating Station, Unit 1	06000352	88	019	02	09	OF	09

TEXT (If more space is required, use additional NRC Form 366A's) (17)

EIIS Codes:

Relay	RLY
Channel	CHA
Reactor Core Isolation Cooling System	BN
Core Spray System	BM
High Pressure Coolant Injection System	BJ
Low Pressure Coolant Injection System	BO
Main Steam Isolation Valve - Leakage Control System	SB
Nuclear Steam Supply Shutoff System	JC
Reactor Enclosure Recirculation System	VA
Control Rod Drive System	AA
Reactor Recirculation System	AD
Standby Gas Treatment System	BH
Post Accident Sampling System	IP
Post LOCA Hydrogen Recombiners	BB
Reactor Protection System	JD

Previous Similar Occurrences:

LER 89-034 (1) concerns environmental qualification of components and the modification process prior to receipt of the Low Power Operating License.

Tracking Code: A99, other Personnel Error
D2, Inadequate Procedure
A2, Failure to follow implementing procedures

(1) The event date for this LER revision related to LER-89-03 is dated June 15, 1989. LER 89-34's event date is May 12, 1989, making the later number LER a previous similar occurrence.