



# PECO NUCLEAR

A Unit of PECO Energy

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10CFR50.73

January 6, 1997

Docket Nos. 50-352  
50-353  
License Nos. NPF-39  
NPF-85

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

SUBJECT: Licensee Event Report  
Limerick Generating Station - Units 1 and 2

This LER reports a reduction in the ability to achieve safe shutdown in the event of a fire as provided by the Fire Protection Program. Instrument gas may not be available to operate the main steam relief valves due to postulated fire damage. This resulted in a failure to meet License Conditions for Limerick Generating Station Units 1 and 2 .

Reference:	Docket Nos. 50-352 50-353
Report Number:	1-96-021
Revision Number:	00
Event Date:	October 26, 1984 Unit 1 June 22, 1989 Unit 2
Discovery Date:	December 5, 1996
Report Date:	January 6, 1997
Facility:	Limerick Generating Station P.O. Box 2300, Sanatoga, PA 19464-2300

This LER is being submitted pursuant to the requirements of License Conditions 2.F for Unit 1 and 2.E for Unit 2.

Very truly yours,

DBN:cah

cc: H. J. Miller, Administrator Region I, USNRC  
N. S. Perry, USNRC Senior Resident Inspector, LGS

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## LICENSEE EVENT REPORT (LER)

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

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  
(MNB 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.

FACILITY NAME (1) Limerick Generating Station, Unit 1 DOCKET NUMBER (2) 05000 352 PAGE (3) 1 OF 7

TITLE (4) Failure to Provide Sufficient Repair Actions Needed to Achieve Cold Shutdown for Fire Safe Shutdown Capability.

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
10	26	84	96	-- 021 --	0	01	06	96	Limerick, Unit 2	05000 353

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)	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)	X 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 J. L. Kantner, Manager - Experience Assessment, LGS TELEPHONE NUMBER (Include Area Code) (610) 718-3400COMPLETE 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)  
YES (If yes, complete EXPECTED SUBMISSION DATE) X NO  
EXPECTED SUBMISSION DATE (15) MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On 12/5/96, a review associated with the Thermo-Lag reduction project determined that a fire Safe Shutdown (SSD) repair would not function as desired due to an incorrect assumption made in the fire SSD design analysis. Following identified repairs, pressurized gas would not remain available to operate the Main Steam Relief Valves (MSRVs) which are required for depressurization control for Unit 1 and Unit 2 in the event of a postulated fire in certain areas of the plant. Actual pressurized gas system operating characteristics were not fully considered when assessing the need for repairs. This resulted in a failure to maintain the provisions of the Fire Protection Program (FPP) and is a violation of a License Condition. Sufficient plant equipment would have remained available to maintain the plant in a hot shutdown condition until necessary repairs could be made to achieve cold shutdown. The potential consequences of this event are further minimized by other permanent design and administrative features of the FPP. The ongoing Thermo-Lag reduction project includes a comprehensive review of all of the assumptions made in the fire SSD analysis, a verification of all of the fire SSD repairs, and a review of all the fire SSD systems to verify physical capability to perform as required.

**LICENSEE EVENT REPORT (LER)**  
**TEXT CONTINUATION**

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.

FACILITY NAME (1)		DOCKET NUMBER (2)		LER NUMBER (6)			PAGE (3)
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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Unit Conditions Prior to the Event

Unit 1 was in Operational Condition (OPCON) 1 (Power Operation) at 100% power when this event was discovered.

Unit 2 was in OPCON 1 at 90% power when this event was discovered. During the investigation and implementation of the immediate corrective actions for this event, Unit 2 was shut down to repair an Electro-Hydraulic Control system leak and to perform a planned maintenance outage. Unit 2 was restarted on December 13, 1996.

Unit 1 and Unit 2 have operated at various power levels since the concern described in this report first existed. There were no systems, components, or structures out of service which contributed to this event.

Background

As a result of concerns identified in NRC Bulletin 92-01 regarding Thermo-Lag fire barriers, a PECO Nuclear engineering review was initiated to reduce the reliance on Thermo-Lag fire barriers. This program involves a verification of all of the equipment and cabling required to achieve and maintain safe shutdown of Unit 1 and Unit 2 in the event of a fire in any area of the plant. PECO Nuclear procedures are utilized to evaluate concerns identified during the verification reviews. Prompt determinations for operability, reportability, the need for compensatory measures, and immediate corrective actions are performed in accordance with these procedures.

Description of the Event

On December 5, 1996, an engineering evaluation associated with the Thermo-Lag reduction effort determined that a fire Safe Shutdown (SSD) repair action would not function as desired due to an incorrect assumption made in the design analysis for the repair. The repair action provides a flow path for the Primary Containment Instrument Gas (PCIG) system (EIIS:CD) to provide gas pressure needed to operate the selected Main Steam Relief Valves (MSRVs, EIIS:RV). In the event of a significant fire in the Main Control Room (MCR), the common Auxiliary Equipment Room (AER), or the Unit 1 or Unit 2 Cable Spreading Rooms

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

(CSRs), operators would need to shutdown both Unit 1 and Unit 2 from the Remote Shutdown Panels using Special Event (SE) procedure SE-1, "Remote Shutdown." This fire SSD method utilizes procedure SE-1-1, "Protected Depressurization Control," to operate the A, C, and N MSRVs to assist in achieving cold shutdown. However, the original analysis performed between 1982 and 1983 assumed the continued availability of the PCIG system throughout the shutdown. A review of actual PCIG system operation and the specific equipment protected from fire damage revealed that the PCIG system may only remain available for up to one (1) hour. The shutdown analysis relies on the PCIG system to operate the MSRVs for up to six (6) hours.

This condition resulted in a failure to maintain the provisions of the approved Fire Protection Program and is a violation of Facility Operating License Conditions 2.C.(3) for the Limerick Generating Station (LGS) Units 1 and 2.

Engineering personnel evaluated the significance of this issue upon its discovery and immediately contacted station personnel to implement appropriate compensatory measures. It was concluded that an hourly fire watch patrol was a sufficient immediate compensatory measure. The basis for this is discussed in the Analysis Section of this report.

Station personnel then verified that the AER and the CSRs were already included on the hourly fire watch patrol rounds and the list of fire protection equipment impairments was revised to include this non-conforming issue. Operations personnel were notified of this concern and the potential impact of the availability of the PCIG system.

A twenty-four (24) hour notification was made to the NRC at 1402 hours on December 6, 1996, in accordance with the requirements of License Conditions 2.F and 2.E for Units 1 and 2, respectively, to report the failure to comply with License Condition 2.C.(3). This report is submitted in accordance with requirements of License Conditions 2.F and 2.E for Units 1 and 2, respectively.



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Analysis of the Event

The actual consequences for this condition are minimal since a fire did not occur challenging the fire protection program or requiring the safe shutdown of either unit. The potential for a fire and the impact of a fire in the MCR, AER, or CSRs is minimized by a combination of many factors. The design of the Fire Protection Program relies on a 'defense-in-depth' approach which serves to:

1. prevent a fire from starting,
2. quickly detect and suppress fires which do start,
3. provide reasonable electrical isolation and separation of circuits in the event of small fires,
4. prevent the rapid spread of fires by selecting fire retardant construction materials, and
5. protect safety related equipment so that a fire will not prevent SSD of the plant.

The potential for a fire and the consequences of postulated fire damage in the specific areas of concern are further mitigated by the specific factors indicated below.

1. Automatic fire detection (EIIS:IC) and suppression equipment (EIIS:KP) exists in all three areas as outlined below:
  - a) The MCR is continually manned and provided with manual fire suppression equipment.
  - b) The AER is protected by an automatic under-floor halon suppression system.
  - c) The CSRs are protected by an automatic water sprinkler system and manually initiated room flooding carbon dioxide system.
2. Divisional separation of equipment and cabling associated with independent trains of SSD equipment per the design reduces the likelihood of damage to the independent trains of equipment in these areas.
3. The transient combustible loading and fire hazard control of these rooms is well established including an existing hourly fire watch patrol in the AER and CSRs as a result of the inoperable Thermo-Lag fire barriers. The use of an hourly fire watch patrol is consistent with the defense-in-depth philosophy in the Branch Technical Position (BTP) CMEB 9.5.1, the LGS Technical Requirements Manual (TRM), and commitments associated with the inoperable Thermo-Lag fire barriers.

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4. The CSRs are controlled such that no transient combustible materials are permitted in the areas.
5. The capability to provide a protected supply of pressurized gas for operation of the MSRVs to achieve cold shutdown was identified by engineering, was being developed, was not a complicated change, and was to be available in the near time frame.
6. Other methods of providing pressurized gas to the MSRVs and several other methods of depressurization control would be available with existing procedural guidance for their use in the event of a limited fire in one of these areas (e.g., other MSRVs, the Automatic Depressurization System (ADS), High Pressure Coolant Injection (HPCI) System (EIIS:BJ), and Reactor Core Isolation Cooling (RCIC) System (EIIS:BN).

In the event of a significant fire in the MCR, AER, or CSRs, operators would have been able to maintain hot shutdown indefinitely from the Remote Shutdown Panel using the RCIC system and the suppression pool cooling mode of the Residual Heat Removal system (EIIS:BO). This would assure integrity of the fuel and primary containment until the necessary cold shutdown repairs (i.e., providing gas pressure to the MSRVs) could be implemented.

The combination of these factors also provide the basis for the adequacy of the interim compensatory actions taken for this discovered condition (i.e., hourly fire watch patrol, control of transient combustible materials, and notification of the licensed operators).

Cause of the Event

The original fire SSD analysis, prior to issuance of the Unit 1 Operating License, incorrectly assumed that the PCIG system would provide a continuous supply of compressed gas and that the only repair needed to assure continued availability of the PCIG system to the MSRVs was an air jumper to open a Primary Containment Isolation Valve. The PCIG system was not designed to be leak tight and the PCIG compressors are needed to maintain the PCIG system headers pressurized for extended periods. The PCIG system air compressors, certain PCIG system valves, and support sub-systems were not protected from postulated fire damage. Additionally, actual PCIG system operating characteristics were not considered in determining how long the PCIG system would remain available following a significant fire.

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The potential unavailability of the PCIG compressors was identified in a fire SSD review performed in 1989. This review was performed as a corrective action to LGS LER 1-88-031. This review did not recognize that the gas receivers would not remain pressurized for an extended period of time. This review incorrectly determined that adequate nitrogen pressure could be maintained using the system receiver tank, obviating the need to analyze the equipment and cables necessary for operation of the PCIG compressors. This analysis also did not take into account actual PCIG system operating characteristics and that the PCIG system is not designed to be leak tight. Less than adequate documentation of assumptions made in the original fire SSD analysis contributed to not recognizing the limited availability of the PCIG system.

The following contributing factors to this deficiency in the fire SSD analysis were also identified.

1. A lack of systems engineering (cross functional) involvement in fire SSD analysis. Historically, the fire SSD analysis has been handled as an electrical engineering function.
2. Documentation of the fire SSD analysis and subsequent reviews were less than adequate. Verification of assumptions were not easily performed since key assumptions were not documented.

The investigation concluded that none of these causes involve willful errors.

Corrective Actions

On December 12, 1996, a protected source of pressurized gas was provided for Unit 1 and Unit 2. This revised fire SSD repair included an air jumper with quick disconnect connectors and a supply of pressurized nitrogen cylinders. Revisions to procedure SE-1-1 were also implemented. A Plant Operations Review Committee (PORC) review of the revised fire SSD repair, the procedure revision to procedure SE-1-1, the changes to the Updated Final Safety Analysis Report (UFSAR), and the associated 10CFR50.59 Safety Evaluation were also completed on December 12, 1996. This restored both Unit 1 and Unit 2 to full compliance with the Operating License Conditions. These actions were completed prior to the restart of Unit 2 from the concurrent planned maintenance outage.

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The following corrective actions are being implemented. These reviews are expected to be completed by December 1, 1997.

1. The scope of the ongoing Thermo-Lag reduction project includes a verification of all of the assumptions made in the fire SSD analysis and will provide a fire SSD analysis that meets current regulatory requirements. This project provides for traceable and maintainable documentation for verification and future use. Cross functional systems engineering involvement is included in the review effort.
2. All of the repair actions in the fire SSD analysis will be reviewed to confirm that the repair will achieve the desired effect, there is sufficient specificity in the procedures for the operator, and the repair is capable of being implemented.
3. A review of the fire SSD systems will be performed to confirm the physical capability of each system to perform as required in the fire SSD analysis and that the repairs to be performed.

The breadth of the review by the Thermo-Lag reduction project will cover the work performed during the original analysis before initial plant startup and any subsequent review or changes made since then.

A review of previously identified non-conformances has been performed to assess the validity of the LGS fire SSD analysis. A review of the findings identified to date by the Thermo-Lag reduction project reveals that compared to the size and depth of the analysis, the number and breadth of the issues is very small. Furthermore, generic implication reviews performed for the identified issues have not led to the conclusion that major design or programmatic deficiencies exist.

#### Previous Similar Occurrences

There have been several LERs that report non-conformances with the fire SSD analysis (e.g., 1-96-015, 1-96-012). These recent issues were also identified during the Thermo-Lag reduction project which includes a complete re-review of the fire SSD analysis. The previously reported issues did not involve the capability of the PCIG system and therefore are not expected to have identified the concern discussed in this report. The previous corrective actions were not intended to address incorrect assumptions in the original SSD analysis and, therefore, are not expected to have corrected the non-conformance identified in this report.