

## PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION

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SANATOGA, PENNSYLVANIA 19464

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J. DOERING, JR.  
PLANT MANAGER  
LIMERICK GENERATING STATION

October 21, 1991

Docket No. 50-352  
License No. NPF-39U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555SUBJECT: Licensee Event Report  
Limerick Generating Station - Unit 1

This voluntary LER reports a physical electrical separation deficiency involving the Unit 1 Reactor Core Isolation Cooling (RCIC) system. This separation deficiency was due to the physical separation distance between cables in the Remote Shutdown Panel being less than the specified installation requirement as a result of installation specification E-1412 being difficult to interpret and less than adequate training of personnel.

Reference:	Docket No. 50-352
Report Number:	1-90-024
Revision Number:	01
Event Date:	June 1989
Discovery Date:	October 17, 1990
Reportability Date:	October 25, 1990
Report Date:	October 21, 1991
Facility:	Limerick Generating Station P.O. Box A, Sanatoga, PA 19464

This revised LER is being submitted as a voluntary report due to further evaluation and justification based upon electrical separation test data obtained during the construction phase of Limerick Generating Station. This evaluation concluded that the deficiency reported in revision 0 of this LER did not result in the inoperability of the RCIC system and is therefore not reportable.

Very truly yours,

WGS:cah

cc: T. T. Martin, Administrator, Region I, USNRC  
T. J. Kenny, USNRC Senior Resident Inspector, LGS9110290426 911021  
PDR ADOCK 05000352  
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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 6										
TITLE (4) Inoperability of the RCIC System Due to a Physical Separation Between Class 1E and Non-Class 1E Cables as a Result of Personnel Error.																								
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)											
1	0	1	7	9	0	9	0	2	4	0	1	1	0	2	1	9	1	0	5	0	0	0	1	1
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5. (Check one or more of the following) (11)																						
5		20.402(k)				20.406(c)				50.73(k)(2)(iv)				73.71(b)										
POWER LEVEL (10)		0 0 0				20.406(k)(1)(i)				50.73(k)(1)				73.71(a)										
		20.406(k)(1)(ii)				50.73(k)(2)				50.73(k)(2)(i)(x)				<input checked="" type="checkbox"/> OTHER (Specify in Abstract below and in cert. NRC Form 308A)										
		20.406(k)(1)(iii)				50.73(k)(2)(i)				50.73(k)(2)(i)(ii)(A)				Voluntary Report										
		20.406(k)(1)(iv)				50.73(k)(2)(ii)				50.73(k)(2)(iv)(i)(B)														
		20.406(k)(1)(v)				50.73(k)(2)(iii)				50.73(k)(2)(i)(x)														
LICENSEE CONTACT FOR THIS LER (12)																								
NAME G. J. Madsen, Regulatory Engineer, Limerick Generating Station										TELEPHONE NUMBER AREA CODE 2 1 5 3 2 7 - 1 2 0 0														
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																								
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC?	CAUSE				SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC?												
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 October 25, 1990, the plant staff determined that the Unit 1 Reactor Core Isolation Cooling (RCIC) system was potentially affected by physical separation deficiencies between Class 1E and non-Class 1E wires in the Unit 1 Remote Shutdown Panel (RSP) 10C201. The appropriate wiring was subsequently sleeved to comply with originally established separation requirements. We have concluded that this condition existed since June 1989, when a modification to the RSP was completed. This condition is due to Installation and Quality Control personnel misinterpreting installation specification E-1412, "Wire and Cable Notes and Details," during installation of the modification. There were no consequences associated with this event because no electrical fault condition existed that could result in cable degradation and subsequent interaction. Corrective actions include a completed inspection program of all Unit 1 and Unit 2 electrical panels, enhancements to the existing training programs, and a revision of installation specification E-1412 to make this document user-friendly. This LER is being revised and submitted as a voluntary report as a result of our further evaluation and justifications which concluded that the deficiency reported in revision 0 of this LER did not result in the inoperability of the RCIC system and is therefore not reportable.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104  
EXPIRES: 8/31/95

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Limerick Generating Station, Unit 1	05000352	90	024	01	02 OF 06

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

Unit Conditions Prior to the Event:

The operating condition of Unit 1 was 5 (Refueling) at a Power Level of 0%. There were no other structures, systems, or components out of service which contributed to this event.

Description of the Event:

On October 17, 1990, during installation of Modification 6040-1 associated with the Limerick Generating Station (LGS) Unit 1 Remote Shutdown Panel (RSP; EIIS:PL) 10C201, a potential physical separation deficiency between Class 1E (EIIS:ED) Division 1 wires associated with the Reactor Core Isolation Cooling (RCIC) system (EIIS:BN) and non-Class 1E wires was discovered. This deficiency was documented on an administratively controlled Equipment Trouble Tag (ETT). The ETT resulted in the generation of a Maintenance Request Form (MRF) to implement corrective actions (i.e., wrapping of the appropriate cabling with thermal insulating material) for the affected cables (EIIS:CBL).

LGS Updated Final Safety Analysis Report (UFSAR), Chapter 8, "Electrical Power," Section 8.1.6.14, states that LGS conforms with the guidance of Regulatory Guide 1.75, Revision 2, 1978, "Physical Independence of Electrical Systems," and also states that, except for specific cases delineated in UFSAR Section 8.1.6.14, a minimum spatial separation distance of six inches will be maintained between Class 1E and non-Class 1E circuits unless barriers are installed. The basis for this position is to prevent damage to Class 1E circuits that could result from the propagation of a fault in a non-Class 1E circuit during accident conditions.

On October 18, 1990, a plant staff review of the information on the ETT identified that a physical separation deficiency existed in the LGS Unit 1 RSP. This physical separation deficiency occurred between Class 1E internal panel wires and non-Class 1E wires. Specifically, the separation deficiency was such that the non-Class 1E wire was less than six inches but greater than 1 inch from the Class 1E wire. The non-Class 1E wire was neither secured to the internal panel structure nor alternatively wrapped with thermal insulation sleeving material as required by installation specification E-1412. Rework (i.e., wrapping of the appropriate wiring with thermal insulating sleeving) was completed on November 8, 1990. On October 25, 1990, we identified that the Class 1E wire involved with the separation deficiency was installed in June 1989 during implementation of modification 5962-1 associated with the RCIC system.

We originally concluded that because of this condition, the Unit 1 RCIC system should have been considered inoperable, and that since the "Action" required by Technical Specifications (TS) Section 3.7.3 was not taken within the specified time period, this condition constituted a condition prohibited by TS. Accordingly, we submitted LER 1-90-024, Revision 0, on November 27, 1990.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/85

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

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

However, since the submittal of the original LER, we have completed an evaluation which permits cabling to be less than six inches apart based on additional analysis of cable configuration and supports. The following discussion provides the basis for accepting a physical electrical separation distance less than six inches for an interim time period until originally specified separation criteria is met.

The original LGS design specification was to provide a minimum of six inches of separation or a barrier between wiring of redundant Class 1E electrical divisions and between Class 1E and non-Class 1E wiring. However, during original fabrication of the LGS Unit 1 panels, we determined that this specification was expensive and difficult to implement in all instances. Therefore, a program that tested various configurations of panel wiring and associated supports was developed and conducted during the construction phase of LGS. The testing showed that electrical isolation between circuits is maintained as long as the wiring does not touch. The testing also showed that proper support of wiring is important inside control panels when the separation distance is less than six inches. The necessary wiring support is dependent upon the specific wiring configuration.

As a result of this test program, a conservative installation criterion was adopted at LGS during the construction phase which required the use of stainless steel cable ties every six inches of length and wire separation of at least one inch. Specification E-1412 and the original LGS Final Safety Analysis Report (FSAR) were changed during initial plant construction to incorporate the results of this testing but only for individually evaluated applications. We had determined that the test data justifies the following separation requirements; 1) Class 1E and non-Class 1E wiring can be touching, and 2) Class 1E wiring must be supported so that it does not touch the Class 1E wiring of other divisions under postulated faulted conditions. Accordingly, when stainless steel cable ties are not used or when the separation is less than one inch, an evaluation of the wiring support system is performed to ensure that thermal growth of the wire under postulated faulted conditions will not allow the wires to touch.

Therefore, based upon further evaluation during the third Unit 1 Refuel Outage of the electrical separation deficiency described in this LER, we have concluded that the cable separation deficiency associated with the RSP 10C201 did not result in the inoperability of the Unit 1 RCIC system, and did not constitute a condition prohibited by TS. As a result of this conclusion, this LER is being revised and submitted as a voluntary report.



## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-2104

EXPIRES 8/31/85

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

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

Analysis of the Event:

There were no consequences associated with this event because no electrical fault condition existed that could result in cable degradation and subsequent interaction.

We consider that the emergency response capability, including the use of Special Events (SE) procedures SE-1 "Safe Shutdown," and SE-6 "Alternate Safe Shutdown," and the LGS Transient Response Implementation Plan (TRIP) procedures, would provide the operators a success path to safely shutdown the plant in the event that a fault condition had occurred. The TRIP procedures, derived from the Emergency Procedure Guidelines developed by the Boiling Water Reactor Owners' Group, provide distinct, symptom-oriented operator guidance in bringing the plant to a cold shutdown condition.

Cause of the Event:

The root cause of this event is a personnel error due to installation personnel misinterpreting installation specification E-1412 "Wire and Cable Notes and Details." Additional contributing factors are: 1) installation specification E-1412 is difficult to use and interpret due to the organization of details and special exceptions added during the construction phase of LGS, and 2) an unfamiliarity with installation specification E-1412 by the installation personnel due to infrequent use and less than adequate training prior to the installation of modification 5962-1.

Installation specification E-1412 was originally written by the Architect Engineer (A/E) to provide guidance to construction personnel who used this specification routinely during the construction phase of LGS Unit 1. Installation specification E-1412 specifies design details for various aspects of electrical cabling and component installations. However, since the change from the plant construction phase to the plant operating phase at LGS, installation specification E-1412 is not used on a daily basis because its major application is now for modifications. Training was not adequately provided to ensure that installation personnel sufficiently understood the requirements and intent of the details and special exceptions contained in installation specification E-1412. The misinterpretation of E-1412 resulted in installation personnel misapplying the required physical separation criteria for the cabling associated with modification 5962-1.

In addition, the Quality Control (QC) inspector who performed the required individual cable separation inspections for the installed cabling associated with modification 5962-1 also failed to properly identify this physical separation deficiency as a result of the same cause and casual factors discussed above.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES 8/31/85

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

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

Corrective Actions:

The Installation Section at LGS has developed a special training program that explains the requirements for electrical separation at LGS and the acceptable methods by which physical separation is maintained. The training was presented to the applicable personnel being processed into the plant for the Unit 1 third refueling outage. This training was incorporated into the orientation training provided to personnel involved with equipment installations and provides adequate instruction on physical separation requirements and heightens awareness of the importance of this issue. This new training resulted in Installation Section personnel identifying the previously existing error in cable separation. Therefore, a high level of confidence exists that physical electrical separation has been maintained in the design, installation, and QC inspections associated with modifications implemented during the Unit 1 third refueling outage.

Additionally, the level of detail and content of the special training program has been reviewed by plant staff personnel and appropriately incorporated into the existing training programs associated with installation specification E-1412 for other plant personnel having the potential to perform internal panel work.

Specification E-1412 was reviewed for possible changes that would clarify and/or enhance these installation requirements. As a result of this review, specification E-1412 was revised to make the document user-friendly.

On November 21, 1990, a complete inspection of the LGS Unit 1 RSP was performed to determine if this condition was an isolated occurrence within this panel. As a result of this inspection, a second separation deficiency was discovered also involving PCIC system cabling. Separately, on November 16, 1990, a separation deficiency was identified in the LGS Unit 1 Primary Containment Atmosphere Sampling System (E1IS:BB) during other unrelated corrective maintenance work. As a result of the three known deficiencies, a task force was established in November, 1990 to investigate the causes and corrective actions. This task force has concluded that the three deficiencies were due to separate causes. On November 26 and 27, 1990, four additional panels were inspected to provide assurances that these are isolated occurrences and that a quality electrical separation program has been maintained. Two potential deficiencies were identified in the fourth panel and were determined not to affect operability of any systems. The two known deficiencies identified November 16 and 21, 1990, have been evaluated for operability and reportability, and were determined to be not reportable in accordance with 10CFR50.73 as a result of the previously described evaluation results and justification.

Since the issuance of LER 1-90-024, Revision 0, we expanded the sample scope of Unit 1 panel inspections to include all Unit 1 electrical panels with the potential of having an electrical separation deficiency. The electrical

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 2150-0104  
EXPIRES 6/21/85

FACILITY NAME (1)	POCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)		
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Limerick Generating Station, Unit 1	0 5 1 0 0 0 3 5 2	9 0	0 2 4	0 1	0 6	OF	0 6

TEXT (If more space is required, use additional NRC Form 866A's) (17)

separation inspections and associated rework was completed during the third Unit 1 Refueling Outage. These electrical separation inspections identified deficiencies in three panels which resulted in the issuance of LER 1-90-035. Similar electrical separation sampling inspections were then performed for Unit 2 and Common electrical panels prior to and during the first Unit 2 refuel outage starting in late March 1991. Electrical separation inspections are complete and deficiencies were found, however, none were determined to affect equipment operability using the above described evaluation.

Previous Similar Occurrences:

LERs 88-037, 88-042, 89-008, 89-009, 89-022, and 89-025 reported conditions involving physical separation deficiencies which resulted in a system becoming inoperable. These LERs were associated with an inspection program initiated during the Unit 1 second refuel outage for common panels that did not have the final QC panel inspection performed. In 1989, the Unit 1 panels were not reinspected since all of these panels did have the final QC panel inspection performed in 1984, prior to Unit 1 startup. These panels were concluded to have adequate physical separation based upon the QC inspections and documentations. Therefore, as a result of recurrent deficiencies, additional electrical separation inspections of Unit 1 and Unit 2 were completed.

Tracking Codes: (A9) - Failure to properly interpret information  
(D) - Procedure Deficiency