

David B. Hamilton
Vice President

440-280-5382

August 23, 2018
L-18-192

10CFR50.73(a)(2)(v)(D)

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Licensee Event Report Submittal

Enclosed is Licensee Event Report (LER) 2018-002, "Failed Fuse Leads to Loss of Safety Function". There are no regulatory commitments contained in this submittal.

If there are any questions or if additional information is required, please contact Mr. Nicola Conicella, Manager – Regulatory Compliance, at (440) 280-5415.

Sincerely,

David B. Hamilton
Vice PresidentEnclosure:
LER 2018-002cc: NRC Project Manager
NRC Resident Inspector
NRC Region III Regional Administrator

Enclosure
L-18-192

LER 2018-002



LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. Facility Name Perry Nuclear Power Plant	2. Docket Number 05000-440	3. Page 1 OF 4
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4. Title:
Failed Fuse Leads to Loss of Safety Function

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name	Docket Number
07	01	2018	2018	002	00	08	23	2018	Facility Name	Docket Number
										05000
										05000

9. Operating Mode	11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)			
1	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
10. Power Level	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
100	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(1)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(i)
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(ii)
		<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input checked="" type="checkbox"/> Other (Specify in Abstract below or in NRC Form 366A)	

12. Licensee Contact for this LER

Licensee Contact Tony Kledzik – Regulatory Compliance	Telephone Number (Include Area Code) 440-280-6188
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13. Complete One Line for Each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to ICES	Cause	System	Component	Manufacturer	Reportable to ICES
B	EF	FU	X999	Y					

14. Supplemental Report Expected	15. Expected Submission Date	Month	Day	Year
<input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date) <input checked="" type="checkbox"/> No				

Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

On July 1, 2018, at 0100 hours, while the plant was at 100 percent rated thermal power, a portion of the Division 1 Emergency Core Cooling System (ECCS) Loss Of Coolant Accident (LOCA) initiation logic was declared inoperable due to the discovery of a failed fuse. The fuse was replaced and the Division 1 ECCS LOCA initiation logic was declared operable at 0230 hours on July 1, 2018. The failed fuse caused the loss of a portion of the Division 1 ECCS LOCA initiation logic, which would have prevented the initiation of the Emergency Closed Cooling (ECC) A system. This resulted in ECC A and its supported systems to be declared inoperable. Low Pressure Core Spray (LPCS) is one of those supported systems and is considered a single train safety system. Inoperability of LPCS is considered an event or condition that could have prevented the fulfillment of a safety function. The failed fuse also caused the loss of a portion of the initiation logic, which would have prevented the automatic isolation of the Nuclear Closed Cooling system and Instrument Air to containment. The loss of containment isolation capability is also considered an event or condition that could have prevented the fulfillment of a safety function.

The cause of the Gould Shawmut TR30R fuse failure is due to a manufacturing defect. Immediate corrective actions replaced the failed fuse. The spare fuse inventory was inspected, and suspect fuses were removed. Inspections are planned for circuits that were identified that could have the suspect fuses. If a suspect fuse is found, it will be replaced.

The safety significance is very small. This issue is being reported in accordance with 10 CFR 50.73(a)(2)(v)(D) as a condition that could have prevented the fulfillment of a safety function. This LER satisfies the evaluation, notification, and reporting obligation to report defects under 10 CFR 21.2(c).



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

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Perry Nuclear Power Plant	05000-440	2018	- 002	- 00

NARRATIVE

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

INTRODUCTION

On July 1, 2018, at 0100 hours, while the plant was at 100 percent rated thermal power, a portion of the Division 1 Emergency Core Cooling System (ECCS) Loss Of Coolant Accident (LOCA) initiation logic was declared inoperable due to the discovery of a failed fuse [FU]. The fuse was replaced and the Division 1 ECCS LOCA initiation logic was declared operable at 0230 on July 1, 2018. The failed fuse caused the loss of a portion of the Division 1 ECCS LOCA initiation logic, which would have prevented the initiation of the Emergency Closed Cooling (ECC) A [CC] system. This resulted in ECC A and its supported systems to be declared inoperable. Low Pressure Core Spray (LPCS) [BM] is one of those supported systems and is considered a single train safety system. Inoperability of LPCS is considered an event or condition that could have prevented the fulfillment of a safety function. The failed fuse also caused the loss of a portion of the initiation logic which would have prevented the automatic isolation of Nuclear Closed Cooling [CC] and Instrument Air [LD] to containment. The loss of containment isolation capability is considered an event or condition that could have prevented the fulfillment of a safety function.

EVENT DESCRIPTION

On June 30, 2018, at 1613 hours the control room received an unexpected out of service alarm for the Residual Heat Removal (RHR) "A" system [BO] and the LPCS system. Initial walkdowns of the control room panels did not indicate any abnormalities associated with these systems. A troubleshooting plan was developed to further identify the cause of the concurrent alarms received in the control room.

On July 1, 2018, at 0100 hours, while implementing the troubleshooting plan, the positive main line fuse was found to be failed in disconnect ED1A06-08. This disconnect serves multiple components associated with the ECCS LOCA initiation logic. The unit supervisor declared the affected portion of the ECCS LOCA logic inoperable and entered the following Technical Specification (TS) action statements:

- TS 3.3.5.1 "ECCS Instrumentation", conditions A and B for the inability to automatically initiate the Division 1 Diesel Generator and Annulus Exhaust Gas Treatment train A.
- TS 3.7.1 "Emergency Service Water (ESW) System-Divisions 1 and 2", condition A for ESW A inoperability.
- TS 3.8.1 "AC Sources-Operating", condition B for Division 1 Diesel Generator inoperability.
- TS 3.3.6.3 "Suppression Pool Makeup (SPMU) System Instrumentation", conditions A and B for the inability to automatically initiate the SPMU A train.
- TS 3.3.6.1 "Primary Containment and Drywell Isolation Instrumentation" conditions A and B for preventing the automatic isolation of Nuclear Closed Cooling system and Instrument Air to containment.



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- TS 3.3.7.1 "Control Room Emergency Recirculation (CRER) System Instrumentation" conditions A and B for the inability to automatically initiate Division 1 CRER.
- TS 3.7.10 "Emergency Closed Cooling Water (ECCW) System" condition A for the inability to automatically initiate the "A" train of ECC.
- TS 3.5.1 "ECCS-Operating" conditions A and C for the inoperability of LPCS and RHR A
- TS 3.5.3 "Reactor Core Isolation Cooling (RCIC) System" condition A for the inoperability of RCIC
- TS 3.6.1.7 "Residual Heat Removal (RHR) Containment Spray System" condition A for the inoperability of RHR A
- TS 3.6.2.3 "Residual Heat Removal (RHR) Suppression Pool Cooling System" condition A for the inoperability of RHR A
- TS 3.6.3.3 "Combustible Gas Mixing System" condition A for the inoperability of the "A" train of Combustible Gas Mixing.
- TS 3.7.4 "Control Room Heating, Ventilating, and Air Conditioning (HVAC) System" condition A for the inoperability of the A train of Control Room HVAC.
- TS 3.3.8.1 "Loss of Power (LOP) Instrumentation" condition A for the inoperability of Division 1 LOP instrumentation.

On July 1, 2018, at 0230 hours, the fuse was replaced and the Division 1 ECCS LOCA initiation logic and associated systems were declared operable. On July 1, 2018, at 0824 hours, Event Notification #53481 was made to the Nuclear Regulatory Commission's Operations Center under 10 CFR 50.72(b)(3)(v)(D).

CAUSE

The removed Gould Shawmut TR30R fuse was quarantined and sent to a laboratory for failure analysis. Failure analysis concluded that the cause of the fuse failure was a manufacturing defect. There was no evidence that the fuse had ever been subjected to a current level that exceeded its current rating. The short circuit element had physically pulled away from the overload element, indicating that the fuse elements were under tension at the time of separation. This tension was likely placed on the fuse element during manufacturing when the two ferrules were crimped onto the fuse barrel. The crimping operation caused one of the ferrules to move outward from the fuse barrel.

EVENT ANALYSIS

A Probabilistic Risk Assessment (PRA) evaluation was performed. The assessment concluded that the June 30, 2018, fuse failure resulted in a very small change to overall plant risk. The corresponding change in Core Damage Frequency (CDF) ($\Delta CDF = 1.0E-09/\text{year}$) and corresponding change in Large Early Release Frequency (LERF) ($\Delta LERF = 1.6E-10/\text{year}$) are below the thresholds of $1.0E-06/\text{year}$ ΔCDF and



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1.0E-07/year delta LERF as discussed in Regulatory Guide 1.174. Based on these results, the risk of this event is very small in accordance with the Regulatory Guide.

CORRECTIVE ACTIONS:

Immediate corrective actions replaced the failed fuse. The spare fuse inventory was inspected to remove the manufacturing lot of suspect fuses. Inspections are being performed for susceptible circuits that could have the suspect fuses. If a suspect fuse is found, it will be replaced.

PREVIOUS SIMILAR EVENTS:

On February 11, 2016, at approximately 1505 hours with the plant in mode 4, an indicated loss of power to the Division 1 4160 volt bus, EH11, occurred. An invalid undervoltage signal tripped the bus supply breaker, and the bus loads shed, as expected. The Division 1 diesel generator (DG) started and loaded the EH11 bus. Subsequently the Division 1 DG was manually shutdown due to cooling water not being available. This de-energized all Division 1 equipment, including the train supplying shutdown cooling at the time.

A Ferraz Shawmut OT-15 fuse was found to exhibit intermittent continuity. Failure analysis and simple troubleshooting methods determined the cause of the loss of the Division 1 bus, EH11, was due to an invalid undervoltage signal caused by the failure of the fuse which supplies the undervoltage and degraded voltage protection circuitry. The failure analysis revealed that the fuse internals were not soldered correctly during the manufacturing process. One of the fuse elements to fuse ferrule connections had flux applied but no solder. A 10 CFR Part 21 report was filed by the supplier on March 22, 2016. This event was reported under 50.73(a)(2)(iv)(A) as an invalid actuation and 50.73(a)(2)(i)(B) for an operation or condition prohibited by technical specifications.

COMMITMENTS

None