

David B. Hamilton
Vice President

440-280-5382

March 28, 2018
L-18-10010CFR50.73(a)(2)(v)(D)
10CFR50.73(a)(2)(i)(B)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) 2018-001, "Loss of Safety Function and Violation of Technical Specifications due to diode failure". 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,

 *FRANK R. PAYNE ACTING*David B. Hamilton
Vice PresidentEnclosure:
LER 2018-001cc: NRC Project Manager
NRC Resident Inspector
NRC Region III Regional Administrator

Enclosure
L-18-100

LER 2018-001



LICENSEE EVENT REPORT (LER)
(See Page 2 for required number of digits/characters for each block)

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.

(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/>

1. FACILITY NAME Perry Nuclear Power Plant	2. DOCKET NUMBER 05000-440	3. PAGE 1 OF 3
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4. TITLE:
Loss of Safety Function and Violation of Technical Specifications due to diode failure

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
11	06	2016	2018	001	00	3	28	2018		05000
									FACILITY NAME	DOCKET NUMBER
										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)
100	<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)
	<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 checked="" 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 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	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	EK	RLY	A160	Y					

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

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

On November 6, 2016, while the plant was at 100 percent rated thermal power, during logic system testing of the Division 2 Diesel Generator (DG), the DG control power breakers tripped. This resulted in loss of control power to the Division 2 DG. It was later discovered that a shorted diode, in parallel with a control circuitry relay, had caused the control power breakers to trip.

The NRC later determined that due to the degradation of the diode, the Division 2 DG had been inoperable since April of 2015 when this particular portion of the control circuitry was last energized. This resulted in an operation or condition prohibited by the plants technical specifications as the DG was inoperable for longer than its 14 day allowed outage time. In addition, during this time period, the Division 1 DG was inoperable at various times for surveillance testing and maintenance, resulting in a loss of safety function for both DG's being inoperable at the same time. The cause of this event was a manufacturing defect in the diode and inadequate design controls over the DG control circuitry. Corrective actions included removal of the diodes from both Division 1 and 2 DG control power circuit and a review of past design changes to verify failure modes have been considered for any new components. The safety significance of this event was determined to be of low to moderate safety significance. This event is being reported under 50.73(a)(2)(i)(B) for an Operations or Condition Prohibited by Technical Specifications and under 50.73(a)(2)(v)(D) for a Loss of Safety Function.



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

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		YEAR	SEQUENTIAL NUMBER	REV NO.
Perry Nuclear Power Plant Unit 1	05000-440	2018	- 001	- 00

NARRATIVE

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

INTRODUCTION

On November 6, 2016, while the plant was at 100 percent rated thermal power, during pneumatic logic board functional testing with the Division 2 Diesel Generator (DG) [DG] inoperable for maintenance, the DG control power breakers [72] tripped. This resulted in loss of control power to the Division 2 DG. It was later discovered that a shorted diode, in parallel with control circuitry relays [RLY], had caused the control power breakers to trip. Past inoperability from this degraded diode resulted in a loss of safety function and a condition prohibited by technical specifications.

EVENT DESCRIPTION

On November 1, 2016, at 0400 hours the Division 2 DG was declared inoperable for scheduled maintenance. On November 6, 2016, during the pneumatic logic board functional check, the DG control power breakers tripped. It was later discovered that a shorted diode (Allen Bradley 199-FSMZ-1 flyback diode), in parallel with a control circuit relay, had caused the control power breakers to trip.

This portion of the control circuitry was last tested in April of 2015.

On June 5, 2017, the NRC issued inspection report "Perry Nuclear Power Plant—NRC Inspection Report 05000440/2017009 And Preliminary White Finding" (ML17156A750) which included the following statement: "The Division 2 Standby Diesel Generator was inoperable and unable to perform its emergency start function from April 2, 2015, until the emergency start diode was replaced and the Division 2 Standby Diesel Generator was returned to service on November 8, 2016, which was longer than the Technical Specification allowed outage time of 14 days."

On August 24, 2017 the NRC issued inspection report "Perry Nuclear Power Plant—Final Significance Determination of a White Finding and Notice Of Violation; NRC Inspection Report 05000440/2017010 and Assessment Follow-Up Letter" (ML17236A187) which made the following statement: "The diode in the diesel generator emergency start circuit failed the next time the emergency start circuit was energized after the April 2015 test. The NRC determined there was no credible degradation mechanism that would degrade the diodes while they were not energized. Therefore, we concluded the diode would have failed the next time the circuit was energized, independent of the time that had elapsed."

Based upon the NRC's position as documented in the aforementioned inspection reports, the Division 2 DG had been inoperable from April 2, 2015, until November 8, 2016, and as such an LER is required for a condition prohibited by the plants technical specifications. The resultant inoperability was a violation of Technical Specification (TS) 3.8.1 "AC Sources-Operating" for exceedance of the 14 day action to restore the DG to operability. In addition, during this time period, the Division 1 DG was inoperable at various times for surveillance testing and maintenance, resulting in a loss of safety function for both Division 1 and Division 2 DG's being inoperable at the same time.



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NARRATIVE

CAUSE

Two root causes were identified for the diode failure impact on the Division 2 DG start circuitry. Based on failure analysis, it was concluded that the failure in November 2016 was the result of a diode manufacturing defect. The second root cause was that a potential failure mechanism was introduced without specifically considering the effects of a shorted diode on the control circuitry of the diesel generator. It was later determined that the diodes were enhancements to the circuit, but not required.

EVENT ANALYSIS

A Probabilistic Risk Assessment (PRA) evaluation of this event from the internal events model perspective indicated a delta core damage frequency (CDF) of 7.8E-06/yr and a delta large early release frequency (LERF) of 1.4E-07/yr or a significance level greater than very small when comparing to the Regulatory Guide 1.174 acceptance thresholds of 1.0E-06/yr and 1.0E-07/yr, respectively. Discussions with the Region III Senior Risk Analyst (SRA), including qualitative assessments perspectives on external events including fire and seismic risk, ultimately concluded similar results based on implementation of the Significance Determination Process (SDP). Applying this process, a final significance of low to moderate safety significance based on the delta core damage frequency (estimated to be 8.8e-06/yr by the SRA) being within the range of greater than 1.0E-06/yr and less than 1.0E-05/yr was determined. Since the large early release frequency (LERF) contribution to the overall significance was no greater than the CDF estimate, CDF was determined to be the appropriate metric to be used for this conclusion.

CORRECTIVE ACTIONS

Corrective actions included removal of the subject diodes from both Division 1 and 2 DG control power circuit and a review of past design changes to verify failure modes have been considered for any new components.

PREVIOUS SIMILAR EVENTS

On May 6, 2016, Operations attempted to start the Division 2 Emergency Diesel Generator for performance of a post maintenance test (PMT) when unexpected alarms and abnormal indications were received. A shorted diode was identified which caused a loss of power to the Division 2 DG controls. The diode was replaced, no grounds were identified (no other diode failures) on the common portion of the control system, and the Division 2 DG subsequently passed the PMT.

The corrective actions for the May 2016 event were focused on eliminating only the failed diode in both the Division 1 and 2 DGs. The apparent cause conclusions were subsequently refuted by laboratory testing performed for the November 6, 2016 event and the investigation was superseded. This was subsequently addressed in the root cause report.

COMMITMENTS

None