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United States Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Perry Nuclear Power Plant
Docket No. 50-440
LER 2005-002

Ladies and Gentlemen:

Enclosed is Licensee Event Report (LER) 2005-002, All Emergency Diesel Generators Declared Inoperable Due To Degraded Testable Rupture Discs. The root cause investigation will be reviewed by the Corrective Action Review Board and is pending executive approval.

There are no regulatory commitments contained in this letter. Any actions discussed in this document that represent intended or planned actions, are described for the NRC's information, and are not regulatory commitments.

If you have questions or require additional information, please contact Mr. Jeffrey J. Lausberg, Manager – Regulatory Compliance, at (440) 280-5940.

Very truly yours

Richard Anderson

Enclosure: LER 2005-002

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III

IE22

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 6/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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.

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

All Emergency Diesel Generators Declared Inoperable Due To Degraded Testable Rupture Discs

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
02	17	2005	2005	- 02 -	00	04	17	2005	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

93%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☒ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(a)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☒ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☒ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☒ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	

12. LICENSEE CONTACT FOR THIS LER

	TELEPHONE NUMBER *(Include Area Code)*
Kenneth Russell, Compliance Engineer, Regulatory Compliance	(440) 280- 5580

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
A	EK	RV	Nova	N					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete EXPECTED SUBMISSION DATE).* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On February 17, 2005, at 1730 hours, with the plant operating at approximately 93% power, division 1, 2, and 3 emergency diesel generators (EDGs) were declared inoperable due to degraded testable rupture discs (TRDs) on their respective exhaust systems.

The cause of the inoperability was determined to be inadequate workmanship in the preparation and testing of the design. Design personnel did not have adequate skills and experience to perform the design or to prepare and direct the testing. The management oversight of the design was unable to detect the inadequate results.

A design change will be completed that removes each TRD and eliminates the possibility that a TRD can fail to open when required.

Training will be conducted to provide guidance on the requirements for design testing and include this event as a case study or example. This training shall include a discussion of the need to consider if the task is within the assigned engineers' level of training and expertise. Design Engineering management will develop guidelines to ensure that tasks are assigned to personnel with the appropriate level of skills and expertise required to perform engineering tasks. Supervisory personnel will be instructed on use of these guidelines in assigning tasks.

This event was reported per 10CFR50.72(b)(3)(ii)(B), unanalyzed condition and 10CFR50.72(b)(3)(v), loss of safety function on ENF 41417. This event was determined to be of very low safety significance.

LICENSEE EVENT REPORT (LER)

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

INTRODUCTION

At Perry Nuclear Power Plant (PNPP), the emergency diesel generators (EDGs)[DG] normally exhaust through roof-mounted silencers [SIL], which are not hardened to resist seismic and tornado loads. The safety-related path is through testable rupture discs (TRDs)[RPD], latching pressure relief valves, located upstream of the silencers in a concrete tornado missile structure (TMS). Exhaust flowing from TRDs enters the interior of the TMS and then discharges to ambient through open passages in the TMS.

EVENT DESCRIPTION

On February 17, 2005, at 1730 hours, with the plant operating at about 93% power, during testing of the division 2 EDG TRD, it was discovered that the TRD required excessive force to open. The function of the TRD is to open to relieve exhaust pressure should the EDGs non-safety exhaust silencer become blocked. Upon inspection of the TRD, some deformation was noted on the TRD damper. Since the possibility that the condition might exist on the other two divisional EDGs could not be ruled out, they were also declared inoperable and Technical Specification (TS) Limiting Condition for Operation (LCO) 3.0.3 was entered. An unanalyzed condition [10CFR50.73(a)(2)(ii)(B)] potentially existed in that the same design potentially affected multiple trains. Since three EDGs were inoperable, it was determined that this resulted in a potential loss of the safety functions to shutdown the reactor [10CFR50.73(a)(2)(v)(A)], to remove decay heat [10CFR50.73(a)(2)(v)(B)], to mitigate the consequences of an accident [10CFR50.73(a)(2)(v)(D)] and an event where a single cause or condition caused at least one independent train to become inoperable in multiple systems [10CFR50.73(a)(2)(vii)].

Technical Specifications LCO 3.0.3 was entered due to declaring 3 EDGs inoperable at 1730 hours on February 17, 2005. This is reportable as a condition prohibited by Technical Specifications [10CFR50.73(a)(2)(i)(B)]. The division 2 EDG was declared operable at 2011 hours after unlatching its TRD and LCO 3.0.3 was exited. Division 1 and 3 EDGs were subsequently declared operable at 2204 hours on February 17, 2005 and 0033 hours on February 18, 2005 respectively following the unlatching of their TRDs.

CAUSE OF EVENT

The cause of the failure was determined to be related to the engineering workmanship of the recent modifications to the testable rupture discs to resolve the longstanding reliability concerns with the EDG TRDs. The effect of warpage and friction at the TRD latch hard-facing were not adequately considered in the development of latch design. Testing performed to support the design modifications was not adequate to demonstrate the TRD would function as designed.

Two of the prototype tests were outside the test acceptance values. This condition was addressed by hard-surfacing the latch mechanism surfaces. Additional testing was not performed since this was considered an enhancement. No specific prototype test acceptance criteria were specified.

Design personnel did not have adequate skills and experience to perform this type of design or to prepare and direct the testing of the prototype. The management oversight of the design was also unable to detect that the engineer was not able to fix the TRD design.

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

EVENT ANALYSIS

The TRDs on the EDG exhaust have a history of the lift setpoints drifting outside the leave-as-is zone. Prior to installing the most recent TRD design, they typically have lifted within the allowable limits. To correct this setpoint drift condition, a newly designed TRD was installed for division 3 EDG in April 2004. The same design was then installed on division 2 EDG and division 1 EDG in October 2004 and in November 2004 respectively.

A lift test has been done to verify operability on quarterly bases. For division 3 the first two tests after installation lifted low and subsequent tests were within the required range. For division 1, the first test performed in January 2005, lifted high. For division 2, the first test in January 2005 also lifted high. On February 17, 2005 division 2 EDG TRD again lifted high and inspection of the TRD disc noted that it was warped. Since the other discs were of the same design, all 3 divisional EDGs were declared inoperable and Technical Specification 3.0.3 was entered. The TRDs were subsequently unlatched to restore EDG operability.

Review of the TRD setpoint drift determined that excessive back-pressure (due to the TRD opening at a higher lift setting than the setpoint value with a partially or fully blocked exhaust silencer) may result in increased fuel consumption rates. Depending on the magnitude of the exhaust back pressure value, and its effects on turbo-charger performance, fuel consumption could increase such that the diesel generator may not be able to supply all of the safety-related equipment loads for the required seven days supply in the diesel generator storage tank. If the TRD failed to open with a partially blocked exhaust silencer that resulted in a sufficiently high back-pressure (approximately 20 times the TRD lift setting), the diesel generator could stall. Opening of the TRDs at a pressure below its setpoint was determined not to be an EDG operability issue.

In terms of significance, the events (that would cause failure of the diesel exhaust system) that rely on the TRDs are a seismic event (Review Level Earthquake or higher) or a tornado (greater than or equal to an F2). Postulating failure of all 3 EDGs as a result of these events is conservative based on the following:

1. A "perfect" damage state is assumed to occur. No credit is taken for the portion of damage states that would rupture the exhaust piping obviating the need for successful TRD operation. Nor is credit taken for damage states that would completely (or nearly completely) block exhaust flow. These would result in rapid pressure increases that would force the TRD latches open. Thus, the analysis assumes that the "perfect" damage state would occur without regard to its relative probability.

2. No credit is taken for shielding or spatial distancing between exhaust piping and silencers. The three systems are on a roof approximately 90 feet across. The analysis assumes that any missiles or winds that might disable one system similarly disable all three.

3. No credit is taken for operator recovery actions that could manually vent the containment which would extend the time available to recover off-site or EDG power sources or provide other means for maintaining level in the reactor.

4. No credit is taken for the portion of core damage sequences that would not lead to a large, early release with exception to the first sequence which accounts for 62% of the CDF with a recovery of offsite power after 24 hours. The majority of core damage sequences involve several hours of operation of reactor core isolation cooling and/or fire protection system operation before the loss of battery-backed power or system pressure/temperature conditions disable the ability to cool the core.

5. No credit is taken for the spatial separation between the diesel generator building and the electrical switchyard. The analysis assumes that all tornadoes that impact the diesel generator building also disable all offsite power sources from the switchyard.

6. No credit is taken for the amount of time that EDGs would operate with higher than normal exhaust back-pressure. This would extend the time to potential core damage. Nor is credit taken for nominal operator actions to monitor the engine operation, notice that turbocharger temperatures were rising, and take actions to prevent engine failure (such as manually opening the TRDs).

Due to the relatively low frequency of the initiating events that would present the condition requiring the testable rupture discs to perform their function, in addition to the relatively low common cause failure potential (based on empirical test data), the combined increase in risk of both a seismic event (Review Level Earthquake) and a greater than or equal to F2 tornado (not occurring concurrently) on the core damage frequency (CDF) is approximately 1.03E-7 events/year. The increase in the large, early release frequency (LERF) was calculated to be 3.9E-8 events/year. Accounting for the more realistic conditions associated with these assumptions would lower the estimate further. These values are below the regulatory Green/White threshold (1.0E-6/yr for CDF and 1.0E-7/yr for LERF) for risk characterization used in the NRC's Significance Determination Process. Based on these calculations, this event would be characterized as green which would be of very low safety significance.

CORRECTIVE ACTIONS

The TRDs were unlatched and returned to an operable condition.

A design change will be completed that removes each TRD and eliminates the possibility that a TRD can fail to open when required.

Training will be initiated on the problem solving and decision making process. This corrective action is to provide guidance for the requirements for prototype proof-testing and include this event as a case study or example. This training shall specifically include a discussion of the need to consider if the task is within the assigned engineers' level of training and expertise.

Design Engineering management will develop guidelines to ensure that tasks are assigned to personnel with the appropriate level of skills and expertise required to perform engineering tasks. Supervisory personnel will be instructed on use of these guidelines in assigning tasks.

PREVIOUS SIMILAR EVENTS

A review of the last 5 years of Licensee Event Reports (LERs) did not identify any events that were attributed to design problems as a result of less than adequate workmanship by staff engineers. LERs were identified related to deficient designs by component manufacturers or engineering service providers such as LER 04-001 which identified an inadequately designed coupling for an emergency service water pump and LER 01-002 which identified non-conservative setpoints for the oscillation power monitors (OPRM). The LER corrective actions consisting of: replacing the coupling with a more robust design and revision of the OPRM setpoints respectively, would not have led to the correction of the TRD issue identified in this LER.

Energy Industry Identification System Codes are identified in the text as [XX].