FENOC™
FirstEnergy Nuclear Operating Company

Perry Nuclear Power Plant
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David B. Hamilton
Vice President

440-280-5382

April 24, 2019
L-19-108

10CFR50.73(a)(2)(iv)(A)

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Licensee Event Report Submittal

Enclosed is Licensee Event Report (LER) 2019-001, "LER 2019-001, Loss of Generator Excitation causes Turbine Trip and Reactor Protection System Actuation". There are no regulatory commitments contained in this submittal.

If there are any questions or if additional information is required, please contact Mr. Glendon Burnham, Manager – Regulatory Compliance, at (440) 280-7538.

Sincerely,

David B. Hamilton
Vice President

Enclosure:
LER 2019-001

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III Regional Administrator

Enclosure
L-19-108

LER 2019-001

NRC FORM 366
(04-2018)

U.S. NUCLEAR REGULATORY COMMISSION

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/

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 3/31/2020

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	2. Docket Number	3. Page
Perry Nuclear Power Plant	05000-440	1 OF 3

4. Title:
Loss of Generator Excitation causes Turbine Trip and Reactor Protection System Actuation

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 05000
02	25	2019	2019 -	001 -	00	04	24	2019	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	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. Power Level	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
74	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ Other (Specify in Abstract below or in NRC Form 366A)	

12. Licensee Contact for this LER

Licensee Contact	Telephone Number (Include Area Code)
Lloyd Zerr – Regulatory Compliance	440-280-5274

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
D	TL	EXC	5ATI	Y					

14. Supplemental Report Expected	15. Expected Submission Date	Month	Day	Year
☐ Yes (If yes, complete 15. Expected Submission Date) ☒ No				

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

On February 25, 2019, at 0024 hours, the Reactor Protection System (RPS) automatically actuated due to turbine stop and control valve closure caused by a turbine trip. The turbine trip was caused by a loss of generator excitation, resulting in the loss of the main generator field.

The cause was determined to be inadequate preventive maintenance (PM) acceptance criteria for generator exciter brush replacement. The criteria for brush inspection and replacement should have added margin to brush lifetime to ensure brushes could not wear to the point where brush spring tension could no longer be properly maintained. Corrective actions included modifying preventive maintenance criteria to add margin to replace brushes earlier in their lifetime, and ensuring all brushes are checked for vibration during the PM.

The plant responded as expected, all control rods inserted and there were no Emergency Core Cooling System (ECCS) actuations. The risk of this event is considered very small in accordance with the Regulatory Guidance. This event is reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event or condition that resulted in an automatic actuation of the RPS.

NARRATIVE

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

INTRODUCTION

On February 25, 2019, while coasting down to enter a refuel outage and with the plant in Mode 1 at approximately 74 percent rated thermal power, the Reactor Protection System (RPS) [JC] automatically actuated due to turbine stop and control valve closure caused by a turbine [TG] trip. The turbine trip was caused by a loss of generator [GEN] excitation [EXC]. The generator received a lockout signal from the loss of excitation relay [RLY] following its associated time delay relay [62] actuation. The plant responded as expected and all control rods inserted and there were no Emergency Core Cooling System (ECCS) actuations. At 0344 hours, notification was made to the NRC Operations Center (Event Notification ENS 53896) in accordance with 10 CFR 50.72(b)(2)(iv)(B) as an event or condition that results in an actuation of the RPS when the reactor is critical. This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event or condition that resulted in an automatic actuation of the RPS.

EVENT DESCRIPTION

On February 25, 2019 at 0024 hours, an RPS actuation was automatically initiated due to turbine stop and control valve closure caused by a turbine trip. The main generator received a lockout signal from the loss of excitation relay following its associated time delay relay actuation. In the six seconds prior to the lockout signal, there was a decrease in grid voltage from approximately 346 Kilovolts (kV) to approximately 311kV. Correspondingly, the main generator Mega Volts Ampere Reactive (MVARs) increased significantly. This equipment response is expected for a valid loss of excitation event and once the field current stopped, the generator acted as an induction motor instead of a synchronous generator and drew MVARs from the grid to support its magnetic field. This flow of MVARs resulted in a decreased local grid voltage until the generator tripped.

The event progression was that one or more of the exciter inboard brushes reached its wear limit. The brush spring(s) was(were) out of range to ensure positive, adequate downward pressure to the brush(es) to assure proper electrical connection was maintained. When the brush spring(s) pressure was limited, the brush(es) began to bounce/chatter. Each time a brush fails to make adequate connection, the current it is carrying is broken. As the radial distance between the brush and collector [COL] ring surface increases, the current is strong enough to cross over the minimal air gap creating an arc. An arc can impose physical damage and create surface defects in the form of pits (peaks and valleys) that act as increased friction to increase the wear rate of other brushes that may ride on the same ring surface. The longer this bouncing and subsequent arcing continues, conditions for impaired electrical connection degrade in an exponential manner. As high current discharges repeatedly occur, arcing also causes increased heating of the collector ring and brushes. Once the radial distance between the brush and collector ring surface increases enough, the air gap becomes great enough that the arc does not connect the brush and collector ring, but finds the path of least resistance, some external source to ground, which is referred to as a "flashover" event.

CAUSE OF EVENT

The direct cause of the generator lockout, and subsequently the turbine trip followed by an RPS actuation, was a flashover of the exciter brush rigging and carbon brushes which resulted in the loss of the main generator field.

The apparent cause of the event was determined to be inadequate preventive maintenance (PM) acceptance criteria for brush replacement. The criteria for exciter brush inspection and replacement should have added margin to ensure that the brushes could not wear to the point where brush spring tension could no longer be properly maintained.

EVENT ANALYSIS

A Probabilistic Risk Assessment (PRA) evaluation was performed for the automatic RPS actuation. A conservative analysis of this uncomplicated plant transient results in a delta Core Damage Frequency that is well below the acceptable threshold of 1x10-6/year as discussed in Regulatory Guide 1.174. The risk of this event is therefore considered very small in accordance with the regulatory guidance. This event was reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event or condition that resulted in an automatic actuation of the RPS.

CORRECTIVE ACTIONS:

A preventative maintenance (PM) revision was performed to modify the brush replacement criteria to add margin to replace brushes earlier in their lifetime, and to ensure that all brushes are checked for vibration during the PM. These actions were completed by 4/2/2019.

Previous Similar Events

A review of LERs and the corrective action database for the past three years identified no similar events.

COMMITMENTS

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