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Harris Nuclear Plant
5413 Shearon Harris Road
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919.362.2000

10 CFR 50.73

September 16, 2019
Serial: RA-19-0302

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

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400/Renewed License No. NPF-63

Subject: Licensee Event Report 2019-001-01

Ladies and Gentlemen:

Duke Energy Progress, LLC, submits the enclosed Licensee Event Report (LER) 2019-001-01 in accordance with 10 CFR 50.73 for Shearon Harris Nuclear Power Plant, Unit 1 (HNP). This report is a planned supplement to LER 2019-001-00 submitted on June 17, 2019. This report describes an event in which both channels of the HNP Turbine Control System Auto-Stop Trip Quadvoter pilot-operated solenoid valves were unable to function as expected. This event had no significance with respect to the health and safety of the public.

There are no regulatory commitments contained within this report.

Please refer any questions regarding this submittal to Sarah McDaniel at (919) 362-2002.

Sincerely,

A handwritten signature in blue ink, appearing to read "John R. Dills", written over a printed name.

John R. Dills

Enclosure: Licensee Event Report 2019-001-01

cc: J. Zeiler, NRC Senior Resident Inspector, HNP
M. Barillas, NRC Project Manager, HNP
NRC Regional Administrator, Region II



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John R. Dills

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cc: J. Zeiler, NRC Senior Resident Inspector, HNP
M. Barillas, NRC Project Manager, HNP
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**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 Shearon Harris Nuclear Power Plant, Unit 1	2. Docket Number 05000 0400	3. Page 1 OF 3
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4. Title Turbine Control System Auto-Stop Trip Solenoid Operated Valves Response Times Impacted

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
04	17	2019	2019	001	01	09	16	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	<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 checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input checked="" 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 Sarah McDaniel, Regulatory Affairs Engineer	Telephone Number (Include Area Code) (919) 362-2002

13. Complete One Line for each Component Failure Described in this Report										
Cause B	System JJ	Component FSV	Manufacturer P070	Reportable to ICES Y	Cause	System	Component	Manufacturer	Reportable to ICES	
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 April 16-17, 2019, the Shearon Harris Nuclear Power Plant, Unit 1, attempted to perform turbine trip testing of each individual solenoid operated valve (SOV) within the Auto-Stop Trip (AST) and Overspeed Protection Control (OPC) Quadvoter Trip Block assemblies. The response received on April 16th for the first AST Quadvoter SOV indicated that the valve was unable to cycle. Troubleshooting efforts were successful in restoring functionality of the valve. The redundant SOV in the A channel tested satisfactorily. On April 17th, testing of the B channel was completed and the first SOV tested failed similarly to the first A channel valve. Troubleshooting efforts were successful in restoring functionality and preemptively applied to the second SOV in the B channel. Based on the test results, it is likely that both channels of the system were non-functional at the same time. With both AST channels rendered non-functional, the system was incapable of depressurizing the AST hydraulic header to trip the main turbine within the time response requirements of Technical Specifications. The root cause of this event is that the vendor design of the Quadvoter utilized spool-type pilot SOVs without adequately addressing inherent design vulnerabilities in a Fyrquel fluid application to ensure consistent, reliable operation of the trip and reset functions. Immediate action was taken to increase the frequency of AST valve testing and to increase the cycling of the solenoid valves for each test. Pilot valve springs were replaced with a stronger spring in all AST valves. Planned corrective actions include a design change to reduce the sensitivity of the pilot SOVs to the determined failure mechanisms and the flushing of AST and OPC Quadvoter Trip Block assemblies.

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

(See NUREG-1022, R.3 for instruction and guidance for completing this form
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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Shearon Harris Nuclear Power Plant, Unit 1	05000-400	2019	001	01

NARRATIVE

Note: Energy Industry Identification System (EIIIS) codes are identified in the text within brackets [].

A. Background

Prior to the event, Shearon Harris Nuclear Power Plant, Unit 1 (HNP), was operating in Mode 1 at approximately 100 percent power under steady state conditions. There were no structures, systems, or components that were known to be inoperable at the time of this event that contributed to the event.

This event is reportable per 10 CFR 50.73(a)(2)(i)(B) as "any operation or condition which was prohibited by the plant's Technical Specifications," 10 CFR 50.73(a)(2)(v) as "any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to: ... (D) Mitigate the consequences of an accident," and 10 CFR 50.73(a)(2)(vii) as "any event where a single cause or condition caused ... two independent trains or channels to become inoperable in a single system designed to: ... (D) Mitigate the consequences of an accident." This is due to the inability of the Auto-Stop Trip (AST) solenoid operated valves (SOVs) [FSV] to actuate to depressurize the AST header and provide the required response time for turbine [TRB] trip.

The Digital Electro-Hydraulic (DEH) system [JJ] was upgraded in April 2018 during refueling outage 21 with a new Turbine Control System (TCS) [JJ]. The TCS consists of a turbine valve control system (TVCS) [JJ] and a turbine protection system (TPS) [JJ]. These two systems work to position the high-pressure and low-pressure turbine steam inlet valves [V] to regulate the flow of steam through the turbine. The TCS provides automatic control of steam flow through the turbine. In addition, the turbine is afforded protection via the AST, Overspeed Protection Control (OPC), and the Secondary Overspeed Protection System (SOPS) [JJ]. The AST and OPC systems utilize logic from TVCS and TPS to control hydraulic trip components named Quadvoters [BLK], which are hydraulic control blocks that house four pilot-operated SOVs arranged into two parallel banks of two SOVs in series. As such, a turbine trip requires both SOVs in one bank to change position and dump header pressure.

Digital outputs from the TCS controllers [DCC] supply the necessary voltages to position the valves to the desired position. This allows hydraulic fluid pressure from the electro-hydraulic pumps [P] to be applied to build AST/OPC header pressure, or to dump it to the vented drain header. The turbine trip condition requires the TCS to send a signal to de-energize the AST SOVs to depressurize the AST header, whereas the OPC utilizes a digital output signal to energize the OPC SOVs to depressurize the OPC header.

B. Event Description

On April 16, 2019, HNP personnel commenced turbine trip testing with the operation of each individual SOV within the AST and OPC Quadvoter Trip Block assemblies. The testing results of one bank of AST Quadvoter SOVs on April 16th show that one valve was unable to cycle, which rendered the bank non-functional. The SOV was manually freed to restore functionality on April 16th. The testing results of the other bank of AST Quadvoter SOVs on April 17th show that an additional valve was unable to cycle, which rendered this bank non-functional as well. The SOV was manually freed to restore functionality on April 17th. With both AST Quadvoter SOV banks non-functional, both AST channels were likely non-functional and the system was incapable of depressurizing the AST hydraulic header to trip the main turbine within the time response requirements of Technical Specifications. As a result of this event, turbine trip protection was not fully functional for a time period since the last successful cycling of the AST SOVs that was completed on April 11th. If plant conditions had required a turbine trip, the turbine would have ultimately performed as expected, though with a slight delay. Upon receipt of a turbine trip signal, the TCS generates an additional, although delayed, demand signal that would energize the OPC solenoids and close the governor valves, which trips the turbine by isolating steam flow to it. For this

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NARRATIVE

reason, the turbine remained capable of being tripped on a delayed demand signal.

C. Causal Factors

The root cause of this event is that the vendor design of the Quadvoter utilized spool-type pilot SOVs without adequately addressing inherent design vulnerabilities in a Fyrquel fluid application to ensure consistent, reliable operation of the trip and reset functions.

D. Corrective Actions

Immediate action was taken to exercise the AST valves and restore functionality. The frequency for performance of AST valve testing was increased to twice per week and cycling of the solenoid valves was increased to five strokes for each test. Operations guidance was issued to maintain turbine housing doors open for additional cooling as allowed by procedure. Pilot valve springs were replaced with a stronger spring in all AST valves to increase margin. Planned corrective actions include a design change to reduce the sensitivity of the pilot SOVs to the determined failure mechanisms and the flushing of AST and OPC Quadvoter Trip Block assemblies.

E. Safety Analysis

The TCS utilizes two on-line maintainable trip block assemblies (AST/OPC Quadvoters) that hydraulically trip the turbine on overspeed conditions or upon receipt of a turbine trip signal. The AST Quadvoter SOVs would not have been able to function upon receiving a signal; however, the OPC Quadvoter SOVs were functional, and would have tripped the turbine on the subsequent delayed demand if a trip signal had been received. The ability of the TCS to send or receive trip signals was not impacted, only the physical opening of the AST Quadvoter SOVs once de-energized.

An assessment of the HNP Final Safety Analysis Report (FSAR) Chapter 6 and Chapter 15 transient accident analyses has been performed to determine if a delayed turbine trip response time would have an adverse effect on the analyzed transient responses. The conclusion of this assessment is that the FSAR Chapter 6 and 15 analyses are not adversely affected by the lack of turbine isolation through throttle valve closure.

TCS maintained the ability to trip the turbine on the subsequent delayed command to the OPC Quadvoter SOVs and there was no significant impact to the health and safety of the public. Based on this evaluation, this condition will not be counted as a safety system functional failure against Performance Indicator MS05, Safety System Functional Failure.

F. Additional Information

A similar condition occurred previously at HNP on July 3, 2018, which was described in LER 2018-003-00.