Progress Energy

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Serial: HNP-08-063
10 CFR 50.73

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

SHEARON HARRIS NUCLEAR POWER PLANT UNIT 1
DOCKET NO. 50-400/LICENSE NO. NPF-63
LICENSEE EVENT REPORT 2008-001-00

Ladies and Gentlemen:

The enclosed Licensee Event Report 2008-001-00 is submitted in accordance with 10 CFR 50.73. This report describes the failure of the Containment Spray Additive Test Flow to meet the Technical Specification Limiting Condition for Operation 3.6.2.2 Surveillance Requirement 4.6.2.2.d.

This document contains no new Regulatory Commitment. Please refer any questions regarding this submittal to Mr. Dave Corlett, Supervisor - Licensing/Regulatory Programs, at (919) 362-3137.

Sincerely,

[signature] for

Kelvin Henderson
Plant General Manager
Harris Nuclear Plant

KH/adz

Enclosure

cc: Mr. P. B. O'Bryan, NRC Sr. Resident Inspector
Ms. M. G. Vaaler, NRC Project Manager
Mr. L. A. Reyes, NRC Regional Administrator, Region II

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NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010
LICENSEE EVENT REPORT (LER) (See reverse 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 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.

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4. TITLE
Containment Spray Additive System Eductor Test Flow Outside of Technical Specification Limits.

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 N/A	DOCKET NUMBER N/A
01	30	2008	2008	- 001 -	00	5	30	2008	FACILITY NAME N/A	DOCKET NUMBER N/A

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)(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)
10. POWER LEVEL	☐ 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)
100%	☐ 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
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Dave Corlett – Licensing Supervisor	919-362-3137

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	BE	EDR	Graham	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 15 single-spaced typewritten lines)*

The Containment Spray Additive System flow test results failed to meet the Technical Specification Surveillance Requirement 4.6.2.2.d. flow rate between 19.5 and 20.5 gpm several times between October 21, 2007 and May 18, 2008. The flow rate was immediately adjusted to 20 gpm each time it was found out of tolerance. Due to the number of repeat occurrences and valve re-adjustments to re-establish the 20 gpm flow rate, a Priority 1 Root Cause Investigation was conducted. However during this degraded condition, the Containment Spray Additive System may not have been capable of maintaining the pH between 7 and 11, as required under accident conditions. This could degrade Iodine scrubbing capabilities or increase corrosion problems. These failures were determined to be reportable as an LER on 3/31/2008. The first set of problems was caused by air entrapment in the Containment Spray Additive System during Refueling Outage 14. Preventative maintenance program and operating procedure revisions were implemented to check for and remove air from the system after system fill and vent and during each refueling outage prior to Mode 4 ascending. The second set of problems was caused by inadequate system design. Operating position and inherent stem-plug looseness in the eductor flow throttle valve interact to cause flow instability. A system design change and operating procedure changes were implemented to reduce valve instability. Additional design changes will be implemented to eliminate flow instability.

Energy Industry Identification System (EIIS) codes are identified in text within brackets [ ].

I. Description of Events

October 21, 2007; 2:50 am - Plant enters Mode 4 operation after Refueling Outage (RFO) 14. Technical Specification 3.6.2.2 states that the Spray Additive System shall be OPERABLE with two spray additive educators each capable of adding Sodium Hydroxide (NaOH) solution from the additive tank to a Containment Spray System [BE] during Modes 1, 2, 3, and 4. Both of the Containment Spray eductors need to be capable of passing 19.5 to 20.5 gpm to satisfy the Technical Specification.

November 12, 2007; 10:00 pm, Plant in Mode 1 at 100% power - While performing OST-1118, "Containment Spray Operability Train-A Quarterly Interval Modes 1-4", Train-A Containment Spray eductor flow was calculated to be 15.5 gpm. Throttle valve 1CT-118 was opened 3/8 of one turn to restore the flow to 20 gpm. Failure was determined by the root cause analysis to be entrapped air restricting flow as detailed in Section II.

November 26, 2007; 2:44 am, Plant in Mode 1 at 100% power – While performing OST-1119, "Containment Spray Operability Train-B Quarterly Interval Modes 1-4", Train-B Containment Spray eductor flow was calculated to be 16.4 gpm. Throttle valve 1CT-119 was slightly opened to restore the flow to 20 gpm. Failure was determined by the root cause analysis to be entrapped air restricting flow as detailed in Section II.

January 4, 2008; 11:48 pm, Plant in Mode 1 at 100% power – While performing OST-1118, the Train-A Containment Spray eductor flow was calculated to be 25.16 gpm. Throttle valve 1CT-118 was closed 1/2 of one turn to restore the flow to 20 gpm. Failure was determined by the root cause analysis to be due to the fact that the entrapped air was no longer present and now the flow was too high.

January 30, 2008 - These events were upgraded to Priority 1 requiring a root cause investigation.

February 22, 2008; 5:03 pm, Plant in Mode 1 at 100% power - While performing OST-1119, Train-B Containment Spray eductor flow was calculated to be 19.3 gpm. Throttle valve 1CT-119 was slightly opened to restore the flow to 20 gpm. Failure was determined by the root cause analysis to be inadequate system design as detailed in Section II.

February 28, 2008; 3:00 pm, Plant in Mode 1 at 100% power - While performing OST-1118, Train-A Containment Spray eductor flow was calculated to be 19.2 gpm. During this performance flow would be adjusted to 20 gpm and drift to values as low as 18.6 gpm before a consistent flow rate of 20 gpm could be established. Failure was determined by the root cause analysis to be inadequate system design as detailed in Section II.

March 1, 2008; 11:30 am, Plant in Mode 1 at 100% power – While performing OST-1119, the Train-B Containment Spray eductor flow was calculated to be 24.0 gpm. Throttle valve 1CT-119 was closed 3/8 of one turn to restore the flow to 20 gpm. Failure was determined by the root cause analysis to be due to the fact that the entrapped air was no longer present and now the flow was too high.

May 18, 2008; 11:17 am, Plant in Mode 1 at 100% power - While performing OST-1118, Train-A Containment Spray eductor flow was calculated to be 18.3 gpm. Throttle valve 1CT-118 was adjusted to restore the flow to 20 gpm. Failure was determined by the root cause analysis to be inadequate system design as detailed in Section II.

The system was required to be Operable starting on October 21, 2007, when HNP entered Mode 4 after RFO14. The estimated length of time that the pH control of the 'A' Containment Spray may not have been controllable between 7 and 11 was 22 days before discovery on November 12 (pH too low), and for 53 days between November 12 and January 4 (pH too high). The pH control of the 'B' Containment Spray may not have been

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controllable between 7 and 11 was 36 days before discovery on November 26 (pH too low), and for 8 days between February 22 and March 1 (pH too high).

II. Cause of Events

There were two root causes for these events.

1. The Root Cause for four of the events was determined to be entrapped air in the system. The first indication of this problem in each train was low Containment Spray eductor flow caused by air being trapped in the system and restricting the flow rate. Both throttle valves, 1CT-118 and 1CT-119 had to be opened by approximately 3/8 of a turn to increase the flow rate to 20 gpm. When the air was finally released from the system, the flow rate was too great, and both valves had to be re-adjusted to approximately their original settings.

   There have been occurrences in the past that the eductor flow did not meet the Tech Spec limits of 19.5 to 20.5 gpm. However, only one set of valve adjustments to either 1CT-118 or 1CT-119 would typically re-establish 20 gpm flow and maintain the flow within the Technical Specification limits for several months without subsequent valve adjustments. It was not until the recurring valve adjustment problems on both trains starting November 12, 2007, that these events appeared different.

   During RFO14, 9/29/2007 to 10/23/2007, there were several tests where a Containment Spray pump was run with the eductor suction flow path isolated that could have allowed air to enter the system. In this isolated alignment, the eductor will draw the upstream eductor suction piping to a negative pressure, potentially drawing air into the system through valve packing leaks. There were no valves in the flow-path with visible active packing leaks at the time of discovery, but it is possible that packing could allow air in-leakage without liquid out-leakage in the system. The presence of air in the Containment Spray Additive system during RFO14 was indicated by a level change in the Containment Spray Additive Tank when valves 1CT-11 and 1CT-12 were cycled for testing. Follow-up investigation suggested the level drop was due to a void in the system. It appears that some of the air remained in the system after RFO14 and had an effect on the eductor flow rate when the system was tested post RFO14. It also explains why subsequent testing performed after the original low flow failures resulted in high flow, as the systems would have had an opportunity to flush or dissolve the air that had entered the system.

2. The Root Cause for three of the events was determined to be inadequate system design. The system is designed to be with the throttle valves 1CT-118 and 1CT-119 operated at approximately 7/8 of a turn (approx 0.144 inch axial distance) from the shut seat for 20 gpm flow. The valve's inherent stem-plug looseness has been measured to be ± 0.1 inch. Although the plug normally moves to the same position (up against the stem) on any pump start, in some cases it does not, and this affects flow through the valve. Hence plug position and flow are not always repeatable. Experience has found that starting and stopping the pumps while making repetitive valve adjustments can lodge the stem-plug in place to pass 20 gpm on a sustained basis. However a significant vibration could loosen the stem-plug connection.

III. Safety Significance

The Containment Spray System is used to remove heat and fission products after a LOCA or main steam line break (MSLB) and for Iodine removal after a LOCA. Iodine is absorbed by water with a pH of 7 or greater. There has been minimal use of aluminum in containment due to degradation by caustic chemical reactions above a pH of 11. In an accident, NaOH flow to the Containment Spray pump suction may not be adequate to maintain the containment spray or sump pH within design limits between 7 and 11. If the Containment Spray eductor flow is higher than 20.5 gpm, the flow rate of sodium hydroxide in a LOCA event could cause the pH of the spray to exceed 11 at 1-2 hours into the event. The high pH condition would exist until the spray-add tank depletes at 2-3 hrs into the event. After tank depletion (accelerated by the high outflow), spray pH will drop below 11 for the duration of the event. This could cause increased degradation of aluminum in containment, resulting in increased chemical precipitant being carried to the containment sump screens. Through evaluation of Containment Spray system parameters during the interval when educator flow was greater than 20.5 gpm, it was shown that the maximum pH did not affect the functionality of the Emergency Core Cooling System sump. If the Containment Spray eductor flow is lower than approximately 19 gpm, the Iodine scrubbing enhancement effect in a LOCA event could be reduced because of the correspondingly lower flow rate of sodium hydroxide. Effectively, the time at which the sump pH reaches the desired value of 7 would be delayed by less than 30 minutes. The sump pH would then remain at or above 7 for the duration of the event. Therefore, this pH change would have minimal impact on Iodine scrubbing.

Since these series of events were declared Priority 1 the test interval for the Containment Spray Additive System flow measurements was reduced to a monthly interval. After implementing the online corrective actions, the testing interval will gradually increase to a bi-monthly interval and then return to a quarterly basis.

This LER was written for a problem found in Mode 1 at 100% power. Since the most adverse conditions for a LOCA or MSLB is for operation at 100% power, this LER is applicable for the most severe operating conditions.

IV. Corrective Actions

There are two sets of corrective actions to address the root causes for these events.

The corrective actions for entrapped air are:

1. Establish a PM to check for, and evaluate or remove, air voids in the Containment Spray Additive System during each refueling outage prior to Mode 4 ascending. Completed 4/28/2008.
2. Revise outage related Operations procedures so that the Containment Spray Eductors are not run with the suction line isolated. Completed 5/29/2008.
3. Revise OP-112, “Containment Spray System” to require a UT check for air voids anytime the Containment Spray Additive System is filled and vented. Completed 5/29/2008.

The corrective actions for inadequate system design:

1. Implement system design change EC 69450 to decrease the educator motivating flow in order to allow the throttle valves 1CT-118 and 1CT-119 to be opened further. Operating the valve with a larger opening will reduce the valve instability caused by the inherent stem-plug looseness. Completed 5/22/2008.
2. Develop and implement a design change to install a more stable throttle valve for 1CT-118 and 1CT-119. Planned completion 5/28/2009.
3. Revise OST-1118/1119 to stop/start pump after any flow adjustment in order to set and maintain 20 gpm. Completed 5/29/2008.

V. Previous Similar Events

A review of the Containment Spray Educator flow in the past documented flow outside the allowed band on the B train. These events were corrected by valve adjustments at the time of occurrence without any additional complications, however throttle valve instability may have been the cause of that condition.