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November 10, 2006
LIC-06-0119

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

Reference: Docket No. 50-285

Subject: Licensee Event Report 2006-004 Revision 0 for the Fort Calhoun Station

Please find attached Licensee Event Report 2006-004, Revision 0, dated November 10, 2006. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B). If you should have any questions, please contact me.

Sincerely,

D. J. Bannister
Plant Manager – Fort Calhoun Station

DJB/DKG/dkg

Attachment

c:
INPO Records Center

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

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Fort Calhoun Station	05000285	1 OF 5

4. TITLE
Loss of Shutdown Cooling Redundant Train Due to Valve Mispositioning

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
09	12	2006	2006	004	00	11	10	2006	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE: 5

10. POWER LEVEL: 0

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
☐ 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)
William J. Blessie, Supervisor-Operations Engineering	402-533-6896

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

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)*

Fort Calhoun Station was shutdown September 9, 2006 to commence a refueling outage. On September 10, 2006, a system lineup was performed to transfer removal of decay heat from the steam generators to the shutdown cooling system. Part of the lineup included opening two shutdown cooling heat exchanger outlet cross-connect valves, SI-173 and SI-174, which are located in a normally locked high radiation area room that is entered when performing shutdown cooling system valve lineups. An equipment operator and radiation protection technician entered the room to perform the valve lineup. Upon completion, the equipment operator reported to a licensed operator in the control room that the lineup was completed.

On September 12, 2006, in preparation to drain the reactor coolant system (RCS) to dump steam generator tubes, a verification of shutdown cooling system lineup was performed. The equipment operator entered the room and found the shutdown cooling heat exchanger outlet cross-connect valve, SI-173, locked closed. The control room supervisor directed the equipment operator to unlock and open SI-173. SI-173 in a locked closed position rendered shutdown cooling heat exchanger, AC-4B, inoperable for the purpose of a decay heat removal loop. As a result of finding SI-173 locked closed, the entire operating procedure checklist was performed and no other discrepancies were found.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort Calhoun Nuclear Station	05000285	2006	- 004 -	00	2 OF 5

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

BACKGROUND

Fort Calhoun Station (FCS) is a two loop, Combustion Engineering (CE) designed pressurized water reactor (PWR). Each loop contains two reactor coolant pumps (RCPs) and one steam generator (SG). The shutdown cooling (SDC) system is designed to cool the reactor coolant system (RCS) from 300F to 130F within 24 hours and to maintain RCS temperature while the plant is in Cold or Refueling Shutdown. The major components of the SDC System are the two low pressure safety injection pumps, two shutdown cooling heat exchangers, four low pressure loop injection valves, piping, valving, and instrumentation. The maximum RCS temperature and pressure for shutdown cooling operation is 300F and 250 psia. The cooldown and heatup rates are controlled to limit thermal stresses. RCS pressure is controlled to prevent cold overpressurization of the reactor vessel.

During refueling, the shutdown cooling heat exchangers operate in conjunction with the low pressure safety injection (LPSI) pumps to maintain a refueling water temperature of 130F or less with a component cooling water temperature of up to 90F. The shutdown cooling heat exchangers may also be used to provide spent fuel pool cooling if the spent fuel pool cooling system fails. If both LPSI pumps fail, a containment spray pump can be aligned to supply alternate shutdown cooling flow.

Technical Specification (TS) 2.1.1(3) reads as follows:

> 210F less than or equal to T_{COLD} less than or equal to 300F or T_{COLD} less than 210F with fuel in the reactor and all reactor vessel head closure bolts fully tensioned.
>
> (a) At least two (2) of the decay heat removal loops listed below shall be OPERABLE:
>
> (i) Reactor coolant loop 1 and its associated steam generator and at least one associated reactor coolant pump.
>
> (ii) Reactor coolant loop 2 and its associated steam generator and at least one associated reactor coolant pump.
>
> (iii) One shutdown cooling pump, one shutdown cooling heat exchanger, and associated shutdown cooling piping.
>
> (iv) One shutdown cooling pump, in addition to that in (iii) above, one shutdown cooling heat exchanger, in addition to that in (iii) above, and associated shutdown cooling piping.
>
> (b) At least one (1) of the decay heat removal loops listed above shall be IN OPERATION.
>
> (c) With no coolant loop IN OPERATION, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and initiate corrective action to return the required coolant loop to operation in 8 hours.

(d) For the purposes of items a(iii) and a(iv) above, the containment spray pumps can be considered as available shutdown cooling pumps only if both of the following conditions are met:

(i) Reactor Coolant System temperature is less than 120F.

(ii) The Reactor Coolant System is vented with a vent area greater than or equal to 47 inches squared.

When Technical Specification 2.1.1(3) is applicable, a single reactor coolant loop or shutdown cooling loop provides sufficient heat removal capability for removing decay heat, but single failure considerations require that least two loops be operable.

EVENT DESCRIPTION

Fort Calhoun Station was shutdown September 9, 2006 to commence the refueling outage. On September 10, 2006, a system lineup was performed per OI-SC-1, "Shutdown Cooling Initiation" Checklist-A to transfer removal of decay heat from the steam generators to the shutdown cooling system.

Part of the lineup included opening two shutdown cooling heat exchanger outlet cross-connect valves, SI-173 and SI-174, located in room 15A. Room 15A is a normally locked high radiation area room that is typically only entered when performing shutdown cooling system valve lineups. Valves SI-173 and SI-174 are locked closed during power operation.

An equipment operator and radiation protection technician entered room 15A to perform the valve lineup. The equipment operator remembered reading the label of SI-173 and comparing it to the checklist, but thought the valve was in the proper position. The valve was not physically verified open, but was only visually (erroneously) checked open. It is the operations management's expectation that valve positions be physically verified as the only true way of determining position. Upon completion, the equipment operator reported to a licensed operator in the control room that the lineup was completed. Shutdown cooling was placed in service on September 10, 2006 at 11:45 Central Daylight Time (CDT) and a plant cooldown continued to Mode 5, Refueling Operations.

On September 12, 2006, in preparation to drain the reactor coolant system (RCS) to dump steam generator tubes, a verification of shutdown cooling system lineup was performed per OI-SC-1, "Shutdown Cooling Initiation" Checklist B to verify proper alignment prior to placing the plant in a reduced inventory condition. At 19:25 CDT, the equipment operator entered room 15A and found the shutdown cooling heat exchanger outlet cross-connect valve, SI-173, locked closed. The control room supervisor directed the equipment operator to unlock and open SI-173. SI-173 in a locked closed position rendered shutdown cooling heat exchanger, AC-4B, inoperable. As a result of finding SI-173 locked closed, the entire OI-SC-1, Checklist A was performed. No other discrepancies were found.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort Calhoun Nuclear Station	05000285	2006	- 004 -	00	4 OF 5

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

Between the time that the last reactor coolant pump was secured on September 10, 2006 at 16:09 (CDT) and SI-173 was opened on September 12, 2006 at 19:25 (CDT), only one decay heat removal loop was operable. This is a violation of Technical Specification 2.1.1(3).

Condition Report 200602965 was written to document this event. This report is being made per 10 CFR 50.73(a)(2)(i)(B)

CONCLUSION

A root cause analysis of this event was performed. The analysis concluded the cause of this event was inadequate work practice to physically verify the position of SI-173.

Contributing Causes

1. Lack of independent verification of the shutdown cooling system line-up represents failure to provide a barrier of defense to ensure quality verification.
2. Lack of rigorous guidance within the infrequently performed procedure indicates there is a heavy reliance on operator experience.

CORRECTIVE ACTIONS

As a result of finding SI-173 locked closed, the entire OI-SC-1, "Shutdown Cooling Initiation" Checklist A was performed. No other discrepancies were found.

A revision to OI-SC-1, "Shutdown Cooling Initiation" was completed to require independent verification of the lineup prior to initiating shutdown cooling. OI-SC-1 also includes a note indicating the expected indications for component cooling water outlet temperatures for shutdown cooling heat exchangers when placing shutdown cooling in service.

A revision to OP-3A, "Plant Shutdown" was completed to verify both shutdown cooling heat exchangers are in service (as indicated by temperature) prior to securing the last reactor coolant pump.

In addition, enhancements are being administered through the Corrective Action Program (CR 200603965).

SAFETY SIGNIFICANCE

This event was deemed to not be nuclear safety significant. At the time of discovery, the amount of time for the reactor core to boil was 120 minutes. In addition, several other cooling methods are available to remove heat from the core should shutdown cooling be required. Fort Calhoun has Abnormal Operating Procedure (AOP) 19, "Loss of Shutdown Cooling" which provides direction for an imminent or actual loss of shutdown cooling. AOP-19 directs the operators to establish shutdown cooling utilizing either high pressure safety injection (HPSI) header, LPSI and HPSI pumps, or HPSI pumps and the chemical and volume control systems.

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

A qualitative assessment was performed by evaluating different failure scenarios that could lead to core damage. Failure of the shutdown cooling heat exchanger, AC-4A, would have caused a loss of shutdown cooling. Failures identified for AC-4A were loss of CCW to the operating heat exchanger or a failure of the manual SI inlet or outlet valves for AC-4A. In either failure mode it would be extremely unlikely as a transfer closed event would have to occur for there to be a failure to provide cooling. A loss of CCW would require either of the CCW supply valves to transfer closed. Both valves fail open on loss of air or power. A spurious signal would be required to close the valves. For the manual isolation valves, this would require a disc to stem separation. In either failure event, this would be extremely remote.

PREVIOUS SIMILAR EVENTS

There have not been any other LERs for valve mispositioning events. However, there have been valve mispositioning events noted in the corrective action program. Condition reports included an event when the safety injection refueling water tank (SIRWT) level was rising when no fill evolution was in progress (CR 200501832), containment sump level was observed to be rising when fill was in progress (CR 200501561), and the spent regenerate tank was relieved when the shutdown cooling purification was being placed back in service (CR 200500906). It was determined that associated valves were found in open positions instead of expected closed positions. These events were of minimal safety significance.

Mispositioning events are routinely tracked and trended to identify adverse trends. These and other events have been reviewed to determine if there is an adverse trend with regards to Operations valve mispositions. The tracking and trending calculated the number of mispositions per 10,000 hours worked and the mispositions per 1000 tags issued. This review determined that there is not an adverse trend in Operations valve mispositionings.