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FPL Energy

Duane Arnold Energy Center

April 2, 2009

NG-09-0299
10 CFR 20.2203

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Duane Arnold Energy Center
Docket 50-331
License No. DPR-49

<u>Licensee Event Report #2009-002-00</u>

Please find attached the subject report submitted in accordance with 10 CFR 20.2203. This letter makes no new commitments or changes to any existing commitments.

Richard L. Anderson
Vice President, Duane Arnold Energy Center
FPL Energy Duane Arnold, LLC

cc: Administrator, Region III, USNRC
Project Manager, DAEC, USNRC
Resident Inspector, DAEC, USNRC

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NRR

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB NO. 3150-0104 EXPIRES: 8/31/2010
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.

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Duane Arnold Energy Center	05000 331	1 OF 6

4. TITLE: Manual Reactor Scram Due to Loss of Condenser Cooling

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	DOCUMENT NUMBER 05000
02	01	09	2009	001	0	04	02	09	FACILITY NAME	DOCUMENT 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)(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)
53%	☐ 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)	VOLUNTARY LER

12. LICENSEE CONTACT FOR THIS LER	
FACILITY NAME	TELEPHONE NUMBER (*Include Area Code*)
Bob Murrell, Engineering Analyst	319-851-7900

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
D	NN	CTW	MO85	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*)

On February 1, 2009, with the plant operating at 53% power, during plant shutdown evolutions in preparations for Refuel Outage (RFO) 21, operators were in the process of securing the 'A' cooling tower in accordance with Operating Instruction 442, Circulating Water System. While throttling the 'A' cooling tower riser isolation valves in preparations for securing the 'A' circulating water pump, a rupture of the 'B' cooling tower west riser occurred. In anticipation of a loss of circ water pit level, a manual scram was inserted at 1800. Following the manual scram, the plant was stabilized per abnormal operating procedures. Containment isolation signals operated as designed with Groups 2, 3, and 4 received.

The cause of this event was an inadequate procedure. Operating Instruction 442 was inadequate to prevent an inappropriate operational configuration that resulted in the failure of the cooling tower riser. A design change restored the failed riser with a more robust design, and enhanced the design of the remaining risers on both cooling towers.

There were no actual safety consequences and no effect on public health and safety as a result of this event.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER YEAR	SEQUENTIAL NUMBER	REV NO.	3. PAGE
Duane Arnold Energy Center	05000 - 331	2009	001	0	2 OF 6

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

I. Description of Event:

On February 1, 2009, the DAEC was reducing reactor power in preparation for entering Refueling Outage (RFO) 21. As part of a normal shutdown, Operating Instruction (OI) 442, Circulating Water System, provides direction for removing one circulating water pump and cooling tower from service. At the time of the event, the operations crew was in the process of performing this activity.

The pre-job brief for this evolution was conducted at 1300 hours. At approximately 1730 hours, the operators assigned to perform this activity arrived at their respective stations: two licensed operators in the control room, two in-plant operators at the 'A' cooling tower breaker house (to throttle the 'A' cooling tower (CT) riser valves closed), and one in-plant operator at the pump house to monitor the securing of the 'A' circulating water pump.

The sequence of removing one circulating water pump and one cooling tower from service per OI 442 is to throttle the cooling tower riser valves on the tower to be removed from service until circulating water discharge pressure is about 35 psig, and to then secure the desired pump. This is a historical pressure limit to prevent the circulating water pump that is to remain in service from running out. The CT riser valves are motor-operated (MO) butterfly valves controlled from hand switches located at the breaker cubicles inside the CT breaker house.

At approximately 1740 hours, the direction was given from the control room to commence throttling the 'A' CT riser valves in the closed direction. The direction given to the operators at the cooling tower was to apply a 10-second closed signal to both riser valves, and then stop and wait for the next throttle closed order to be given from the control room. During this process, control room operators were monitoring computer point F015, circulating water discharge pressure (note this is the only indication in the control room for this parameter.) The F015 reading prior to the start of the evolution was 29.8 psig. This computer point is fed from PT4205, which had an open Work Request Card (WRC) (A84341) written on November 10, 2008 for erratic indications. This WRC was scheduled to be worked during RFO 21.

Upon the application of the first throttle closed signal, it was discovered that CT riser valve MO4250 did not reposition. This was ascertained when the cooling tower operators did not see dual indication at the breaker. After consulting with the control room, the cooling tower operators proceeded to the sparging valve to check the condition of the limit switch which provides the interlock between the sparging valve and a close permissive for MO4250. It was determined that the limit switch had hung up when the valve was opened. (Note that the sparging valve had been opened several hours prior.) The operator then tapped the switch and it positioned into place. The time required leaving the breaker house, traveling to the sparging valve, tapping the limit switch, and returning to the breaker house was approximately 10 minutes.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Duane Arnold Energy Center	05000 - 331	2009	001	0	3 OF 6

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

At approximately 1750 hours, the cooling tower operators gave a 10-second closed signal to MO4250 and saw dual valve indication. From this point forward, the cooling tower operators continued to close both risers when directed by the control room using 10-second closure signals. Between each bump closed, approximately 1 minute elapsed until the next bump close while the operators in the control room monitored system pressure on F015 between each order. A total of four to five 10-second closure signals were given to the riser valves.

While the operators at the cooling tower were throttling the riser isolation valves, the pump house operator observed the local discharge pressure increase from 29 psig at the start of the evolution to 33 psig after the 4th or 5th bump closed. Pressure indication at this time on computer point F015 was 30.3 psig. The pump house operator reported this to the control room and the direction was given that the local pressure reading would be used as the OI target since it was reading more conservatively. The pump house operator also stated that both local pressure indicators responded together.

At approximately 1755 hours, the order was given to throttle the riser valves closed by applying a 5-second signal. At the end of this 5-second signal, both riser valves lost the dual indication and showed green only (full-closed). This was reported to the control room and the control room operators decided to secure the circulating water pump per procedure.

After the last 5-second bump closed on the risers, the pump house operator noted no pressure change on the local pressure indicators as compared to before the last 5-second bump. Shortly after this point, the pump house operator observed indications of circulating pump cavitation. Specifically, the operator heard the pumps rumbling and noticed both circulating water pump local discharge pressure indicators oscillating around 10 psig. The operator also noted circulating pit level lowering as it passed through 10 feet.

Between 1754 hours and 1800 hours, circulating pit level lowered from 19 feet to 6 feet. Annunciator Response Procedure (ARP) 1C06A, D-11, Circ Water Pit Lo Level, directs a manual reactor scram if circulating pit level cannot be restored and maintained above 8 feet. At 1800 hours, with the reactor at 53% power, a reactor manual scram was initiated.

II. Assessment of Safety Consequences:

There was no direct impact on nuclear safety as a result of this event. The event resulted in the initiation of a manual scram in anticipation of a loss of circulating water. The On Shift Analysis completed for the scram concluded that all safety systems operated as necessary.

The plant was stabilized per abnormal operating procedures. Containment isolation signals operated per design with Groups 2, 3, and 4 received.

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

An unexpected loss of one 161 KV bus in the switchyard also occurred during this event. This was caused by a breaker failure lockout of the bus caused by signal from the output breaker. This output breaker did open.

The power loss of the 161 KV bus had minor plant effect. One power supply to essential service offsite transformer 1X3 was lost due to the bus lockout. The transformer and offsite circuit remained available. The plant did sustain a temporary loss of spent fuel pool cooling system. Cooling was restored with no level or temperature complications.

Essential power remained available with both onsite SBDG's and offsite circuits current source. All ECCS were available. All safety related equipment operated as designed, except Reactor Core Isolation Cooling (RCIC) turbine which had difficulty in automatic control. Manual control of RCIC was effective. This behavior is not unexpected during the low flow conditions in which RCIC was operating.

Therefore, the plant shutdown did not result in any radiological or nuclear concern which would impact the health and safety of the public.

This event did not result in a Safety System Functional Failure.

III. Cause of Event:

A root cause evaluation was completed (RCE 1079). The RCE determined that operating practices on the day of the event placed the plant in a configuration that the cooling towers were not designed for. This event revealed that the cooling towers were not designed to have both circ water pumps discharging over a single tower. The metallurgical report completed as a result of the failure indicated that the 'B' tower west riser failed catastrophically by separating at the slip joint between the riser and the distribution header at the top of the cooling tower. Based on the fact that the failure was from the forces exerted from the increased flow seen on the 'B' cooling tower as a result of isolating the risers on the 'A' cooling tower, the RCE concluded that the root cause of the event was that OI 442 was inadequate to prevent an inappropriate operational configuration. This inappropriate operational configuration revealed the fact that the cooling towers were never designed to individually receive rated discharge flow from both circ water pumps. The team identified one contributing factor associated with the plugged pressure transmitter, PT4205, which provided a computer point to the control room for circ water pump discharge pressure. The plugging delayed the expected circ pump discharge pressure increase that should have been seen while throttling the 'A' cooling tower riser isolation valves. This resulted in the control room allowing for further throttling of the 'A' cooling tower riser until the riser isolation valves were fully closed.

IV. Corrective Actions:

Immediate Actions Taken

Engineering Change Package (ECP) 1884 restored the failed riser of the 1E069B cooling tower with a more robust design, and enhanced the design of the remaining risers on both the cooling tower risers. This also addressed the extent of condition. The modified riser design now conservatively supports corresponding flow for two pump operation over a single tower.

OI 442, Circulating Water System, was revised by Procedure Work Request (PWR) 45894 to specify the sources to be used for circulating water pump discharge pressure wherever it is called upon to be read.

Long Term Corrective Actions

1. Conduct a design review to determine the equipment manipulations needed for the transition between one- and two-pump operations. The review should determine whether pump runout is a concern. If so, determine the correct riser valve position to prevent pump runout while securing the first cooling tower. This design review shall include a consideration with regards to pipe pressure limits and hydraulic forces.

2. Based on conclusions of long term corrective action #1, revise OI 442 to provide cooling tower riser isolation valve closure guidance. This will address the extent of cause associated with the process of transitioning from two to one cooling tower operations.

3. Create a preventive maintenance action to inspect PT4205, Circ Water Pump Supply Pressure sensing line, for blockage on a periodicity that supports the current operating cycle such that the inspection occurs prior to the start of an RFO.

4. Establish a means to identify degraded computer points that are used in the manipulation of plant equipment and to track their resolution.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Duane Arnold Energy Center	05000 - 331	2009	001	0	6 OF 6

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

V. Additional Information:

Previous Similar Occurrences:

A review of LERs over the previous 5 years revealed the following similar occurrences:

LER 2007-007 - Reactor Scram Due to 1A2 Non-essential Bus Lockout
LER 2007-006 - Reactor Shutdown as a Result of a Chemistry Excursion
LER 2006-005 - Reactor Scram During Main Turbine Testing
LER 2003-005 - Unplanned Manual Reactor Scram due to High Reactor Coolant Conductivity
LER 2003-006 - Unplanned Manual Reactor Scram due to Degrading Condenser Vacuum

EIIS System and Component Codes:

Cooling Tower - CTW

Reporting Requirements:

This event is reportable under 10 CFR 50.73(a)(2)(iv)(A).