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FPLEnergy.

Duane Arnold Energy Center

January 5, 2007

NG-07-0004

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

Licensee Event Report #2006-005-00

Please find attached the subject Licensee Event Report (LER) submitted in accordance with 10 CFR 50.73. This letter contains no new NRC commitments.

Gary Van Middlesworth
Site Vice President, Duane Arnold Energy Center
FPL Energy Duane Arnold, LLC

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

IE22

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

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 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.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Duane Arnold Energy Center	05000 331	1 OF 5

4. TITLE
Reactor Scram During Main Turbine Testing

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
11	06	2006	2006	- 5 -	0	01	05	2007	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE
1

10. POWER LEVEL
100%

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)*
Robert J. Murrell Regulatory Affairs 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

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 November 6, 2006, at 0110, while operating at 100% power, during the performance of Main Turbine Operational Tests, Surveillance Test Procedure (STP) NS93001, Section 7.3, "Overspeed Trip Device and Mechanical Trip Valve Test (Test A)," a reactor scram occurred. Investigation into this event has determined that the scram was initiated by Reactor Protection System (RPS) actuation due to at least three Turbine Stop Valves less than 90 percent open.

The cause of this Turbine Stop Valve closure was a noise spike, of some level, in combination with normally open relays being closed (possibly stuck). Corrective actions included the replacement of a suspect cable, that was determined to be the most likely cause of the noise spike, the burnishing of relay contacts, and the replacement of a relay board.

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

I. Description of Event:

On November 6, 2006, at 0110, while operating at 100% power, during the performance of Main Turbine Operational Tests, Surveillance Test Procedure (STP) NS93001, Section 7.3, "Overspeed Trip Device and Mechanical Trip Valve Test (Test A)," a reactor scram occurred. The testing is performed with the mechanical trip lockout in place to prevent an actual turbine trip. The scram occurred just prior to the portion of the test that resets the Mechanical Trip Valve (MTV), the front standard trip finger, and the Lockout Valve. The scram was initiated by Reactor Protection System (RPS) actuation due to least three Turbine Stop Valves less than 90 percent open.

An investigation into this event determined that an erroneous speed error signal (signal spikes) was induced into the speed control circuitry, most likely when the limit switch for the MTV actuated during the test. The investigation determined that these signal spikes on the speed control circuit may have been transmitted from the front standard due to multiple degraded cables. Combined Intermediate Valve Fast Closure was the first signal received by the First Hit Panel on the Electro Hydraulic Control system due to a speed error signal versus valve position of greater than 5 percent. Turbine Stop Valve #2 (SV2) closure, normally defeated when the main generator is synched to the grid, was allowed to occur in response to the perceived overspeed condition due to the normally open contacts of a mercury-wetted relay being closed (possibly stuck). The remaining three Turbine Stop Valves also closed due to a slaved relation to SV2 which should be defeated except during startup, turbine trip, shell and chest warming. The slave relation was allowed to occur due to the normally open contacts of another mercury-wetted relay being closed (possibly stuck).

The erroneous speed error signal had not cleared prior to the Turbine Trip because the Intercept Valves had remained closed. Thus, the closure of the Intercept Valves and Control Valves would have occurred in the same timeframe in response to the erroneous speed error signal, even if the Stop Valves had not closed (i.e., mercury wetted relay contacts were open per design), and closure of the normal steam flow path would cause reactor pressure to increase rapidly to the scram setpoint. Additionally, during this event, reactor pressure increased to the scram setpoint approximately three seconds following the scram and RPT from Stop Valve position (i.e., reactor power had been significantly reduced). Therefore, the speed control unit noise sensitivity is cited as the single root cause since the erroneous speed error signal alone would have resulted in a scram. The noise generation and closed relay contacts were determined to be contributing factors.

There were no structures, systems, or components inoperable at the start of the event.

II. Assessment of Safety Consequences:

Scram #06-001 was an automatic RPS trip initiated by TSV position ≤ 90% open. From the On-Shift Analysis, the key plant responses related to nuclear significance are:

- "A" and "B" Recirculation Pumps tripped [RPT from TSV position]
- Maximum reactor pressure was 1075 psig
- No safety-relief valves opened
- Minimum reactor water level was 164"

- Maximum reactor water level was 208"
- PCIS Group 2 isolation [reactor water level below 170"]
- PCIS Group 3 isolation [reactor water level below 170"]
- PCIS Group 4 isolation [reactor water level below 170"]
- All safety-related equipment functioned as expected

The Turbine Trip with Bypass event (an Anticipated Operational Occurrence) described in Updated Final Safety Analysis Report (UFSAR) 15.1.2.2.1 results in safety-relief valves opening in response to the reactor pressure increase. As described above, the plant response (no safety-relief valves opening) for this scram was much milder and clearly bounded by the Turbine Trip with Bypass event described in UFSAR 15.1.2.2.1. Therefore, in terms of nuclear safety, this scram was non-significant.

III. Cause of Event:

One root cause (RC) and three contributing factors (CFs) were identified for this event:

RC1 – An inadequately shielded cable allowed a noise spike of some level to interrupt normal Speed Control Unit operation, causing a false overspeed signal.

CF1 – Noise was generated, likely from manipulation of a component in the Front Standard, which coupled to the Speed Control Unit circuitry.

CF2 – Relay K4B17 normally open contacts were closed (possibly stuck), allowing speed error to be connected to SV2 amplifier. This contact should be open at full power.

CF3 – K1B12 relay normally open contacts were closed (possibly stuck), allowing the slave relation between SV2 and the other SVs to exist while synchronized to the grid such that when SV2 closed, all main stop valves closed.

IV. Corrective Actions:

The following corrective actions have resulted from this event:

Corrective Actions to Restore

- **CWO-A74355** (complete) – New mercury-wetted relay boards were installed during troubleshooting and left in place.
- **CWO-A74357** (complete) – The Main Turbine Mechanical Trip Interlock Switch contacts were burnished.
- **CWO-A79431** (complete) – The Mechanical Trip Valve Switch cable was meggered and replaced.

Interim Corrective Actions (mitigation)

- **PWR-35701** (complete) – STP NS930001 was quarantined until Refuel Outage (RFO) 20.

- **CA044709** (complete) – Revised STP NS930001 per PWR-36036 to un-quarantine the STP to permit performance of Sections 7.1, 7.2, 7.6, 7.7, 7.8, 7.9 and 7.12. Sections 7.3, 7.4, 7.5, 7.10 and 7.11 remain quarantined and are not to be performed until concerns have been resolved per CAPs 44120 and 45313. STP NS930001 was approved and issued on 12/14/2006 as Revision 19.

Corrective Actions to Prevent Recurrence (CATPRs)

- **CA044782** (due 03/01/2007) – As part of the Heater Bay Cable Replacement Project:

  Replace all Front Standard wiring between TJB1 and field devices. Specify optimum cable design for heat and oil environment. This action will be performed under CWO-A74574.

  Replace SSPU cables (T00002HA, T00002JA, and T00002KA) from TJB1 to 1C049. Cable is original, shows signs of insulation cracking at TJB1, and appears from troubleshooting data to be noise sensitive.

Other Corrective Actions

- **CA044783** (due 03/23/2007) – Investigate/test components that may be sources of significant noise and implement a small modification to install noise suppression as warranted to reduce the generation of noise.

- **CA044784** (due 03/23/2007) – Employ voltage checks at startup following RFO20 for suspect relays KL4B17 and K1B12 to ensure proper contact state.

- **CA044785** (due 02/02/2007) – Institute a Pre Planned Task (PPT) for each refueling outage to remove all EHC mercury-wetted relay boards, mechanically agitate them, test them in a test fixture, and return them to service. The PPT is to be first performed during RFO 20.

- **CA044786** (due 02/02/2007) – Develop a test to monitor the front standard and speed control unit, and re-perform STP NS930001, Section 7.3, just prior to RFO20, without tripping the unit.

- **CA044787** (due 10/03/2007) – Revise PPT-05960 to inspect the wiring harness in the turbine front standard to include detailed instructions and adjust the frequency from 1YR to 1R0 to allow a more intrusive inspection. Revised PPT to be implemented beginning with RFO21 due to replacements being performed under CA044782.

V. Additional Information:

Previous Similar Occurrences:

A review of LERs at the DAEC over the last 3 years identified no LERs with similar events with similar causes.

EIIS System and Component Codes:

TG Main Turbine Control Fluid System

Reporting Requirements:

This report is being submitted under 10 CFR 50.73(a)(2)(iv)(A).