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**FPL Energy.**  
**Duane Arnold Energy Center**

May 4, 2006

NG-06-0360  
10 CFR 50.73

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 #2006-001-00

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 D. Van Middlesworth  
Vice President, Duane Arnold Energy Center  
FPL Energy Duane Arnold, LLC

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

JE22

# 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: 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 [infocollect@nrc.gov](mailto:infocollect@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NE0B-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.

|   |                                      |                          |
|---|--------------------------------------|--------------------------|
| <b>1. FACILITY NAME</b><br>Duane Arnold Energy Center | <b>2. DOCKET NUMBER</b><br>05000 331 | <b>3. PAGE</b><br>1 OF 4 |
|---|--------------------------------------|--------------------------|

**4. TITLE**  
Inoperability of Control Building/Standby Gas Treatment System (CB/SBGT) Instrument Air Compressor 1K-4

| 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 |
| 03            | 05  | 2006 | 2006          | 1                 | 0       | 05             | 04  | 2006 |                              | 05000         |
|               |     |      |               |                   |         |                |     |      | FACILITY NAME                | DOCKET NUMBER |
|               |     |      |               |                   |         |                |     |      |                              | 05000         |

|                               |  |   |   |   |  |  |  |  |  |  |  |  |
|-------------------------------|--|---|---|---|--|--|--|--|--|--|--|--|
| <b>9. OPERATING MODE</b><br>1 | <b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:</b> (Check all that apply) |   |   |   |  |  |  |  |  |  |  |  |
|                               | <input type="checkbox"/> 20.2201(b)  | <input type="checkbox"/> 20.2203(a)(3)(i)             | <input type="checkbox"/> 50.73(a)(2)(i)(C)  | <input type="checkbox"/> 50.73(a)(2)(vii)     |  |  |  |  |  |  |  |  |
| <b>10. POWER LEVEL</b><br>96% | <input type="checkbox"/> 20.2201(d)  | <input type="checkbox"/> 20.2203(a)(3)(ii)            | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(viii)(A) |  |  |  |  |  |  |  |  |
|                               | <input type="checkbox"/> 20.2203(a)(1)   | <input type="checkbox"/> 20.2203(a)(4)                | <input type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(viii)(B) |  |  |  |  |  |  |  |  |
|                               | <input type="checkbox"/> 20.2203(a)(2)(i)  | <input type="checkbox"/> 50.36(c)(1)(i)(A)            | <input type="checkbox"/> 50.73(a)(2)(iii)   | <input type="checkbox"/> 50.73(a)(2)(ix)(A)   |  |  |  |  |  |  |  |  |
|                               | <input type="checkbox"/> 20.2203(a)(2)(ii)   | <input type="checkbox"/> 50.36(c)(1)(ii)(A)           | <input type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x)       |  |  |  |  |  |  |  |  |
|                               | <input type="checkbox"/> 20.2203(a)(2)(iii)  | <input type="checkbox"/> 50.36(c)(2)                  | <input type="checkbox"/> 50.73(a)(2)(v)(A)  | <input type="checkbox"/> 73.71(a)(4)          |  |  |  |  |  |  |  |  |
|                               | <input type="checkbox"/> 20.2203(a)(2)(iv)   | <input type="checkbox"/> 50.46(a)(3)(ii)              | <input type="checkbox"/> 50.73(a)(2)(v)(B)  | <input type="checkbox"/> 73.71(a)(5)          |  |  |  |  |  |  |  |  |
|                               | <input type="checkbox"/> 20.2203(a)(2)(v)  | <input type="checkbox"/> 50.73(a)(2)(i)(A)            | <input type="checkbox"/> 50.73(a)(2)(v)(C)  | <input type="checkbox"/> OTHER                |  |  |  |  |  |  |  |  |
|                               | <input type="checkbox"/> 20.2203(a)(2)(vi)   | <input checked="" type="checkbox"/> 50.73(a)(2)(i)(B) | <input type="checkbox"/> 50.73(a)(2)(v)(D)  | Specify in Abstract below or in NRC Form 366A |  |  |  |  |  |  |  |  |

**12. LICENSEE CONTACT FOR THIS LER**

|   |  |
|---|--|
| FACILITY NAME<br>DAEC, Clara Rushworth, Licensing | TELEPHONE NUMBER (Include Area Code)<br>(319) 851-7157 |
|---|--|

**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 |
|-------|--------|-----------|---------------|--------------------|-------|--------|-----------|---------------|--------------------|
| X     | BI     | SHV       | VOGT          | Y                  |       |        |           |               |                    |

|  |  |
|--|--|
| <b>14. SUPPLEMENTAL REPORT EXPECTED</b><br><input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO | <b>15. EXPECTED SUBMISSION DATE</b><br>MONTH: _____ DAY: _____ YEAR: _____ |
|--|--|

**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On March 5, 2006, with the plant operating at 96% power in Mode 1, during testing of Control Building/Standby Gas Treatment System (CB/SBGT) Instrument Air Compressor 1K-4 per Surveillance Test Procedure (STP) 3.7.9-02, "CB/SBGTS Instrument Air Compressors System Leakage and Capacity Test," it was necessary to shutdown Compressor 1K-4 due to overheating. An unplanned Limiting Condition for Operation (LCO) was entered. It was subsequently determined that the valve stem and disc for V13-0141, 1K-4 Emergency Service Water (ESW) Supply Header Isolation, had separated on February 8, 2006, causing flow blockage and loss of cooling flow to 1K-4. Therefore the Completion Times associated with LCO 3.7.9 were exceeded.

The valve that failed was a Henry Vogt, model SW 12111, 1" gate valve. The valve disc failed due to corrosion bonding of the disc and seat upon closure and localized intergranular stress corrosion cracking (IGSCC). The disc was manufactured from 416 martensitic stainless steel with a Rockwell hardness of C50. This combination made it highly susceptible to IGSCC.

There were no actual safety consequences and no effect on public health and safety as a result of this event. This event is reportable under 10CFR50.73(a)(2)(i)(B).

**LICENSEE EVENT REPORT (LER)**

| 1. FACILITY NAME           | 2. DOCKET | 6. LER NUMBER |                   |                 | 3. PAGE |
|----------------------------|-----------|---------------|-------------------|-----------------|---------|
| Duane Arnold Energy Center | 05000 331 | YEAR          | SEQUENTIAL NUMBER | REVISION NUMBER | 2 OF 4  |
|                            |           | 2006          | - 001             | - 00            |         |

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

**I. Description of Event:**

On March 5, 2006, with the plant operating at 96% power in Mode 1, during testing of Control Building/Standby Gas Treatment System (CB/SBG) Instrument Air Compressor 1K-4 per Surveillance Test Procedure (STP) 3.7.9-02, "CB/SBGTS Instrument Air Compressors System Leakage and Capacity Test," it was necessary to shutdown Compressor 1K-4 due to overheating. An unplanned Limiting Condition for Operation (LCO) was entered.

Troubleshooting was performed and it was determined that flow was blocked in a segment of cooling water piping containing 1" manual valve V13-0141 (1K-4 Emergency Service Water (ESW) Supply Header Isolation) and cooling water inlet check valve V13-0121. The check valve was disassembled and no signs of failure were discovered. On March 7, 2006, the section of piping containing V13-0141 and V13-0121 was removed, and upon inspection, it was discovered that the valve stem and disc of V13-0141 were separated.

The STP had last been performed successfully on January 30, 2006, as indicated by a cooling water return temperature of 56° F. On February 7, 2006, valve V13-0141 had been closed to provide an isolation boundary for maintenance. It is concluded that the disc fractured while attempting to re-open the valve on February 8, 2006.

Technical Specification (TS) LCO 3.7.9 states that two CB/SBG Instrument Air subsystems shall be OPERABLE in MODES 1, 2, and 3. With one CB/SBG Instrument Air subsystem inoperable (Condition A), required features, supported by the inoperable CB/SBG Instrument Air subsystem, are to be declared inoperable when the redundant required features are inoperable (4 hours from discovery of Condition A concurrent with inoperability of redundant required features), and the CB/SBG Instrument Air subsystems are to be restored to OPERABLE status (within 7 days).

A review of electronic log entries for 'A' SBGT (redundant required feature) indicates that on February 27, 2006 (at 2108), planned TS LCO 3.6.4.3 Condition A (One SBGT subsystem inoperable) was entered. On March 1, 2006 (at 2359), the LCO was exited. A redundant ('A' SBGT) required feature was therefore inoperable for a period of 50.85 hours. Evidence indicates that the V13-0141 disc/stem separation occurred on February 8, 2006. Therefore the Completion Times associated with LCO 3.7.9 Condition A (4 hours to declare equipment supported by 1K4 inoperable when 'A' SBGT was inoperable from February 27 to March 1, and 7 days to restore CB/SBG Instrument Air subsystem to OPERABLE status), and Condition B (be in mode 3 in 12 hours and mode 4 in 36 hours) were exceeded.

**II. Assessment of Safety Consequences:**

The instrument air system is comprised of three main compressors (1K-90A, B, and C) and a backup air compressor (1K-1) which supply air to loads during normal operation. Since 1K-90A, B, and C are powered from non-essential sources, these compressors do not operate during loss-of-offsite power events.

Instrument air compressors 1K-3 and 1K-4 are classified as safety related, and as such are relied upon to initiate and maintain air pressure necessary for operation of essential loads. However, the backup air compressor 1K-1, although not classified as safety related, can be manually aligned to receive power from an essential source. As such it is capable of supplying required loads during loss-of-offsite power events. This capability reduces reliance on 1K-3 and 1K-4 for achieving a safe shutdown state.

Compressor 1K-4 (normally in standby mode) supplies air for control of equipment relied upon for responding to design basis accidents. The importance of the compressor in mitigating core damage or preventing a significant radiological release to the environment, however, is relatively low. The DAEC's instrument air system contains redundant components and power supplies, which serves to decrease reliance on 1K-4 for support of safe shutdown systems. Also, many components that rely on instrument air for operation remain in, or change to a fail-safe state with regard to their primary function. The inability of the 1K-4 instrument air compressor to perform its intended safety function of supplying compressed air to other systems is judged to have a low impact on plant risk.

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|----------------------------|-----------|---------------|-------------------|-----------------|---------|
| Duane Arnold Energy Center | 05000 331 | YEAR          | SEQUENTIAL NUMBER | REVISION NUMBER | 3 OF 4  |
|                            |           | 2006          | -- 001            | -- 00           |         |

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

This report is being submitted pursuant to 10CFR50.73(a)(2)(i)(B). There were no actual safety consequences associated with this event. There was no effect on public health and safety as a result of this event.

**III. Cause of Event:**

The installed valve was a Henry Vogt model SW12111, 1" gate valve with a 13% chrome trim. Laboratory analysis indicates that the valve trim was manufactured from type 416 stainless steel, heat treated to Rockwell hardness of C50.

The valve disc had separated into three pieces, fracturing at the 90-degree corners of the tee slot (geometric stress riser). Both fracture surface conditions suggest a recent failure, within a few months. The exposed surface was coated with corrosion deposits, the deposits were essentially iron oxide with some white areas consistent with river water silt.

A scanning electron microscope examination showed that the disc microstructure was tempered martensite with manganese sulfide stringers. The disc fracture was intergranular and corrosion products were contained within the cracks. Generally, martensitic steels are susceptible to intergranular stress corrosion cracking (IGSCC) if their temper results in a Rockwell hardness greater than C24.

The cause of the failure was identified as use of an IGSCC susceptible material in a valve that was installed in a corrosion conducive environment (installation of inappropriate material for the required environment). Corrosion bonding of the valve disc to the seat caused the force required to open the valve to exceed the yield strength of the disc in the presence of IGSCC. Cracking due to IGSCC existed prior to the catastrophic failure and contributed to a weakened state of the valve disc.

**IV. Corrective Actions:**

Valve V13-0141 was replaced with a valve that is less susceptible to IGSCC.

A review was performed of the applications of this type of IGSCC-susceptible valve. Valves identified as SW 12111 where failure had no impact on TS or plant risk per Probabilistic Risk Assessment (PRA), or would be self-revealing, were eliminated from further consideration. This review identified nine additional valves which will be replaced. The valves identified are V13-0098 (1K-4 ESW Cooling Water Supply Downstream Isolation), V13-0100 (1K-3 ESW Cooling Water Supply Downstream Isolation), V13-0139 (1K-3 ESW Supply Header Isolation), V13-0055 (Residual Heat Removal (RHR) Pump 1P-229A Seal Cooler ESW Inlet Isolation), V13-0057 (RHR Pump 1P-229C Seal Cooler ESW Inlet Isolation), V13-0059 (Core Spray (CS) Pump 1P-211A Motor Cooler ESW Inlet Isolation), V13-0041 (RHR Pump 1P-229D Seal Cooler ESW Inlet Isolation), V13-0043 (CS Pump 1P-211B Motor Cooler ESW Inlet Isolation) and V13-0040 (RHR Pump 1P-229B Seal Cooler ESW Inlet Isolation). A corrective action has been initiated to track their replacement.

Actions were taken to assure that these nine valves are operable (pending their replacement). Valves V13-0098 (1K-4 ESW Cooling Water Supply Downstream Isolation), V13-0100 (1K-3 ESW Cooling Water Supply Downstream Isolation) and V13-0139 (1K-3 ESW Supply Header Isolation) were proven to have flow passing through them by the completion of a surveillance test procedure on March 29, 2006. On April 6, 2006, while A ESW was running, flow was verified through V13-0055 (RHR Pump 1P-229A Seal Cooler ESW Inlet Isolation), V13-0057 (RHR Pump 1P-229C Seal Cooler ESW Inlet Isolation) and V13-0059 (CS Pump 1P-211A Motor Cooler ESW Inlet Isolation). On April 9, 2006, while B ESW was running, flow was verified through V13-0041 (RHR Pump 1P-229D Seal Cooler ESW Inlet Isolation) and V13-0043 (CS Pump 1P-211B Motor Cooler ESW Inlet Isolation). Flow could not be verified through V13-0040 (RHR Pump 1P-229B Seal Cooler ESW Inlet Isolation). Subsequently, a work request card and corrective action program request were initiated. An engineering evaluation determined that the B RHR pump is operable without flow through the pump seal cooler.

To verify continued operability of these nine valves pending their replacement, a tag out has been implemented for configuration control of the susceptible valves. It ensures that if any of the valves in question are used to establish a boundary, then, upon restoration, means other than valve position indication must be used to verify system flow.

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|----------------------------|-----------|---------------|-------------------|-----------------|---------|
| Duane Arnold Energy Center | 05000 331 | YEAR          | SEQUENTIAL NUMBER | REVISION NUMBER | 4 OF 4  |
|                            |           | 2006          | -- 001            | -- 00           |         |

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

V. Additional Information:

Previous Similar Occurrences:

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

EIIS System and Component Codes:

Emergency Service Water System: BI

Gate Valve (Shutoff Valve): SHV

Reporting Requirements:

This report is being submitted pursuant to 10CFR50.73(a)(2)(i)(B).