



Omaha Public Power District

444 South 16<sup>th</sup> Street Mall  
Omaha, NE 68102-2247

LIC-12-0159  
October 27, 2012

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

Reference: Docket No. 50-285

**Subject: Licensee Event Report 2012-007, Revision 1, for the Fort Calhoun Station**

Please find attached Licensee Event Report 2012-007, Revision 1, dated October 27 2012. This report is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(A) and 50.73(a)(2)(i)(B). No commitments are being made in this letter.

If you should have any questions, please contact me.

Sincerely,

Louis P. Cortopassi  
Site Vice President and CNO

LPC/epm

Attachment

c: E. E. Collins, Jr., NRC Regional Administrator, Region IV  
L. E. Wilkins, NRC Project Manager  
J. C. Kirkland, NRC Senior Resident Inspector

|   |  |
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| <b>NRC FORM 366</b><br>(10-2010)  | <b>U.S. NUCLEAR REGULATORY COMMISSION</b><br>APPROVED BY OMB: NO. 3150-0104<br>EXPIRES: 10/31/2013 |
| <h2 style="margin: 0;">LICENSEE EVENT REPORT (LER)</h2> <p style="margin: 0;">(See reverse for required number of digits/characters for each block)</p> |  |

|   |                                     |                          |
|---|-------------------------------------|--------------------------|
| <b>1. FACILITY NAME</b><br>Fort Calhoun Station | <b>2. DOCKET NUMBER</b><br>05000285 | <b>3. PAGE</b><br>1 OF 3 |
|---|-------------------------------------|--------------------------|

|   |
|---|
| <b>4. TITLE</b><br>Failure of Pressurizer Heater Sheath |
|---|

| 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 |
| 5             | 9   | 2010 | 2012          | - 007             | - 1     | 10             | 27  | 2012 | FACILITY NAME                | DOCKET NUMBER |
|               |     |      |               |                   |         |                |     |      |                              | 05000         |

|   |   |   |  |   |  |
|---|---|---|--|---|--|
| <b>9. OPERATING MODE</b><br><br><div style="text-align: center; font-size: 24px;">5</div> | <b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:</b> <i>(Check all that apply)</i> |   |  |   |  |
| <b>10. POWER LEVEL</b><br><br><div style="text-align: center; font-size: 24px;">0</div>   | <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)     |  |
|   | <input type="checkbox"/> 20.2201(d)   | <input type="checkbox"/> 20.2203(a)(3)(ii)  | <input checked="" 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>Erick Matzke     | TELEPHONE NUMBER <i>(Include Area Code)</i><br>402-533-6855 |

| 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 |
| A   | AB     | EHTR      | WATLOW        | Y                  |       |        |           |               |                    |

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

|   |  |
|---|--|
| <b>ABSTRACT</b> <i>(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)</i><br><p>On May 9, 2010, during power operation, pressurizer heater number 26 failed on ground fault. There was no indication of a reactor coolant system barrier breach at that time. During inspections to determine the physical integrity of a failed pressurizer heater it was determined that the heater sheath (number 26) was cracked. Due to the location of the heater sheath crack, this is considered a degradation of the reactor coolant system boundary. The initial visual inspection of heater 26 in November 2011 did not identify the cracking. During efforts to remove the heater, a crack was observed on May 19, 2012. The crack was above and below the heater support plate. The crack was an axial crack showing some branching. The crack was about an inch above and inch below the heater support plate. These inspections were being performed as a result of operating experience. On May 23, 2012, it was determined that the pressurizer heater sheath was part of the reactor coolant system boundary.</p> <p>The root cause of this failure is fabrication of the heater sheath during the manufacturing process induced high tensile residual stresses on the outer surface of the sheaths.</p> <p>The heater sheath has been removed and replaced. The other heater sheaths have been inspected and none of them had indications of cracking.</p> |  |
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**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

| 1. FACILITY NAME     | 2. DOCKET | 6. LER NUMBER |                      |            | 3. PAGE |
|----------------------|-----------|---------------|----------------------|------------|---------|
| Fort Calhoun Station | 05000285  | YEAR          | SEQUENTIAL<br>NUMBER | REV<br>NO. | 2 OF 3  |
|                      |           | 2012          | - 007                | - 1        |         |

**NARRATIVE**

**BACKGROUND**

Fort Calhoun Station (FCS) is a two-loop reactor coolant system of Combustion Engineering (CE) design. The pressurizer and its associated heaters were replaced in the fall of 2006 as part of a plant upgrade project. The pressurizer is designed with 36 pressurizer heaters. The heaters are 480 VAC immersion heaters with an output of approximately 25 (23.6) kilowatts each. Each heater is 1.252 inches in diameter, approximately 5 feet long, and protrudes vertically into the pressurizer through sleeves welded in the bottom head of the pressurizer. The heaters and sheaths were manufactured by Watlow Electric Manufacturing. The pressurizer and its heaters were replaced in 2006 to eliminate Alloy 600 issues.

FCS Technical Specification 2.1.4(1) requires: RCS operational LEAKAGE shall be limited to:

a. No Pressure Boundary LEAKAGE

**EVENT DESCRIPTION**

On May 9, 2010, during power operation, pressurizer heater number 26 failed on ground fault. There was no indication of a reactor coolant system barrier breach at that time. During inspections to determine the physical integrity of a failed pressurizer heater it was determined that the heater sheath (number 26) was cracked. Due to the location of the heater sheath crack, this is considered a degradation of the reactor coolant system barrier. The initial visual inspection of heater 26 in November 2011 did not identify the cracking. It appears that the crack expanded during the intervening period. During efforts to remove the heater, a crack was observed on May 19, 2012. The crack was above and below the heater support plate. The crack was an axial crack showing some branching. The crack was about an inch above and inch below the heater support plate. These inspections were being performed as a result of operating experience. On May 23, 2012, it was determined that the pressurizer sheath was part of the reactor coolant system boundary. However, there were no indications of any external RCS leakage.

At 1854 Central Daylight Time (CDT) on May 23, 2012, an 8-hour notification was made to the Headquarters Operations office (HOO), under 10CFR50.72 (b)(3)(ii)(A). This report is being made per 10CFR50.73 (a)(2)(ii)(A) and 50.73 (a)(2)(i)(B).

This LER reports a condition that was documented in the FCS corrective action program on several occasions. A ground on a pressurizer heater on May 9, 2010, was only reviewed with respect to the Technical Specification requirements for available pressurizer heaters. When the potential challenge to the reactor coolant boundary due to a failed pressurizer heater was identified on August 5, 2011, the Operations review focused on the current operating conditions, noting that the condition would need to be resolved prior to start up. The station paradigm inappropriately concluded that reportability could be evaluated at a later date since current operating conditions were not challenged, and that the 60-day reporting window commenced when the event was determined to be reportable. In addition, FCS resources were focused on flood response and mitigation due to the extensive flooding that occurred along the Missouri River beginning in June 2011. FCS had declared an Unusual Event on June 6, 2011, due to rising river level and river projections, and resources were focused on flood response and asset protection. This condition was initially reported in Event Notification (EN) 47953 on May 23, 2012, at 1854 CDT. FCS has been systematically addressing issues that have been identified since June 2011, in response to the flooding conditions, switchgear fire, and increased oversight. This LER is being submitted beyond the 60-day regulatory reporting requirement due to non-conservative decisions with respect to procedural and regulatory reportability requirements and resource constraints caused by the operating challenges which began in June 2011.

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**NARRATIVE**

**CONCLUSION**

Based on forensic testing of the failed heater, the direct cause of these cracks was intergranular stress corrosion cracking (IGSCC) in the pressurizer heater sheath. It should be noted the three criteria required to produce IGSCC include high tensile residual stresses, a susceptible material and a conducive environment.

The root cause of this failure is high tensile residual stresses on the outer surface of the sheaths induced by the manufacturing process. Contributing to this failure was the Fort Calhoun Station organization did not resolve a problem, identified through industry operating experience, in a timely and effective manner to prevent failure of heater number 26. Other contributors include; a high temperature condition in the area where heater number 26 penetrates the support plate, localized sensitized grain boundaries in the heater sheath material, and axial stringers of oxide inclusions on the outside diameter surface of the heater sheath. All three criteria (tensile stress, a conducive environment, a susceptible material) for producing and accelerating IGSCC were present.

**CORRECTIVE ACTIONS**

**Actions to Prevent Recurrence**

The cracked heater has been removed and replaced. The other heater sheaths have been rigorously inspected to ensure any cracks would be identified. None of the other heater sheaths had indications of cracking.

Additional actions will be tracked in the stations corrective action system.

**SAFETY SIGNIFICANCE**

While the heater sheath crack caused the electrical failure of the pressurizer heater, the heater design includes a secondary seal (not the RCS pressure boundary) that prevented any leakage from the reactor coolant system. This integral safety function operated as anticipated and designed. FCS performed a bare metal inspection of the pressurizer bottom head and confirmed that there were no indications of any external RCS leakage from any of the heaters or their penetrations. Therefore this event had no impact on the health and safety of the public.

**SAFETY SYSTEM FUNCTIONAL FAILURE**

This event does not result in a safety system functional failure in accordance with NEI-99-02.

**PREVIOUS EVENTS**

The station has not had any previous cracking of pressurizer heater sheaths.