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10 CFR 50.73

Serial: RNP-RA/16-0018

**MAR 21 2016**

United States Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2  
DOCKET NO. 50-261/RENEWED LICENSE NO. DPR-23

LICENSEE EVENT REPORT NO. 2016-001-00:  
INSUFFICIENT SERVICE WATER FLOW TO MOTOR-DRIVEN AUXILIARY FEEDWATER PUMP  
OIL COOLERS

Ladies and Gentlemen:

Pursuant to 10 CFR 50.73, Duke Energy Progress, Inc. is submitting the attached Licensee Event Report. Corrective actions were completed that restored full compliance with NRC regulations. Should you have any questions regarding this matter, please contact Mr. S. Connelly, Acting Manager – Nuclear Regulatory Affairs at (843) 857-1569.

This document contains no new regulatory commitments.

Sincerely,

R. Michael Glover  
Site Vice President

RMG/jmw

Attachment

c: Regional Administrator, NRC, Region II  
NRC Resident Inspector, HBRSEP  
D. Galvin, NRR

United States Nuclear Regulatory Commission  
Attachment to Serial: RNP-RA/16-0018  
6 Pages (including this cover page)

**H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2**  
**INSUFFICIENT SERVICE WATER FLOW TO MOTOR-DRIVEN AUXILIARY**  
**FEEDWATER PUMP OIL COOLERS**



**LICENSEE EVENT REPORT (LER)**  
(See Page 2 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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@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.

|  |   |                          |
|--|---|--------------------------|
| <b>1. FACILITY NAME</b><br>H. B. Robinson Steam Electric Plant, Unit No. 2 | <b>2. DOCKET NUMBER</b><br>05000          261 | <b>3. PAGE</b><br>1 OF 5 |
|--|---|--------------------------|

**4. TITLE**  
Inoperability of Motor-Driven Auxiliary Feedwater Pumps Due to Insufficient Lube Oil 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                | DOCKET NUMBER |
| 01            | 19  | 2016 | 2016          | 001               | 00      | 03             | 21  | 2016 | FACILITY NAME                | DOCKET NUMBER |
|               |     |      |               |                   |         |                |     |      |                              | 05000         |
|               |     |      |               |                   |         |                |     |      |                              | 05000         |

**9. OPERATING MODE**          **11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)**

|  |   |   |  |   |
|--|---|---|--|---|
| <b>1</b>                                 | <input type="checkbox"/> 20.2201(b)         | <input type="checkbox"/> 20.2203(a)(3)(i)             | <input type="checkbox"/> 50.73(a)(2)(ii)(A)          | <input type="checkbox"/> 50.73(a)(2)(viii)(A) |
|  | <input type="checkbox"/> 20.2201(d)         | <input type="checkbox"/> 20.2203(a)(3)(ii)            | <input type="checkbox"/> 50.73(a)(2)(ii)(B)          | <input type="checkbox"/> 50.73(a)(2)(viii)(B) |
|  | <input type="checkbox"/> 20.2203(a)(1)      | <input type="checkbox"/> 20.2203(a)(4)                | <input type="checkbox"/> 50.73(a)(2)(iii)            | <input type="checkbox"/> 50.73(a)(2)(ix)(A)   |
|  | <input type="checkbox"/> 20.2203(a)(2)(i)   | <input type="checkbox"/> 50.36(c)(1)(i)(A)            | <input type="checkbox"/> 50.73(a)(2)(iv)(A)          | <input type="checkbox"/> 50.73(a)(2)(x)       |
| <b>10. POWER LEVEL</b><br><br><b>100</b> | <input type="checkbox"/> 20.2203(a)(2)(ii)  | <input type="checkbox"/> 50.36(c)(1)(ii)(A)           | <input type="checkbox"/> 50.73(a)(2)(v)(A)           | <input type="checkbox"/> 73.71(a)(4)          |
|  | <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2)                  | <input type="checkbox"/> 50.73(a)(2)(v)(B)           | <input type="checkbox"/> 73.71(a)(5)          |
|  | <input type="checkbox"/> 20.2203(a)(2)(iv)  | <input type="checkbox"/> 50.46(a)(3)(ii)              | <input type="checkbox"/> 50.73(a)(2)(v)(C)           | <input type="checkbox"/> 73.77(a)(1)          |
|  | <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)(D)           | <input type="checkbox"/> 73.77(a)(2)(i)       |
|  | <input type="checkbox"/> 20.2203(a)(2)(vi)  | <input checked="" type="checkbox"/> 50.73(a)(2)(i)(B) | <input checked="" type="checkbox"/> 50.73(a)(2)(vii) | <input type="checkbox"/> 73.77(a)(2)(ii)      |
|  |   | <input type="checkbox"/> 50.73(a)(2)(i)(C)            | <input type="checkbox"/> OTHER                       | Specify in Abstract below or in NRC Form 366A |

**12. LICENSEE CONTACT FOR THIS LER**

|  |  |
|--|--|
| LICENSEE CONTACT<br>S. Connelly - Acting Manager, Nuclear Regulatory Affairs | TELEPHONE NUMBER (Include Area Code)<br>(843) 857-1569 |
|--|--|

**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     | ISV       | L300          | 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> | MONTH | DAY | YEAR |
|  |                                     |       |     |      |

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

At 1540 hours EST on 01/19/2016 with H. B. Robinson Steam Electric Plant, Unit No. 2, in Mode 1 at 100 percent power, Motor-Driven Auxiliary Feedwater (MDAFW) pump "B" failed its surveillance test due to flow switch FSL-1633B failure to indicate service water flow to the Oil Cooler and Packing Channel Cooler. It was discovered that flow was blocked due to stem and disc separation on the MDAFW pump "A" and "B" cooling flow return isolation valve, SW-115. This blockage rendered both MDAFW trains inoperable for a period longer than allowed by plant Technical Specifications (TS). TS 3.7.4, Auxiliary Feedwater (AFW) System, requires four AFW flow paths and three AFW pumps be operable in Modes 1, 2, and 3, and Mode 4 when steam generator is used for heat removal, allowing 24 hours to restore one of two inoperable MDAFW pumps to operable status. Since two MDAFW pumps were inoperable due to common cause for approximately 52 hours, this condition is reportable as a condition prohibited by TS under 10 CFR 50.73(a)(2)(i) (B), and reportable under 10 CFR 50.73(a)(2)(vii), Common Cause Inoperability of Independent Trains or Channels. The total duration of both trains of MDAFW being unavailable was limited to approximately 3 hours.

An investigation concluded that the failed valve (SW-115) was likely installed in poor condition, without documentation, and outside of design specifications prior to 1978. The valve has been replaced with a valve meeting current design specifications. The health and safety of the public was not jeopardized as a result of this condition.



**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@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 | 6. LER NUMBER |                   |         | 3. PAGE |
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| H. B. Robinson Steam Electric Plant, Unit No. 2 | 05000 261 | YEAR          | SEQUENTIAL NUMBER | REV NO. | 2 OF 5  |
|   |           | 2016          | - 001             | - 00    |         |

**NARRATIVE**

**BACKGROUND**

**Regulatory**

Technical Specification (TS) 3.7.4, Auxiliary Feedwater (AFW) System[BA], requires four flow paths and three AFW pumps[P] be operable in Modes 1, 2, and 3, and Mode 4 when steam generator[SG] is used for heat removal. If one motor-driven auxiliary feedwater (MDAFW) pump is inoperable, the licensee must enter Condition A - restore the inoperable MDAFW pump to operable status within 7 days. If two MDAFW pumps are inoperable, the licensee must enter Condition B - restore one MDAFW pump to operable status within 24 hours. If the completion time for Condition A or B is not met, Condition C is entered - be in MODE 3 within 6 hours AND be in MODE 4 within 18 hours. The regulatory impact to the station as a consequence of this circumstance necessitates a 60-day licensee event report (LER) to the Nuclear Regulatory Commission (NRC) under 10 CFR 50.73(a)(2)(i)(B), "Operation or Condition Prohibited by Technical Specifications," and 10 CFR 50.73(a)(2)(vii), "Common Cause Inoperability of Independent Trains or Channels."

**Technical**

Service Water (SW)[BI] is supplied to inboard and outboard packing channel coolers and the lube oil cooler[CLR] for the "A" and "B" MDAFW pumps. The design requires that oil temperatures in the MDAFW lube oil coolers be maintained below 140 degrees Fahrenheit (F). The Updated Final Safety Analysis Report, Table 9.2.1-2, shows flow to a single MDAFW pump as 15 gallons per minute (gpm), but it is clarified that this value is for sizing the SW system and individual component flows may vary. The SW flow switches (FSL-1633A/B)[FIS] are factory set at 10 gpm and provide indication of flow. Analysis has shown that 2.36 gpm SW flow to the MDAFW Pump is adequate to maintain lube oil temperatures below 140F at the TS limited SW temperature of 99F. The maximum SW temperature observed since the most recent successful Operational Surveillance Test (OST) was 74F and this temperature was used in analysis of the required SW flow. Engineering evaluation has shown that for the period following the most recent successful OST, 1.04 gpm to the MDAFW pump is adequate to maintain lube oil temperatures below 140F. When one looks at the period following the Point of Discovery (1/19/2016 - 1/22/2016), the maximum SW temperature was 56F, providing additional margin for the period in question.

**EVENT DESCRIPTION**

At 0231 hours EST on 1/19/2016, with the plant in Mode 1 at 100 percent power and no involvement of out-of-service structures, systems or components, the motor-driven auxiliary feedwater (MDAFW) pump "B" was taken out of service and declared inoperable for regularly scheduled maintenance. The plant then entered Limiting Condition of Operation (LCO) 3.7.4, Condition A, as required by Technical Specifications: restore to operable within 7 days and within 8 days of discovery of failure to meet LCO or be in Mode 3 within 6 hours and Mode 4 within 18 hours. At 1540 hours EST on 1/19/2016, following completion of scheduled maintenance, MDAFW pump "B" failed its surveillance test (OST-201-2, MDAFW Systems Component Test - Train "B") due to SW flow switch FSL-1633B failing to indicate flow to the oil cooler and packing channel cooler via illumination of the 'SW ON' light[LI] on the reactor turbine generator board (RTGB)[MCBD]. The auxiliary operator (non-licensed) observed normal conditions for the surveillance test, such as typical flow noise, physical temperature of the pump and pump casing and other associated sounds in the room. The operator (non-licensed) initiated Condition Report (CR) 1992738 to document the failure of the flow switch to actuate during the surveillance. At this time, MDAFW pump "B" was still inoperable and had not been returned to service; however, it was aligned for service and would have functioned on a valid start signal. MDAFW pump "A" was protected to ensure it was available.

A work order (WO 20051516) was created to investigate and repair flow switch FSL-1633B. Troubleshooting efforts confirmed that the flow switch (FSL-1633B), temperature control valve (TCV-1903A)[TCV], and the lube oil cooler were all operating properly and not restricting flow, indicating that flow restriction and/or blockage was downstream of vent valve SW-299. To validate flow, actions were initiated to install a portable ultrasonic flow meter (UFM)[FI] on the pipe.

**LICENSEE EVENT REPORT (LER)  
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**NARRATIVE**

**EVENT DESCRIPTION (Continued)**

The rate of flow was determined to be 2.2 gpm to the "B" MDAFW pump with all equipment in the normal configuration, confirming there was partial blockage in the "B" line. At this point, the MDAFW pump "B" check valve (SW-563)[V] was considered to be the most likely cause of flow restriction/blockage since it is the only active component in the flow path.

On 1/22/16 at 0326, a temporary modification was completed and turned over to Operations to provide an alternate flow path. A post-modification test resulted in a flow rate of 12.4 gpm, as measured by the UFM, causing the 'SW ON' light to illuminate on the RTGB. MDAFW pump "B" was declared operable at this time.

At 0330 on 1/22/16, after "B" MDAFW pump had been declared operable, the service water temperature control valve for MDAFW pump "A" (TCV-1903A) was failed open to determine if sufficient flow existed to the "A" MDAFW train. The light on flow switch FSL-1633A and the light on the RTGB illuminated for approximately 45 seconds, then the light extinguished. MDAFW pump "A" was declared inoperable at 0330. Subsequently, a UFM was installed on MDAFW pump "A" SW line. When the process was repeated the UFM read essentially zero SW flow. It was evident at this time that there was an obstruction in the common return line.

Maintenance performed a line inspection of valve SW-564[V], which is slightly upstream of SW-115. When the threaded piping was removed, SW-115 was found to have a separated disc/stem assembly. A temporary hose was installed downstream of SW-564, and flow from MDAFW pump "A" was found to be approximately 11-12 gpm. SW-115 was removed from the line and turned over to Engineering.

SW-115 was replaced with a new, stainless steel valve. Check valves SW-563 and SW-562[V] were inspected and found to be satisfactory. Following repairs, the equipment was restored to the normal configuration. Post-modification testing confirmed adequate flow to both the "A" (12.1 gpm) and "B" (14.17 gpm) MDAFW pumps.

Analysis indicates that due to the amount of restriction created by the SW-115 blockage, and differential pressure between the north and south SW headers, had both pumps auto-started, only the pump being supplied from the higher pressure header would have received adequate flow while the other pump would have received no flow. The period of concern is 52.27 hours between 1/19/16 1403, when the clearance on MDAFW pump "B" was lifted, and 1/22/16 0320, when MDAFW pump "B" was returned to operable status. Analysis shows that MDAFW pump "B", which was considered out of service would have received adequate flow while MDAFW pump "A", which was protected, would have received no flow and was therefore inoperable. "B" was aligned for service at this time and would have started and functioned on a valid start signal. This condition (Operation Prohibited by TS) existed for greater than the 24 hours allowed by TS 3.7.4, Condition B. Consequently, TS 3.7.4, Condition C, was not met. Condition C requires the plant to be in Mode 3 within 6 hours of failing to meet Condition A or B. The plant was not in the required action statement at the time. During the 52.27 hour period analyzed, both trains were technically inoperable which constituted the Operation Prohibited by TS, however at least one pump would have received adequate cooling flow and would have performed its function. Of the 52.27 hours, there were 3.1 hours following manipulation of the vent valves when conditions were changed in the common return header. During this 3.1 hours, neither train would have received cooling flow and thus the condition is also reportable as a common cause inoperability of independent trains or channels. During the entire 52.27 hours the SDAFW pump and the "C" AFW remained available to perform the system function to provide AFW, if required.

**CAUSAL FACTORS**

On 1/22/16, SW-115 was removed from the common SW header and sent to the Duke Energy Progress, Nuclear Engineering Department, Metallurgy Services for examination. Upon removal, the disc from the SW-115 rising stem globe valve was found to be below the valve seat and was separated from the stem. The probable cause of the disc's detachment from the stem was opening the valve after the disc went beneath the seat. Extensive, asymmetric erosion had occurred to the end of the valve stem suggesting the disc had been separated from the stem for a long period of time. A weld repair was observed on the side of the valve body that corresponded to a large crack on the interior of the valve, which suggests this valve had a leak issue during its service prior to SW system installation. Additional cracks were observed on the interior and exterior of the opposing side of the valve body, but no evidence of leaking was present.

**LICENSEE EVENT REPORT (LER)  
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**NARRATIVE**

**CAUSAL FACTORS (Continued)**

Original plant drawings from 1970 show only SW-564 was installed on the common return cooling water line. However, in 1978 the flow diagram shows both SW-564 and SW-115 installed on the common return cooling water line. The design specification for the piping is stainless steel with welded fittings; SW-564 meets this specification. SW-115 is a bronze, threaded valve and does not meet said design specification. The fact that SW-115 is a bronze valve did not cause it to fail. There is reasonable assurance that SW-115 was in poor condition at the time of installation. If a new bronze valve had been installed then, this event may not have occurred.

**CORRECTIVE ACTIONS**

Corrective actions taken to restore compliance with regulations are listed below.

**Immediate:**

1. CR 1992738 generated to capture event in Corrective Action Program

**Completed:**

1. Failure Analysis of globe valve SW-115
2. Work Orders 20052152 and 20051516 were completed for troubleshooting the flow blockage, inspection of check valve SW-562, inspection of check valve SW-563, inspection of manual isolation valve SW-564 and replacement of manual isolation valve SW-115.
3. Engineering Evaluation of the replacement for SW-115.

**SAFETY ANALYSIS**

The safety significance of both the "A" and "B" MDAFW trains being unavailable for the period of 3.1 hours and having only one train available for an additional period of 49.17 hours is very low. This is because of the other risk mitigating features of Robinson Nuclear Plant which includes the independent AFW pump C and the turbine-driven auxiliary feedwater pump. In addition RNP has pre-staged FLEX equipment that could perform a similar safety function. This FLEX equipment was not credited in this risk analysis but could yield additional risk decreases.

**ADDITIONAL INFORMATION**

A review of the service water Industry Operating Experience (OE) was performed for a five (5) year span from 2011 to 2016. Several reports were reviewed for applicability based on subject titles, however no OE reviewed had the same or similar circumstances as the subject condition, where an inappropriate component, not rated for its application, was installed in the plant.

Additionally, an OE search was performed of the Robinson Corrective Action Database for a period of ten (10) years from January of 2005 to February of 2016. The search produced several condition reports, but none of the OE would have prompted the need to examine the valve in question, SW-115.

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**NARRATIVE**

**ADDITIONAL INFORMATION (Continued)**

An additional review of industry OE was performed for topics related to subject of this event report; no lesson learned from the OE reviewed would have prevented this event.

Energy Industry Identification System (EIIS) codes for systems and components relevant to this event are identified in the text of this document within brackets [ ].