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March 27, 2015
BW150030

10 CFR 50.73

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

Braidwood Station, Unit 2
Facility Operating License No. NPF-77
NRC Docket No. STN 50-457

Subject: Licensee Event Report 2015-001-00 – Steam Generator Atmospheric Relief Manual Isolation Valve Fails to Close During Quarterly Surveillance Due to Long Term Corrosion

The enclosed Licensee Event Report (LER) is being submitted in accordance with 10 CFR 50.73, "Licensee Event Report System."

There are no regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact Mr. Phillip J. Raush, Regulatory Assurance Manager, at (815) 417-2800.

Respectfully,

Mark Kanavos
Site Vice President
Braidwood Station

Enclosure: LER 2015-001-00

cc: NRR Project Manager – Braidwood Station
Illinois Emergency Management Agency – Division of Nuclear Safety
US NRC Regional Administrator, Region III
US NRC Senior Resident Inspector (Braidwood Station)
Illinois Emergency Management Agency – Braidwood Representative

IE22
NRR

bcc: Site Vice President – Braidwood Station
Director – Licensing
Manager, Licensing – Braidwood, Byron and LaSalle County Stations
Regulatory Assurance Manager – Braidwood Station
Braidwood Nuclear Licensing Administrator
Exelon Document Control Desk Licensing

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

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.

# LICENSEE EVENT REPORT (LER)

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**4. TITLE**

Steam generator atmospheric relief manual isolation valve fails to close during quarterly surveillance due to long term corrosion

| 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 |
| | | | | | | | | | N/A | N/A |
| 01 | 26 | 2015 | 2015 | - 001 | - 00 | 03 | 27 | 2015 | FACILITY NAME: N/A | DOCKET NUMBER: N/A |

| 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) |
| | ☐ 20.2203(a)(2)(iii) | ☐ 50.36(c)(2) | ☐ 50.73(a)(2)(v)(A) | ☐ 73.71(a)(4) |
| 100 | ☐ 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**

| LICENSEE CONTACT | TELEPHONE NUMBER *(Include Area Code)* |
|---|---|
| Phillip J. Raush – Manager, Braidwood Regulatory Assurance | (815) 417-2800 |

**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 | SB | ISV | A391 | Y | N/A | N/A | N/A | N/A | N/A |

| 14. SUPPLEMENTAL REPORT EXPECTED | 15. EXPECTED SUBMISSION DATE | MONTH | DAY | YEAR |
|---|---|---|---|---|
| ☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO | | N/A | N/A | N/A |


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

On January 26, 2015 while performing a quarterly surveillance stroke test of the 2C Steam Generator (SG) Power Operated Relief Valve (PORV), 2MS018C, the associated SG PORV manual isolation valve, 2MS019C, failed to close. The last successful quarterly stroke of 2MS019C was performed on October 27, 2014.

A failure analysis performed concluded that moisture had been present in the valve's gear box for an extended period of time, causing corrosion and pitting in the 2MS019C actuator. The degradation removed enough material to cause the remaining intact cross-sections to fail during the attempt to close the valve on January 26, 2015.

There is the potential that a condition prohibited by technical specifications (TS) existed before discovery, for a time longer than permitted by TS, based on the surveillance frequency. This event is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B), "Any operation or condition which was prohibited by the plant's Technical Specifications." Corrective actions included repairing the valve, performing a failure analysis of the actuator gears from 2MS019C, and performing an extent of condition review on similar valves.

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**NARRATIVE**

A. Plant Condition Prior to Event

Event Date/Time: January 26, 2015 / 0246 hours CST

Unit 2: Mode 1 - Power Operations, Reactor Power 100 percent

Reactor Coolant System [AB]: Normal operating temperature and pressure. There was no inoperable equipment that contributed to this event.

B. Description of Event

On January 26, 2015, while performing a quarterly valve stroke surveillance the 2C steam generator power operated relief valve (SG PORV) manual isolation valve, 2MS019C, failed to close.

2MS019C, also known as a 'block valve' per the technical specification (TS) 3.7.4 bases, is an 8 inch Anchor/Darling Valve Company manual isolation gate valve for the Main Steam (MS) system. The SG PORV manual block valves must be capable of closing to isolate a failed open SG PORV valve.

2MS019C is manually operated using a 20 inch hand wheel. The hand wheel shaft drives a spur gear which ultimately drives a beveled gear. This bevel gear drives a larger 49 tooth bevel gear that rotates the valve stem nut. The large 49 tooth bevel gear is orientated vertically within the 2MS019C valve actuator gear box.

On January 26, 2015, Equipment Operators (EO) attempted to close 2MS019C, but the stem of the valve did not move. The EO then attempted to open 2MS019C, and the valve stem moved approximately one inch. The EO reattempted to close 2MS019C, but the stem moved approximately one-half inch before the hand wheel began to spin freely with little resistance.

Based upon equipment failure analysis, the 2MS019C actuator failure was caused by severe corrosion and pitting in two consecutive teeth on the 49 tooth bevel gear. The bevel gear corrosion/pitting patterns indicated there was exposure to water within the gear box. The degradation removed enough material to cause the remaining intact cross-sections to fail by overloading during an attempt to close the valve. Significant corrosion and pitting degradation were also observed on other teeth for approximately two-thirds of the bevel gear circumference. Based on the magnitude of the corrosion and pitting, it is likely that moisture had been present in the gear box for an extended period of time. The most likely source of moisture was packing leakage that condensed on the underside of the yoke, dripped onto the stem and flowed downward into the actuator gear box.

There is the potential that the valve would not have been capable of closing since the last quarterly surveillance. The degraded 2MS019C actuator condition potentially existed longer than the 30 day completion time associated with TS 3.7.4, "SG PORV," which would constitute a condition prohibited by technical specifications.

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**NARRATIVE**

Event Timeline:

On August 14, 2007, a small packing leak (water was leaking into the valve yoke) was identified on 2MS019C. The packing leak stopped without any maintenance action.

On November 12, 2008, 2MS019C valve actuator was rebuilt with new parts, including the large 49 tooth bevel gear. During this maintenance activity, water was found inside the actuator gear box. No valve or valve packing work was performed.

On April 14, 2014, a packing leak of approximately 10 drops per minute was identified on 2MS019C.

On September 17, 2014, 2MS019C packing was adjusted to resolve the packing leak.

On October 27, 2014, the 2MS019C quarterly main steam system valve stroke surveillance was successfully completed by stroking 2MS019C closed and opened 5 times.

On January 26, 2015, while performing quarterly MS system valve stroke surveillance, 2MS019C failed to close.

C. Cause of Event

2MS019C failure analysis determined the large 49 tooth bevel gear failure was caused by excessive corrosion. The bevel gear corrosion was attributed to water intrusion into the actuator gear box resulting from a historic valve packing leak. The valve packing leak identified on April 2014 was characterized as a "steady drip/small stream...steam is condensing as it exits the packing leading to approximately 10 drops per minute." 2MS019C is orientated horizontal which allows the condensing steam to be directed into the valve actuator gear box. The actuator gear box accumulates condensed steam and water, which provided the corrosion mechanism for the failed spur gear. The spur gear corrosion was localized to the portion of spur gear directly impacted by the accumulated water in the actuator gear box.

D. Safety Significance

The function of the SG PORV block valve is to isolate a failed open SG PORV. One SG PORV line for each of the four steam generators is provided. Each SG PORV line consists of one SG PORV and an associated block valve. The SG PORVs are provided with upstream block valves to permit testing at power, and to provide an alternate means of isolation.

The failure of the 2C steam generator power operated relief valve block valve, 2MS019C, to close is not considered an event or condition that could have prevented fulfillment of a safety function. This condition did not create any actual plant or safety consequences because the 2MS018C was always operable and capable of operating on demand.

E. Corrective Actions

2MS019C valve actuator was repaired on January 29, 2015. Damaged components, including the large 49 tooth spur gear were replaced.

An extent of condition review was performed verifying no current or historical SG PORV block valve packing leaks existed that could cause water intrusion into the other Unit 1 and Unit 2 SG PORV block valve actuator gear boxes.

# LICENSEE EVENT REPORT (LER)
# CONTINUATION SHEET

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**NARRATIVE**

F. Previous Occurrences

No previous similar events are known.

G. Component Failure Data

The failed component was the 2C SG PORV block valve, 2MS019C actuator, model number 93-14799 manufactured by Anchor/Darling Valve Company.

This event has been reported to ICES (315341).