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10 CFR 50.73

September 12, 2011  
BW110089

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

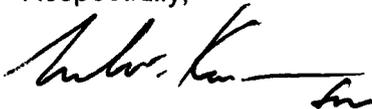
Braidwood Station, Unit 2  
Facility Operating License No. NPF-77  
NRC Docket No. STN 50-457

Subject: Licensee Event Report 2011-002-00 – Unit 2 – Auxiliary Feedwater System Inoperability  
Due to Additional Asiatic Clam Shells in Essential Service Water Supply Piping

The enclosed Licensee Event Report 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. Chris VanDenburgh, Regulatory Assurance Manager, at (815) 417-2800.

Respectfully,



Daniel J. Enright  
Site Vice President  
Braidwood Station

Enclosure: LER 2011-002-00

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

FE22  
NRR

# 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: 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 Section (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> Braidwood Station, Unit 2	<b>2. DOCKET NUMBER</b> 05000457	<b>3. PAGE</b> 1 of 4
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**4. TITLE**  
Auxiliary Feedwater System Inoperability Due to Additional Asiatic Clam Shells in Essential Service Water Supply Piping

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
07	14	2011	2011	- 002	- 00	09	12	2011	N/A	N/A
									FACILITY NAME	DOCKET NUMBER
									N/A	N/A

<b>9. OPERATING MODE</b>  1	<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>  100	<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 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 checked="" 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 Chris VanDenburgh, Regulatory Assurance Manager	TELEPHONE NUMBER <i>(Include Area Code)</i> (815) 417-2800
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <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 N/A	DAY N/A	YEAR N/A
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**ABSTRACT** *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On July 14, 2011, relic Asiatic clam shells were found in the essential service water suction piping between the cross-tie valves 2AF006A and 2AF017A, which provides a backup water source for the 2A Train auxiliary feedwater (AF) system.

At 1418, Technical Specifications Limiting Condition for Operation (LCO) 3.7.5, "Auxiliary Feedwater (AF) System," Condition A, "One AF train inoperable" was entered for the 2A AF train. Additional flushing of the suction piping was performed, and at 1151 on July 16, 2011, the 2A AF train was declared operable and the LCO exited.

The apparent causes for the event were: 1) Failure to perform a complete borescope inspection of the piping to verify no additional relic clam shells remained in the 2A AF suction piping from a May 9, 2011 event (reference LER 2011-001); and 2) Inadequate flushing techniques to remove shells from the 2A AF suction allowed for a significant amount of clam shells to remain in the system.

Corrective actions taken included flushing of the 2A AF suction piping between the 2AF006A and 2AF017A valves using improved flushing techniques, performing a complete borescope inspection of the 2A AF suction piping for remaining clam shells, and completion of the extent of condition flushing activities for the 1A, 1B and 2B AF trains.

There have been two similar Licensee Event Reports in the past three years: Unit 2 2008-001 and Unit 2 2011-001.

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**NARRATIVE**

**A. Plant Operating Conditions Before the Event:**

Event Date: July 14, 2011

Unit: 2                      MODE: 1                      Reactor Power: 100 percent

Unit 2 Reactor Coolant System [AB]:                      Normal operating temperature and pressure

Pertinent Auxiliary Feedwater (AF) [BA] System Details:

The AF system is designed to provide adequate water to the steam generators (SGs) to cool the unit down safely to 350 deg F at which time the residual heat removal (RH) [BP] system can be utilized. The AF system consists of two trains; Train A with a motor driven pump and Train B with a diesel engine driven pump. Each AF pump can deliver flow to all four SGs through air operated flow control valves.

The normal and preferred source for the AF system is the non-safety related condensate storage tank (CST). The safety related essential service water (SX) [BI] system provides a safety related and seismically qualified backup water source to the CSTs. Two motor-operated pump suction valves (2AF017A/B and 2AF006A/B) in series per pump are provided on the SX supply lines.

Historically, the suction piping between the 2AF017A/B and 2AF006A/B was maintained in a drained (dry-layup) condition. The original design intention of this arrangement was to prevent the possibility of raw water from contaminating the secondary side of the SGs during normal operation or transients not requiring the safety related make up source. The concern is that SG tube (primary reactor coolant pressure boundary) integrity could be compromised from exposure to raw water. The protection from SX intrusion was accomplished by the two normally closed cross-tie valves 2AF006A/B and 2AF017A/B. The space between the 2AF017A/B and 2AF006A/B valves was intentionally drained and monitored for leak-by as an added measure to ensure SX water did not intrude into the AF system and challenge the integrity of the SG tubes, a fission product barrier.

In March 2011, due to concerns identified with the drained section of piping between the cross-tie valves, actions were initiated to install vent lines and fill the drained section of piping between the cross-tie valves.

Prior to this event, on May 9, 2011, approximately 41.25 square inches of Asiatic clam shells were found during actuation testing of the 2AF006A and 2AF017A valves. An evaluation of past operability concluded the 2A train of AF was not operable due to the quantity of clam shells found, which had the potential to be transported through the 2A AF system and block flow through the AF flow control valves to the SGs (2AF005A-D). Troubleshooting was performed to remove the clam shells and the 2A AF system was declared operable based on 10 minutes of flushing the suction piping with no clam shells identified. Subsequent investigation determined the shells were from historic, dead (relic) Asiatic clams. This event is addressed under Unit 2 LER 2011-001-00.

**B. Description of Event:**

No structures, systems or components were inoperable at the start of this event that contributed to the event.

On July 14, 2011, during extent of condition investigation of the May 9, 2011 event, greater than 70 square inches of relic clam shells were flushed out of the 2A AF suction piping between 2AF017A and 2AF006A. The amount of relic clam shells that were flushed out of the system did not support 2A train operability, despite previous acceptance of the 2A AF system as operable following efforts to remove the relic clam shells on May 9, 2011.

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**NARRATIVE**

At 1418, Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.7.5, "Auxiliary Feedwater (AF) System," Condition A, "One AF train inoperable" was entered for the 2A AF train. Troubleshooting was initiated to perform additional flushing of the suction piping. At 1151 on July 16, 2011, the 2A AF was declared operable and LCO 3.7.5, Condition A was exited.

TS LCO 3.7.5, Condition A requires restoring the AF train to OPERABLE status within 72 hours. This condition existed for a longer period of time than is allowed by LCO 3.7.5 Condition A; therefore, this event is being reported pursuant to 10 CFR 50.73(a)(2)(i)(B), any operation or condition which was prohibited by Technical Specifications.

Additionally, as there were time periods between May 9, 2011 and July 14, 2011 where the 2B AF train was declared inoperable for testing or maintenance, this event is also being reported pursuant to 10 CFR 50.73(a)(2)(v)(B) as a condition that could have prevented the fulfillment of a system's safety function.

**C. Cause of Event**

The investigation identified two apparent causes:

1. Failure to perform a complete borescope inspection of the piping to verify no additional relic clam shells remained in the 2A AF suction piping allowed for continued inoperability of the system.
  - Clam shells were previously discovered in the 2A AF suction line from SX and no borescope inspection was performed to verify all shells were removed from the system.
  - The borescope inspection to verify operability performed on July 15, 2011, showed shells had settled in the bends of the piping near the 2AF017A and 2AF006A valves and surrounding the drain. A borescope inspection of the entire pipe when the clam shells were initially discovered would have identified the need to perform more effective flushing.
2. Inadequate flushing techniques to remove shells from the 2A AF suction piping allowed for a significant amount of clam shells to remain in the system.
  - No flow criterion was established for acceptability of the flushing technique in providing reasonable assurance for operability. No quantitative analysis was performed to evaluate what velocity would be adequate to flush the clam shells from the system and therefore, it was not realized that the flows established during troubleshooting flushes were not adequate.
  - The only mechanism that could be used to remove clam shells from the 2A AF suction piping as it was designed was through the drain line. The original piping configuration did not include a drain of sufficient size to permit achievement of the nominal flushing flow velocities since the volume of piping between the 2AF017A and 2AF006A was designed to be maintained in a "dry layup" condition.

**D. Safety Consequences:**

There were no actual safety consequences impacting plant or public safety as a result of this event. Braidwood Station has not experienced an actual event that required the AF system to perform its safety function with flow supplied by the SX system. Flow to the AF system from the CSTs would not have been impacted by Asiatic clams in the SX system. Therefore, the existence of the clams in the SX supply line has not impacted AF flow to the SGs.

In a design basis accident, an Engineered Safety Feature (ESF) signal will actuate the AF system, and the AF pumps will initially draw condensate from the CST. If the CST becomes depleted or unavailable coincident with AF ESF actuation, a low suction header pressure signal opens valves 2AF017A and 2AF006A, allowing pump supply from SX. Upon this action, the clam shells in the piping between valves 2AF017A and 2AF006A would pass through the 2A AF pump and on to the 2A Train AF control valves (2AF005A-D). The presence of the Asiatic clam shells in the 2A SX supply header had the potential to be transported through the 2A AF system and block flow through the AF control valves. While this condition affected the 2A Train AF, there were four time periods since

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**NARRATIVE**

May 9, 2011, where the 2B AF train was declared inoperable for testing or maintenance. Therefore, this event represents a safety system functional failure.

From a risk perspective, the loss of function would only occur if, during a design basis accident, the CSTs were lost, 2B AF train fails or is unavailable due to maintenance, and the clam shells propagated through the system causing a loss of the 2A AF train. The probability of these three events occurring concurrently is considered unlikely. The potential impact of clam shells in the 2A Train AF is considered as a low safety significance due to the low probability associated with events that would require use of SX as a suction source for the AF system.

During the time of past inoperability of the 2A AF pump (May 9, 2011 to July 14, 2011), there were four instances where the 2B AF pump was inoperable but available: for performance of surveillance testing; for SX supply to the 2B AF pump suction line flushing for extent of condition; and for performance of valve strokes. At all times during this time period, although the 2B AF pump was inoperable, it was available to perform its design basis function based on the pre-determined and pre-briefed risk management actions established to maintain component availability.

**E. Corrective Actions:**

Corrective actions taken include:

- Flushing of the 2A AF suction piping between the 2AF006A and 2AF017A valves using improved flushing techniques (i.e., removing the drain line and completely draining the pipe between flushes).
- Performing a complete inspection of the 2A AF suction piping for remaining clam shells.
- Completion of the extent of condition flushing activities for the 1A, 1B and 2B AF trains.

**F. Previous Occurrences:**

There has been two previous, similar Licensee Event Reports identified at the Braidwood Station in the past three years:

- Licensee Event Report Number 2008-001 – 2A Essential Service Water Train Inoperable Due to Strainer Fouling from Bryozoa Deposition and Growth
- Licensee Event Report Number 2011-001 – Asiatic Clam Shells in Essential Service Water Supply Piping to the 2A Auxiliary Feedwater Pump Resulted in Auxiliary Feedwater System Inoperability

**G. Component Failure Data:**

Manufacturer  
N/A

Nomenclature  
N/A

Model  
N/A

Mfg. Part Number  
N/A