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September 27, 2002  
BW020106

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

Braidwood Station, Unit 1  
Facility Operating License No. NPF-72  
NRC Docket No. STN 50-456

Subject:    Submittal of Supplemental Licensee Event Report Number 2002-002-01, "Failure of Pressurizer PORV Instrument Air Accumulator Isolation Check Valves to Isolate Caused by Improper Maintenance Procedures"

The enclosed Supplemental Licensee Event Report (LER) is being submitted in accordance with 10 CFR 50.73, "Licensee event report system", paragraph (a)(2)(i)(B). The supplement is being issued due to reclassification of the failure as a Safety System Functional Failure.

Should you have any questions concerning this letter, please contact Amy Ferko, Regulatory Assurance Manager, at (815) 417-2699.

Respectfully,



James D. von Suskil  
Site Vice President  
Braidwood Station

Enclosure:    LER Number 2002-002-01

cc:    Regional Administrator - Region III  
      NRC Braidwood Senior Resident Inspector

IE22

<b>NRC FORM 366</b> (7-2001)	<b>U.S. NUCLEAR REGULATORY COMMISSION</b>	<b>APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004</b> Estimated burden per response to comply with this information collection request 50 0 hrs Reported lessons learned are incorporated into the licensing process and fed back to industry Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U S Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to <a href="mailto:brs1@nrc.gov">brs1@nrc.gov</a> , and to the Desk Officer, Office of Information and Regulatory Affairs, NOEB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503 If a means used to impose 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>LICENSEE EVENT REPORT (LER)</b>		

<b>1. FACILITY NAME</b> Braidwood, Unit 1	<b>2. DOCKET NUMBER</b> STN 05000456	<b>3. PAGE</b> 1 of 4
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**4. TITLE**  
 Failure of Pressurizer PORV Instrument Air Accumulator Check Valves to Isolate Caused by Improper Maintenance Procedures

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEA	SEQUENTIAL NUMBER	REV NO	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	16	2002	2002-002-01			9	27	2002	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 §: (Check all that apply)</b>								
<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"/>	73.73(a)(2)(vii)(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"/>	73.73(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		
<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>					

12. LICENSEE CONTACT FOR THIS LER	
NAME Mike Smith, System Engineering Manager	TELEPHONE NUMBER (Include Area Code) (815) 417-2243

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT										
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO epix		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
D	AB	Valve	A415	Yes		N/A	N/A	N/A	N/A	N/A

14. SUPPLEMENTAL REPORT EXPECTED				15. EXPECTED SUBMISSION DATE			
Yes (if yes, complete EXPECTED SUBMISSION DATE).		X	NO		MONTH	DAY	YEAR

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

On April 16, 2002, Braidwood Station discovered that both trains of Unit 1 pressurizer power operated relief valves (PORV) instrument air accumulator check valves were likely incapable of isolating the instrument air (IA) accumulators from the IA supply header for operating cycle 9. The failure of the check valves to isolate IA would result in the PORVs being inoperable in the event of a loss of IA to the containment building.

The root cause of the check valve failures was an incorrect link bushing gap that resulted in valve disc o-ring interference with the valve seat. This interference resulted in o-ring displacement from the disc o-ring groove, preventing proper closure of the check valve. The incorrect bushing gap was caused by not using the correct maintenance procedures in the past. Corrective actions to prevent recurrence are to (1) revise the work orders for the pressurizer PORV IA accumulator check valves to ensure the correct maintenance procedure is used for all maintenance on the check valves, (2) ensure the correct post maintenance testing is performed following maintenance activities on the check valves, and (3) revise the PORV testing surveillance to ensure that testing is performed only after all maintenance activities are complete.

The simultaneous failure of both Unit 1 pressurizer PORVs caused by a loss of IA has been determined to be risk significant in accordance with the Significance Determination Process.

This event is being reported pursuant to 10CFR50.73(a)(2)(i)(B).

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A. Plant Operating Conditions Before The Event:

Unit: 1                      Event Date: 4/16/2002                      Event Time: 0900  
MODE: 1                      Reactor Power: 100 percent

Reactor Coolant System (RCS) [AB] Temperature: 580 degrees F, Pressure: 2235 psig

B. Description of Event:

There were no systems or components inoperable at the beginning of this event that contributed to the severity of the event.

During refueling outage A1R09 the Operations Department executed 1BwOSR 3.4.11.3, 'Pressurizer PORV Instrument Air Accumulator Check Valve Test'. This surveillance is required by Technical Specification Surveillance Requirement 3.4.11.3 which states: "Perform a complete cycle of each solenoid air control valve and check valve on the air accumulators in PORV control systems". This surveillance is required to be performed once per 18 months. In addition to this requirement, in order to demonstrate operability of the pressurizer PORV [AB] Instrument Air (IA) [LD] accumulators, procedure 1BwOSR 3.4.11.3 also performs an as-found and as-left seat leakage test of the accumulator isolation check valves. The procedure demonstrates valve seating prior to cycling the valve. The check valves are then leak tested after the cycling to demonstrate an acceptable as-left condition.

The Unit 1 check valves, 1RY085A and 1RY086A (isolation valves for the train A accumulator tank) and 1RY085B and 1RY086B (isolation valves for the train B accumulator tank), failed to meet the acceptance criteria during the as-found seat leakage test. The check valves would have been incapable of maintaining pressurizer PORV IA accumulator pressure during a loss of IA supply to the containment building [NH].

All four check valves were removed from the system and inspected and repaired. The inspection of the check valves found the disc seat o-ring partially dislocated from the o-ring groove. The partial dislocation of the o-ring was preventing the full closure of the check valve disc. The o-rings were replaced with new o-rings and the check valves were returned to service. Subsequent completion of 1BwOSR 3.4.11.3 verified proper operation of the check valves and as-left seat tightness.

This event, and the activities that took place during refueling outage A1R09 were documented in an Apparent Cause Evaluation (ACE). The ACE documented the cause of the surveillance failure as o-ring displacement. However, the ACE failed to determine the cause of the o-ring displacement. The ACE also reported a previous o-ring displacement that occurred in 1998. The o-ring displacement that occurred in 1998 was not documented in the Corrective Action Program at that time. A later review of this ACE determined that it needed to be re-opened for further investigation through the root cause process.

In an attempt to understand the cause of the failures, a spare check valve was inspected and tested. A physical examination of this check valve revealed that the o-ring had tendencies to impact the side, or drag across the edge, of the valve seat

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rather than dropping onto the valve seat. A more detailed inspection found the length of the link bushing created an excessive link bushing gap. The excessive gap resulted in a loose valve disc that dropped below the valve seat during the closure stroke. The excessive link bushing gap resulted in the o-ring impacting the side of the valve seat. It was apparent that this interference could result in displacement of the o-ring.

The spare check valve was setup in a test rig. The intent of the test was to evaluate the performance of the check valve under various airflow conditions to simulate accumulator refill that occurs after maintenance and testing activities. The existing link bushing gap on the spare valve matched the existing link bushing gap on the Unit 1 check valves so that the test results provided information directly applicable to the installed check valves. During the airflow tests, the spare check valve was observed to chatter at a high rate (approximately 240 opening/closing strokes per minute). After approximately seven minutes of chattering, the check valve became stuck in the open position. Inspection of the check valve revealed the disc o-ring partially displacement from the disc groove. The o-ring was re-installed and the disc was rotated to test a different section of the o-ring. The second test resulted in a similar outcome.

Based on the test results, it was clear that the excessive link bushing gap could cause problems for check valve operability. Maintenance instructions associated with the previous inspection and repair of the pressurizer PORV Instrument Air accumulator check valves did not make use of the guidance available with regard to proper link bushing gap.

C. Cause of Event

The root cause of the Unit 1 check valve failures was the incorrect link bushing gap that resulted in disc o-ring interference with the valve seat. This interference resulted in o-ring displacement from the disc o-ring groove. The o-ring displacement was caused by the combination of improper link bushing length and the large number of valve cycles that occurred during IA accumulator refill. O-ring displacement prevented proper closure of the check valve. The incorrect bushing gap was caused by past maintenance practices not using the correct maintenance procedure to verify an acceptable link bushing gap.

D. Safety Consequences:

The simultaneous failure of both Unit 1 pressurizer PORVs caused by a loss of IA has been evaluated. This failure degrades the ability to use the pressurizer PORVs for primary bleed and feed cooling following a dual unit loss of offsite power and failure of both Unit 1 Auxiliary Feedwater [BA] Pumps. Although IA can be restored to the pressurizer PORVs by loading a Station Air Compressor [LF] and Non-essential Service Water [KG] Pump onto an Emergency Diesel Generator [EK], this additional action considerably increases the probability of core damage for these scenarios. This failure also degrades the ability to depressurize the RCS following a Steam Generator Tube Rupture event as air must be restored to the containment building. For these reasons, the failure event is considered risk significant in accordance with the Significance Determination Process.

The failure of the pressurizer PORVs is considered a Safety System Functional Failure.

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**E. Corrective Actions:**

The corrective actions developed include:

- a. Performing the necessary repairs to the Unit 1 valves in refueling outage A1R10
- b. Revising 1BwOSR 3.4.11.3 to insure the as-left seat leakage test is performed after all maintenance is completed on the pressurizer PORV IA accumulators.
- c. Revising the Maintenance procedure to include the proper guidance with respect to link bushing gap dimensions.
- d. Replacing the check valve discs with an upgraded full-dovetail design to provide an additional barrier to o-ring displacement.

**F. Previous Occurrences:**

Dating back to refueling outage A1R03 in 1992, the pressurizer PORV IA accumulator check valves on Braidwood Unit 1 have been repaired in 5 of the last 7 refueling outages.

The following is a summary of the history of the Braidwood Unit 1 check valves.

Fall 1992/A1R03	All four check valves fail leakage surveillance
Spring 1994/A1R04	Two of the four valves fail leakage surveillance
Fall 1995/A1R05	All four check valves fail leakage surveillance
Spring 1997/A1R06	All four check valves pass leakage surveillance
Fall 1998/A1R07	All four check valves pass leakage surveillance
Spring 2000/A1R08	All four check valves pass leakage surveillance
Fall 2001/A1R09	All four check valves fail leakage surveillance

**G. Component Failure Data:**

<u>Manufacturer</u>	<u>Nomenclature</u>	<u>Model</u>	<u>Mfg. Part Number</u>
Anderson and Co., Greenwood	Check Valve (Pressurizer Power Operated Relief Valve Accumulator Isolation)	CV1B	N04-2480-520