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July 31, 1992
BW/92-400

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Dear Sir:

The enclosed Licensee Event Report from Braidwood Generating Station is being transmitted to you in accordance with the requirements of 10CFR50.73(a)(2)(v), which requires a 30-day written report.

This report is number 92-006-00, Docket No. 50-456.

K. L. Kofron
Station Manager
Braidwood Nuclear Station

KLK/AS/dla
601ZD85G

Enclosure: Licensee Event Report
No. 92-006-00

cc: NRC Region III Administrator
NRC Resident Inspector
INPO Record Center
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LICENSEE EVENT REPORT (LER) — Form Rev 2.0

Facility Name (1)	Docket Number (2)	Page (3)
Braidwood 1	0 5 0 0 0 4 5 6	1 of 0 6

Title (4)
Both Trains of Boron Dilution Prevention System Assumed to be Previously Inoperable as a Result of Analysis Deficiency

Event Date (5)			LER Number (6)			Report Date (7)			Other facilities Involved (8)	
Month	Day	Year	Year	Sequential Number	Revision Number	Month	Day	Year	Facility Names	Docket Number(s)
									Braidwood 2	0 5 0 0 0 4 5 7
0 7	0 1	9 2	9 2	0 0 6	0 0	0 7	2 3	9 2		0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)			
	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)	1	20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
0 9 9		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	Other (Specify in Abstract below and in Text)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

Name	TELEPHONE NUMBER
	AREA CODE
J. Sanchez, Technical Staff Engineer Ext. 2490	8 1 5 4 5 8 - 2 8 0 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		Expected Submission Date (15)	Month	Day	Year
X	Yes (If yes, complete EXPECTED SUBMISSION DATE)	NO	0 7	0 1	9 4

ABSTRACT (Limit to 1400 spaces, i.e, approximately fifteen single-space typewritten lines) (16)

At 1409 on July 1, 1992, Braidwood Station received an operability assessment, ENC-QE-40.1, regarding the Boron Dilution Protection System (BDPS) (NR) [IG]. The operability assessment was precipitated by the discovery of two non-conservative assumptions in the safety analysis for the system. On-Site Review 92-056 was immediately convened that concurred with the determination that BDPS is to be considered operable under a certain set of conditions. However, when the plant is outside of these conditions, the BDPS subsystem may not be capable of performing its intended safety function. Special Operating Order SO-ST-0053 was revised to implement the findings and recommendations of the operability assessment by detailing the conditions necessary for BDPS operability. This Special Operating Order will remain in effect until further safety analysis can be performed that will provide permanent resolution of this issue. There have been no previous reportable occurrences of an improper analysis of the BDPS system.

A. PLANT CONDITIONS PRIOR TO EVENT:

Event Date/Time 07/01/92 / 1409

Unit 1 MODE 1 - Operations Rx Power 099% RCS [AB] Temperature/Pressure NOT / NOP

Unit 2 MODE 1 - Operations Rx Power 099% RCS [AB] Temperature/Pressure NOT / NOP

B. DESCRIPTION OF EVENT:

At 1409 on July 1, 1992, Braidwood Station received an operability assessment, ENC-QE-40.1, regarding the Boron Dilution Protection System (BDPS) (NR) [IG]. The Boron Dilution Protection System installed at Braidwood Station was designed as an automatic system to prevent the reactor from going critical in Modes 3, 4, and 5 due to a boron dilution accident as described in the Updated Final Safety Analysis Report Chapter 15.4.6. An operability assessment, performed by the Commonwealth Edison Nuclear Fuel Services Department, based upon an engineering evaluation performed by Westinghouse Electric Corporation, has determined that the Boron Dilution Protection System is OPERABLE in Modes 3, 4, and 5 only under a certain set of conditions.

The operability assessment indicates that if all of these conditions are not satisfied while the reactor is in Modes 3, 4, or 5, then the Boron Dilution Protection System cannot be relied upon to prevent the reactor from going critical in the event of a boron dilution accident.

Onsite Review 92-056 concurred with the Operability Assessment determination.

A Special Operating Order SO-ST-0053 was revised stating that, if while in Modes 3, 4, or 5 all of these conditions are not satisfied, the Boron Dilution Protection System shall be declared INOPERABLE and all appropriate Technical Specification Action Requirements shall be implemented.

This issue is applicable to both units.

This Special Operating Order will remain in effect until further safety analysis can be performed that will provide permanent resolution of this issue.

On March 4, 1992, Westinghouse issued a Potential Issue (PI) on the operability of the Boron Dilution Protection System. This PI was issued because two potential non-conservatisms were identified in the original Safety Analysis for this system:

1. The assumed Inverse Countrate Ratio (ICRR) curve in the analysis was found to be non-conservative at another Westinghouse plant.

2. The setpoint for the flux doubling did not include an uncertainty analysis.

At the time the PI was received from Westinghouse, insufficient information was available to determine operability of the system. Pursuant to the PI issued by Westinghouse, Braidwood Station, in concert with Nuclear Fuel Services (NFS), Nuclear Licensing (NLA), and Byron Station agreed on the conservative compensatory actions included in Special Operating Order SO-ST-0053. These actions mitigated the probability and consequences of a dilution accident by maintaining a high shutdown margin and administratively controlling the valves capable of contributing to an inadvertent dilution. These actions were:

Whenever either unit was in Modes 3, 4, or 5:

1. The required shutdown margin was increased to a minimum of:

   Mode 4: 1.45%
   Mode 5: 1.84%

2. Manual valve _BR7004 to the primary water system was locked closed.

3. Administrative controls were implemented that required the possible dilution paths be isolated (valves CV8428, _CV8435, _CV8441, _CV8439 locked closed and verified closed and air or electrical power removed from CV111B) before draining the pressurizer level below the bottom of the indicated range while in Mode 5.

4. Administrative controls were implemented that required the Boron Thermal Regeneration System (BTRS) be isolated prior to draining the pressurizer level below the bottom of the indicated range while in Mode 5, and that the demineralizer water supply valve for the demineralizer flush be locked closed. Also that demineralizer flush operations performed while in Mode 5 should only be performed under strict administrative procedure. The procedure should consider that additional valves be closed and written verification & independent check be obtained that the valves to the primary water system or demineralized water supply were reshut and locked after flushing operations.

5. Flushing the emergency boration line with primary water should be strictly controlled and allowed only when the charging rate was monitored and controlled to less than 130 gpm.

6. The outlet valves from the Boric Acid Storage Tanks were verified open after any maintenance activities.

Since that time, Nuclear Fuel Services (NFS) and Engineering and Nuclear Construction (ENC) have pursued evaluating the operability of the system, and concluded that the generic concerns for the BDPS system are applicable to Braidwood and Byron:

1. The assumed ICRR curve does not bound the Byron and Braidwood sites. It was found that the curve from Braidwood Unit 1 Cycle 3 has been the most bounding thus far, and that it will likely remain bounding.

2. The corresponding setpoint methodology does not account for any uncertainties associated with the hardware, calibration procedures, instrument drift, or signal noise. Although it has not been possible to provide a quantitative uncertainty for the circuitry at this time, a best estimate of the uncertainty for the doubling setpoint is 30%, thus making the analysis setpoint 2.6.

Through the performance of specialized safety analysis cases, Nuclear Fuel Services (NFS) concluded that BDPS remains OPERABLE in certain conditions. However, the analysis failed to demonstrate operability for all conditions. If any of these conditions are not met, the system is to be considered INOPERABLE. The conditions are:

1. The Shutdown Margin must be at least 1300 pcm in Modes 3, 4, and 5.

2. All Loop Stop Isolation Valves must be open.

3. At least 1 Reactor Coolant Pump must be operating.

4. The Source Range Nuclear Instrumentation Count Rate must be at least 10 counts per second.

With any of the preceding conditions not being met, both trains of BDPS shall be declared inoperable and the appropriate Technical Specification actions taken.

This issue is reportable under Title 10, Code of Federal Regulations, Part 50, Section 73, (a)(2)(v), any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

C. CAUSE OF EVENT:

The cause for this event was inadequate safety analysis and subsequent review for the Boron Dilution Protection System.

At the time of the original analysis, Westinghouse used the most limiting ICRR available from the industry in the input assumptions to the postulated accidents. However, development of new low leakage loading patterns and neutron source positions have rendered that ICRR non-bounding.

It is not known exactly why an instrument uncertainty analysis was not included in the design of the BDPS setpoint. However, it is believed that the fact that BDPS was not a part of the original design of the plant and that BDPS does not have its own Limiting Condition for Operability in the Byron/Braidwood Technical Specifications contributed to this oversight.

D. SAFETY ANALYSIS:

It has been concluded that BDPS may be incapable of performing its intended safety function in the event of a boron dilution accident under certain plant conditions. However, the safety analysis performed merely failed to demonstrate acceptable performance for all conditions using the present analysis method. After implementing possible improvements to the method of analysis, a wider spectrum of conditions may be acceptable for BDPS operability.

There were no previous administrative controls, policies, procedures, or operating practices in place to prevent either unit from operating in what has now been determined to be an unanalyzed condition.

Had certain plant conditions existed where the BDPS system was inoperable and a dilution accident was initiated, two other sources for indication of the decrease in shutdown margin were available to alert the operator. During shutdown conditions, the Source Range indication is broadcast audibly in the control room and containment. Also, the High Flux at shutoown annunciator, which is intended to notify personnel of an inadvertent criticality during fuel load and is set to actuate at an instantaneous indication of 5 times the background countrate, is available in Modes 3 through 6.

Furthermore, the consequences of an unmitigated dilution accident do not pose a substantial safety hazard. Analysis performed by Los Alamos National Laboratory (LANL) for the NRC has concluded that an unmitigated dilution of a PWR in a shutdown Mode would result in a return to power and may result in an increase in reactor coolant system pressure and some fuel damage. LANL further concluded that the return to power transient would be self limiting by virtue of the inherent negative feedback of the reactor. The self limiting return to power would also limit fuel damage and repressurization.

E. CORRECTIVE ACTIONS:

Upon the notification of this concern to Braidwood, the compensatory actions documented under OSR 92-056 were promptly implemented.

Upon the receipt of the Operability Assessment from NFS specifying the conditions necessary for BDPS operability, Braidwood Station immediately implemented the following actions:

1. The Special Operating Order (SO-ST-0053) was revised to implement the four conditions for operability.

2. The station's Nuclear Regulatory Commission Resident Inspector was notified of this condition.

3. The station made the required Emergency Notification System phone call within the required 4 hours.

Future actions will be necessary to resolve this issue for the long-term. A LER supplement will be issued when the long-term resolution is completed. A synopsis of the necessary actions may include the following:

1. ENC will quantify the uncertainty of the doubling setpoint that will be used in future analysis. This will be tracked to completion by action item 456-180-92-00601.

2. Braidwood Station will determine the maximum primary flow rate through flow orifice 1CV17M. The analysis may benefit from a lower flow rate. This will be tracked to completion by action item 456-180-92-00602.

3. NFS will continue the investigation to attempt to demonstrate a wider array of operable conditions. This will be tracked to completion by action item 456-180-92-00603.

4. Consideration will be given to initiating a Technical Specification change that will break BDPS out into its own LCO. This LCO will establish the conditions for operability with the appropriate action statement. This will be tracked to completion by action item 456-180-92-00604.

F. PREVIOUS OCCURRENCES:

There have been no previous reportable occurrences of an improper analysis of the BDPS system, although non-conservatisms in the analysis of this system have occurred in the past. This event was initiated by a discovery at Comanche Peak.

G. COMPONENT FAILURE DATA:

This event was not the result of component failure, nor did any components fail as a result of this event.