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Braidwood Generating Station
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Tel 815-458-2801



November 22, 1995
BW/95-0114

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

Gentlemen:

The enclosed Licensee Event Report from Braidwood Generating Station is being transmitted in accordance with the requirement of 10 CFR 50.73(a)(2)(ii), which requires a 30-day written report.

This report is number 95-015-00, Docket No. 50-456.

Yours truly,

J. Tulon
Station Manager
Braidwood Nuclear Station

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Enc: Licensee Event Report
No. 456-95-015-00

cc: NRC Region III Administrator
NRC Resident Inspector
INPO Record Center
ComEd Distribution Center
I.D.N.S.
I.D.N.S. Resident Inspector

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LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

FACILITY NAME (1) Braidwood Station Unit 1	DOCKET NUMBER (2) 05000456	PAGE (3) 1 OF 5
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TITLE (4)
Degradation of Steam Generator Tubes Exceeds Technical Specification Limit

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 NAME	DOCKET NUMBER
10	24	95	95	-- 015	-- 00	11	22	95	None	05000
									FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9) 6	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)										
POWER LEVEL (10) 0	20.2201(b)			20.2203(a)(2)(v)			50.73(a)(2)(i)			50.73(a)(2)(viii)	
	20.2203(a)(1)			20.2203(a)(3)(i)			X 50.73(a)(2)(ii)			50.73(a)(2)(x)	
	20.2203(a)(2)(i)			20.2203(a)(3)(ii)			50.73(a)(2)(iii)			73.71	
	20.2203(a)(2)(ii)			20.2203(a)(4)			50.73(a)(2)(iv)			OTHER	
	20.2203(a)(2)(iii)			50.36(c)(1)			50.73(a)(2)(v)			Specify in Abstract below or in NRC Form 366A	
20.2203(a)(2)(iv)			50.36(c)(2)			50.73(a)(2)(vii)					

LICENSEE CONTACT FOR THIS LER (12)	
NAME Larry Alexander, Site Engineering	TELEPHONE NUMBER (Include Area Code) (815) 458-2801 x2251

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)									
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
				N					

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

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

A Steam Generator (SG) Tube Inservice Inspection initiated on Braidwood Unit 1 (Westinghouse Model D-4 Steam Generators) revealed SGs 1A, 1B, 1C, and 1D as Category C-3. Per Specification 4.4.5.2.e, a SG will be classified in Category C-3 if more than 10% of the total tubes inspected are degraded or more than 1% of the total tubes inspected are defective. A SG tube is considered degraded if it has an imperfection of greater than or equal to 20% nominal tube wall thickness. A SG tube is considered defective if it has an imperfection of greater than or equal to 40% nominal tube wall thickness. The primary cause of this event is Axial Outside Diameter Stress Corrosion Cracking (ODSCC). Corrective actions include the continuation of ethanolamine injection with review of other alternate amines, continuation of the molar ratio program which began in Cycle 4, and the continuation of the elevated hydrazine program.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

A: PLANT CONDITIONS PRIOR TO EVENT:

UNIT: Braidwood 1
 EVENT DATE/TIME: October 24, 1995 / 16:55 CDST
 MODE: 6 - REFUEL
 REACTOR POWER: 0%
 RCS [AB] TEMPERATURE/PRESSURE: 80F / 0 PSIG

B. DESCRIPTION OF EVENT:

On October 7, 1995, a Steam Generator (SG) Tube Inservice Inspection was initiated on Braidwood Unit 1 in accordance with Technical Specification Surveillance requirement (TSSR) 4.4.5.0. TSSR 4.4.5.2.c requires that the results of each sample inspection be classified into one of three categories. A SG will be classified in Category C-3 if more than 10% of the total tubes inspected are degraded or more than 1% of the inspected tubes are defective. A SG tube is considered degraded if it has an imperfection of greater than or equal to 20% nominal tube wall thickness. A SG tube is considered defective if it has an imperfection of greater than or equal to 40% nominal tube wall thickness.

The initial sample size of 100% of all inservice SG tubes was selected for the inspection. The initial sample inspection resulted in the following SGs being classified into Category C-3 based on the following reasons:

- 1A On October 27, 1995 at 22:00 hours, greater than 1% of the 4073 inservice tubes being defective.
- 1B On October 24, 1995 at 16:55 hours, greater than 1% of the 4476 inservice tubes being defective.
- 1C On October 23, 1995 at 21:00 hours, greater than 1% of the 3872 inservice tubes being defective.
- 1D On October 29, 1995 at 21:45 hours, greater than 1% of the 4213 inservice tubes being defective.

The exact number of tubes exceeding the 40% through wall limit is not known since the eddy current examination was performed assuming approval of a 3.0 Volt Interim Plugging Criteria (IPC) Technical Specification amendment. Enough eddy current examinations were performed to verify the results met Category C-3. At the time of the examination, the only approved Technical Specification SG tube plugging limit was the 40% through wall limit. The 1.0 Volt IPC that was in effect for Braidwood Unit 1 Cycle 5 had expired. At the time of the SG eddy current examination, the 3.0 Volt IPC had not been approved by the NRC. The 3.0 Volt IPC was approved by the NRC on November 9, 1995 in a letter from M. D. Lynch to D. L. Farrar, ISSUANCE OF AMENDMENTS (TAC NOS. M91671, M91672, M91673 AND M91674). None of the SGs meet the criteria for Category C-3 based on the 3.0 Volt IPC. Most of the defective tubes based on the 40% through wall criteria are due to indications at the hot leg tube support plate regions.

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Notification per Technical Specification Table 4.4-2 pursuant to 10 CFR 50.72 (b) (2) (i) for steam generators being classified in Category C-3 was initiated within four hours of the times listed above.

This event is being reported pursuant to 10CFR50.73 (a) (2) (ii), which requires a 30-day written report.

C. CAUSE OF EVENT:

The SG tube eddy current inspection performed during the Unit 1 fifth refuel outage met the requirements for the implementation of the 3.0 Volt IPC. The requirements for the 3.0 Volt IPC calls for 100% bobbin coil probe examination of all hot leg tubes down to the lowest cold leg indication. The lowest cold leg indication is determined by a minimum examination of 20% of the SG tubes full length. Rotating Pancake Coil (RPC) inspections were performed on all hot leg support plate indications greater than 3.0 volts and all cold leg support plate indications greater than 1.0 volt. In addition, a minimum of 20% of the hot leg indications between 1.0 and 3.0 volts were inspected by RPC. The bobbin coil inspection resulted in 4136 indications being identified at the support plate regions. The RPC inspection verified that the support plate indications are predominately axially oriented outside diameter stress corrosion cracking (ODSCC) and that the indications are confined within the thickness of the SG tube support plates. In addition to the ODSCC at the support plate regions, axial and circumferential cracks were identified at the top-of-tubesheet roll transition region. These top-of-tubesheet indications resulted in 30 tubes being removed from service. The top-of-tubesheet indications are also a result of ODSCC. Two tubes were removed from service due to wear greater than 40% through wall at the Anti-Vibration Bars.

D. SAFETY ANALYSIS:

Since the 3.0 Volt IPC amendment had not been approved at the time of determining which category applies to each SG, the only approved plugging/repair limit was 40% through wall. This resulted in the four SGs being classified as Category C-3. Since this time, the 3.0 Volt IPC amendment has been approved (prior to entering Mode 4). The decision to plug tubes was based on the approved 3.0 Volt IPC. With the 3.0 Volt IPC approved, none of the SGs meet the criteria of Category C-3. With the 3.0 Volt IPC approved, SGs 1A, 1B, 1C, and 1D meet Category C-2. There are no reporting requirements for Category C-2. By applying the 3.0 Volt IPC criteria, fewer tubes were required to be plugged. With the additional 139 tubes plugged during this inspection, Braidwood Unit 1 has 9.9% of the total SG tubes plugged with a single loop maximum of

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16.2% plugged in the 1C SG loop. A recent amendment to Technical Specification 3.2.3 reduced the required RCS total flowrate to greater than or equal to 371,400 gpm. The new RCS flowrate value is based on 24% of the total SG tubes being plugged with a maximum of 30% of the SG tubes in a single loop being plugged. With the use of the 3.0 Volt IPC, Braidwood Unit 1 should meet the RCS flow requirements.

Based on the extensive work completed by ComEd and its contractors, it is concluded that Braidwood Unit 1 can operate safely with the use of IPC. The application of a 1.0 Volt IPC during Cycle 5 caused no significant negative impact on any system, equipment, or operating mode. The evaluation of the 3.0 Volt IPC identified no significant hazards. ComEd will continue its efforts with the industry to understand the root cause of the tube degradation and take appropriate effective correct actions to mitigate future degradation.

E. CORRECTIVE ACTIONS:

The dominate form of corrosion in the Braidwood Unit 1 SGs is ODSCC at the support plate regions. Braidwood Station implemented the following programs to mitigate the corrosive environment in the tube support plate region which leads to ODSCC:

Industry Guidelines

Compliance with the EPRI Secondary Chemistry Guidelines, Revision 3.

SG Tube Crevice Fouling

Maintain hotwell dissolved oxygen concentrations < 3 ppb

Use of advanced amines, such as ethanolamine (ETA), for secondary pH control

SG Crevice pH

Braidwood implemented the secondary SG Boric Acid program at the start of Cycle 5 for mitigation of SG Tube Support Plate ODSCC per EPRI Boric Acid Application Guidelines. Both low power boric acid soaks during startup and full power operation on boric acid chemistry was implemented. This program will be continued for at least the startup from the Unit 1 fifth refuel outage (A1R05).

Evaluation of SG hideout return data during shutdown to assess the impact of operating chemistry on SG crevice chemistry, and potential formation of caustic crevices which can cause Tube Support Plate ODSCC.

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The molar ratio control program begun at the start of Cycle 4 will be maintained. This program adjusts the sodium to chloride ratio in the SG by adding ammonium chloride to the condensate system.

SG Sodium Reduction

Installed a reverse osmosis unit in the makeup water system to reduce sodium input to the secondary side.

Performed 100% eddy current inspection on the four condenser water boxes over the last three refuel outages.

SG Electrochemical Potential (ECP) Reduction

Continue the use of high hydrazine concentrations for maintaining reducing conditions in the SGs and passivation of piping systems and components.

Braidwood does not have any copper components in its feedwater or condensate systems.

Currently, Braidwood Station, in conjunction with our Corporate Chemistry Support Organization, is pursuing additional methods to further enhance our SG corrosion control program. They are as follows:

The addition of other amines either with ETA or in place of ETA will be evaluated to optimize the pH control and minimize iron transport. This is being tracked to completion by NTS# 456-180-94-00702.

Chemistries are being evaluated to improve iron transport out of the SG. The goal is to increase the efficiency of iron removal via the SG blowdown system. This is being tracked to completion by NTS# 456-180-94-00703.

F. PREVIOUS OCCURRENCES:

Occurrences of ODSCC indications at tube support plate intersections has been seen at Braidwood Unit 1 in previous outages, as documented by LER 94-007-00 and LER 95-003. The number of tubes showing indication of ODSCC has been increasing each outage. This is the third inspection on Braidwood Unit 1 that resulted in being classified into Category C-3. A search of previous LERs identified only the previous Unit 1 outages (A1R04 and A1M05) as previous occurrences of SG tube degradation.

G. COMPONENT FAILURE DATA:

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