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U. S. Nuclear Regulatory Commission
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Subject: Braidwood Station Unit 1
Cycle 5 Mid-Cycle Outage
Steam Generator Inservice Inspection Report
Docket No. STN 50-456

References: (1) NUREG-1276, Technical Specifications,
Braidwood Station, Unit Nos. 1 and 2

Specification 4.4.5.5.c of Reference (1) requires that results of steam generator (SG) tube inspections which fall into Category C-3 shall be reported in a Special Report to the Commission pursuant to Specification 6.9.2 within thirty days and prior to resumption of plant operation. This report shall provide a description of investigations conducted to determine the cause of tube degradation and corrective measures taken to prevent recurrence.

The results of the initial sample inspection resulted in the following SGs being classified into Category C-3 based on the number of defective tubes found this outage:

- 1A on March 3, 1995 at 09:15 hours
- 1C on March 2, 1995 at 12:30 hours
- 1D on March 3, 1995 at 19:45 hours

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.

The enclosure summarizes the inspection results. Included are the C-3 Classification totals for each SG with the current Interim Plugging Criteria (IPC) applied. Also included is a description of the investigations being performed to determine the cause of degradation and corrective actions to prevent recurrence.

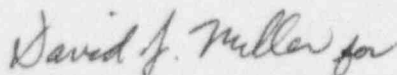
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Please direct any questions regarding this submittal to Doug Huston, Braidwood Licensing Supervisor, (815) 458-2801, extension 2511.

Yours truly,



K. L. Kofron
Station Manager
Braidwood Nuclear Station

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Enclosures

Attachments

cc: S. G. DuPont, Senior Resident Inspector, Braidwood
R. R. Assa, Braidwood Project Manager, NRR
J. B. Martin, Regional Administrator, Region III

**Braidwood Station Unit 1
Cycle 5 Mid-Cycle Outage
Steam Generator C-3 Report**

On February 23, 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.

An initial sample size of 100% of all available tubes was selected.

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 in non-Tube Support Plate regions. In the tube support plate regions, a tube is considered to be defective if it contains an indication greater than 2.7 volts or if it contains an indication greater than 1 volt but less than or equal to 2.7 volts and it is confirmed by rotating pancake coil (RPC) inspection.

The results of the initial sample inspection resulted in the following SGs being classified into Category C-3 based on the following number of defective tubes found this outage:

- 1A On March 3, 1995 at 09:15 hours, 256 tubes out of 4335 (5.9%)
- 1C On March 2, 1995 at 12:30 hours, 319 tubes out of 4212 (7.6%)
- 1D On March 3, 1995 at 19:45 hours, 190 tubes out of 4407 (4.3%)

All support plate indications greater than 1.0 volt were examined using 3-coil RPC probes. Of these indications, 834 were confirmed by use of RPC. Since some tubes had indications at multiple hot leg support plates, the total number of tubes effected was 815.

Attachment A provides, by SG, the number of tubes plugged this outage as well as those plugged in previous outages. This attachment also includes the reason why each tube was plugged during this outage.

Technical Specification 4.4.5.5.c requires results of SG tube inspections which fall into Category C-3 to be reported in a Special Report to the Commission pursuant to Specification 6.9.2 within 30 days and prior to resumption of plant operation. This report shall provide a description of investigations conducted to determine the cause of the tube degradation and corrective measures to prevent recurrence.

INVESTIGATION OF DEGRADATION ROOT CAUSE

The Interim Plugging Criteria (IPC) calls for RPC inspection of all support plate indications greater than 1 volt and less than or equal to 2.7 volts. In addition, all indications greater than 2.7 volts were inspected by RPC. Inspection results were typical of other plants having axially oriented cracks due to Outer Diameter Stress Corrosion Cracking (ODSCC) confined within the tube support plate intersections.

CORRECTIVE MEASURES TO REDUCE DEGRADATION

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 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.
- Evaluation of SG hideout return 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.
- 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 3 out of the 4 condenser water boxes over the last two refuel outages. The fourth condenser water box is scheduled for the refuel outage in the Fall of 1995.

SG Electrochemical Potential (ECP) Reduction

- Continue 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.
- 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.

Attachment A

A1M05 Plugging Results

	SG 1A	SG 1B	SG 1C	SG 1D	TOTALS
Total Tubes	4578	4578	4578	4578	18312
Previously Plugged Tubes	243	58	366	171	838
Total Tubes Inspected This Outage	4335	4520	4212	4407	17474
A1M05 Tube Support Plate Pluggable	235	41	315	180	771
Anti Vibration Bar Wear	2	0	1	0	3
Confirmed Wedge Location Indication	17	2	12	13	44
Top of Tubesheet Circumferential Cracks	4	0	11	0	15
Misc. Top of Tubesheet Indications	4	1	1	1	7
A1M05 Total Tubes Plugged	262	44	340	194	840
Restart Total Tubes Available	4073	4476	3872	4213	16634
Total Tubes Plugged (%)	11.0	2.2	15.4	8.0	9.2