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U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001**Subject: Beaver Valley Power Station, Unit No. 1**  
**Docket No. 50-334, License No. DPR-66**  
**1R14 Steam Generator Tube Plug Special Report**

In accordance with Beaver Valley Power Station (BVPS) Unit No. 1 Technical Specification 4.4.5.5.a which requires that a Steam Generator Special Report be submitted within 15 days of completion of steam generator inspections, the following is submitted for the examinations performed during the 1R14 refueling outage:

#### Eddy Current Examination

One hundred percent of the in-service tubes in Rows 3 through 46 from Steam Generators RC-E-1A, RC-E-1B and RC-E-1C were examined full length with bobbin coil probes. In-service tubes in Rows 1 and 2 were examined with bobbin coil probes to the uppermost tube support plate in each leg. The U-bend regions of the tubes in Rows 1 and 2 were examined with single coil (mid range & high frequency) Plus Point probes. A twenty percent random sample of the Row 3 U-bend region was also examined with single coil (mid range & high frequency) Plus Point probes.

Per the Technical Specification requirements for Alternate Repair Criteria (Generic Letter 95-05), all distorted tube support plate signals with bobbin coil voltages > 2.00 volts were further evaluated with 3-coil Plus Point probes. Those signals > 2.00 volts, that were confirmed (detected) with the Plus Point probes, were repaired by tube plugging. Distorted support plate signals  $\leq 2.00$  volts were randomly sampled with Plus Point probes to confirm the morphology being observed remained Outside Diameter Stress Corrosion Cracking (ODSCC).

The following additional examinations were also performed:

All dents with bobbin coil voltages  $\geq 5.00$  volts located at tube support plates were re-examined with 3-coil Plus Point probes. No indications were observed.

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100 hot leg tube support plate residual signals with amplitudes large enough to mask a 1.00 volt indication were re-examined with Plus Point probes in each steam generator. For cases where the Plus Point probes identified a flaw, the 200 kHz bobbin was used to establish a DSI amplitude in the Mix channel.

One hundred percent of the hot leg top-of-tubesheet region was examined in each steam generator with 3-coil Plus Point probes. In addition, a twenty percent random sample of the cold leg top-of-tubesheet region was examined in each steam generator. Indications observed during this examination were repaired by tube plugging.

#### Tube Plug Removal

The remaining Framatome Inconel 600 rolled plugs (236 total) were removed from RC-E-1A and RC-E-1B. These locations were subsequently re-plugged with Westinghouse mechanical plugs manufactured from Inconel 690 material.

#### Bulged Tubesheet Sleeves

The steam generator examination conducted at 1R14 revealed the following condition which is considered a "new" degradation mechanism for BVPS.

Four tubes in RC-E-1B that were sleeved at 1R13 with full length tubesheet sleeves would not permit the passage of an eddy current probe during the 1R14 steam generator examination. Subsequent remote visual examination revealed that these sleeves had collapsed. These tubes were removed from service by plugging. All other sleeved tubes permitted passage of the appropriate eddy current probe and were successfully inspected by eddy current testing.

The cause for the collapsed sleeves is understood. This degradation mechanism is known as the "flow diode" or the "Obrigheim" effect and has occurred in sleeved joints at several other sites. Through wall degradation of the parent tube or the parent tube/sleeve interface at the mechanical roll can permit water to enter the crevice created between the parent tube and the sleeve. The water which enters the crevice while the plant is in a cold condition can become trapped when the plant heats up since the flow path created by the through wall degradation can close during hot conditions. The pressure created by the trapped water at hot conditions is sufficient to collapse the sleeve.

This condition has been evaluated for BVPS Unit 1. The evaluation has recognized the potential for additional sleeves to collapse due to the flow diode effect and has concluded that the structural integrity of the sleeve weld and mechanical roll will not be jeopardized.


Summary of Tubes Removed

Attachment 1 lists the number of tubes removed from service from each steam generator during 1R14. The number of tubes removed from service as listed in Table 1 of this letter differs from the number of defective tubes stated in FENOC Letter L-01-129 dated October 4, 2001, which provided the Category C-3 report. The information compiled for the Category C-3 report was assembled prior to the completion of the 1R14 eddy current examinations.

The complete and detailed results of the steam generator tube inspection will be submitted within the next 12 months in accordance with BVPS No. 1 Technical Specification 4.4.5.5.b.

If there are any questions concerning this matter, please contact Mr. Thomas S. Cosgrove, Manager, Regulatory Affairs at 724-682-5203.

Sincerely,

  
Lew W. Myers

Attachment

- c: Mr. L. J. Burkhart, Project Manager  
Mr. D. M. Kern, Sr. Resident Inspector  
Mr. H. J. Miller, NRC Region I Administrator

## Attachment 1

Listed below is a summary of tubes removed from service in each steam generator:

**Table 1**

	RC-E-1A	RC-E-1B	RC-E-1C
<b>Number of tubes previously removed from service</b>	<b>592</b>	<b>408</b>	<b>368</b>
<b>Number of tubes removed from service during 1R14:</b>	<b>70</b>	<b>40</b>	<b>60</b>
Breakdown of tubes removed from service 1R14:			
> 2.00 Volts (Tech. Spec. Limit for Alternate Repair Criteria)	6	4	6
Volumetric Indications at Tube Support Plates	3	0	5
Hot Leg Indications Above Top-of-Tube Sheet	32	19	23
Hot Leg Indications Within Tube Sheet	8	3	5
Volumetric Indications Above Top-of-Tube Sheet	6	1	0
Non Quantifiable Indications Above Top-of-Tube Sheet	2	0	5
Row 1 U-Bend Indications	1	1	1
Cold Leg Thinning	5	1	0
Restricted Hot Leg Tube Sheet Sleeves	0	4	N/A
Support Plate Indications Above Installed Sleeves (See Note 1)	6	1	N/A
Wear Indications Due to Interaction with Sludge Lance Rail (See Note 2)	1	3	4
Tube Administratively Plugged (See Note 3)	0	3	11
<b>Number of tubes removed from service after 1R14</b>	<b>662</b>	<b>448</b>	<b>428</b>
<b>Number of Framatome Inconel 600 plugs replaced (Hot Leg)</b>	<b>73</b>	<b>47</b>	<b>N/A</b>
<b>Number of Framatome Inconel 600 plugs replaced (Cold Leg)</b>	<b>73</b>	<b>43</b>	<b>N/A</b>

**Note 1:** Several low row tubes had support plate indications that could not be examined with a 0.720" diameter bobbin probe due to sleeves being installed in the hot leg tubesheet. Access from the opposite leg could not be accomplished with a 0.720" probe.

**Note 2:** Scratches were observed visually from the secondary side of the generator on several Row 1 tubes. Further investigation revealed small volumetric type wear indications (< 5% TW) approximately 22.0" above the tubesheet. These wear locations coincide with the location of the support feet for the sludge lancing rail.

**Note 3:** In 1983, tubes in several locations were cut out to retrieve loose parts. These tubes were cut at the top of the tubesheet and again at 10.0" above the tubesheet. This left a tube remnant approximately 40.0" long extending down from the first tube support plate. In preparation for the power uprates for Unit 1, tubes around these locations were conservatively stabilized and plugged. This conservative measure provides added protection should these remnants rub against adjacent tubes due to increased cross flow velocities in the uprated conditions. Also, one tube in RC-E-1C was plugged with a sentinel plug due to concerns with anti-vibration bar flow induced vibration in the uprated condition.