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SUBJECT: S/G EDDY CURRENT - IP2

Based on May 27-30, 1997 Information collected and assessed during Inspection 97-07

Background

IP2 has four Westinghouse Model 44 steam generators. High temperature mill annealed Alloy 600 tubing. 5.8% of the 13040 tubes have been plugged during the 23 years of service. An additional 2.9% have been plugged prior to service. Current analysis permits plugging 25% of the tubes. The unit has had four forced outages caused by tube leaks. The last inservice event occurred in 1988 as a result of a leaking plug.

S/G Eddy Current

The tube examination program was prepared in accordance with the EPRI steam generator tube inspection guidelines. As a result of early eddy current inspection findings an expansion was made to inspect all support plate intersections with the Cecco-5 probe and all full lengths with the bobbin coil probe.

In terms of the probes being used in this eddy current examination, the inspector noted that the **Cecco-5 transmit-receive eddy current probe** is being used as the primary inspection probe. **Rotating coil probes, primarily Plus Point probes**, are being used to characterize the indications identified by the Cecco-5 probe. **The bobbin coil portion of the Cecco-5 probe** is being used to examine the straight portions of the tube at elevations higher than 20 inches above the tube sheet. The tube sheet area and the lower 20 inches are being examined with the Cecco probe.

Explanation on the Probes

Good for Detection - Cecco 5 probe operate differently from rotating probes. For example, a Cecco 5 probe (Fig. 1) contains multiple transmit and receive coils (rather than just a combined coil) and the Cecco probe is not rotated as it is pulled through the tube. Like the rotating probes, the Cecco probes are sensitive to circumferentially orientated degradation; however, characterization of the degradation is currently limited. A major advantage of the Cecco probes is that they are capable of a much higher inspection speed (i.g., 12 to 15 inches per second) than the rotating probes.

Good for Characterization - The Plus Point Probe is sensitive to both axial and circumferentially orientated degradation. It was originally developed for surface examination for reactor vessel welds and was designed to reduce geometry and permeability effects (Fig. 2).

W/D

Subsequent Communications Between The Region and NRR (June 27, 1997)

We participated in a conference call between NRR and the licensee to discuss the SGs eddy current activities at IP2. We captured the following highlights: the eddy current testing has identified a new degradation mechanism operational in the steam generator tubes outside diameter stress corrosion cracking. Using Cecco-5 eddy current probes, indications were seen in the support plate crevices, in the sludge pile area above the tube sheet, and the crevice between the tube sheet and the tubes. At least one indication in each of these areas has been characterized by the rotating Plus Point probe. A ten inch long axial indication within the tube sheet crevice is a prime candidate for in-situ pressure testing of the tube.

In the primary side of the SGs to date (June 27 '97) 98 defective tubes have been identified for plugging. Steam Generator will have more than 1% of the inspected tubes plugged. 308 new distorted roll indications (DRIs) have been noted. These indications will be characterized and rerolled. Seven steam generator plugs plug-in-plug (PIPs) and plug-at-plug (PAPs) were surrounded by boron rings. These plugs will be drilled out and replaced with Westinghouse Alloy 690 mechanical plugs. The end of one Westinghouse explosive appears to have broken off. This is a portion that extended past the tube end and is not in the seal area. No boron crystals were present around this plug.

In the secondary side flow slot examination of Steam Generator 22 and 23 showed closure of one flow slot in Steam Generator 23. The flow slots of the other two steam generators will be examined. The Hillside port examined in Steam Generators 22 and 23-flow holes were open, and a small amount of corrosion deposit surrounded about a 1/2 inch of the tube above the support plate.

The licensee has performed a comparison of probes Cecco-5 to Plus Point by examining 124 intersections. Cecco reported 1 tube support plate indication and 5 sludge pile indications Plus Point did not report any indications.