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SUBJECT: Part 21 rept re failure of charging SI pump miniflow check valves.

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CP&L

Carolina Power & Light Company
PO Box 165
New Hill NC 27562

William R. Robinson
Vice President
Harris Nuclear Plant

SEP 2 9 1995

SERIAL: HNP-95-087

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
10 CFR 21 REPORT - CHARGING SAFETY INJECTION PUMP MINIFLOW CHECK VALVE DEFICIENCY

Gentlemen:

On September 27, 1995, Carolina Power & Light Company (CP&L) determined that deficiencies associated with Charging Safety Injection Pump (CSIP) Miniflow Check Valves at the Harris Nuclear Plant were reportable under 10 CFR 21. CP&L hereby submits the enclosed report describing a deficiency in Anchor Darling supplied 2" check globe valves which resulted in not meeting forward flow requirements through the CSIP miniflow lines and also resulted in excessive valve backseat leakage. Harris Nuclear Plant LER 95-008 dated September 28, 1995, describes an event where the "B" CSIP was placed in service when it was inoperable because of the inability of it's miniflow check valve to meet forward flow testing requirements. Due to plant conditions at the time (Mode 4) this failure of the check valve did not create a substantial safety hazard. However, the forward flow deficiency could have created a substantial safety hazard under different plant conditions and may also be applicable to other nuclear plants.

Questions regarding this submittal may be referred to Mr. T. D. Walt at (919) 362-2711.

Sincerely,

W R Robinson

MGW

Enclosure

c: Mr. S. D. Ebneter
Mr. S. A. Elrod
Mr. N. B. Le
Mr. F. Bensinger (Anchor Darling Valve)

060025

JE19

ENCLOSURE TO HNP-95-087

CAROLINA POWER & LIGHT COMPANY
HARRIS NUCLEAR PLANT

FAILURE OF CHARGING SAFETY INJECTION PUMP MINIFLOW CHECK VALVES

SEPTEMBER 29, 1995

REPORTABLE UNDER 10 CFR 21

SUBJECT:

Harris Nuclear Plant, 10 CFR 21 reportable deficiency. Failure of Charging Safety Injection Pump (CSIP) Miniflow Check Valves.

ITEM WHICH FAILS TO COMPLY:

2" - 1878 Socket Ends Stainless Steel Piston Check Globe Valve
(HNP Valve Nos. 1CS-179 & 1CS-193)

SUPPLIED BY:

Anchor Darling Valve Company, Williamsport, Pa. 17701.

NATURE OF DEFICIENCY:

Check valves 1CS-179 and 1CS-193 are in the miniflow lines for the CSIPs Trains A & B respectively. The original valves installed utilized a bonnet-to-body seal weld. During Refueling Outage No. 5 (May 1994) a design change was implemented to replace the original valves with the subject valves which utilize a pressure seal bonnet closure design. This modification was completed to improve accessibility to the valve's internals for ASME Section XI inspection purposes. There were no recorded occurrences of forward flow or backseat failures with the original valves.

The design function of these check valves is twofold. First, the valve is designed to provide forward flow through the miniflow line during normal and accident conditions. Miniflow ensures that there is at least 60 GPM through a CSIP even if the pump becomes dead-headed due to high Reactor Coolant System (RCS) pressure conditions. Therefore, these check valves must be capable of passing adequate forward flow to allow the miniflow line to accomplish its safety function.

Second, the valve is designed to prevent backflow through the miniflow line to prevent flow diversion from an operating CSIP in the event one of the other CSIPs failed or was not in service. Flow diversion might prevent sufficient flow to the RCS and thereby prevent the CSIP from meeting its safety function. Thus, these check valves must be capable of preventing backflow to accomplish their safety function.

These valves have exhibited deficiencies since October 7, 1994. The following is a short description of these deficiencies:

> On October 7, 1994, Valve 1CS-179 exhibited back leakage (value not recorded) and the valve piston was replaced.

NATURE OF
DEFICIENCY: (continued)

On January 13, 1995, Valve 1CS-179 was tested and exhibited 6 GPM back leakage.

On January 13, 1995, Valve 1CS-193 was tested and exhibited 3 GPM back leakage. Corrective maintenance found the resilient seat only two thirds the way around the disc.

On July 8, 1995, 1CS-193 failed a backseat test due to the valve being stuck open. The disc assembly which consisted of a disc, disc skirt, retaining ring, and resilient (soft) seat was replaced with a single piece disc assembly (without a soft seat) supplied by Anchor Darling.

On August 4, 1995, 1CS-193 failed a forward flow test.

The cause of these failures appear to be the cocking of the piston towards the valve outlet port. The cocking was apparently caused by the relatively large hydraulic surge which occurs when the CSIP is started.

These valves were installed in May 1994. They were ordered using a specification which included the following technical requirements:

4.1.3 "All materials except packing,..., shall be suitable for a minimum of 40 years service."

4.3.2 "The valve design shall be based on the following pressure and temperature. The valve must maintain pressure integrity and operability at these conditions. The valves shall also be capable of operation with the specified differential pressure across the valve disc.

Design Pressure:	2735 psig for stainless valves.
Design Temperature:	650°F metal-to-metal seat design on piston check.
Differential Pressure:	2735 psig for stainless steel valves."

5.8 "The valve parts shall be compatible with the specified environment and shall be of suitable material to withstand the operating conditions specified herein."

7.4.2 "Following the shell hydrostatic test, seat leakage testing shall be performed in accordance with MSS-SP-61, except the hold time shall be 5 minutes minimum. Allowable leakage is 2 cc/hr. per inch of nominal valve size."

There are two additional safety-related valves of this type installed in the plant at this time:

1CS-536 Boric Acid Transfer Pump A Discharge Check Valve
1CS-546 Boric Acid Transfer Pump B Discharge Check Valve

NATURE OF
DEFICIENCY: (continued)

These two valves operate at approximately 120 psi, while the CSIP check valves operate at 2712 psi. Therefore this application is at significantly lower pressure than the CSIP miniflow application and are not subject to the large hydraulic forces caused by pump start-up. These valves were installed on February 4, 1994 and have undergone surveillance testing with no occurrence of forward flow or backseat failures. The defect in question is not considered applicable to these valves.

SAFETY IMPLICATIONS:

The substantial safety hazard that could have been created is the failure of these valves to pass sufficient forward flow to protect the CSIP when alternate miniflow is required and to prevent backflow through the miniflow line to prevent flow diversion from an operating CSIP in the event one of the other CSIPs failed or was not in service.

DATE PROBLEM
WAS CONFIRMED:

The need to evaluate this deviation was identified on August 17, 1995. It was evaluated and determined to be reportable on September 27, 1995.

PROBLEM REPORTED:

On September 29, 1995, the NRC Operations Center was notified of this reportable item under 10 CFR 21.

CORRECTIVE ACTION:

The valves that experienced failures (1CS-179 and 1CS-193) were replaced by valves of the same design as originally installed. The modification which replaced these valves and the acceptance testing demonstrating full flow was completed on September 25, 1995. The original check valve design is still in use on the third CSIP (C Train). No recorded forward flow or backseat failures have occurred on this valve. No further corrective action is planned.

11/4/99

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Carolina Power & Light Company
Harris Nuclear Plant
PO Box 165
New Hill NC 27562

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SERIAL: HNP-99-150

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
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SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
SPECIAL REPORT - STEAM GENERATOR TUBE INSERVICE INSPECTION RESULTS

Dear Sir or Madam:

In accordance with Harris Nuclear Plant (HNP) Technical Specification 4.4.5.5.b, Carolina Power & Light Company provides the enclosed special report. This report is a summary of the results of the steam generator tube inservice inspections performed in October and November 1998 during the HNP Refueling Outage Number 8.

Please refer any questions regarding this submittal to Mr. J. H. Eads at (919) 362-2646.

Sincerely,

D. B. Alexander

D. B. Alexander
Manager, Regulatory Affairs
Harris Plant

AEC

Enclosure

c: Mr. J. B. Brady (NRC Senior Resident Inspector)
Mr. R. J. Laufer (NRR Project Manager, HNP)
Mr. L. A. Reyes (NRC Regional Administrator, Region II)

A001

Shearon Harris Nuclear Power Plant

Cycle 8

Steam Generator

Inspection Summary

Table of Contents

1.0 Introduction

Steam Generator (SG) inspection and repair at the Harris Nuclear Plant (HNP) was completed for the Cycle 8 refueling outage (RFO8). Examinations of the tubing were performed with eddy current tests (ECTs) and visual examination. Tubes have been removed from service by plugging, and in some tubes mechanical stabilizers have been installed.

Inspections were also performed of steam generator internals and the tube support structures by remote and direct visual techniques.

The examinations resulted in a total of 72 tubes being plugged: 39 in SG "A", 15 in SG "B" and 18 in SG "C". The history for tubes plugged is included in Appendix E.

Taken as a whole, the HNP inspection results show less active corrosion induced tube degradation than is found in similar steam generator types at other plants. Corrosion induced degradation has been slowly increasing; however, a slightly elevated increase in circumferential cracking is noted over cycle 7 in SG "A".

Tube wear at support structures has not shown increased progression over what has been seen in previous cycles.

ECT noted loose part signals or indications during the inspection which were dispositioned as discussed further in this summary.

2.0 Original Examination Plan

2.1 Description of Steam Generator Tube Inspection Scope

An extensive inspection was performed on the HNP steam generator tubes. The inspection scope exceeded prevailing requirements and met or exceeded industry guidelines and accepted good practice. Qualifications of the hardware, procedures and personnel requirements met or exceeded prevailing regulations and accepted industry guidelines and good practice.

Testing scope and scope expansion logic were planned prior to the beginning of inspection activities to address Technical Specification requirements, EPRI Guidelines and to specifically address known degradation phenomena and potential new degradation.

The inspection was completed on November 10, 1998. Table 1 is the planned inspection scope and Table 2 is the summary of tubes plugged. In summary, the original inspection planned scope was: 1) 100% of all tubes with bobbin coil eddy current testing, 2) 100% of all tubes with Plus Point® rotating coil (RC) eddy current testing at the hot leg top-of-tubesheet, 3) a sample of hot leg dents, manufacturing buff marks and other benign indications with Plus Point®, 4) a 20% sample of tubes with Plus Point® in the tight radii U-bends (rows 1 through 3), and 5) a 20% sample of the pre-heater expanded tubes in SG "B".

3.0 Expansion Plan

3.1 Bobbin Expansion Plans

A comprehensive test program for RFO8 included a 100% bobbin probe examination of all open tubes. Therefore, no expansion criteria was utilized.

3.2 RC (Rotating Coil) Expansion Plans

No sample expansions were required consistent with preplanning, the EPRI Guidelines methodology, and site Technical Specifications. Some additional RC probe testing was performed to bound certain loose part indications. RC examinations were performed around loose part indications and expanded by a one-tube boundary until no further indications were reported. Bounding was limited to SGs "A" and "B".

4.0 Examination Results

Indications of tube wall loss and tube cracking were noted from tube inspections and are attributed to corrosion and mechanical wear. Corrosion indications were located at hot leg tube expansion transitions and within the hot leg tubesheet. Tube wear was noted at support structures in the cold leg pre-heater area and at the anti-vibration bars (AVBs) Minor wear was recorded where loose parts were previously detected. Table 2 is a summary of tubes plugged and the nature of the indication. Table 3 is a summary of all indications recorded during RFO8.

The examination results for each of the steam generators, per the HNP Technical Specifications, were classified as C-2. The classification criteria is based on bobbin examinations and classified per the following:

- C-1: Less than 5% of the total tubes inspected are degraded tubes and none of the inspected tubes are defective.
- C-2: One or more tubes, but not more than 1% of the total tubes inspected are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.
- C-3: More than 10% of the total tubes inspected are degraded tubes, or more than 1% of the inspected tubes are defective.

4.1 Volumetric Indications

HNP has a Technical Specification plugging limit of 40% through wall. This plugging limit is a conservative limit which includes penalties for sizing uncertainty and cycle growth rates. One tube was plugged at HNP during RFO8 which exceeded this plugging limit. This tube had an AVB wear indication of 42%. Another tube had AVB wear of 37% and was preventively plugged. Although vibration wear continues to increase during each cycle, its progression is gradual and is not considered to be detrimental to continued operation.

Other volumetric indications have been evaluated on a case-by-case basis. Since HNP does not have a qualified depth sizing technique for volumetric indications other than wear, the characteristics and history of each such signal is evaluated. All volumetric indications were in proximity to a loose part signal or previous loose part signal and were characterized by RC examination as volumetric. If a loose part was present, the indication was classified as a Loose Part Indication (LPI) and repaired by plugging and stabilizing. If a loose part was not present, but the indication is adjacent to a loose part, it was considered a Single Volumetric Indication (SVI). Informational sizing of the LPI and SVI indications revealed that the depth of the largest volume indication was 16%. All LPI and SVI indications were preventively plugged. LPI indications were stabilized if the indication was located at the 02C support or below and showed change since RFO7.

4.2 Circumferential Indications

Stress Corrosion Cracking (SCC) indications at the hot leg top-of-tube-sheet transition area have been observed at HNP since RFO5. Progression of the corrosion has increased as predicted by statistical models; however, SG "A" showed a slight increase in activity during Cycle 8 as compared to SGs "B" and "C". HNP utilized an analytical, deterministic screening criteria to verify that circumferential indications did not exceed safety margins. The screening criteria was used to assist in determining tubes for in-situ pressure testing. This criteria consisted of determining circumferential extent, voltage integral, and percent degraded area (PDA). The criteria is expressed below:

Attribute	Limit
Circumferential Extent	270 deg
Voltage Integral	0.3 volt
PDA	53%

None of the circumferential indications exceeded the threshold values. Therefore, in-situ pressure testing was not performed.

4.3 Axial Indications

Axial SCC near the top-of-tube-sheet transition on the hot leg side was observed in four tubes in SG "C". One tube in each of the three steam generators also exhibited SCC in the tubesheet area. While HNP is qualified for Alternate Repair Criteria in the tube sheet area (F*), this option was not invoked during RFO8, and tubes were repaired (plugged). Axial indications were also screened per the deterministic screening criteria to verify that axial indications did not exceed safety margins.

None of the axial indications exceeded the threshold values. Therefore, in-situ pressure testing was not performed.

4.4 In-Situ Pressure Testing

In those cases where non-destructive testing indicates marginal or indeterminate ability to meet the performance criteria stated above, direct measurement of the pressure retaining ability of the tubing is performed using in-situ pressure testing. The testing methodology is consistent with prevailing industry practice. Entire tubes or portions of tubes are tested at pressures sufficient to demonstrate a pressure retaining margin consistent with the ASME Code, applicable Regulatory Guides and industry guidance. The test parameters are the result of site-specific calculations for the required pressure. The pressurization rates and hold points are procedurally controlled. Corrections in the pressure required to demonstrate margin are conservatively increased to account for tooling characteristics and for temperature. Measurement and test equipment are calibrated and controlled to appropriate quality assurance requirements. Methods are employed to determine leakage, if any, during the pressure test.

During RFO8, no tubes exceeded performance criteria described above. As such, in-situ pressure testing was not required.

4.5 Additional Evaluations

In addition to eddy current inspections, other non-destructive tests were performed to evaluate steam generator condition. These were remote visual examination of installed tube plugs, foreign object search and retrieval (FOSAR), and remote and direct visual examination of the SG upper internals.

No indications of degradation or leakage were reported from the tube plug inspection.

Inspections were performed on the top-of-tubesheet on all three steam generators. FOSAR was included and parts were removed from SGs "B" and "C". A limited inspection was performed on SG "A" due to water clarity. Sampling of the tube bundle as well as the tube lane and "T" slots was included for SGs "B" and "C".

No significant findings were reported with the as found condition of the tubes.

Inspections were also performed in the upper steam dryer section of SG "B". No significant findings were reported other than erosion of the down-comer barrels above the swirl vanes just below the upper deck welds. Action was taken to evaluate the structural and operational integrity of the down-comer barrels through contact with Westinghouse. The erosion was further characterized by UT thickness readings as well as other operational information for all three steam generators as recommended by Westinghouse. The Westinghouse evaluation concluded the steam generator down-comer degradation indicates that continued operation of steam generator "B" for two operating cycles will be acceptable. The steam generators are scheduled for replacement in two cycles. A visual examination was additionally performed on the suspect area in steam generator "C" with similar, but less severe degradation viewed. Based on the results of SG "C", and the excess structural margin in SG "B", it was decided further investigation of SG "A" was not warranted.

Table 1
RFO8 Summary of Planned Steam Generator Tube Inspection

	S/G A	S/G B	S/G C
	Number of Tubes/Percent of Tubes		
Bobbin - Full Length	4543/100%	4561/100%	4538/100%
Plus Point - Tight Radii U-Bends Row 1 - 3	68/20%	68/20%	68/20%
Plus Point - Expansion Transition - H/L TTS	4543/100%	4561/100%	4538/100%
Plus Point - Pre-Heater expanded tubes (two intersections per tube)	n/a	26/20%	n/a
Plus Point - Hot Leg Dents, Buff marks and benign indications	36/20%	40/20%	46/20%
Plus Point - Retest of Bobbin Coil Indications - Volumetric, Loose Parts and other Diagnostic examinations.	29/100%	65/100%	3/100%

Table 2
RFO8 Tubes Plugged For Indications of Tube Degradation

Indication Orientation and Location	Steam Generator		
	SG A	SG B	SG C
Axial indications below the inlet top-of-tubesheet	1	1	1
Both circumferential and axial oriented indications that do not intersect and are near the expansion transition at the hot leg top-of-tubesheet	0	0	1[h]
Circumferentially oriented indications near the expansion transition at the hot leg top-of-tubesheet	29[h]	3[h]	11[h]
Axially oriented indications near the expansion transition at the hot leg top-of-tubesheet	0	0	3
Preventive plugging of tubes with loose part indications[1]	6[c]	11(9[c])	0
Wear at an AVB support (Exceeding Plugging Limits)	1	0	0
Wear at an AVB support (Preventive Plugging)	0	0	1
Volumetric indication at a miscellaneous location in a tube	2	0	1
Total Plugged - 72	**39**	**15**	**18**

h = Hot Leg Stabilizer installed
c = Cold Leg Stabilizer installed

1 One tube in SG "A" (row 38 column 99) also included a obstruction (dent) which would not pass a 0.580" bobbin probe. This criteria would also recommend a preventive tube plug.

Table 3
RFO8 Indication Summary

Indication Category	Steam Generator		
	SG A	SG B	SG C
Axial indications below the inlet top-of-tubesheet	1	1	1
Both circumferential and axial oriented indications that do not intersect and are near the expansion transition at the hot leg top-of-tubesheet	0	0	1
Circumferentially oriented indications near the expansion transition at the hot leg top-of-tubesheet	29	3	11
Axially oriented indications near the expansion transition at the hot leg top-of-tubesheet	0	0	3
Loose Part Indications (wear associated)	4	10	0
Loose Part Signals (no wear associated)	12	24	7
Wear 0-19%	20	9	24
20-29%	3	2	5
30-39%	0	1	6
40%-100%	1	0	0
Volumetric indications (VOL, SVI)	7	9	6
Total	**77**	**59**	**64**

Note: The above documents the number of tubes, not indications. Some tubes have more than one indication or indication category.

5.0 Examination Techniques and Equipment

The hardware, qualification of techniques and qualifications of personnel met or exceeded regulatory requirements, industry guidance and prevailing industry good practice. The resolution process employed sufficient independence to preclude a systematic bias. The primary diagnostic tool used on defects was the Plus Point® rotating eddy current coil. This tool is currently the state-of-the-art tool for detection and categorization of certain defects.

The eddy current examination was performed by ABB Combustion Engineering, Inc.(ABB), utilizing Zetec MIZ-30 digital data acquisition and analysis systems. The following coil types were used for the tube examinations:

Bobbin coil	A610M/ULC	.610" Diameter magnetic bias
	A580SF/RM	.580" Diameter spring flex magnetic bias
Rotating coil	P610MRPC3C	.610" Diameter Three coil (.115"Mid-frequency, .080"High frequency Pancake, Plus point Mid-frequency
	P580MRPC1C	.580" Diameter One Coil Plus Point Mid-frequency. Mag. Bias
	P580MRPC2C	.580" Diameter Two Coil (.115" Mid-frequency Pancake, Plus Point Mid-frequency)

The data was independently analyzed by two groups of certified Level IIA (minimum) qualified data analysts (QDAs). Discrepancies between the two sets of evaluation results were reviewed by Lead Level III eddy current examiners representing both Primary and Secondary analysis groups. ABB performed data acquisition and primary data analysis while Framatome Technology, Inc. (FTI) performed secondary data analysis. Both primary and secondary analysis were performed remotely via LAN/WAN at the Verner & James Company located in Redmond, Washington, and FTI located in Lynchburg, Virginia, respectively. Potentially repairable indications, as well as a sample of non-degraded tubes, were also reviewed by an independent Level III analyst.

A site-specific performance demonstration was required for all data analysts. The performance demonstration consisted of a written and practical examination. The written exam was based on knowledge of the analysis procedure, while the practical examination focused on successful completion of analysis of actual data. Data was compiled from prior outages at HNP along with other indications from similar plants that could potentially be found in HNP steam generators.

Two data management systems were used at HNP. The primary system was ABB's ISIS-tube tracking system that was the database of record. The second was Zetec's Data Management System that was used to provide a second check and process other information used for on-line data review and historic review.

Appendix A
SG "A" Summary Data Sheets

Row/Col	Reel	Complete Date	Vlts	Deg	CH	Ind. Desc.	Indication Location		Util 1	Util 2	Probe	Extent Tested	Dataset
17 79	1C091	11/09/98	0.3	0	P 5	4	02C	-0.30			A610MULC	TEHTEC	BOBBIN
27 29	1C047	11/06/98	0.3	0	P 2	14	02C	-0.37			A610MULC	TEHTEC	BOBBIN
31 64	1C034	11/06/98	0.7	0	P 2	21	AV2	0.40			A610MULC	TEHTEC	BOBBIN
34 59	1C029	11/05/98	0.4	0	P 2	19	06C	0.29			A610MULC	TEHTEC	BOBBIN
35 97	1C060	11/07/98	0.4	0	P 2	12	AV2	0.00			A610MULC	TEHTEC	BOBBIN
39 64	1C030	11/06/98	0.5	0	P 2	20	AV3	0.00			A610MULC	TEHTEC	BOBBIN
40 59	1C029	11/05/98	0.3	0	P 2	16	AV4	-0.05			A610MULC	TEHTEC	BOBBIN
42 59	1C029	11/05/98	0.3	0	P 2	13	AV1	-0.05			A610MULC	TEHTEC	BOBBIN
42 59	1C029	11/05/98	0.3	0	P 2	16	AV3	0.00			A610MULC	TEHTEC	BOBBIN
43 59	1C030	11/06/98	0.3	0	P 2	13	AV1	0.11			A610MULC	TEHTEC	BOBBIN
46 59	1C029	11/05/98	0.5	0	P 2	21	AV3	-0.10			A610MULC	TEHTEC	BOBBIN
46 59	1C029	11/09/98	0.6	0	P 2	24	AV4	-0.05			A610MULC	TEHTEC	BOBBIN
47 42	1C050	11/06/98	0.5	0	P 5	5	02C	0.32			A610MULC	TEHTEC	BOBBIN
47 56	1C030	11/06/98	0.4	0	P 2	16	AV1	-0.08			A610MULC	TEHTEC	BOBBIN
47 56	1C030	11/06/98	1.0	0	P 2	30	AV4	-0.13			A610MULC	TEHTEC	BOBBIN
47 56	1C030	11/09/98	2.1	0	P 2	42	AV3	-0.11			A610MULC	TEHTEC	BOBBIN
47 56	1C030	11/06/98	0.6	0	P 2	23	AV2	-0.08			A610MULC	TEHTEC	BOBBIN
47 56	1C030	11/06/98	0.8	0	P 2	25	AV2	0.46			A610MULC	TEHTEC	BOBBIN
48 38	1C025	11/05/98	0.7	0	P 5	9	07C	-0.15			A610MULC	TEHTEC	BOBBIN
49 36	1C025	11/05/98	0.8	0	P 5	10	07C	-0.32			A610MULC	TEHTEC	BOBBIN
49 37	1C025	11/05/98	1.5	0	P 5	17	07C	0.00			A610MULC	TEHTEC	BOBBIN
49 38	1C025	11/05/98	1.5	0	P 5	17	07C	-0.14			A610MULC	TEHTEC	BOBBIN
49 39	1C050	11/06/98	0.7	0	P 5	8	07C	0.38			A610MULC	TEHTEC	BOBBIN
49 40	1C050	11/06/98	0.5	0	P 5	5	07C	0.30			A610MULC	TEHTEC	BOBBIN
49 43	1C050	11/06/98	1.5	0	P 5	15	07C	0.21			A610MULC	TEHTEC	BOBBIN
49 44	1C050	11/06/98	0.3	0	P 5	4	07C	0.21			A610MULC	TEHTEC	BOBBIN
49 45	1C050	11/06/98	0.7	0	P 5	8	07C	0.27			A610MULC	TEHTEC	BOBBIN
49 46	1C050	11/06/98	0.4	0	P 5	5	07C	0.38			A610MULC	TEHTEC	BOBBIN
49 48	1C028	11/06/98	0.4	0	P 2	16	05C	-0.30			A610MULC	TEHTEC	BOBBIN
49 70	1C032	11/06/98	0.3	0	P 2	10	07C	-0.11			A610MULC	TEHTEC	BOBBIN
Subtotal %TW Indications:	30												
38 99	1C093	11/09/98	0.3	72	P 1	LPI	02C	0.78			P610MRPC3C	03C02C	LPS_EXP1
39 98	1C088	11/09/98	0.4	102	P 3	LPI	02C	0.80			P610MRPC3C	02C02C	BOBBIN
40 95	1C095	11/09/98	0.3	51	P 3	LPI	02C	0.50			P610MRPC3C	03C02C	LPS_EXP2
40 97	1C093	11/09/98	0.2	95	P 3	LPI	02C	0.40			P610MRPC3C	03C02C	LPS_EXP1
Subtotal LPI Indications:	4												
8 108	1H067	11/08/98	0.7	68	9	LPS	TSH	0.22		CPL	B610MRPC3C	TSHTSH	MRPCTSH
12 106	1H067	11/08/98	1.9	83	9	LPS	TSH	0.26		CPL	B610MRPC3C	TSHTSH	MRPCTSH
12 107	1H067	11/08/98	0.9	81	9	LPS	TSH	0.21		CPL	B610MRPC3C	TSHTSH	MRPCTSH
14 10	1H014	11/07/98	0.6	269	9	LPS	TSH	1.15		CPL	B610MRPC	TSHTSH	MRPCTSH
15 10	1H015	11/06/98	0.1	89	9	LPS	TSH	1.20		CPL	P610MRPC3C	TSHTSH	MRPCTSH
37 99	1H082	11/10/98	0.7	156	8	LPS	TSH	0.57		CPL	P610MRPC3C	TSHTSH	MRPCTSH
38 99	1C093	11/09/98	0.3	88	9	LPS	02C	0.78			P610MRPC3C	03C02C	LPS_EXP1
39 98	1C088	11/09/98	0.3	89	9	LPS	02C	0.66			P610MRPC3C	02C02C	BOBBIN
39 98	1C093	11/09/98	0.2	89	9	LPS	02C	0.79			P610MRPC3C	03C02C	LPS_EXP1
40 95	1C095	11/09/98	0.3	83	9	LPS	02C	0.39			P610MRPC3C	03C02C	LPS_EXP2
40 96	1C095	11/09/98	0.4	87	9	LPS	02C	1.84			P610MRPC3C	03C02C	LPS_EXP2
40 97	1C093	11/09/98	0.6	85	9	LPS	02C	0.48			P610MRPC3C	03C02C	LPS_EXP1
41 95	1C095	11/09/98	0.4	85	9	LPS	02C	0.45			P610MRPC3C	03C02C	LPS_EXP2
41 95	1C095	11/09/98	0.4	87	9	LPS	02C	1.40			P610MRPC3C	03C02C	LPS_EXP2
Subtotal LPS Indications:	14												
5 14	1H017	11/06/98	0.3	76	5	MCI	TSH	-0.27			P610MRPC3C	TSHTSH	MRPCTSH
19 30	1H031	11/06/98	0.3	90	5	MCI	TSH	-0.10			P610MRPC3C	TSHTSH	MRPCTSH
19 30	1H031	11/07/98	0.2	84	5	MCI	TSH	-0.10			P610MRPC3C	TSHTSH	MRPCTSH
22 74	1H036	11/07/98	0.2	82	5	MCI	TSH	-0.17			B610MRPC	TSHTSH	MRPCTSH
24 71	1H036	11/07/98	0.2	125	5	MCI	TSH	-0.23			B610MRPC	TSHTSH	MRPCTSH
26 69	1H036	11/07/98	0.3	126	5	MCI	TSH	-0.17			B610MRPC	TSHTSH	MRPCTSH
Subtotal MCI Indications:	6												

Row/Col	Reel	Complete Date	Vlts	Deg	CH	Ind. Desc.	Indication	Location	Util 1	Util 2	Probe	Extent Tested	Dataset
38 99	1C092	11/09/98		0		OBS					A580SFRM	08CTEC	BOBBIN
Subtotal OBS Indications:		1											
3 108	1H068	11/08/98	0.2	0	P 3	SAI	TSH	-3.33			P610MRPC3C	TSHTSH	MRPCTSH
3 108	1H068	11/09/98	2.3	24	P 3	SAI	TSH	-3.33			P610MRPC3C	TSHTSH	MRPCTSH
Subtotal SAI Indications:		2											
3 16	1H017	11/06/98	0.3	52	5	SCI	TSH	-0.24			P610MRPC3C	TSHTSH	MRPCTSH
4 17	1H016	11/06/98	0.3	104	5	SCI	TSH	-0.35			P610MRPC3C	TSHTSH	MRPCTSH
4 86	1H051	11/07/98	0.2	117	5	SCI	TSH	-0.25			P610MRPC3C	TSHTSH	MRPCTSH
5 13	1H015	11/06/98	0.3	77	5	SCI	TSH	-0.27			P610MRPC3C	TSHTSH	MRPCTSH
5 24	1H054	11/09/98	0.2	109	5	SCI	TSH	-0.36			P610MRPC3C	TSHTSH	MRPCTSH
5 57	1H072	11/09/98	0.1	85	5	SCI	TSH	-0.07			P610MRPC3C	TSHTSH	MRPCTSH
5 67	1H019	11/06/98	0.3	109	5	SCI	TSH	-0.09			P610MRPC3C	TSHTSH	MRPCTSH
6 71	1H020	11/06/98	0.9	65	5	SCI	TSH	-0.04			P610MRPC3C	TSHTSH	MRPCTSH
15 28	1H054	11/09/98	0.1	125	5	SCI	TSH	-0.17			P610MRPC3C	TSHTSH	MRPCTSH
15 29	1H054	11/09/98	0.2	125	5	SCI	TSH	-0.12			P610MRPC3C	TSHTSH	MRPCTSH
19 28	1H029	11/06/98	0.2	107	5	SCI	TSH	-0.13			P610MRPC3C	TSHTSH	MRPCTSH
19 28	1H029	11/07/98	0.7	89	5	SCI	TSH	-0.13			P610MRPC3C	TSHTSH	MRPCTSH
19 31	1H031	11/06/98	0.2	62	5	SCI	TSH	-0.09			P610MRPC3C	TSHTSH	MRPCTSH
19 31	1H031	11/07/98	0.3	90	5	SCI	TSH	-0.09			P610MRPC3C	TSHTSH	MRPCTSH
21 76	1H037	11/07/98	0.3	88	5	SCI	TSH	-0.17			B610MRPC3C	TSHTSH	MRPCTSH
22 75	1H036	11/07/98	0.3	94	5	SCI	TSH	-0.09			B610MRPC	TSHTSH	MRPCTSH
23 75	1H037	11/07/98	0.3	94	5	SCI	TSH	-0.14			B610MRPC3C	TSHTSH	MRPCTSH
24 61	1H033	11/07/98	0.4	124	5	SCI	TSH	-0.14			B610MRPC3C	TSHTSH	MRPCTSH
24 74	1H036	11/07/98	0.2	76	5	SCI	TSH	-0.14			B610MRPC	TSHTSH	MRPCTSH
25 61	1H034	11/07/98	0.2	104	5	SCI	TSH	0.07			B610MRPC	TSHTSH	MRPCTSH
26 71	1H036	11/07/98	0.2	128	5	SCI	TSH	-0.21			B610MRPC	TSHTSH	MRPCTSH
26 72	1H036	11/07/98	0.2	103	5	SCI	TSH	-0.24			B610MRPC	TSHTSH	MRPCTSH
26 73	1H036	11/07/98	0.3	82	5	SCI	TSH	-0.13			B610MRPC	TSHTSH	MRPCTSH
27 64	1H034	11/07/98	0.2	118	5	SCI	TSH	-0.15			B610MRPC	TSHTSH	MRPCTSH
27 67	1H034	11/07/98	0.2	89	5	SCI	TSH	0.05			B610MRPC	TSHTSH	MRPCTSH
28 46	1H043	11/10/98	0.2	74	5	SCI	TSH	-0.24			P610MRPC3C	TSHTSH	MRPCTSH
28 46	1H043	11/07/98	0.2	74	5	SCI	TSH	-0.24			P610MRPC3C	TSHTSH	MRPCTSH
Subtotal SCI Indications:		27											
25 99	1H093	11/10/98	0.8	49	4	SVI	01H	23.56			P610MRPC3C	03HTSH	BOBBIN
34 62	1C088	11/09/98	0.3	69	P 3	SVI	02C	0.83			P610MRPC3C	02C02C	BOBBIN
Subtotal SVI Indications:		2											
16 46	1H084	11/09/98	0.5	98	P 1	VOL	01H	9.76		MBH	P610MRPC3C	01H03H	SI/HL
21 68	1H084	11/09/98	0.3	64	P 1	VOL	09H	31.16		MBH	P610MRPC3C	09H10H	SI/HL
38 56	1H084	11/09/98	0.8	87	P 1	VOL	10H	35.22		MBH	P610MRPC3C	10H11H	SI/HL
45 88	1H089	11/09/98	0.1	27	3	VOL	08H	20.34		MBH	P610MRPC3C	08H09H	BOBBIN
48 59	1H084	11/09/98	0.4	93	P 1	VOL	09H	18.60		MBH	P610MRPC3C	09H10H	SI/HL
Subtotal VOL Indications:		5											

Appendix B
SG "B" Summary Data Sheets

Owner: C P & L Plant: Shearon Harris RF08 Date: 12/10/98
Component: SG B Outage: 9810 Page: 1

Row/Col	Reel	Complete Date	Vlts	Deg	CH	Ind. Desc.	Indication Location		Util 1	Util 2	Probe	Extent Tested	Dataset
28 97	2C061	11/07/98	0.4	0	P 2	17	AV4	0.00			A610MULC	TEHTEC	BOBBIN
30 94	2C040	11/06/98	0.2	0	P 2	15	AV2	0.05			A610MULC	TEHTEC	BOBBIN
40 96	2C095	11/08/98	1.5	0	P 5	14	02C	0.60			A610MULC	TEHTEC	BOBBIN
41 38	2C006	11/04/98	0.4	0	P 2	17	AV3	-0.16			A610MULC	TEHTEC	BOBBIN
42 56	2C034	11/06/98	0.5	0	P 2	27	AV2	0.13			A610MULC	TEHTEC	BOBBIN
45 59	2C039	11/06/98	0.8	0	P 2	27	AV1	-0.24			A610MULC	TEHTEC	BOBBIN
45 59	2C039	11/06/98	0.7	0	P 2	25	AV4	-0.32			A610MULC	TEHTEC	BOBBIN
45 63	2C039	11/06/98	0.3	0	P 2	12	AV2	-0.05			A610MULC	TEHTEC	BOBBIN
46 59	2C036	11/06/98	0.8	0	P 2	30	AV2	-0.05			A610MULC	TEHTEC	BOBBIN
46 59	2C036	11/06/98	0.7	0	P 2	30	AV4	-0.16			A610MULC	TEHTEC	BOBBIN
47 72	2C041	11/09/98	0.4	0	P 2	18	05C	0.44			A610MULC	TEHTEC	BOBBIN
48 72	2C038	11/06/98	0.2	0	P 2	19	05C	0.55			A610MULC	TEHTEC	BOBBIN
49 48	2C091	11/08/98	0.8	0	P 5	8	07C	0.42			A610MULC	TEHTEC	BOBBIN
49 84	2C095	11/08/98	0.4	0	P 5	4	07C	-0.36			A610MULC	TEHTEC	BOBBIN
Subtotal %TW Indications:	14												
5 85	2C094	11/08/98	0.8	65	P 3	LPI	06C	0.36			P610MRPC3C	06C06C	BOBBIN
33 64	2C094	11/08/98	0.5	48	P 3	LPI	02C	0.39			P610MRPC3C	02C02C	BOBBIN
33 65	2C094	11/08/98	0.6	71	P 3	LPI	02C	0.90			P610MRPC3C	02C02C	BOBBIN
34 64	2C102	11/09/98	0.5	118	P 3	LPI	02C	0.48			P610MRPC3C	03C02C	LPS_EXP2
34 65	2C102	11/09/98	0.5	86	P 3	LPI	02C	0.56			P610MRPC3C	03C02C	LPS_EXP2
39 98	2C098	11/09/98	0.1	96	P 2	LPI	02C	3.42			P610MRPC3C	02C03C	LPS_EXP1
40 95	2C094	11/08/98	0.2	81	P 3	LPI	02C	0.75			P610MRPC3C	02C02C	BOBBIN
40 96	2C094	11/08/98	0.2	102	5	LPI	02C	2.03			P610MRPC3C	02C02C	BOBBIN
40 96	2C094	11/08/98	1.5	78	P 3	LPI	02C	0.59			P610MRPC3C	02C03C	BOBBIN
40 97	2C094	11/08/98	0.7	164	P 3	LPI	02C	1.99			P610MRPC3C	02C03C	BOBBIN
40 97	2C094	11/08/98	0.2	28	P 3	LPI	02C	3.24			P610MRPC3C	02C03C	BOBBIN
48 86	2C094	11/08/98	1.2	89	P 3	LPI	01C	0.69			P610MRPC3C	01C01C	BOBBIN
Subtotal LPI Indications:	12												
5 85	2C094	11/08/98	0.4	77	9	LPS	06C	0.40			P610MRPC3C	06C06C	BOBBIN
6 86	2C102	11/09/98	0.4	74	9	LPS	06C	0.73			P610MRPC3C	07C06C	LPS_EXP2
7 112	2H078	11/08/98	0.6	71	9	LPS	TSH	0.20		PLH	P610MRPC3C	TSHTSH	MRPCTSH
8 95	2H052	11/07/98	0.2	73	9	LPS	TSH	0.19			P610MRPC3C	TSHTSH	MRPCTSH
16 92	2H052	11/07/98	0.3	74	9	LPS	TSH	0.23		CPL	P610MRPC3C	TSHTSH	MRPCTSH
21 109	2H080	11/08/98	0.6	89	9	LPS	TSH	0.29			B610MRPC3C	TSHTSH	MRPCTSH
22 109	2H079	11/08/98	0.8	82	9	LPS	TSH	0.25			B610MRPC3C	TSHTSH	MRPCTSH
28 55	2H037	11/06/98	0.4	83	9	LPS	TSH	0.05	01	CPL	B610MRPC3C	TSHTSH	MRPCTSH
28 56	2H037	11/06/98	0.5	88	9	LPS	TSH	0.16	01	CPL	B610MRPC3C	TSHTSH	MRPCTSH
29 64	2H040	11/06/98	0.3	75	9	LPS	TSH	0.22		CPL	P610MRPC3C	TSHTSH	MRPCTSH
31 49	2H038	11/07/98	0.3	76	9	LPS	TSH	0.52		CPL	B610MRPC3C	TSHTSH	MRPCTSH
33 63	2C102	11/09/98	0.6	84	9	LPS	02C	0.45			P610MRPC3C	03C02C	LPS_EXP2
33 64	2C094	11/08/98	0.6	78	9	LPS	02C	0.40			P610MRPC3C	02C02C	BOBBIN
33 65	2C094	11/08/98	0.5	0	9	LPS	02C	0.87			P610MRPC3C	02C02C	BOBBIN
34 64	2C102	11/09/98	0.8	83	9	LPS	02C	0.42			P610MRPC3C	03C02C	LPS_EXP2
34 65	2C102	11/09/98	0.9	83	9	LPS	02C	-0.62			P610MRPC3C	03C02C	LPS_EXP2
35 28	2H026	11/06/98	0.3	85	9	LPS	TSH	0.22		CPL	P610MRPC3C	TSHTSH	MRPCTSH
35 29	2H026	11/06/98	0.6	81	9	LPS	TSH	0.24		CPL	P610MRPC3C	TSHTSH	MRPCTSH
39 98	2C098	11/09/98	0.3	93	9	LPS	02C	3.45			P610MRPC3C	02C02C	LPS_EXP1
40 95	2C094	11/08/98	0.6	0	9	LPS	02C	0.72			P610MRPC3C	02C02C	BOBBIN
40 96	2C094	11/08/98	0.4	0	9	LPS	02C	1.08			P610MRPC3C	02C03C	BOBBIN
40 96	2C094	11/08/98	0.0	78	9	LPS	02C	2.09			P610MRPC3C	02C02C	BOBBIN
40 97	2C094	11/08/98	0.9	0	9	LPS	02C	1.96			P610MRPC3C	02C03C	BOBBIN
40 97	2C094	11/08/98	0.3	0	9	LPS	02C	3.21			P610MRPC3C	02C03C	BOBBIN
41 95	2C094	11/09/98	0.6	18	P 3	LPS	02C	1.62			P610MRPC3C	02C02C	BOBBIN
48 86	2C094	11/08/98	0.4	0	9	LPS	01C	0.66			P610MRPC3C	01C01C	BOBBIN
Subtotal LPS Indications:	26												

Row	Col	Reel	Complete Date	Vlts	Deg	CH	Ind. Desc.	Indication Location		Util 1	Util 2	Probe	Extent Tested	Dataset
41	81	2H090	11/08/98	3.7	35	P 2	MAI	TEH	6.56			P610MRPC3C	TSHTEH	BOBBIN
41	81	2H090	11/08/98	3.7	35	P 3	MAI	TEH	6.56			P610MRPC3C	TSHTEH	BOBBIN
41	81	2H090	11/08/98	1.2	40	P 2	MAI	TEH	11.29			P610MRPC3C	TSHTEH	BOBBIN
41	81	2H090	11/08/98	1.2	40	P 3	MAI	TEH	11.29			P610MRPC3C	TSHTEH	BOBBIN
41	81	2H090	11/08/98	4.8	36	P 3	MAI	TEH	11.82			P610MRPC3C	TSHTEH	BOBBIN
41	81	2H090	11/08/98	4.8	36	P 3	MAI	TEH	11.82			P610MRPC3C	TSHTEH	BOBBIN
Subtotal MAI Indications:				6										
41	81	2H090	11/08/98	1.9	33	P 3	SAI	TEH	0.39			P610MRPC3C	TSHTEH	BOBBIN
41	81	2H090	11/08/98	1.9	33	P 2	SAI	TEH	0.39			P610MRPC3C	TSHTEH	BOBBIN
Subtotal SAI Indications:				2										
13	94	2H051	11/07/98	0.1	130	5	SCI	TSH	-0.17			P610MRPC3C	TSHTSH	MRPCTSH
13	94	2H051	11/08/98	0.1	130	5	SCI	TSH	-0.17			P610MRPC3C	TSHTSH	MRPCTSH
20	71	2H041	11/08/98	0.4	98	5	SCI	TSH	-0.12			P610MRPC	TSHTSH	MRPCTSH
24	42	2H035	11/08/98	0.2	110	5	SCI	TSH	-0.10			B610MRPC	TSHTSH	MRPCTSH
Subtotal SCI Indications:				4										
5	86	2C102	11/09/98	0.6	52	P 3	VOL	06C	0.47			P610MRPC3C	07C06C	LPS_EXP2
5	86	2C103	11/09/98	0.3	81	P 3	VOL	06C	0.47			P610MRPC3C	07C06C	LPS_EXP3
6	70	2H013	11/05/98	1.5	97	4	VOL	01H	20.26		MBH	P610MRPC3C	03HTSH	BOBBIN
11	48	2H082	11/08/98	0.1	128	P 3	VOL	03H	12.84		MBH	P610MRPC3C	05H03H	SI/HL
15	12	2H012	11/05/98	3.3	67	4	VOL	TSH	3.62		MBH	P610MRPC3C	01HTSH	SI/HL
15	62	2H013	11/05/98	1.1	110	4	VOL	05H	30.07		MBH	P610MRPC3C	07H05H	BOBBIN
17	78	2H044	11/08/98	2.0	130	4	VOL	TSH	2.41		MBH	P610MRPC3C	TSHTSH	MRPCTSH
22	76	2C094	11/09/98	0.2	110	5	VOL	05C	11.45		MBH	P610MRPC3C	05C06C	BOBBIN
33	46	2H012	11/05/95	10.0	110	4	VOL	10H	25.97		MBH	P610MRPC3C	11H10H	SI/HL
33	46	2H012	11/04/98	5.5	117	4	VOL	10H	37.51		MBH	P610MRPC3C	11H10H	SI/HL
35	71	2C094	11/09/98	0.2	81	P 3	VOL	09C	21.62		MBH	P610MRPC3C	09C10C	BOBBIN
Subtotal VOL Indications:				11										

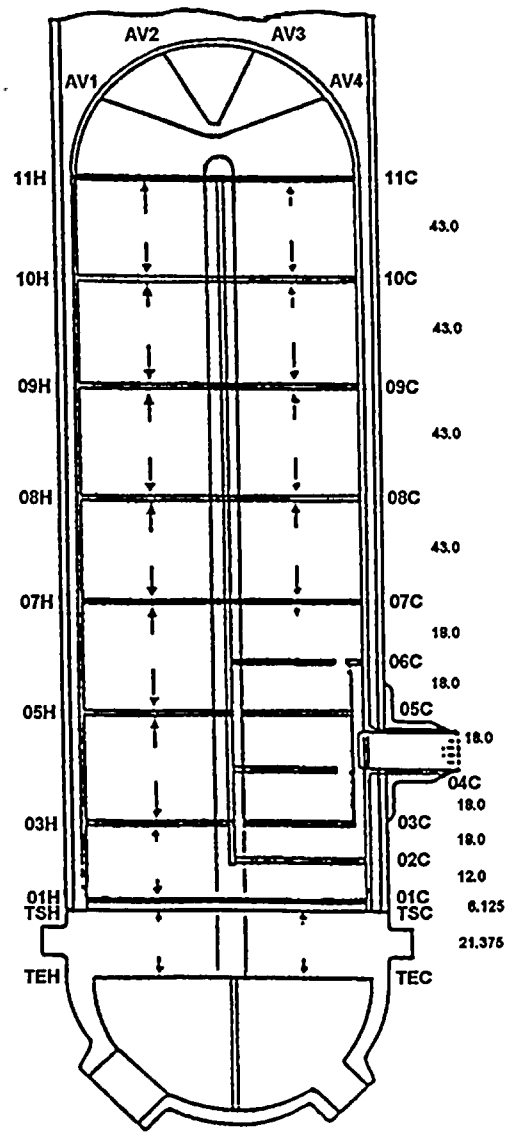
Appendix C
SG "C" Summary Data Sheets

Row/Col	Reel	Complete Date	Vlts	Deg	CH	Ind. Desc.	Indication Location		Util 1	Util 2	Probe	Extent Tested	Dataset
23 45	3C062	11/07/98	0.6	0	P 2	19	AV2	0.00			A610MULC	TEHTEC	BOBBIN
25 45	3C062	11/07/98	0.7	0	P 2	22	AV2	0.00			A610MULC	TEHTEC	BOBBIN
27 46	3C062	11/07/98	0.2	0	P 2	12	AV1	0.00			A610MULC	TEHTEC	BOBBIN
28 45	3C061	11/06/98	0.4	0	P 2	18	AV1	0.00			A610MULC	TEHTEC	BOBBIN
28 46	3C061	11/07/98	0.4	0	P 2	18	AV2	-0.58			A610MULC	TEHTEC	BOBBIN
30 46	3C061	11/06/98	0.7	0	P 2	24	AV1	-0.35			A610MULC	TEHTEC	BOBBIN
30 46	3C061	11/06/98	0.4	0	P 2	17	AV3	-0.10			A610MULC	TEHTEC	BOBBIN
31 45	3C062	11/08/98	1.2	0	P 2	32	AV1	0.28			A610MULC	TEHTEC	BOBBIN
33 43	3C036	11/06/98	0.6	0	P 2	22	AV3	0.05			A610MULC	TEHTEC	BOBBIN
33 45	3C036	11/06/98	0.5	0	P 2	18	AV1	0.18			A610MULC	TEHTEC	BOBBIN
33 45	3C036	11/06/98	0.3	0	P 2	12	AV3	-0.10			A610MULC	TEHTEC	BOBBIN
34 44	3C035	11/06/98	0.9	0	P 2	33	AV2	0.00			A610MULC	TEHTEC	BOBBIN
34 45	3C035	11/06/98	0.4	0	P 2	19	AV3	0.00			A610MULC	TEHTEC	BOBBIN
34 46	3C035	11/06/98	1.3	0	P 2	37	AV3	-0.28			A610MULC	TEHTEC	BOBBIN
34 59	3H085	11/08/98	1.2	0	P 5	11	03C	0.08			A610MULC	TECTEH	BOBBIN
37 86	3C080	11/08/98	0.3	0	P 2	10	AV3	-0.05			A610MULC	TEHTEC	BOBBIN
39 59	3C040	11/06/98	0.3	0	P 2	12	AV3	-0.23			A610MULC	TEHTEC	BOBBIN
39 74	3C042	11/07/98	0.2	0	P 2	7	AV3	0.00			A610MULC	TEHTEC	BOBBIN
39 86	3C080	11/08/98	1.0	0	P 2	29	AV3	0.15			A610MULC	TEHTEC	BOBBIN
40 19	3C003	11/04/98	0.7	0	P 2	26	AV4	0.00			A610MULC	TEHTEC	BOBBIN
40 56	3C037	11/06/98	0.2	0	P 2	12	AV1	0.00			A610MULC	TEHTEC	BOBBIN
40 56	3C037	11/06/98	0.4	0	P 2	19	AV3	-0.15			A610MULC	TEHTEC	BOBBIN
40 60	3C039	11/06/98	0.3	0	P 2	14	AV2	0.15			A610MULC	TEHTEC	BOBBIN
41 20	3C003	11/04/98	1.1	0	P 2	34	AV4	0.00			A610MULC	TEHTEC	BOBBIN
41 56	3C038	11/06/98	0.5	0	P 2	19	AV2	0.00			A610MULC	TEHTEC	BOBBIN
43 59	3C040	11/06/98	0.4	0	P 2	16	AV2	-0.10			A610MULC	TEHTEC	BOBBIN
44 59	3C039	11/06/98	0.9	0	P 2	30	AV2	-0.56			A610MULC	TEHTEC	BOBBIN
45 56	3C038	11/07/98	1.4	0	P 2	35	AV1	0.21			A610MULC	TEHTEC	BOBBIN
45 56	3C038	11/06/98	0.6	0	P 2	22	AV4	0.10			A610MULC	TEHTEC	BOBBIN
45 61	3C040	11/06/98	0.4	0	P 2	18	02C	-0.31			A610MULC	TEHTEC	BOBBIN
46 38	3C009	11/04/98	0.3	0	P 2	15	03C	-0.23			A610MULC	TEHTEC	BOBBIN
48 37	3C009	11/04/98	0.4	0	P 2	17	07C	-0.36			A610MULC	TEHTEC	BOBBIN
48 38	3C015	11/04/98	0.4	0	P 5	4	03C	-0.25			A610MULC	TEHTEC	BOBBIN
48 40	3C100	11/09/98	0.4	0	P 5	4	03C	-0.27			P610MRPC2C	TEHTEC	BOBBIN
48 59	3C039	11/06/98	0.3	0	P 2	13	AV2	0.48			A610MULC	TEHTEC	BOBBIN
48 59	3C039	11/06/98	0.2	0	P 2	11	AV3	-0.05			A610MULC	TEHTEC	BOBBIN
48 59	3C039	11/06/98	0.3	0	P 2	14	AV1	-0.33			A610MULC	TEHTEC	BOBBIN
49 34	3C005	11/04/98	0.3	0	P 2	14	AV2	0.16			A610MULC	TEHTEC	BOBBIN
49 38	3C015	11/04/98	0.5	0	P 5	5	07C	-0.38			A610MULC	TEHTEC	BOBBIN
49 40	3C035	11/06/98	0.3	0	P 2	15	07C	-0.31			A610MULC	TEHTEC	BOBBIN
49 67	3H085	11/08/98	0.9	0	P 5	8	07C	-0.30			A610MULC	TECTEH	BOBBIN
Subtotal %TW Indications:	41												
4 114	3H065	11/08/98	0.2	67		9	LPS	TSH	0.77	CPL	B610MRPC3C	TSHTSH	MRPCTSH
49 42	3H053	11/07/98	0.5	87		9	LPS	TSH	0.53	PLH	P610MRPC3C	TSHTSH	MRPCTSH
49 43	3H053	11/07/98	0.4	80		9	LPS	TSH	0.41	PLH	P610MRPC3C	TSHTSH	MRPCTSH
49 44	3H053	11/07/98	0.4	77		9	LPS	TSH	0.35	PLH	P610MRPC3C	TSHTSH	MRPCTSH
49 55	3H053	11/07/98	0.6	87		9	LPS	TSH	0.38	PLH	P610MRPC3C	TSHTSH	MRPCTSH
49 56	3H060	11/08/98	0.5	87		9	LPS	TSH	0.33	PLH	P610MRPC3C	TSHTSH	MRPCTSH
49 70	3H055	11/07/98	0.3	83		9	LPS	TSH	0.96	PLH	P610MRPC3C	TSHTSH	MRPCTSH
Subtotal LPS Indications:	7												
21 74	3H033	11/06/98	0.3	53	P	3	MAI	TSH	-0.27		P610MRPC3C	TSHTSH	MRPCTSH
21 74	3H033	11/07/98	0.2	0	P	3	MAI	TSH	-0.27		P610MRPC3C	TSHTSH	MRPCTSH
21 83	3H041	11/08/98	3.8	35	P	3	MAI	TSH	-3.29		P610MRPC3C	TSHTSH	MRPCTSH
Subtotal MAI Indications:	3												
2 36	3H050	11/08/98	0.2	88		5	MCI	TSH	-0.30		B610MRPC3C	TSHTSH	MRPCTSH
6 28	3H050	11/08/98	0.2	83		5	MCI	TSH	-0.28		B610MRPC3C	TSHTSH	MRPCTSH
Subtotal MCI Indications:	2												

Row/Col	Reel	Complete Date	Vlts	Deg	CH	Ind. Desc.	Indication Location		Util 1	Util 2	Probe	Extent Tested	Dataset
13 63	3H016	11/07/98	7.4	27	P 3	SAI	TSH	-0.26			P610MRPC3C	TSHTSH	MRPCTSH
23 43	3H035	11/07/98	0.1	75	P 3	SAI	TSH	0.08			P610MRPC3C	TSHTSH	MRPCTSH
23 43	3H035	11/08/98	0.2	90	P 3	SAI	TSH	0.05			P610MRPC3C	TSHTSH	MRPCTSH
23 44	3H035	11/07/98	0.2	67	P 3	SAI	TSH	-0.09			P610MRPC3C	TSHTSH	MRPCTSH
23 44	3H035	11/07/98		0	P 3	SAI	TSH	-0.12			P610MRPC3C	TSHTSH	MRPCTSH
Subtotal SAI Indications:	5												
1 38	3H051	11/07/98	0.3	97	5	SCI	TSH	-0.34			P610MRPC3C	TSHTSH	MRPCTSH
1 38	3H051	11/08/98	0.5	90	5	SCI	TSH	-0.34			P610MRPC3C	TSHTSH	MRPCTSH
1 74	3H018	11/05/98	0.2	91	5	SCI	TSH	-0.38			B610MRPC	TSHTSH	MRPCTSH
1 74	3H018	11/07/98	0.4	90	5	SCI	TSH	-0.38			B610MRPC	TSHTSH	MRPCTSH
2 22	3H050	11/08/98	0.3	59	5	SCI	TSH	-0.19			B610MRPC3C	TSHTSH	MRPCTSH
2 29	3H050	11/08/98	0.2	123	5	SCI	TSH	-0.27			B610MRPC3C	TSHTSH	MRPCTSH
5 21	3H051	11/07/98	0.4	87	5	SCI	TSH	-0.26			P610MRPC3C	TSHTSH	MRPCTSH
5 21	3H051	11/08/98	0.5	90	5	SCI	TSH	-0.26			P610MRPC3C	TSHTSH	MRPCTSH
7 34	3H051	11/07/98	0.2	36	5	SCI	TSH	-0.20			P610MRPC3C	TSHTSH	MRPCTSH
7 34	3H051	11/08/98	0.5	90	5	SCI	TSH	-0.20			P610MRPC3C	TSHTSH	MRPCTSH
7 73	3H018	11/05/98	0.2	68	5	SCI	TSH	-0.34			B610MRPC	TSHTSH	MRPCTSH
7 73	3H018	11/07/98	0.6	90	5	SCI	TSH	-0.31			B610MRPC	TSHTSH	MRPCTSH
12 48	3H071	11/08/98	0.2	129	5	SCI	TSH	-0.18			P610MRPC3C	TSHTSH	MRPCTSH
22 42	3H034	11/08/98	0.1	83	5	SCI	TSH	0.00			P610MRPC3C	TSHTSH	MRPCTSH
22 42	3H034	11/06/98	0.1	83	5	SCI	TSH	0.00			P610MRPC3C	TSHTSH	MRPCTSH
23 44	3H035	11/08/98	0.5	90	5	SCI	TSH	-0.20			P610MRPC3C	TSHTSH	MRPCTSH
23 44	3H035	11/07/98	0.2	121	5	SCI	TSH	-0.17			P610MRPC3C	TSHTSH	MRPCTSH
Subtotal SCI Indications:	17												
40 46	3C099	11/09/98	0.6	85	4	SVI	02C	0.89			P610MRPC3C	02C02C	BOBBIN
Subtotal SVI Indications:	1												
8 36	3H008	11/05/98	2.1	148	4	VOL	03H	16.22		MBH	P610MRPC3C	03H05H	SI/HL
15 65	3H016	11/06/98	0.7	107	P 2	VOL	TSH	-0.87		MBH	P610MRPC3C	TSHTSH	MRPCTSH
16 85	3H089	11/09/98	0.3	101	5	VOL	01H	0.41		MBH	P610MRPC3C	01H01H	SI/HL
18 86	3H044	11/07/98	0.3	128	5	VOL	TSH	-0.74		NQH	P610MRPC3C	TSHTSH	MRPCTSH
21 8	3H021	11/07/98	0.3	90	4	VOL	TSH	0.62			P610MRPC3C	TSHTSH	MRPCTSH
21 8	3H021	11/05/98	0.4	102	4	VOL	TSH	0.62		NQH	P610MRPC3C	TSHTSH	MRPCTSH
Subtotal VOL Indications:	6												

Appendix D
Tube Support Diagram

The model D4 SG's were built by Westinghouse and the plant started operations in 1987. There are 3 SG's each having 4578 tubes. The tubes are mill annealed Inconel 600 with dimensions of 0.75" OD x 0.043" wall thickness. Supports include carbon steel drilled supports; eight on the hot leg side and eleven on the cold leg side and anti-vibration bars in the u-bend section.



Appendix D
Data Legend and Indication Codes

Row:	Indicates the row number of a given tube
Col:	Indicates the column number of a given tube
Complete Date:	Indicates the date the exam was completed
Vlts:	Indicates the voltage response of a given indication[2]
Deg:	The measured phase angle of a given indication
CH:	Indicates the channel used to measure and evaluate a given indication
Ind. Desc.:	The measured percent through-wall of a given indication based on the measured phase angle/amplitude and the associated calibration curve established for the particular channel, or analysis indication code, e.g. LPS = Loose Part Signal, etc.
Indication Location:	Indicates the indication location relative to known landmarks such as the top of the tube sheet, horizontal supports and anti-vibration bars (AVB's).
Util 1:	A field used for classifying various indications
Util 2:	A field used for classifying various indications
Probe:	Indicates the probe type and diameter.
Extent Tested:	Indicates the tube length or section examined
Dataset:	Grouping title used by the ISIS database system. May include subset information such as EXP1, EXP2 for subset expansion group.

Indication Codes

Bobbin Codes

ADI	Absolute Drift Indication
ADR	Absolute Drift -- A 130 KHz absolute baseline drift in the positive vertical plane.
ADS	Absolute Drift Signal
APT	Absolute Positive Trace -- An abrupt indication evidenced only on absolute channels.
BLG	Bulge
CUD	Copper
DDS	Distorted Dent Signal
DEI	Distorted Expansion Indication
DEP	Deposit
DES	Distorted Expansion Signal
DFS	Differential Freespan Signal
DNT	Dent -- CDS Record at $\geq$2 volts on P1 ; Except U-Bend area at $\geq$ 5 volts
DRH	Distorted Roll History -- Baseline data indicates same or similar type signal response.
DRI	Distorted Roll Indication -- Indicates a distorted roll transition signal at the top of the tubesheet.
DSH	Distorted Support History -- Baseline data indicates same or similar type signal response.
DSI	Distorted Support Indication -- Indicates a distorted support signal

2 Voltage is relative as a measurement of indication size based on an established standard.

DSS	Distorted Support Signal
DTH	Distorted Tubesheet History -- Baseline data indicates same or similar type signal response.
DTI	Distorted Tubesheet Indication
DTS	Distorted Tubesheet Signal
EXP	EXPanded tube -- This indicates the location of an expansion at the second or third cold leg support in the baffle region.
IDC	Inside Diameter Chatter
IDV	Inside Diameter Variation
INF	Indication not found -- Previously reported indication is not found during the current analysis.
INR	Indication not Reportable -- INR will be used by production analysts to indicate a previous indication is not recordable according to the present guideline parameters. Secondly, by resolution analysts when both Primary and Secondary Resolution analysts agree the indication is dispositioned not to be a flaw. Refer to section 7.2.9 and 10.1.3 for further details.
LAR	Lead Analyst Review -- This notation is used by the Analyst when an indication is found which is not specifically addressed in the procedure. The Lead Analyst/or Senior Analyst is required to review data from all indications designated LAR by the Analyst.
LOS	Lift Off Signal
LPI	Loose Part Indication -- A signal from a loose part which indicates a possible degraded area.
LPS	Loose Part Signal
MBH	Manufacturing Buff History -- Baseline data indicates same or similar type signal response.
MBM	Manufacturing Burmish Mark
NDD	No Detectable Degradation (blank)
NQH	Non-quantifiable History -- Baseline data indicates same or similar type signal response.
NQI	Non-quantifiable Indication -- This notation is used to record an indication which may be indicative of a flaw but does not show good frequency correlation or is distorted. This flag will indicate to the lead analyst that history should be reviewed for this tube, or further evaluation may be required, possibly with alternative examination techniques.
NQS	Non Quantifiable Signal
NRE	No Roll Expansion
NSY	Noisy Tube
NTE	No Tubesheet Expansion
OBS	OBStructed -- Used only as a final call when the smallest allowable probe diameter will not pass the location.
OXP	Over Expansion
PID	Positive Identification -- Used to verify a pluggable location.
PLG	Plugged
PLI	Plate Ligament Indication
PLP	Possible Loose Part -- Foreign object on secondary side
PLS	Plate Ligament Signal -- Support ligament crack or other distortion - requires further investigation
PTE	Partial Tube Expansion
PVN	Permeability Variation -- Reported at >3 volts when using a magnetic bias probe.
RBD	Retest Bad Data
RES	Retest Restricted Tube
RFX	Retest Fixture
RIC	Retest Incomplete
RID	Retest Identification
RND	Retest No Data
RWS	Re-run with Wear Std. Z-9130
SLG	Sludge
VOL	Volumetric
WAR	Wear Indication

RC Codes

SAI	Single Axial Indication
MAI	Multiple Axial Indication -- More than one indication in the same axial plane.
SCI	Single Circumferential Indication
SVI	Single Volumetric Indication
MCI	Multiple Circumferential Indication -- More than one indication in the same circumferential plane.
MMI	Mixed Mode Indication -- More than one indication in the axial and circumferential detection plane.
POS	Possible Indication -- Used to flag an indication for Lead Analyst review.
PIT	Acronym to describe a volumetric indication indicating a pit-type flaw.
VOL	Volumetric Indication -- This code may be used for certain indications such as MBM (Manufacturing Buff/Burnish Mark). Disposition of these indications will be based on historic review, flaw location, etc.

When both Primary and Secondary resolution analysts agree that an indication is dispositioned as a "non-flaw", a selection of an appropriate reason from the following lists has been made. The two digit number associated with the reason was entered in the Utility 1 field. This will allow future examinations to know this signal was reviewed and dispositioned. The code of INR along with volts, degrees and location information was entered as applicable.

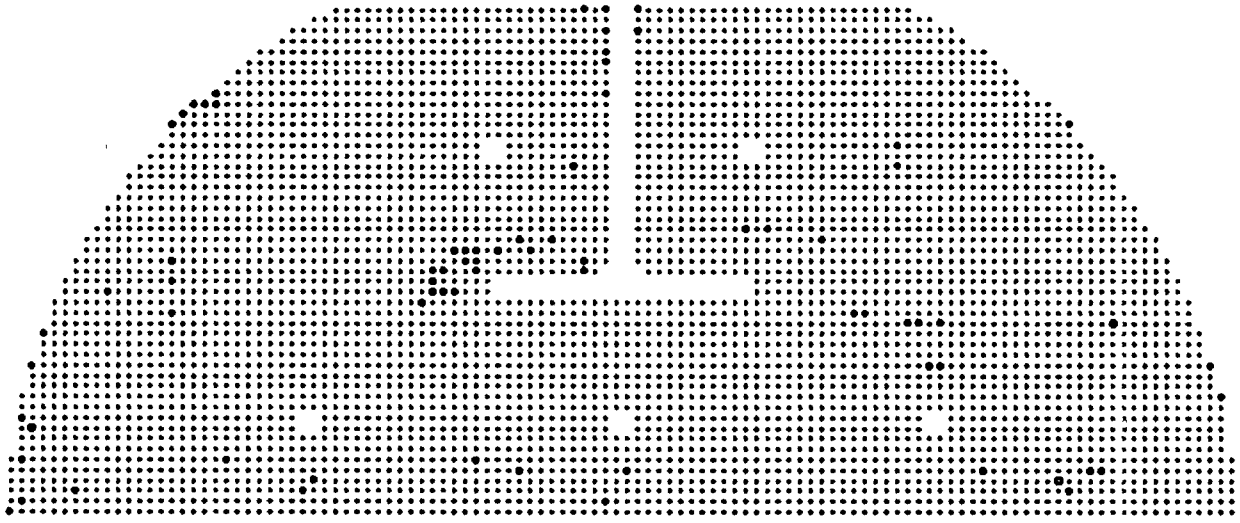
Bobbin code	Reason
01	Signal represents a deposit (copper, magnetite)
02	Signal is < recording criteria (< 0%)
03	Signal is permeability (no flaw components)
04	Mix Residual
05	Tube Noise
06	Doesn't adhere to procedure

RC Code	Reason
21	Deposit - No Flaw Component
22	Geometry - Top of Tubesheet
23	Mix Residual
24	Non Relevant Response - Non-flaw like in nature

Utility 2 fields are used to document classification of certain indications. If an indication is present in history, an indication code with a "H" is entered in this field. For example, if a Manufacturing Buff Mark is examined with a rotating coil, it may receive a VOL indication code (volumetric indication). If upon review of the indication history the signal is present, the code "MBH" or Manufacturing Buff mark History is entered in Utility 2. Utility 2 field was also used for CP&L concurrence of indications which were preventively repaired, such as certain Loose Part Signals (LPS). In this case CPL was inserted in the Utility 2 field.

Datasets are grouping names used by the ISIS database system. These listings indicate which test plan contains the examination data. For example, the BOBBIN dataset indicates the tube was recorded under the bobbin probe test plan. A special interest exam, or 'diagnostic' exam may be listed as SI/HL for exam test plans on the hot leg. LPS_EXP1 would indicate the tube indications are reported under an expansion test plan for loose part indications.

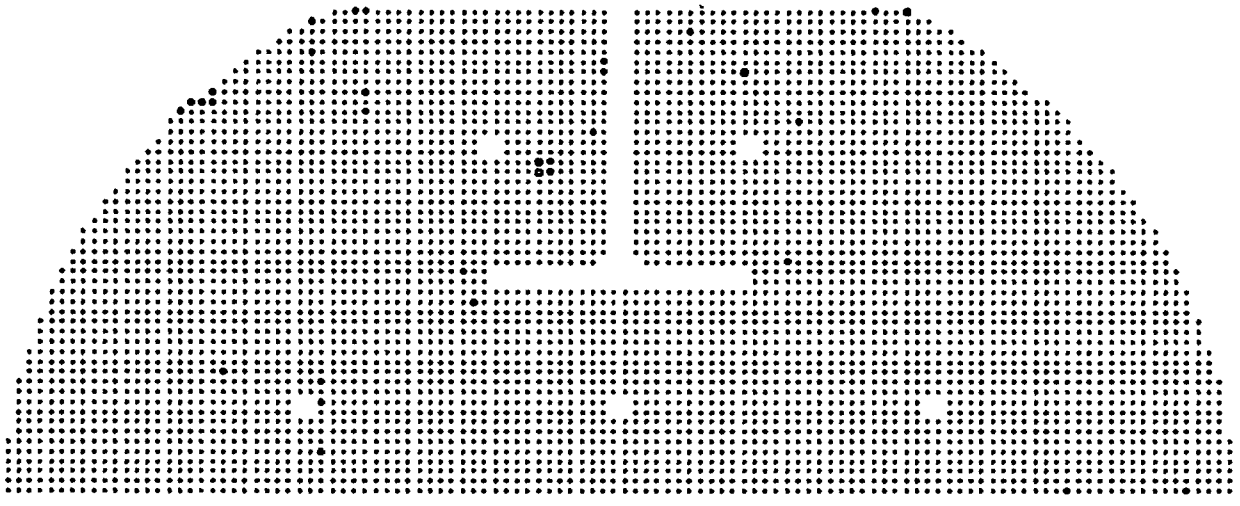
Appendix E
Tube Plug Map and Plug History



SG "A" Plugs:

35 Black = Previous Plugs

39 Red = RFO8 Plugs

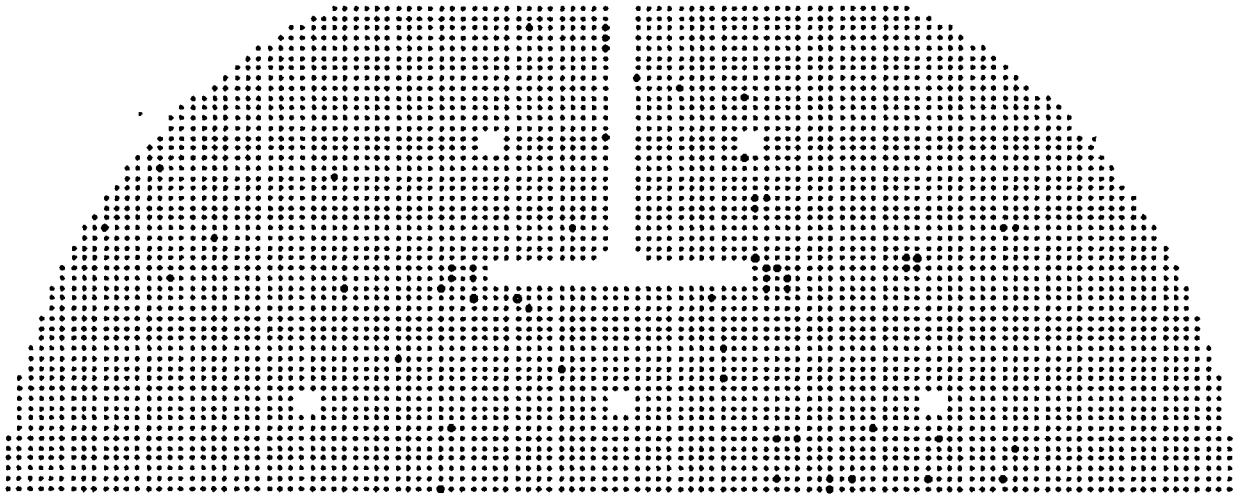


SG "B" Plugs

17 Black = Previous Plugs

15 Red = RFO8 Plugs

Appendix E
Tube Plug Map and Plug History



SG C Plugs

40 Black = Previous Plugs

18 Red = RFO8 Plugs

Harris Nuclear Plant SG Plugging Summary

Tube Plugging By Inspection

Number of tubes affected (degradation mechanism)

Inspection		A		B		C	Σ
PSI	3	3 (Mfg def)	2	2 (Mfg def)	6	2 (Mfg def), 4 (parts)	11
RFO1	6	3 (AVB), 1(HLTSP), 2(G)	2	2 (AVB)	2	2 (AVB)	10
RFO2	1	1 (AVB)			2	1 (HL TSP), 1 (CL TSP)	3
FO	2	2 (parts)					2
RFO3	3	3 (F*)			1	1 (AVB)	4
RFO4					2	2 (tubepull)	2
RFO5			3	2 (freespo), 1 (F*)			3
RFO6	3	1(SCI), 1(F*), 1(SAI)	2	1(F*), 1(SAI)	6	1(SCI), 2(AVB),3(SAI)	11
RFO7	17	8(*CI),2(SAI),4(PLI),2(OBS),1(PIT)	8	2(SCI),3(MAI),2(OBS),1(PLI)	21	10(*CI),6(SAI),1(VOL),2(PLI),2(AVB)	46
RFO8	39	29(*CI),1(*AI),2(SVI),1(AVB),6(LP*)	15	3(*CI),1(*AI),11(LP*)	18	12(*CI),5(*AI),1(SVI),1(AVB)	72
Total	74		32		58		164

Tubes Plugged by RFO

Insp	EFPY	Tube Plugging By SG					Total % Plugged			
		A	B	C	Σ	Cum	A	B	C	Cum
PSI	0	3	2	6	11	11	0.07%	0.04%	0.13%	0.08%
RFO1	1.10	6	2	2	10	21	0.20%	0.09%	0.17%	0.15%
RFO2	2.00	1	0	2	3	24	0.22%	0.09%	0.22%	0.17%
FO	2.77	2			2	26	0.26%	0.09%	0.22%	0.19%
RFO3	3.05	3	0	1	4	30	0.33%	0.09%	0.24%	0.22%
RFO4	4.27	0	0	2	2	32	0.33%	0.09%	0.28%	0.23%
RFO5	5.54	0	3	0	3	35	0.33%	0.15%	0.28%	0.25%
RFO6	6.78	3	2	6	11	46	0.39%	0.20%	0.42%	0.33%
RFO7	8.12	17	8	21	46	92	0.76%	0.37%	0.87%	0.67%
RFO8	9.45	39	15	18	72	164	1.62%	0.70%	1.27%	1.19%
						Current percent tubes plugged				1.19%

Tube Plugging By Degradation Mechanism

Number of indications plugged (each cycle).

Cause		A		B		C	Σ
AVB Wear	5	3(1), 1(2), 1(8)	2	2(1)	8	2(1), 1(3), 2(6), 2(7), 1(8)	15
Mfg. Def	3	3(PSI)	2	2(PSI)	2	2(PSI)	7
Loose Parts	12	2(FO),4(7), 6(8)	12	1(7), 11(8)	6	4(PSI), 2(7)	30
F* PWSCC	5	3(3), 1(6), 1(7)	4	1(5), 1(6), 2(7)	1	1(8)	10
TS PWSCC	3	1(6), 1(7), 1(8)	3	1(6), 1(7), 1(8)	14	3(6), 6(7), 5(8)	20
HL TTS OD Circ	38	1(6), 8(7), 29	5	2(7), 3(8)	23	1(6), 10(7), 12(8)	66
HL TSP	1	1(1)			1	1(2)	2
Freespan	2	2(8)	2	2(5)	1	1(8)	5
Geometry	5	2(1), 2(7), 1(8)	2	2(7)	1	1(7)	8
Other					2	2(4–tubepull)	2
CL TSP	1	1(7)			1	1(2)	2
Total Inds.	75		32		60		167

13723 Number of tubes available from start of service
4578 Number of tubes–design each SG
13734 Total number of tubes–design
13570 Current tubes in service

*Note: Some tubes have multiple repairable indications.

Mfg. Def	Defect found and plugged during SG Manufacture
PSI	Preservice Inspection
TS PWSCC	Primary Water Stress Corrosion Cracking above the F* region
F*	The region from the top of tubesheet or top of last hardroll below which defects can be left in service
HL TTS OD Circ	Outside diameter circumferential cracking at top of hotleg tubesheet
HL TSP	Indications found at the hot leg tube support plates
CL TSP	Indications found at the cold leg tube support plates
Freespan	Indications found in the freespan (between TSP's)
*CI	Single (SCI) or Multiple (MCI) circumferential indication (same as HL TTS OD Circ)
*AI	Single (SAI) or Multiple (MAI) axial indication (normally the same as TS PWSCC)
AVB	Anti-vibration bar wear (in the UBend region)

Note "Geometry" indications are for restricted tubes, over/under rolls etc.