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March 16, 2005

PG&E Letter DCL-05-024

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Docket No. 50-323, OL-DPR-82
Diablo Canyon Unit 2
Special Report 05-01 - Results of Steam Generator (SG) Tube Inspections for Diablo Canyon Power Plant Unit 2 Twelfth Refueling Outage

Dear Commissioners and Staff:

In accordance with Technical Specifications (TS) 5.6.10.e and TS 5.6.10.f, Enclosure 1 provides the 90-day reporting of results of Unit 2 SG W* alternate repair criteria (ARC) tubesheet inspections and calculated steam line break leakage from application of all ARC.

In accordance with TS 5.6.10.h, Enclosure 2 provides the 120-day reporting of results of Unit 2 SG primary water stress corrosion cracking ARC inspections at dented tube support plate (TSP) intersections.

In accordance with TS 5.6.10.i and PG&E's commitment to Generic Letter 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking (ODSCC)," Enclosure 3 provides the 90-day reporting of results of Unit 2 SG voltage-based ARC inspections for TSP ODSCC, prepared by Framatone-ANP for PG&E.

If you have any questions, please contact John Arhar at (805) 545-4629.

Sincerely,

Donna Jacobs

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cc: David L. Proulx
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A001

SPECIAL REPORT 05-01

W* ALTERNATE REPAIR CRITERIA 90-DAY REPORT

DIABLO CANYON POWER PLANT UNIT 2 TWELFTH REFUELING OUTAGE

NRC Reporting Requirements

Diablo Canyon Power Plant (DCPP) Technical Specification (TS) 5.6.10.e requires that the results of the inspection of Wstar (W*) tubes be reported to the Commission pursuant to 10 CFR 50.4 within 90 days following return to service of the steam generators (SG). The report shall include:

1. Identification of W* tubes. Per TS 5.5.9.d.1.k, a W* tube is a tube left in service with degradation within or below the W* length.

2. W* inspection distance measured with respect to the Bottom of the WEXTEX Transition (BWT) or the top of tubesheet, whichever is lower.

3. Elevation and length of axial indications within the flexible W* distance and the angle of inclination of clearly skewed axial cracks (if applicable).

4. The total steam line break leakage for the limiting SG per WCAP-14797, Revision 1, ("Generic W* Tube Plugging Criteria for 51 Series Steam Generator Tubesheet Region WEXTEX Expansions").

DCPP TS 5.6.10.f requires that the aggregate calculated steam line break (SLB) leakage from application of all alternate repair criteria (ARC) be reported to the Commission pursuant to 10 CFR 50.4 within 90 days following return to service of the SGs.

W* Inspections and Results

This report implements the DCPP TS reporting criteria. W* ARC was implemented for the fourth time in DCPP Unit 2 during the Unit 2 twelfth refueling outage (2R12). SG inspections and repairs were completed in November 2004.

One hundred percent of the SG tubes were inspected by bobbin from tube end to tube end. One hundred percent of the hot leg top of tubesheet (TTS) WEXTEX region was inspected by Plus Point in each SG. Cold leg TTS Plus Point inspections were not required.

Table 1 provides a comprehensive list of axial primary water stress corrosion cracking (PWSCC) indications detected in the hot leg WEXTEX region during 2R12 Plus Point

inspections. Not included in Table 1 are tubes with PWSCC in the plug expansion zone (PEZ). The following TS-required reporting information is extracted from Table 1:

1. *Identification of W* tubes.* Sixty-nine single axial PWSCC indications in 63 hot leg tubes were detected during the 100 percent hot leg top of tubesheet Plus Point inspection. Table 1 column labeled "W* Cand" identifies 62 tubes, containing a total of 68 single axial PWSCC indications (SAI), that are categorized as W* tubes because they satisfied W* ARC requirements. A total of 61 tubes, with 67 axial PWSCC indications were returned to service under W* ARC. There were no tubes with circumferential indications detected at the top of tubesheet or in the WEXTEX region.

   Two tubes with axial PWSCC indications in the WEXTEX region were plugged, as described below.

   - One W* tube (SG 21 R3C59) was plugged because of in situ testing performed up to 3 times normal operating differential pressure (3NOdP). This was a repeat axial PWSCC indication with a large Plus Point voltage (7.13 volts) in close proximity to the top of tubesheet (upper crack tip located 0.73 inch below the TTS). The indication could have been left in service under W*, but was required to be plugged after 3NOdP in situ testing, even though no leakage was detected as discussed later. The tube had been deplugged in a prior outage and returned to service under W* ARC. The tube also had PWSCC in the plug expansion zone, which is discussed later.

   - One new axial PWSCC indication (non-W* tube SG 23 R31C51) was plugged due to failure to meet W* ARC requirements, in that the upper crack tip (UCT) extended above BWT after accounting for nondestructive examination (NDE) uncertainty. The UCT was 0.57 inch below the TTS. The BWT was measured as 0.42 inch below the TTS. After addition of NDE uncertainty in locating the UCT relative to BWT as required by the W* methodology, the UCT is located just slightly above the BWT (by 0.13 inch), requiring the tube to be plugged. The maximum depth of the indication was 31 percent through-wall as measured by Plus Point. The indication was detectable in 2R11 based on a lookup review, and exhibited a slightly negative crack length growth rate.

   PWSCC in Plug Expansion Zone (PEZ) in Deplugged Tubes.

   Table 4 identifies 93 W* tubes for which 2R12 Plus Point inspections detected PWSCC in the PEZ. The tubes were deplugged in an earlier outage and returned to service under various ARC. Of these, 37 tubes are also listed in Table 1 because they have axial PWSCC in the WEXTEX region. This degradation mechanism was discovered in 1R12 (reference INPO operating experience OE 18236), and is only susceptible in tubes that were deplugged and returned to service. PEZ PWSCC occurs in the shop hard roll region, which is located about 2.75 inches above the

tube end. The mechanical plugs (either rib plugs or roll plugs) are expanded into the tube within the shop hard roll region, and this region is termed as the PEZ. The cause of the PEZ PWSCC is likely due to the sensitization of the tube material from the tungsten inert gas (TIG) plug removal process, because the cracking is limited to the location of the expanded location of the plugs and is limited to tubes that have been deplugged using the TIG process. When the plug is removed and the tube returned to service with high reactor coolant system (RCS) temperature (about 604°F), PWSCC developed in as little as 1 cycle.

Because of W* ARC, PEZ PWSCC does not require the tube to be plugged and no accident-induced SLB is postulated. The indications are located within the original shop hard roll, such that leakage is precluded during all plant conditions.

PWSCC was not active at the time of deplugging based on proactive Plus Point inspection of full-length hot leg tubesheets of deplugged tubes in 2R9, which showed no detectable degradation (NDD).

All of the susceptible PEZ locations in all Unit 2 SGs were Plus Point inspected in 2R12 to gain knowledge of this damage mechanism and to assist in cause determination. The Plus Point inspection extent was specified as tube end hot to 4 inches above tube end hot. Inspection of this region is not required based on W* ARC requirements, because PEZ locations are well below the W* lengths. Degradation detected in the PEZ locations is acceptable to remain in service under W* ARC. Table 3 provides a matrix of the 115 potentially susceptible tubes (SG, type of plug removed, and outage removed) and shows that 93 were confirmed to have PWSCC based on 2R12 inspections. All of the 96 2R9 plugs were removed using the Framatome-ANP TIG relaxation process, and only 3 of these PEZ locations were NDD based on 2R12 inspections. All 19 of the 2R3 plugs were removed using the Westinghouse drilling process, and all of these PEZ locations were NDD based on 2R12 inspections.

For each tube with PEZ PWSCC, Table 4 provides the type of plug that was removed (Westinghouse rib plug or Framatome-ANP roll plug), the outage in which deplugging occurred (either 2R9 or 2R3), the number of PWSCC indications detected, maximum voltage, crack lower and upper extents, and location of the bottom of the shop roll transition (BRT) with respect to the tube end. Multiple axial indications were identified at 92 PEZ locations. All the indications were located in the plug expansion zones, within the shop hard roll region, as the cracks extents were located below the BRT.

As mentioned earlier, one tube with PEZ PWSCC was plugged (SG 21 R3C59), and a Framatome long rolled plug was used in both the hot and cold legs. Therefore, a total of 92 tubes with PEZ PWSCC were returned to service, 36 of which also have axial PWSCC in the WEXTEX region.

2. *W* inspection distance measured with respect to BWT or TTS, whichever is lower.* For the 100 percent Plus Point hot leg TTS exam, the inspection extent relative to the TTS was specified as +2/-8.5 inches. Assuming no degradation in the W* length, 8.5 inches below the TTS constitutes the W* inspection distance. This distance bounds W* lengths for hot leg Zone A and Zone B (5.2 inch and 7.0 inch, respectively, relative to BWT) and cold leg Zone A and Zone B (5.5 inch and 7.5 inch, respectively, relative to BWT), and includes margin for a nominal distance from BWT to TTS plus NDE uncertainty in measuring W* length. If degradation is detected in the W* region, the inspection extent must bound the calculated flexible W* length. The "W* Insp Ext wrt BWT" column in Table 1 lists the W* inspection distances measured with respect to BWT for tubes in which axial PWSCC was detected (in all cases, BWT was lower than the TTS). The W* inspection distance must be greater than or equal to the W* flexible length.

3. *Elevation and length of axial indications within the flexible W* distance.* See "LCT", "UCT" and "Crack Length" columns in Table 1 for elevation of the UCT, elevation of the lower crack tip (LCT), and crack length of the axial indications. The elevations of the UCT and LCT are relative to the TTS.

   Angle of inclination of clearly skewed axial cracks (if applicable). SG 23 R21C38 repeat axial PWSCC indication in the W* length was identified to be inclined based on a review of the Plus Point data. Per W* ARC requirements, the inclination angle was measured as 37 degrees based on 0.080 inch pancake coil. The NDE uncertainty on measurement of the crack angle is 6.8 degrees for 0.080 inch pancake coil. Therefore, the total inclination angle is 43.8 degrees, less than the 45-degree plugging limit defined for W* ARC inclined indications. In addition, the total length of the indication was 0.49 inch, and after applying a growth rate of 0.119 inch/effective full power year (EFPY) over the next cycle (1.33 EFPY), the projected end of cycle (EOC) 13 crack length is 0.65 inch. This projected crack length is less than the 2.0 inches plugging limit defined for W* ARC inclined indications. Therefore, based on the shallow inclination angle and projected short length, the indication was left in service under W* ARC.

4. *The total steam line break leakage for the limiting SG per WCAP-14797.* SLB leakage attributed to each W* indication at EOC 12 (condition monitoring (CM)) and projected EOC 13 (operational assessment (OA)) are listed in "CM Leak Rate" and "OA Leak Rate" columns in Table 1. The W* leakage model conservatively assumes all W* indications are through-wall cracks. The total SLB leakage for each SG is provided in Table 5 (CM) and Table 6 (OA), and reflects the sum of the individual leak rates listed in Table 1. Note that SG 2-1 R3C59, SG 2-4 R13C40, SG 2-4 R16C10, and SG 24 R24C26 (two indications) were in situ leak tested and no leakage was detected. The CM leak rates for these five indications are listed in Table 1 for information only and are based on the leakage model in WCAP-14797, Revision 1. However, when calculating the total SG 2-4 leak rate in Table 5, no CM

leakage was assigned to these five indications based on the results of the in situ leak tests.

Table 5 and Table 6 report the following SLB leak rates for condition monitoring and operational assessment, pursuant to TS 5.6.10.e.4 and TS 5.6.10.f. For W* ARC, the SLB differential pressure is conservatively assumed to be 2560 psi. For PWSCC ARC and voltage-based ARC, the SLB differential pressure is assumed to be 2405 psi.

1. Total W* ARC SLB leakage for each SG at EOC 12 (condition monitoring). The maximum leak rate is 0.571 gpm (at room temperature) in SG 2-3.

2. Total W* ARC SLB leakage for each SG at EOC 13 (operational assessment). The maximum leak rate is 0.604 gpm (at room temperature) in SG 2-3.

3. The aggregate calculated EOC 12 (condition monitoring) SLB leakage from application of voltage-based ARC, PWSCC ARC, W* ARC, and non-ARC degradation. The maximum leak rate is 0.815 gpm (at room temperature) in SG 2-4.

4. The aggregate calculated EOC 13 (operational assessment) SLB leakage from application of voltage-based ARC, PWSCC ARC, W* ARC, and non-ARC degradation. The maximum leak rate is 3.874 gpm (at room temperature) in SG 2-4.

Table 7 reports the projected EOC 12 leak rates from the prior cycle operational assessment for comparison with the as-found leak rates listed in Table 5. The prior cycle projected leak rates are higher than the as-found CM leak rates in all SGs, reflecting the conservatism of the ARC methodology.

Axial PWSCC Growth Rates

Of the 69 axial PWSCC indications in the hot leg WEXTEX region that were detected in 2R12 (Table 1), 4 were new indications and 65 were repeat W* indications that had been left in service in the prior inspection. The 4 new indications were detectable in the 2R11 lookup review. As a result, 69 additional growth rate data points were available for evaluation, and their average growth rate was 0.011 inch per EFPY at Thot of 604°F.

After addition of the 69 Cycle 12 data points, the updated W* growth rate distribution now consists of 256 data points from DCPP Units 1 and 2, with a 95 percent cumulative probability of 0.118 inch per EFPY at 604°F. The W* methodology requires that, if the new growth data and deletion of the oldest cycle of growth data results in a minimum of 200 data points, then the oldest cycle of data may be excluded. There are 205 data points from Unit 2 cycles 10, 11, and 12. Therefore, the following data is excluded: Unit 2 cycles 8 and 9, and Unit 1 cycles 8, 9, 10, 11, and 12. The 95 percent cumulative probability of the 205 data points is 0.119 inch per EFPY at 604°F, and this value is used for the OA growth rate.

The actual length of Unit 2 Cycle 12 was 1.52 EFPY. The projected length of Unit 2 Cycle 13 is 1.33 EFPY.

In Situ Leak Testing

In Situ Test Screening Methodology

In support of W* leak rate model validation, PG&E Letter DCL-01-095 dated September 13, 2001, defined a four-step sequential screening process for determining the need for in situ leak testing of axial PWSCC indications in the WEXTEX region. The screening criteria are described below. PG&E's assessment of the 69 axial PWSCC indications detected in 2R12 with respect to the screening criteria is tabulated in Table 2, and is also summarized below.

- Step 1: Prior leak tested W* indications with maximum Plus Point voltages greater than or equal to 1.25 times the prior leak test voltage are carried to Step 2. W* indications with no prior leak test are also carried to step 2.

  PG&E evaluation: Five W* indications had been leak tested in prior outages and for two of these indications (SG 2-1 R3C59 crack 1 and SG 24 R3C5 crack 1), the Plus Point voltage increased by more than the 25 percent threshold, so these two indications were carried to step 2. The 64 indications with no prior in situ test were also carried to step 2. Therefore, a total of 66 indications were carried to step 2.

- Step 2: Indications with maximum Plus Point voltages exceeding the critical voltage (V_{crit}) are leak tested independent of other parameters. V_{crit} equals 4.0 volts for nondeplugged indications and 6.0 volts for deplugged indications. Indications with maximum Plus Point voltages less than V_{crit} are carried to Step 3.

  PG&E evaluation: Of the 66 indications, 38 were carried to step 2 and had been deplugged in a prior outage, and 28 had not been deplugged. One of the deplugged indications exceeded 6.0 volts Plus Point (SG 2-1 R3C59 7.13 volts), and none of the nondeplugged indications exceeded 4.0 volts Plus Point. As such, one of the indications required in situ testing due to exceeding V_{crit}. Therefore, the remaining 65 indications were carried to step 3.

- Step 3: Indications with maximum Plus Point voltages exceeding V_{thr} are carried to the Step 4 depth evaluation. A minimum of the five largest voltage indications are carried to the depth evaluation if less than five indications exceed the voltage threshold. V_{thr} equals 2.5 volts for nondeplugged indications and 4.0 volts for deplugged indications.

  PG&E evaluation: Of the 28 nondeplugged axial PWSCC indications carried to step 3, two maximum Plus Point voltages exceeded the 2.5 volt V_{thr} threshold value

(SG 2-1 R11C48 2.78 volts and SG 2-1 R30C59 3.2 volts). Of the 37 deplugged axial PWSCC indications carried to step 3, none exceeded the 4.0-volt V_{thr} threshold value. Therefore, 2 indications were carried to the step 4 depth evaluation. Because there were less than 5 indications carried to the depth evaluation, the remaining 63 indications were ranked from highest to lowest Plus Point voltage. The 5 highest voltages were carried to step 4, all in SG 2-4: R7C38 crack 2 at 2.17 volts, R13C40 at 2.57 volts, R16C10 at 2.76 volts, R20C47 at 2.44 volts, and R24C26 crack 1 at 2.35 volts. Therefore, a total of 7 indications were carried to step 4.

- Step 4 (depth evaluation): Indications with maximum depths exceeding the maximum depth leakage threshold (MD_{L-thr}) over lengths greater than the deep crack length threshold (L_{L-min}) are leak tested. MD_{L-thr} equals 80 percent and L_{L-min} equals 0.1 inch.

  PG&E evaluation: All axial PWSCC indications in the WEXTEX region were depth profiled using the same techniques as axial PWSCC at dented tube support plate (TSP) intersections. For each indication, the flaw length exceeding 80 percent maximum depth is listed in Table 2. Of the 7 indications carried to the step 4 depth evaluation, 2 exceeded 80 percent maximum depth over 0.1 inch (SG 2-4 R13C40 and SG 2-4 R24C26 crack 1). Therefore, these 2 indications required in situ testing. SG 2-1 R3C59 also exceeded 80 percent maximum depth over 0.1 inch, and was required to be in situ tested per step 1 criteria. Five additional indications exceeded 80 percent maximum depth over 0.1 inch, but were excluded from in situ leak testing based on elimination in earlier steps.

2R12 In Situ Testing of W Indications*

As discussed above, three indications that exceeded the in situ test screening criteria were in situ leak tested: SG 2-4 R13C40, SG 2-4 R24C26 crack 1, and SG 2-1 R3C59. SG 2-4 R16C10 (deplugged tube) was also in situ leak tested at PG&E's discretion because the Plus Point voltage (2.76 volts) was the highest ranked voltage in the Step 3 evaluation. SG 2-4 R24C26 crack 2 was also leak tested because it was in the same tube as SG 2-4 R24C26 crack 1.

The 5 indications in 4 tubes were in situ tested (full tube length test) up to NOdP conditions, and no leakage was detected. Except for SG 2-1 R3C59, the tests were terminated and the tubes were returned to service. For SG 2-1 R3C59, PG&E decided to continue the test to the differential pressure at SLB (dPSLB), then to 3NOdP, and then the tube was plugged. R3C59 had the largest Plus Point voltage identified to date in an axial PWSCC indication returned to service under W*, and its upper crack tip was located near the BWT. No leakage was observed at any of these higher test pressures, thus validating several assumptions: the tight WEXTEX tubesheet constraint effectively limits leakage from through-wall indications even when the indications are located in the

general proximity of the BWT, and no leakage at SLB conditions would be expected if no in situ test leakage was observed at normal operating conditions.

Post in situ testing Plus Point inspections were conducted on the 4 indications returned to service (SG 2-4 R13C40, R16C10, and R24C26 cracks 1 and 2). Post in situ testing Plus Point inspections on SG 2-1 R3C59 was not required and not conducted. The post in situ eddy current results for the 4 indications are provided in Table 1a, and show that the indications continued to meet W* ARC requirements for return to service. The operational assessment leak rates for these 4 indications are based on the post in situ eddy current results.

Based on the in situ test results, the total SG condition monitoring SLB leakage assessment in Table 5 assumes no leakage from the 5 indications. The CM leak rates assigned from the W* leak method for these 5 indications are provided in Table 1 for information. The Table 6 total SG OA leakage assessment conservatively assumes that the 4 indications returned to service will contribute to SLB leakage at EOC 13 based on the W* leak method.

Tube Integrity Performance Monitoring

Condition Monitoring Performance Criteria to Limit Free Span Cracking: The UCT of W* indications returned to service under W* ARC in the prior inspection (2R11) shall remain below the TTS at EOC 12 by at least the NDE uncertainty on locating the crack tip relative to the TTS. The "UCT to TTS" column in Table 1 provides the EOC 12 elevation of the upper crack tip relative to the top of tubesheet, accounting for NDE uncertainty in locating the crack relative to the top of tubesheet. In all cases, the EOC 12 crack tip for indications returned to service in 2R11 is below the top of tubesheet, as indicated by "Yes" in the column "UCT below TTS?" Therefore, the performance criterion was satisfied for condition monitoring at EOC 12.

Accident-Induced Leakage Performance Criteria: W* leak rates under postulated SLB conditions, when combined with SLB leak rates from application of GL 95-05 voltage-based ARC and PWSCC ARC, and SLB leak rates from non-ARC degradation mechanisms, shall not exceed 10.5 gpm (at room temperature) in the faulted SG for condition monitoring and operational assessment. The 10.5 gpm limit was approved by the NRC as License Amendment (LA) 156/156. The aggregate calculated SLB leakage at EOC 12 is 0.815 gpm for the limiting SG. The aggregate calculated SLB leakage at EOC 13 is 3.874 gpm for the limiting SG. In both assessments, SLB leakage is less than the allowable limit. Therefore, the performance criterion has been satisfied for condition monitoring at EOC 12 and operational assessment at EOC 13.

Table 1
2R12 Axial PWSCC Indications in Hot Leg WEXTEX Tubesheet Region (Excluding PWSCC at Tube End)

SG	Row	Col	Volt	Crack No	Cal	LCT	UCT	Crack Length	Total Length	MD adj	UCT to TTS	UCT below TTS	W* Zone	W* Length	BWT	Dist UCT to BWT	UCT Below W*	UCT Below BWT	EOC (N+1) UCT	EOC (N+1) UCT Below TTS	W* Cand	Inspect Extent	W* Insp Ext wrt BWT	Flex W* Length	Insp Ext Satisfied	CM Leak Rate	2R11 OA Pred Leak Rate	Dist EOC (N+1) UCT to BWT	OA Leak Rate	Prev W*Ind	Tube Plug
21	3	59	7.13	1	17	-1.59	-0.73	0.86	0.86	100	-0.51	Yes	B1	7.12	-0.42	0.03	No	Yes	-0.35	Yes	Yes	-11.39	10.88	6.00	Yes	0.044	0.045	-0.13	0.000	Yes	Yes
	6	77	0.59	1	17	-1.48	-1.35	0.13	0.13	69	-1.13	Yes	B4	7.12	-0.40	0.67	No	Yes	-0.97	Yes	Yes	-10.32	9.83	7.27	Yes	0.023	0.031	0.51	0.027	Yes	
	7	24	0.25	1	17	-2.06	-1.95	0.11	0.11	34	-1.73	Yes	B3	7.12	-0.37	1.30	No	Yes	-1.57	Yes	Yes	-11.95	11.49	7.25	Yes	0.014	0.017	1.14	0.016	Yes	
	7	62	4.37	1	17	-2.4	-1.48	0.92	0.92	99	-1.26	Yes	B2	7.12	-1.19	0.01	No	Yes	-1.10	Yes	Yes	-21.40	20.12	8.06	Yes	0.045	0.045	-0.15	0.045	Yes	
	8	32	0.56	1	17	-2.08	-1.96	0.12	0.12	63	-1.74	Yes	B2	7.12	-0.39	1.29	No	Yes	-1.58	Yes	Yes	-9.59	9.11	7.26	Yes	0.015	0.017	1.13	0.017	Yes	
	9	49	0.9	1	17	-2.31	-2.04	0.27	0.27	56	-1.82	Yes	B1	7.12	-0.36	1.40	No	Yes	-1.66	Yes	Yes	-10.30	9.85	7.41	Yes	0.014	0.017	1.24	0.016	Yes	
	10	49	0.21	1	17	-1.25	-1.11	0.14	0.14	37	-0.89	Yes	B1	7.12	-0.3	0.53	No	Yes	-0.73	Yes	Yes	-10.14	9.75	7.28	Yes	0.027	0.044	0.37	0.031	Yes	
	11	37	0.44	1	17	-7.84	-7.72	0.12		29	-7.50	Yes	B2	7.12	-0.41	7.03	No	Yes	-7.34	Yes	Yes	-10.93	10.43		Yes	0.001	0.001	6.87	0.001	Yes	
	11	37	0.67	2	17	-6.94	-6.76	0.18	0.57	52	-6.54	Yes	B2	7.12	-0.41	6.07	No	Yes	-6.38	Yes	Yes	-10.93	10.43	7.74	Yes	0.001	0.001	5.91	0.001	Yes	
	11	37	0.4	3	17	-2.15	-1.88	0.27		52	-1.66	Yes	B2	7.12	-0.41	1.19	No	Yes	-1.50	Yes	Yes	-10.93	10.43		Yes	0.016	0.019	1.03	0.018	Yes	
	11	39	1.43	1	17	-1.79	-1.63	0.16	0.16	52	-1.41	Yes	B1	7.12	-0.42	0.93	No	Yes	-1.25	Yes	Yes	-10.83	10.32	7.30	Yes	0.019	0.023	0.77	0.022	Yes	
	11	40	0.35	1	17	-0.97	-0.86	0.11	0.11	40	-0.64	Yes	B1	7.12	-0.49	0.09	No	Yes	-0.48	Yes	Yes	-10.94	10.36	7.25	Yes	0.042	0.045	-0.07	0.045	Yes	
	11	48	2.78	1	17	-5.26	-4.80	0.46	0.46	88	-4.58	Yes	B1	7.12	-0.42	4.10	No	Yes	-4.42	Yes	Yes	-10.01	9.50	7.60	Yes	0.004	0.006	3.94	0.005	Yes	
	13	49	0.3	1	17	-1.84	-1.73	0.11	0.11	57	-1.51	Yes	B1	7.12	-0.66	0.79	No	Yes	-1.35	Yes	Yes	-10.33	9.58	7.25	Yes	0.022	0.030	0.63	0.024	Yes	
	23	70	1.27	1	17	-1.75	-1.35	0.40	0.40	66	-1.13	Yes	A	5.32	-0.22	0.85	No	Yes	-0.97	Yes	Yes	-11.43	11.12	5.74	Yes	0.015	0.025	0.69	0.021	Yes	
	30	59	3.2	1	17	-11.27	-10.66	0.61	0.61	85	-10.44	Yes	B4	7.12	-0.15	10.23	Yes	Yes	-10.28	Yes	Yes	-13.81	13.57	7.12	Yes	0.000	0.000	10.07	0.000	Yes	
																									Raw:	0.302	0.365		0.289		
																									Insitu Adj:	0.257					
22	5	18	0.94	1	20	-1.33	-0.9	0.43	0.43	74	-0.68	Yes	B4	7.12	-0.24	0.38	No	Yes	-0.52	Yes	Yes	-12.24	11.91	7.57	Yes	0.031	0.034	0.22	0.037	Yes	
	10	48	0.4	1	21	-3.2	-3.1	0.10	0.10	28	-2.88	Yes	B1	7.12	-0.09	2.73	No	Yes	-2.72	Yes	Yes	-12.02	11.84	7.24	Yes	0.008	0.009	2.57	0.008	Yes	
	10	56	0.65	1	21	-1.1	-0.94	0.16	0.16	39	-0.72	Yes	B1	7.12	-0.58	0.08	No	Yes	-0.56	Yes	Yes	-12.14	11.47	7.30	Yes	0.043	0.045	-0.08	0.045	Yes	
	13	43	0.39	1	21	-1.49	-1.36	0.13	0.13	39	-1.14	Yes	B1	7.12	-0.45	0.63	No	Yes	-0.98	Yes	Yes	-11.90	11.36	7.27	Yes	0.024	0.033	0.47	0.028	Yes	
	31	25	4.29	1	20	-2.26	-1.66	0.60	0.60	87	-1.44	Yes	A	5.32	-0.55	0.83	No	Yes	-1.28	Yes	Yes	-12.24	11.60	5.94	Yes	0.016	0.025	0.67	0.022	Yes	
																										0.121	0.145		0.140		
23	2	91	0.76	1	40	-0.95	-0.55	0.40	0.40	58	-0.33	Yes	A	5.32	-0.23	0.04	No	Yes	-0.17	Yes	Yes	-10.05	9.73	5.74	Yes	0.044	0.045	-0.12	0.045	Yes	
	3	69	1.51	1	40	-1.15	-0.80	0.35	0.35	80	-0.58	Yes	B2	7.12	-0.34	0.18	No	Yes	-0.42	Yes	Yes	-10.08	9.65	7.49	Yes	0.038	0.043	0.02	0.045	Yes	
	4	90	0.61	1	40	-1.08	-0.91	0.17	0.17	37	-0.69	Yes	A	5.32	-0.19	0.44	No	Yes	-0.53	Yes	Yes	-10.00	9.72	5.51	Yes	0.029	0.033	0.28	0.034	Yes	
	5	51	0.57	1	40	-2.13	-2.01	0.12	0.12	55	-1.79	Yes	B1	7.12	-0.24	1.49	No	Yes	-1.63	Yes	Yes	-10.06	9.73	7.26	Yes	0.013	0.015	1.33	0.015	Yes	
	5	55	1.69	1	40	-2.29	-1.94	0.35	0.35	74	-1.72	Yes	B1	7.12	-0.19	1.47	No	Yes	-1.56	Yes	Yes	-10.02	9.74	7.49	Yes	0.014	0.015	1.31	0.015	Yes	
	6	77	0.21	1	28	-1.83	-1.74	0.09	0.09	25	-1.52	Yes	B4	7.12	-0.42	1.04	No	Yes	-1.36	Yes	Yes	-8.56	8.05	7.23	Yes	0.013	0.020	0.88	0.017	Yes	
	7	52	4.53	1	28	-1.45	-0.71	0.74	0.74	100	-0.49	Yes	B1	7.12	-0.28	0.15	No	Yes	-0.33	Yes	Yes	-9.01	8.64	7.88	Yes	0.040	0.044	-0.01	0.045	Yes	
	7	59	1.37	1	40	-1.73	-1.33	0.40	0.40	90	-1.11	Yes	B1	7.12	-0.31	0.74	No	Yes	-0.95	Yes	Yes	-10.18	9.78	7.54	Yes	0.022	0.023	0.58	0.025	Yes	
	7	92	1.33	1	40	-1.13	-0.78	0.35	0.35	58	-0.56	Yes	A	5.32	-0.24	0.26	No	Yes	-0.40	Yes	Yes	-10.24	9.91	5.69	Yes	0.035	0.041	0.10	0.042	Yes	
	8	93	1.33	1	28	-0.89	-0.56	0.33	0.33	52	-0.34	Yes	A	5.32	-0.26	0.02	No	Yes	-0.18	Yes	Yes	-9.85	9.50	5.67	Yes	0.045	0.045	-0.14	0.045	Yes	
	9	63	0.44	1	28	-1.28	-1.12	0.16	0.16	40	-0.90	Yes	B2	7.12	-0.38	0.46	No	Yes	-0.74	Yes	Yes	-8.59	8.12	7.30	Yes	0.029	0.034	0.30	0.033	Yes	
	12	48	0.25	1	40	-2.18	-2.09	0.09	0.09	37	-1.87	Yes	B1	7.12	-0.29	1.52	No	Yes	-1.71	Yes	Yes	-9.96	9.58	7.23	Yes	0.013	0.017	1.36	0.015	Yes	
	14	24	0.4	1	40	-1.80	-1.68	0.12	0.12	31	-1.46	Yes	B4	7.12	-0.16	1.24	No	Yes	-1.30	Yes	Yes	-10.27	10.02	7.26	Yes	0.011	0.012	1.08	0.013	Yes	
	16	24	0.31	1	41	-1.26	-1.13	0.13	0.13	52	-0.91	Yes	B4	7.12	-0.16	0.69	No	Yes	-0.75	Yes	Yes	-9.70	9.45	7.27	Yes	0.022	0.024	0.53	0.027	Yes	
	19	71	1.01	1	28	-2.22	-1.90	0.32	0.32	52	-1.68	Yes	A	5.32	-0.38	1.24	No	Yes	-1.52	Yes	Yes	-8.74	8.27	5.66	Yes	0.008	0.010	1.08	0.009	Yes	
	21	38	0.59	1	41	-1.48	-0.99	0.49	0.49	52	-0.77	Yes	B3	7.12	-0.33	0.38	No	Yes	-0.61	Yes	Yes	-10.23	9.81	7.63	Yes	0.031	0.036	0.22	0.037	Yes	
	21	83	0.61	1	40	-1.15	-0.90	0.25	0.25	67	-0.68	Yes	A	5.32	-0.31	0.31	No	Yes	-0.52	Yes	Yes	-10.05	9.65	5.59	Yes	0.033	0.043	0.15	0.040	Yes	
	25	37	1.3	1	28	-1.41	-1.04	0.37	0.37	71	-0.82	Yes	B4	7.12	-0.31	0.45	No	Yes	-0.66	Yes	Yes	-8.83	8.43	7.51	Yes	0.029	0.041	0.29	0.034	Yes	
	31	51	0.49	1	45	-0.68	-0.57	0.11	0.11	31	-0.35	Yes	A	5.32	-0.42	-0.13	No	No	-0.19	Yes	No	-10.49	9.98	5.45	Yes	0.045	-	-0.29	0.000	No	Yes
	32	55	1.45	1	28	-1.34	-0.91	0.43	0.43	71	-0.69	Yes	A	5.32	-0.37	0.26	No	Yes	-0.53	Yes	Yes	-8.63	8.17	5.77	Yes	0.035	0.043	0.10	0.042	Yes	
	45	37	1.55	1	40	-1.54	-1.22	0.32	0.32	67	-1.00	Yes	A	5.32	-0.28	0.66	No	Yes	-0.84	Yes	Yes	-9.27	8.90	5.66	Yes	0.022	0.028	0.50	0.027	Yes	
																										0.571	0.612		0.604		

Table 1
2R12 Axial PWSCC Indications in Hot Leg WEXTEX Tubesheet Region (Excluding PWSCC at Tube End)
Continued

SG	Row	Col	Volt	Crack No	Cal	LCT	UCT	Crack Length	Total Length	MD adj	UCT to TTS	UCT below TTS	W* Zone	W* Length	BWT	Dist UCT to BWT	UCT Below W*	UCT Below BWT	EOC (N+1) UCT	EOC (N+1) UCT Below TTS	W* Cand	Inspect Extent	W* Insp Ext wrt BWT	Flex W* Length	Insp Ext Satisfied	CM Leak Rate	2R11 OA Pred Leak Rate	Dist EOC (N+1) UCT to BWT	OA Leak Rate	Prev W*Ind	Tube Plug
24	2	10	0.43	1	19	-1.53	-1.4	0.13	0.13	37	-1.18	Yes	A	5.32	-0.2	0.92	No	Yes	-1.02	Yes	Yes	-10.52	10.23	5.47	Yes	0.012	0.022	0.76	0.018	Yes	
	3	5	2.01	1	19	-1.96	-0.82	1.14	1.14	100	-0.60	Yes	A	5.32	-0.29	0.25	No	Yes	-0.44	Yes	Yes	-10.85	10.47	6.48	Yes	0.035	0.042	0.09	0.042	Yes	
	3	12	0.48	1	19	-2.87	-2.74	0.13	0.36	58	-2.52	Yes	A	5.32	-0.28	2.18	No	Yes	-2.36	Yes	Yes	-10.64	10.27	5.72	Yes	0.004	0.004	2.02	0.004	Yes	
	3	12	0.89	2	19	-2.53	-2.3	0.23		67	-2.08	Yes	A	5.32	-0.28	1.74	No	Yes	-1.92	Yes	Yes	-10.64	10.27		Yes	0.005	0.006	1.58	0.006	Yes	
	3	17	0.54	1	19	-3.74	-3.58	0.16	0.16	77	-3.36	Yes	B4	7.12	-0.06	3.24	No	Yes	-3.20	Yes	Yes	-10.53	10.38	7.30	Yes	0.002	0.005	3.08	0.003	Yes	
	4	35	1.17	1	19	-1.84	-1.6	0.24	0.24	67	-1.38	Yes	B1	7.12	-0.25	1.07	No	Yes	-1.22	Yes	Yes	-10.32	9.98	7.38	Yes	0.018	0.024	0.91	0.020	Yes	
	5	31	0.65	1	19	-1.21	-0.93	0.28	0.28	61	-0.71	Yes	B2	7.12	-0.33	0.32	No	Yes	-0.55	Yes	Yes	-10.61	10.19	7.42	Yes	0.033	0.044	0.16	0.039	Yes	
	5	36	0.53	1	19	-2.13	-1.95	0.18	0.18	74	-1.73	Yes	B1	7.12	-0.14	1.53	No	Yes	-1.57	Yes	Yes	-10.48	10.25	7.32	Yes	0.013	0.017	1.37	0.015	Yes	
	5	37	0.29	1	19	-4.7	-4.54	0.16	0.66	71	-4.32	Yes	B1	7.12	-0.28	3.98	No	Yes	-4.16	Yes	Yes	-10.42	10.05	7.82	Yes	0.005	0.006	3.82	0.005	Yes	
	5	37	2.08	2	19	-4.54	-4.04	0.50		97	-3.82	Yes	B1	7.12	-0.28	3.48	No	Yes	-3.66	Yes	Yes	-10.42	10.05		Yes	0.006	0.008	3.32	0.006	Yes	
	5	53	2.09	1	19	-1.97	-1.57	0.40	0.40	87	-1.35	Yes	B1	7.12	-0.26	1.03	No	Yes	-1.19	Yes	Yes	-10.83	10.48	7.54	Yes	0.018	0.021	0.87	0.020	Yes	
	5	61	0.4	1	56	-10.32	-10.22	0.10	0.10	59	-10.00	Yes	B1	7.12	-0.22	9.72	Yes	Yes	-9.84	Yes	Yes	-11.91	11.6	7.12	Yes	0.000	-	9.56	0.000	No	
	6	33	1.31	1	19	-3.11	-2.79	0.32	0.32	74	-2.57	Yes	B2	7.12	-0.16	2.35	No	Yes	-2.41	Yes	Yes	-10.48	10.23	7.46	Yes	0.008	0.009	2.19	0.008	Yes	
	7	4	0.66	1	19	-1.22	-1.06	0.16	0.16	61	-0.84	Yes	A	5.32	-0.21	0.57	No	Yes	-0.68	Yes	Yes	-10.75	10.45	5.50	Yes	0.025	0.031	0.41	0.030	Yes	
	7	38	1.77	1	19	-7.38	-7.01	0.37	1.05	77	-6.79	Yes	B1	7.12	-0.25	6.48	No	Yes	-6.63	Yes	Yes	-10.55	10.21	8.21	Yes	0.001	0.001	6.32	0.001	Yes	
	7	38	2.17	2	19	-4.91	-4.23	0.68		74	-4.01	Yes	B1	7.12	-0.25	3.70	No	Yes	-3.85	Yes	Yes	-10.55	10.21		Yes	0.005	0.007	3.54	0.006	Yes	
	7	53	0.3	1	19	-2.75	-2.61	0.14	0.14	49	-2.39	Yes	B1	7.12	-0.34	1.99	No	Yes	-2.23	Yes	Yes	-10.92	10.49	7.28	Yes	0.010	0.012	1.83	0.011	Yes	
	13	4	0.42	1	19	-1.3	-1.17	0.13	0.13	55	-0.95	Yes	A	5.32	-0.23	0.66	No	Yes	-0.79	Yes	Yes	-10.44	10.12	5.47	Yes	0.022	0.027	0.50	0.027	Yes	
	13	40	2.3	1	19	-2.11	-1.64	0.47	0.47	90	-1.42	Yes	B2	7.12	-0.21	1.15	No	Yes	-1.26	Yes	Yes	-10.44	10.14	7.61	Yes	0.017	0.021	0.99	0.023	Yes	
	15	10	0.36	1	19	-1	-0.82	0.18	0.18	43	-0.60	Yes	A	5.32	-0.21	0.33	No	Yes	-0.44	Yes	Yes	-10.46	10.16	5.52	Yes	0.032	0.039	0.17	0.039	Yes	
	16	10	2.71	1	19	-2.34	-1.82	0.52	0.52	77	-1.60	Yes	A	5.32	-0.29	1.25	No	Yes	-1.44	Yes	Yes	-10.51	10.13	5.86	Yes	0.008	0.008	1.09	0.009	Yes	
	20	47	2.44	1	19	-1.77	-1.36	0.41	0.41	71	-1.14	Yes	B2	7.12	-0.25	0.83	No	Yes	-0.98	Yes	Yes	-10.47	10.13	7.55	Yes	0.021	0.026	0.67	0.023	Yes	
	24	26	2.35	1	19	-2.06	-1.65	0.41	0.57	97	-1.43	Yes	A	5.32	-0.32	1.05	No	Yes	-1.27	Yes	Yes	-10.38	9.97	5.93	Yes	0.009	0.012	0.89	0.020	Yes	
	24	26	0.73	2	19	-1.52	-1.36	0.16		52	-1.14	Yes	A	5.32	-0.32	0.76	No	Yes	-0.98	Yes	Yes	-10.38	9.97		Yes	0.018	-	0.60	0.027	No	
	25	64	1.8	1	19	-1.44	-1.1	0.34	0.34	71	-0.88	Yes	B4	7.12	-0.35	0.47	No	Yes	-0.72	Yes	Yes	-10.78	10.34	7.48	Yes	0.028	0.031	0.31	0.033	Yes	
	26	45	1.77	1	19	-3.95	-3.59	0.36	0.36	74	-3.37	Yes	B4	7.12	-0.23	3.08	No	Yes	-3.21	Yes	Yes	-10.48	10.16	7.50	Yes	0.003	0.003	2.92	0.003	Yes	
	26	64	0.64	1	41	-1.01	-0.81	0.20	0.20	52	-0.59	Yes	B4	7.12	-0.36	0.17	No	Yes	-0.43	Yes	Yes	-10.87	10.42	7.34	Yes	0.039	-	0.01	0.045	No	
																									Raw:	0.397	0.425		0.484		
																									Insitu Adj:	0.345					

Table 1a
Post In Situ W* Evaluation of SG 2-4 Axial PWSCC Indications in Hot Leg WEXTEX Tubesheet Region

SG	Row	Col	Ind	Volts	Crack No	Cal	LCT	UCT	Crack Length	Total Length	MD adj	UCT to TTS	UCT below TTS	W* Zone	W* Length	BWT	Dist UCT to BWT	UCT Below W* ?	UCT Below BWT?	EOC (N+1) UCT	EOC (N+1) UCT Below TTS?	W* Cand	Inspect Extent	W* Insp Ext wrt BWT	Flex W* Length	Insp Ext Satisfied ?	Dist EOC (N+1) UCT to BWT	OA Leak Rate
2-4	13	40	SAI	2.57	1	70	-1.87	-1.35	0.52	0.52	90	-1.13	Yes	B2	7.12	-0.21	0.86	No	Yes	-0.97	Yes	Yes	-10.44	10.14	7.66	Yes	0.70	0.023
2-4	16	10	SAI	2.76	1	70	-2.3	-1.76	0.54	0.54	77	-1.54	Yes	A	5.32	-0.29	1.19	No	Yes	-1.38	Yes	Yes	-10.51	10.13	5.88	Yes	1.03	0.009
2-4	24	26	SAI	2.66	1	70	-2.03	-1.49	0.54	0.70	100	-1.27	Yes	A	5.32	-0.32	0.89	No	Yes	-1.11	Yes	Yes	-10.38	9.97	6.06	Yes	0.73	0.020
2-4	24	26	SAI	0.73	2	70	-1.42	-1.26	0.16		58	-1.04	Yes	A	5.32	-0.32	0.66	No	Yes	-0.88	Yes	Yes	-10.38	9.97		Yes	0.50	0.027

Table 2 - 2R12 In Situ Test Screening of W* Indications

SG	Row	Col	Ind	Volt	Crack No	LCT	UCT	Deplugged?	Tube Plug	Prior Insitu	Prior Insitu Voltage	Vcr	Vth	Step 1	Step 2	Step 3	Rank	Manual Rank	L>80% TW MD	Step 4	Insitu Req'd	Insitu Performed
21	3	59	SAI	7.13	1	-1.59	-0.73	Yes	Yes	Yes	4.67	6	4	Go to Step 2	Test	NA			0.71	NA	YES	YES
	6	77	SAI	0.59	1	-1.48	-1.35	Yes				6	4	Go to Step 2	Go to Step 3	Rank	37		0		No	
	7	24	SAI	0.25	1	-2.06	-1.95	Yes				6	4	Go to Step 2	Go to Step 3	Rank	60		0		No	
	7	62	SAI	4.37	1	-2.4	-1.48	Yes		Yes	4.08	6	4	Stop	N/A	N/A			0.25	N/A	No	
	8	32	SAI	0.56	1	-2.08	-1.96					4	2.5	Go to Step 2	Go to Step 3	Rank	40		0		No	
	9	49	SAI	0.9	1	-2.31	-2.04					4	2.5	Go to Step 2	Go to Step 3	Rank	26		0		No	
	10	49	SAI	0.21	1	-1.25	-1.11					4	2.5	Go to Step 2	Go to Step 3	Rank	62		0		No	
	11	37	SAI	0.44	1	-7.84	-7.72					4	2.5	Go to Step 2	Go to Step 3	Rank	45		0		No	
	11	37	SAI	0.67	2	-6.94	-6.76					4	2.5	Go to Step 2	Go to Step 3	Rank	30		0		No	
	11	37	SAI	0.4	3	-2.15	-1.88					4	2.5	Go to Step 2	Go to Step 3	Rank	49		0		No	
	11	39	SAI	1.43	1	-1.79	-1.63	Yes				6	4	Go to Step 2	Go to Step 3	Rank	16		0		No	
	11	40	SAI	0.35	1	-0.97	-0.86					4	2.5	Go to Step 2	Go to Step 3	Rank	55		0		No	
	11	48	SAI	2.78	1	-5.26	-4.80					4	2.5	Go to Step 2	Go to Step 3	Go to Step 4			0.08	Stop	No	
	13	49	SAI	0.3	1	-1.84	-1.73					4	2.5	Go to Step 2	Go to Step 3	Rank	57		0		No	
	23	70	SAI	1.27	1	-1.75	-1.35	Yes				6	4	Go to Step 2	Go to Step 3	Rank	22		0		No	
	30	59	SAI	3.2	1	-11.27	-10.66					4	2.5	Go to Step 2	Go to Step 3	Go to Step 4			0.03	Stop	No	
22	5	18	SAI	0.94	1	-1.33	-0.9					4	2.5	Go to Step 2	Go to Step 3	Rank	25		0		No	
	10	48	SAI	0.4	1	-3.2	-3.1					4	2.5	Go to Step 2	Go to Step 3	Rank	49		0		No	
	10	56	SAI	0.65	1	-1.1	-0.94	Yes				6	4	Go to Step 2	Go to Step 3	Rank	32		0		No	
	13	43	SAI	0.39	1	-1.49	-1.36	Yes				6	4	Go to Step 2	Go to Step 3	Rank	53		0		No	
	31	25	SAI	4.29	1	-2.26	-1.66	Yes		Yes	3.82	6	4	Stop	N/A	N/A			0.19	N/A	No	
23	2	91	SAI	0.76	1	-0.95	-0.55	Yes				6	4	Go to Step 2	Go to Step 3	Rank	28		0		No	
	3	69	SAI	1.51	1	-1.15	-0.80					4	2.5	Go to Step 2	Go to Step 3	Rank	14		0		No	
	4	90	SAI	0.61	1	-1.08	-0.91					4	2.5	Go to Step 2	Go to Step 3	Rank	35		0		No	
	5	51	SAI	0.57	1	-2.13	-2.01	Yes				6	4	Go to Step 2	Go to Step 3	Rank	39		0		No	
	5	55	SAI	1.69	1	-2.29	-1.94					4	2.5	Go to Step 2	Go to Step 3	Rank	12		0		No	
	6	77	SAI	0.21	1	-1.83	-1.74	Yes				6	4	Go to Step 2	Go to Step 3	Rank	62		0		No	
	7	52	SAI	4.53	1	-1.45	-0.71	Yes		Yes	3.9	6	4	Stop	N/A	N/A			0.43	N/A	No	
	7	59	SAI	1.37	1	-1.73	-1.33	Yes				6	4	Go to Step 2	Go to Step 3	Rank	17		0.05		No	
	7	92	SAI	1.33	1	-1.13	-0.78	Yes				6	4	Go to Step 2	Go to Step 3	Rank	18		0		No	
	8	93	SAI	1.33	1	-0.89	-0.56	Yes				6	4	Go to Step 2	Go to Step 3	Rank	18		0		No	
	9	63	SAI	0.44	1	-1.28	-1.12					4	2.5	Go to Step 2	Go to Step 3	Rank	45		0		No	
	12	48	SAI	0.25	1	-2.18	-2.09	Yes				6	4	Go to Step 2	Go to Step 3	Rank	60		0		No	
	14	24	SAI	0.4	1	-1.80	-1.68	Yes				6	4	Go to Step 2	Go to Step 3	Rank	49		0		No	
	16	24	SAI	0.31	1	-1.26	-1.13	Yes				6	4	Go to Step 2	Go to Step 3	Rank	56		0		No	
	19	71	SAI	1.01	1	-2.22	-1.90	Yes				6	4	Go to Step 2	Go to Step 3	Rank	24		0		No	
	21	38	SAI	0.59	1	-1.48	-0.99	Yes				6	4	Go to Step 2	Go to Step 3	Rank	37		0		No	
	21	83	SAI	0.61	1	-1.15	-0.90	Yes				6	4	Go to Step 2	Go to Step 3	Rank	35		0		No	
	25	37	SAI	1.3	1	-1.41	-1.04	Yes				6	4	Go to Step 2	Go to Step 3	Rank	21		0		No	
	31	51	SAI	0.49	1	-0.68	-0.57		Yes			4	2.5	Go to Step 2	Go to Step 3	Rank	43		0		No	
	32	55	SAI	1.45	1	-1.34	-0.91	Yes				6	4	Go to Step 2	Go to Step 3	Rank	15		0		No	
	45	37	SAI	1.55	1	-1.54	-1.22	Yes				6	4	Go to Step 2	Go to Step 3	Rank	13		0		No	

Table 2 - 2R12 In Situ Test Screening of W* Indications
Continued

SG	Row	Col	Ind	Volt	Crack No	LCT	UCT	Deplugged?	Tube Plug	Prior Insitu	Prior Insitu Voltage	Vcr	Vth	Step 1	Step 2	Step 3	Rank	Manual Rank	L>80% TW MD	Step 4	Insitu Req'd	Insitu Performed
24	2	10	SAI	0.43	1	-1.53	-1.4	Yes				6	4	Go to Step 2	Go to Step 3	Rank	47		0		No	
	3	5	SAI	2.01	1	-1.96	-0.82	Yes		Yes	1.51	6	4	Go to Step 2	Go to Step 3	Rank	8		0.85		No	
	3	12	SAI	0.48	1	-2.87	-2.74	Yes				6	4	Go to Step 2	Go to Step 3	Rank	44		0		No	
	3	12	SAI	0.89	2	-2.53	-2.3	Yes				6	4	Go to Step 2	Go to Step 3	Rank	27		0		No	
	3	17	SAI	0.54	1	-3.74	-3.58					4	2.5	Go to Step 2	Go to Step 3	Rank	41		0		No	
	4	35	SAI	1.17	1	-1.84	-1.6	Yes				6	4	Go to Step 2	Go to Step 3	Rank	23		0		No	
	5	31	SAI	0.65	1	-1.21	-0.93					4	2.5	Go to Step 2	Go to Step 3	Rank	32		0		No	
	5	36	SAI	0.53	1	-2.13	-1.95					4	2.5	Go to Step 2	Go to Step 3	Rank	42		0		No	
	5	37	SAI	0.29	1	-4.7	-4.54	Yes				6	4	Go to Step 2	Go to Step 3	Rank	59		0		No	
	5	37	SAI	2.08	2	-4.54	-4.04	Yes				6	4	Go to Step 2	Go to Step 3	Rank	7		0.27		No	
	5	53	SAI	2.09	1	-1.97	-1.57	Yes				6	4	Go to Step 2	Go to Step 3	Rank	6		0.05		No	
	5	61	SAI	0.4	1	-10.32	-10.22					4	2.5	Go to Step 2	Go to Step 3	Rank	49		0		No	
	6	33	SAI	1.31	1	-3.11	-2.79					4	2.5	Go to Step 2	Go to Step 3	Rank	20		0		No	
	7	4	SAI	0.66	1	-1.22	-1.06	Yes				6	4	Go to Step 2	Go to Step 3	Rank	31		0		No	
	7	38	SAI	1.77	1	-7.38	-7.01	Yes				6	4	Go to Step 2	Go to Step 3	Rank	10		0		No	
	7	38	SAI	2.17	2	-4.91	-4.23	Yes				6	4	Go to Step 2	Go to Step 3	Rank	5	Go to Step 4	0	Stop	No	
	7	53	SAI	0.3	1	-2.75	-2.61					4	2.5	Go to Step 2	Go to Step 3	Rank	57		0		No	
	13	4	SAI	0.42	1	-1.3	-1.17					4	2.5	Go to Step 2	Go to Step 3	Rank	48		0		No	
	13	40	SAI	2.3	1	-2.11	-1.64	Yes				6	4	Go to Step 2	Go to Step 3	Rank	4	Go to Step 4	0.26	Test	YES	YES
	15	10	SAI	0.36	1	-1	-0.82	Yes				6	4	Go to Step 2	Go to Step 3	Rank	54		0		No	
	16	10	SAI	2.71	1	-2.34	-1.82	Yes				6	4	Go to Step 2	Go to Step 3	Rank	1	Go to Step 4	0	Stop	No	YES
	20	47	SAI	2.44	1	-1.77	-1.36	Yes				6	4	Go to Step 2	Go to Step 3	Rank	2	Go to Step 4	0	Stop	No	
	24	26	SAI	2.35	1	-2.06	-1.65					4	2.5	Go to Step 2	Go to Step 3	Rank	3	Go to Step 4	0.23	Test	YES	YES
	24	26	SAI	0.73	2	-1.52	-1.36					4	2.5	Go to Step 2	Go to Step 3	Rank	29		0		No	YES
	25	64	SAI	1.8	1	-1.44	-1.1	Yes				6	4	Go to Step 2	Go to Step 3	Rank	9		0		No	
	26	45	SAI	1.77	1	-3.95	-3.59					4	2.5	Go to Step 2	Go to Step 3	Rank	10		0		No	
	26	64	SAI	0.64	1	-1.01	-0.81					4	2.5	Go to Step 2	Go to Step 3	Rank	34		0		No	

Column – Tables 1 and 2	Legend and Notes for Tables 1 and 2
SG	Steam generator
Row	Tube Row
Col	Tube Column
SAI	Single axial indication
Volts	Peak voltage from Plus Point coil
Crack No	Crack number
Cal	Calibration group
LCT	Elevation (inch) of lower crack tip (LCT), relative to the top of tubesheet (TTS).
UCT	Elevation (inch) of upper crack tip (UCT), relative to the TTS.
Crack Length	Length of crack (inch)
Total Length	Total length of multiple cracks (inch)
MD adj	Maximum depth of crack as adjusted by PWSCC ARC software, percent through-wall
UCT to TTS	Adjusted elevation (inch) of the UCT relative to TTS, including $\Delta NDE_{CT\text{-}TTS}$ (Plus Point NDE uncertainty on locating the crack tip relative to the TTS).
UCT below TTS?	If the adjusted elevation of the UCT (including NDE uncertainty) is located below TTS, then the tube is a W* candidate.
W* Zone	W* tubesheet zone based on crack location.
W* Length	W* length is 7.12 inch for hot leg Zone B and 5.32 inch for hot leg Zone A, and includes ΔNDE_W (NDE uncertainty in measuring the W* depth).
BWT	Elevation of the bottom of the WEXTEX transition (BWT), inch, measured by bobbin relative to the TTS.
Dist UCT to BWT	Distance (inch) from the UCT to BWT, minus $\Delta NDE_{CT\text{-}BWT}$ (Plus Point NDE uncertainty on locating the crack tip relative to the BWT).
UCT below W*?	If the UCT is located below the W* length, then the tube is a W* tube. Any type of degradation below the W* length is acceptable.
UCT below BWT?	If the UCT is located below BWT, then the tube is a W* candidate.
EOC (n+1) UCT	Elevation (inch) of UCT relative to TTS at the end of the next operating cycle, based on growing the UCT at 0.119 inch/EFPY.
EOC (n+1) UCT below TTS?	If the UCT is below TTS at the end of the next cycle, a free span indication is precluded and the tube is a W* candidate.
W* Cand?	If the UCT is below BWT and the EOC (n+1) UCT is projected to be below TTS at the end of the next cycle, then the tube is a W* tube (candidate).
Inspect Extent	Elevation of Plus Point inspection relative to TTS (inch).
W* Inspect Ext wrt BWT	W* inspection distance with respect to BWT, also referred to as the W* inspection distance (inch). This is the Plus Point inspection extent relative to BWT. The W* inspection distance below BWT is equal to the Plus Point inspection extent below TTS, plus measured distance from BWT to TTS, plus bobbin NDE uncertainty in locating BWT relative to TTS. The W* inspection distance must be greater than or equal to the flexible W* length.
Flex W* Length	Flexible W* length relative to BWT (inch), equal to W* Length + $\sum Cl_i$ (total axial crack length) + $N_{CL}*\Delta NDE_{CL}$ (number of indications times Plus Point NDE uncertainty with measuring length of axial cracks) + $N_{CL}*\Delta CG$ (number of indications times crack growth, 0.119 inch/EFPY)
Insp Extent Satisfied	The inspection extent must be greater than the flexible W* length.
CM Leak Rate	Condition monitoring SLB leak rate, gpm at room temperature, based on distance of UCT to BWT, using Figure 6.4-3 of WCAP-14797 Rev 1. No accident leakage is assigned to indications with UCT below W* length.
2R11 OA Pred Leak Rate	Leak rate (gpm at room temperature) from prior cycle operational assessment prediction, provided to compare against as found CM

Column – Tables 1 and 2	Legend and Notes for Tables 1 and 2
	leak rate.
Dist EOC (N+1) UCT to BWT	Distance (inch) of the UCT relative to BWT at end of the next cycle, minus ΔNDE_{CT-BWT} (Plus Point NDE uncertainty on locating the crack tip relative to the BWT), based on growing the UCT at 0.119 inch/EFPY. This entry is not applicable to indications that are plugged.
OA Leak Rate	Operational assessment leak rate, gpm at room temperature, at end of next cycle based on distance of EOC (n+1) UCT to BWT, using Figure 6.4-3 of WCAP-14797 Rev 1. No accident leakage is assigned to an indication with UCT below W* length.
Prev W* Indication?	If the indication was left in service in the prior cycle, it is classified as a previous W* indication (repeat indication). Otherwise, the indication is new.
Deplugged?	Tube was deplugged in a prior outage.
Tube Plugged?	Tube was plugged during the current outage.
Prior In Situ?	The tube was in situ tested in a prior outage.
Prior In Situ Voltage	If prior in situ testing was performed, the Plus Point voltage of the indication in the outage that in situ leak testing was performed.
Vcr	Critical voltage for determining need for in situ testing
Vth	Threshold voltage for determining need for in situ testing
Steps 1 through 4	Logical steps used for screening indications for in situ testing based on NRC commitments
Rank	Plus Point voltage ranking of indications as required by in situ screening Step 3
Manual Rank	Five largest Plus Point voltages are manually ranked for further screening
L >80% TW MD	The length of the indication that exceeds 80 percent maximum depth, based on Plus Point line–by-line sizing.
In Situ Req'd?	Identifies indications that require in situ leak testing based on the four step screening logic
In Situ performed	The indication was in situ tested.

Table 3
Unit 2 Deplugged Tube Population and 2R12 Plus Point Inspection Results

Unit 2 Tubes Deplugged and Inservice in U2C12								
SG	Roll			Rib				Total
	2R11	2R10	2R9	2R11	2R10	2R9	2R3	
21			11					11
22			21					21
23			20				19 drill	39
24			38			6		44
Total			90			6	19	115

Tubes with Plus Point Indications in Plug Expansion Zone (PEZ)								
SG	Roll			Rib				Total
	2R11	2R10	2R9	2R11	2R10	2R9	2R3	
21			9					9
22			21					21
23			20					20
24			37			6		43
Total			87			6		93

Note: All plugs removed in 2R9 used the TIG removal process, and full length tubesheet Plus Point inspections were performed after plug removal and no degradation was detected. All plugs removed in 2R3 used the drill process.

Table 4
2R12 PWSCC Indications in the Plug Expansion Zone (PEZ)

SG	Row	Col	Outage Plug Removed	Type Plug Removed	Removal Method	Tube end indication	# Ind	Max Volts	Crack Lower Extent relative to TEH, inch	Crack Upper Extent relative to TEH, inch	Bottom of Roll Transition (BRT)
21	3	59	2R9	Roll	TIG	MAI	2	5.31	0.49	1.98	2.45
21	6	77	2R9	Roll	TIG	MAI	8	5.86	0.61	2.31	2.86
21	7	24	2R9	Roll	TIG	MAI	4	5.46	0.56	2.44	3.01
21	11	39	2R9	Roll	TIG	MAI	8	5.47	0.59	2.23	2.73
21	23	43	2R9	Roll	TIG	MAI	5	6.36	0.62	2.23	2.69
21	23	47	2R9	Roll	TIG	MAI	9	5.23	0.68	2.15	2.66
21	23	70	2R9	Roll	TIG	MAI	7	5.81	0.61	2.46	2.91
21	26	48	2R9	Roll	TIG	MAI	7	4.49	0.47	2.23	2.64
21	27	49	2R9	Roll	TIG	MAI	7	4.4	0.49	2.27	2.73
22	4	28	2R9	Roll	TIG	MAI	7	5.39	0.54	2.03	2.65
22	5	3	2R9	Roll	TIG	MAI	4	5.14	0.53	1.88	2.51
22	6	24	2R9	Roll	TIG	MAI	8	3.53	0.41	2.04	2.51
22	7	27	2R9	Roll	TIG	MAI	7	7.1	0.45	2.05	2.62
22	8	36	2R9	Roll	TIG	MAI	7	5.42	0.41	1.98	2.51
22	8	43	2R9	Roll	TIG	MAI	8	5.47	0.42	2.04	2.47
22	10	56	2R9	Roll	TIG	MAI	8	6.18	0.44	2.11	2.57
22	12	39	2R9	Roll	TIG	MAI	5	5.82	0.51	2.17	2.6
22	13	43	2R9	Roll	TIG	MAI	7	7.11	0.43	2.07	2.51
22	14	45	2R9	Roll	TIG	MAI	7	6.42	0.46	2.12	2.52
22	15	42	2R9	Roll	TIG	MAI	8	5.09	0.5	2.09	2.49
22	16	49	2R9	Roll	TIG	MAI	8	6.93	0.53	1.94	2.53
22	19	15	2R9	Roll	TIG	MAI	4	5.5	0.52	2.43	2.97
22	19	75	2R9	Roll	TIG	MAI	9	3.78	0.42	2.04	2.59
22	20	73	2R9	Roll	TIG	MAI	4	6.19	0.55	2.13	2.56
22	21	41	2R9	Roll	TIG	MAI	4	5.02	0.41	1.92	2.56
22	22	44	2R9	Roll	TIG	MAI	8	5.42	0.59	2.12	2.58
22	23	23	2R9	Roll	TIG	MAI	6	4.63	0.42	2.13	2.52
22	25	44	2R9	Roll	TIG	MAI	6	5.39	0.49	2.14	2.61
22	31	25	2R9	Roll	TIG	SAI	1	6.07	0.5	1.91	2.5
22	41	42	2R9	Roll	TIG	MAI	5	4.97	0.42	2.05	2.75
23	2	91	2R9	Roll	TIG	MAI	7	4.39	0.49	1.98	2.62
23	4	47	2R9	Roll	TIG	MAI	9	4.71	0.59	2.1	2.59
23	5	51	2R9	Roll	TIG	MAI	8	5.68	0.59	2.18	2.85
23	6	77	2R9	Roll	TIG	MAI	7	3.16	0.48	2.02	2.5
23	7	52	2R9	Roll	TIG	MAI	8	4	0.65	2.13	2.82
23	7	59	2R9	Roll	TIG	MAI	8	4.82	0.56	2.06	2.88
23	7	92	2R9	Roll	TIG	MAI	7	5.13	0.6	2.01	2.54
23	8	93	2R9	Roll	TIG	MAI	7	5.36	0.51	2.03	2.57
23	12	48	2R9	Roll	TIG	MAI	8	4.91	0.71	2.62	3.35
23	14	24	2R9	Roll	TIG	MAI	4	6.24	0.55	2.09	2.5
23	16	24	2R9	Roll	TIG	MAI	7	4.7	0.59	2.15	2.49

Table 4
2R12 PWSCC Indications in the Plug Expansion Zone (PEZ)

SG	Row	Col	Outage Plug Removed	Type Plug Removed	Removal Method	Tube end indication	# Ind	Max Volts	Crack Lower Extent relative to TEH, inch	Crack Upper Extent relative to TEH, inch	Bottom of Roll Transition (BRT)
23	17	70	2R9	Roll	TIG	MAI	9	4.56	0.57	1.98	2.46
23	19	71	2R9	Roll	TIG	MAI	9	3.47	0.61	1.99	2.52
23	21	38	2R9	Roll	TIG	MAI	7	4.36	0.51	2.08	2.46
23	21	83	2R9	Roll	TIG	MAI	7	3.96	0.6	2.07	2.52
23	25	37	2R9	Roll	TIG	MAI	8	4.87	0.56	2.1	2.44
23	32	55	2R9	Roll	TIG	MAI	8	3.8	0.58	2.15	2.8
23	33	34	2R9	Roll	TIG	MAI	6	5.32	0.38	2.08	2.6
23	44	44	2R9	Roll	TIG	MAI	8	3.75	0.47	2.04	2.72
23	45	37	2R9	Roll	TIG	MAI	8	4.08	0.5	2.27	2.82
24	2	10	2R9	Roll	TIG	MAI	7	5.32	0.68	2.38	2.97
24	3	5	2R9	Rib	TIG	MAI	8	2.21	0.92	2.05	2.81
24	3	12	2R9	Roll	TIG	MAI	8	4.35	0.72	2.22	2.85
24	4	35	2R9	Roll	TIG	MAI	8	5.88	0.76	2.29	2.85
24	4	59	2R9	Roll	TIG	MAI	9	5.33	0.65	2.34	2.85
24	5	37	2R9	Rib	TIG	MAI	7	1.66	1.01	2.11	2.8
24	5	53	2R9	Rib	TIG	MAI	10	1.86	1.15	2.01	2.88
24	6	15	2R9	Roll	TIG	MAI	6	4.68	0.48	2.07	2.52
24	6	73	2R9	Roll	TIG	MAI	7	4.35	0.68	2.24	2.84
24	7	4	2R9	Roll	TIG	MAI	4	4.1	0.56	2.28	2.74
24	7	38	2R9	Roll	TIG	MAI	10	5.04	0.69	2.22	2.83
24	8	29	2R9	Roll	TIG	MAI	8	4.22	0.46	2.08	2.52
24	9	29	2R9	Roll	TIG	MAI	8	4.18	0.56	2.07	2.5
24	11	74	2R9	Roll	TIG	MAI	8	5.4	0.74	2.15	2.84
24	11	87	2R9	Roll	TIG	MAI	4	5.06	0.58	1.45	2.8
24	12	23	2R9	Roll	TIG	MAI	7	3.94	0.55	2.21	2.63
24	13	40	2R9	Roll	TIG	MAI	8	3.24	0.59	2.04	2.72
24	15	10	2R9	Roll	TIG	MAI	6	5.06	0.47	2.08	2.56
24	15	74	2R9	Roll	TIG	MAI	7	4.92	0.67	2.11	2.84
24	15	75	2R9	Roll	TIG	MAI	8	3.66	0.66	2.15	2.83
24	15	76	2R9	Roll	TIG	MAI	6	5.03	0.64	2.2	2.84
24	16	10	2R9	Rib	TIG	MAI	9	2.47	0.75	2.02	2.49
24	19	28	2R9	Roll	TIG	MAI	9	4.89	0.5	2.27	2.66
24	19	41	2R9	Roll	TIG	MAI	6	5.69	0.68	2.49	2.81
24	19	74	2R9	Roll	TIG	MAI	10	3.88	0.67	2.18	2.85
24	20	47	2R9	Rib	TIG	MAI	6	3.02	1.12	2.27	2.84
24	20	77	2R9	Roll	TIG	MAI	3	3.54	0.72	2.36	2.86
24	21	34	2R9	Roll	TIG	MAI	7	4.58	0.41	2.03	2.48
24	22	44	2R9	Roll	TIG	MAI	8	5.3	0.58	2.27	3.02
24	22	48	2R9	Roll	TIG	MAI	10	3.94	0.52	2.51	3.02
24	23	75	2R9	Roll	TIG	MAI	7	4.43	0.69	2.13	2.8
24	25	64	2R9	Roll	TIG	MAI	9	5.33	0.6	2.07	2.83

Table 4
2R12 PWSCC Indications in the Plug Expansion Zone (PEZ)

SG	Row	Col	Outage Plug Removed	Type Plug Removed	Removal Method	Tube end indication	# Ind	Max Volts	Crack Lower Extent relative to TEH, inch	Crack Upper Extent relative to TEH, inch	Bottom of Roll Transition (BRT)
24	25	73	2R9	Roll	TIG	MAI	8	4.08	0.65	2.1	2.91
24	25	79	2R9	Roll	TIG	MAI	10	4.26	0.65	2.21	2.83
24	27	23	2R9	Roll	TIG	MAI	8	1.67	0.64	2.19	2.87
24	29	53	2R9	Rib	TIG	MAI	3	1.88	1.24	1.77	2.59
24	35	34	2R9	Roll	TIG	MAI	8	3.66	0.95	2.48	2.87
24	36	25	2R9	Roll	TIG	MAI	6	5.23	0.75	2.44	2.92
24	36	67	2R9	Roll	TIG	MAI	7	4.84	0.54	2.08	2.53
24	37	46	2R9	Roll	TIG	MAI	7	4.27	0.77	2.41	2.9
24	38	65	2R9	Roll	TIG	MAI	5	2.09	0.58	1.52	2.59
24	41	47	2R9	Roll	TIG	MAI	6	4.6	0.59	1.88	2.9
24	42	41	2R9	Roll	TIG	MAI	7	1.5	1.12	2.31	3.02

Table 5
DCPP Unit 2 Condition Monitoring Steam Line Break Leak Rates for Alternate Repair Criteria

EOC 12 Condition Monitoring Leak Rate (gpm at room temperature)	SG 2-1	SG 2-2	SG 2-3	SG 2-4
W* ARC (Note 2)	0.257	0.121	0.571	0.345
Voltage-Based ARC (Note 1)	0.15	0.09	0.04	0.47
PWSCC ARC	0	0	0	0
Non-ARC degradation	0	0	0	0
Aggregate ARC	0.407	0.211	0.611	0.815

Note 1: Voltage-based ARC leak rates are described in Enclosure 3.
Note 2: Five indications were in situ leak tested and did not leak at SLB pressure, and no SLB leak rate is assigned to these indications when calculating the total SG leak rate.

Table 6
DCPP Unit 2 Operational Assessment Steam Line Break Leak Rates for Alternate Repair Criteria

EOC 13 Operational Assessment Leak Rate (gpm at room temperature)	SG 2-1	SG 2-2	SG 2-3	SG 2-4
W* ARC	0.289	0.140	0.604	0.484
Voltage-Based ARC (note 1)	0.95	0.64	0.40	3.25
PWSCC ARC	0	0	0	0
Non-ARC degradation	0	0	0	0
Aggregate ARC	1.239	0.780	1.004	3.734

Note 1: Voltage-based ARC leak rates are described in Enclosure 3.

Table 7
DCPP Unit 2 Prior Cycle W* ARC Leak Rate Predictions

Predicted EOC 12 Leak Rate (from prior cycle OA) (gpm at room temperature)	SG 2-1	SG 2-2	SG 2-3	SG 2-4
W* ARC	0.365	0.145	0.612	0.425

SPECIAL REPORT 05-01

TSP PWSCC ALTERNATE REPAIR CRITERIA 120-DAY REPORT

DIABLO CANYON POWER PLANT UNIT 2 TWELFTH REFUELING OUTAGE

NRC Reporting Requirements

PWSCC ARC for axial PWSCC at dented TSP was implemented for the second time in DCPP Unit 2 during 2R12. 2R12 SG inspections and repairs were completed in November 2004.

For implementation of ARC for axial PWSCC at dented TSPs, DCPP TS 5.6.10.h requires that the results of the condition monitoring and operational assessments be reported to the NRC within 120 days following completion of the inspection. This report implements the DCPP TS reporting criteria.

To satisfy the TS, this report includes the following:

- Tabulations of indications found in the inspection, tubes repaired, and tubes left in service under the ARC.
- Growth rate distributions for indications found in the inspection and growth rate distributions used to establish the tube repair limits.
- Plus Point confirmation rates for bobbin-detected indications when bobbin is relied upon for detection of axial PWSCC in less than or equal to 2-volt dents.
- For CM, an evaluation of any indications that satisfy burst margin requirements based on the Westinghouse burst pressure model, but do not satisfy burst margin requirements based on the combined Argonne National Laboratory (ANL) ligament tearing and through-wall burst pressure model.
- Performance evaluation of the operational assessment (OA) methodology for prediction of flaw distributions as a function of flaw size.
- Evaluation results of number and size of previously reported versus new PWSCC indications found in the inspection, and the potential need to account for new indications in the operational assessment burst evaluation.
- Identification of mixed mode (axial PWSCC and circumferential) indications found in the inspection and an evaluation of the mixed mode indications for potential impact on the axial indication burst pressures or leakage. In addition, as committed in DCL-02-045, performance of a trending analysis to assess the potential for increasing mixed mode affects over time.
- Any corrective actions found necessary in the event that condition monitoring requirements are not met.

Dented TSP Plus Point Inspection Scope

The 2R12 Plus Point dent inspection scope for greater than 2-volt dents was based on greater than 2-volt dents called in the prior 2R11 outage. The greater than 2-volt dent population and number of greater than 2-volt dents inspected by Plus Point in 2R12 is provided in Table 1.

The dented TSP inspection criteria and expansion plan criteria described below are based on PG&E letter to the NRC dated April 16, 2001, and WCAP-15573, Revision 1, "Depth-Based SG Tube Repair Criteria for Axial PWSCC at Dented TSP Intersections – Alternate Burst Pressure Calculation."

Plus Point inspection criteria for axial PWSCC left in service

Plus Point inspections shall be conducted on 100 percent of axial PWSCC indications at dented TSP intersections that were left in service in Unit 2 Cycle 12. Forty-seven axial PWSCC indications had been left in service in Cycle 12 under PWSCC ARC.

Plus Point inspection criteria for > 2 and < 5-volt dents and for ≥ 5-volt dents

On a SG-specific basis, Plus Point inspections shall be conducted on 100 percent of ≥ 5 volt dented intersections up to and including the highest hot leg TSP elevation where PWSCC (at any size dent), circumferential indications (at any size dent), or axial outside diameter stress corrosion crack (ODSCC) not detected by bobbin (AONDB) (at ≥ 5-volt dent) have been previously detected in that SG in the prior two outages, or current outage (expansion required), plus 20 percent of ≥ 5-volt dents at the next higher TSP elevation. In each SG where 100 percent hot leg TSP Plus Point inspections are not required, Plus Point inspections shall be conducted on 20 percent of ≥ 5-volt dents at each hot leg TSP. For any 20 percent sample, a minimum of 50 ≥ 5-volt dents shall be inspected. If the population of ≥ 5-volt dents at that TSP elevation is less than 50, then 100 percent of the ≥ 5-volt dents at that TSP shall be inspected.

On a SG-specific basis, Plus Point inspections shall be conducted on 100 percent of > 2 and < 5-volt dented intersections up to and including the highest hot leg TSP elevation where PWSCC (at any size dent), circumferential indications (at any size dent), or ≥ 2-inferred-volt AONDB (at > 2 and < 5-volt dent) have been previously detected in that SG in the prior two outages, or current outage (expansion required), plus 20 percent of > 2 and < 5-volt dent at the next higher TSP elevation. If a SG is free from PWSCC (at any size dent), circumferential indications (at any size dent) and ≥ 2-inferred-volt AONDB (at > 2 and < 5-volt dent), then Plus Point inspections shall be conducted on 20 percent of > 2 and < 5-volt dents at 1H. For any 20 percent sample, a minimum of 50 > 2 and < 5-volt dents shall be inspected. If the population of > 2 and < 5-volt dents at that TSP elevation is less than 50, then 100 percent of the > 2 and < 5 volt dents at that TSP shall be inspected.

The highest TSP where PWSCC or circumferential indications have been found in the prior two outages in Unit 2 is 5H for SG 2-2, 3H for SG 2-3, and 3H for SG 2-4. In

SG 2-1, no PWSCC or circumferential indications have been detected. Because all inferred bobbin voltages for AONDB indications have been less than 2-volts, AONDB indications do not factor into the inspection scope. Based on this information, the following Plus Point dent inspection criteria was implemented to meet the requirements specified above:

≥ 5-volt dents:

- 100% in all SGs, both hot leg and cold leg.

> 2 and < 5-volt dents:

- SG 2-1: 20% at 1H
- SG 2-2: 100% from 1H to 5H, 20% at 6H
- SG 2-3: 100% from 1H to 3H, 20% at 4H
- SG 2-4: 100% from 1H to 3H, 20% at 4H

In addition, the above 2 to 5-volt dent Plus Point inspection plan was augmented by Plus Point inspection of 100% of 2 to 5-volt dented TSPs in the hot and cold legs that had never been inspected by Plus Point in any prior outage. These dents were located at TSPs outside of the defined critical areas and buffer zones, and mostly located in the cold legs. No PWSCC was detected in this augmented inspection, thus confirming that the defined critical areas are adequate.

In 2R12, no axial PWSCC or circumferential indications were detected in SG 2-1, no axial PWSCC or circumferential indications were detected above 5H in SG 2-2, and no axial PWSCC or circumferential indications were detected above 3H in SGs 2-3 and SG 2-4. Therefore, no expansion of the Plus Point dent inspection program was required.

Plus Point inspection for less than or equal to 2-volt dents

One hundred percent of the tubes were inspected by bobbin coil, and the bobbin coil was relied upon for detection of axial PWSCC in ≤ 2-volt dents. As a result, Plus Point inspection of ≤ 2-volt dents was only required if the bobbin coil detected a distorted inside diameter support signal (DIS) at a dented TSP intersection. One hundred percent of DIS indications were inspected by Plus Point.

Plus Point inspection criteria for detection of circumferential indications at dents

On a SG-specific basis, if a circumferential indication or ≥ 2-inferred-volt AONDB is detected in a dent of "x" volts in the prior two outages, or current outage (expansion required), then Plus Point inspections shall be conducted on 100 percent of dents greater than "x - 0.3"-volts up to the affected TSP, plus 20 percent of dents greater than "x – 0.3"-volts at the next higher TSP. "X" is defined as the lowest dent voltage where a circumferential crack or ≥ 2-inferred-volt AONDB was detected in that SG. For any 20 percent sample, a minimum of 50 "x – 0.3"-volt dents shall be inspected. If the

population of "x – 0.3"-volt dents at that TSP elevation is less than 50, then 100 percent of the "x – 0.3"-volt dents at that TSP shall be inspected.

The smallest dent in which a Unit 2 circumferential crack has been detected in the prior two outages was 6.74 volts (in SG 2-2). Thus, dents greater than 6.44 volts are required to be inspected (i.e., 6.74 – 0.3 = 6.44). The existing 2-volt dent inspection cutoff for 2R12 Plus Point inspection is much less than the 6.44-volt threshold for circumferential cracking, and was therefore sufficient. In 2R12, 3 circumferential indications at dented TSPs were detected, and the associated dent voltages were much greater than 5-volts. Therefore, no Plus Point expanded inspection scope for dents less than 2-volts was necessary.

Tabulations of indications found in the inspection, tubes repaired, and tubes left in service under the ARC.

Sixty-four axial PWSCC indications at dented TSP intersections were detected in 2R12. Table 5 provides a tabulation of indications, including the following information:

- For plugged indications, the reason for plugging
- Identifies the indication as repeat or new.
- Adjusted NDE measurements of length, maximum depth, average depth, voltage, and crack location relative to the TSP centerline.
- OA burst pressure (free span and total length) using the ANL and EPRI burst model. A burst pressure of 6100 psi in Table 5 represents a predicted burst pressure ≥ 6100 psi since all pressures predicted to exceed 6100 psi are grouped at 6100 psi to reduce computer storage requirements in the analysis.
- OA SLB leak rate (free span and total length) using the ANL ligament-tearing model.

The PWSCC ARC allows axial PWSCC indications to remain in service at dented TSP intersections if the following PWSCC ARC conditions are satisfied for each indication:

- OA free span burst pressure (based on the combined ANL ligament-tearing and EPRI through-wall burst pressure model) exceeds 3NOdP. The 3NOdP burst pressure is equal to 4419 psi.
- OA total length burst pressure (based on the combined ANL ligament-tearing and EPRI through-wall burst pressure model) exceeds 1.4 dPSLB. The 1.4 dPSLB burst pressure is equal to 3367 psi, based on a dPSLB of 2405 psi (pressurizer PORV setpoint plus uncertainty).
- OA free span leak rate, when combined with free span leak rates from other degradation mechanisms, is less than 1 gpm (0.7 gpm at room temperature) in a faulted SG.

- OA total length leak rate, when combined with leak rates from other degradation mechanisms, is less than 10.5 gpm (room temperature) in a faulted SG.

- The indication is less than 40 percent through-wall outside the TSP crevice.

In addition to the above PWSCC ARC conditions, axial PWSCC indications must satisfy the following exclusion criteria in order to remain in service:

- The indication is not located at a TSP intersection located in the wedge region or 7H/7C high bending stress region.

- The indication is not located at a TSP intersection that contains cracked or missing TSP ligaments.

- The indication is not located at a TSP intersection that contains another degradation mechanism.

- The indication is not located in a tube that contains another repairable indication.

Forty-seven axial PWSCC indications at dented TSPs had been left in service in 2R11 due to PWSCC ARC. Following 2R12 Plus Point inspection, one of the repeat indications was resized as two separate indications based on a lookup of 2R11 data. Therefore, there were 48 repeat indications. After application of PWSCC ARC requirements, 7 of the 48 repeat axial PWSCC indications were plugged. Five indications were plugged because they were greater than 40 percent through-wall outside the TSP crevice. One indication was plugged because it was located at the same TSP as one of the indications that exceeded 40-percent through-wall depth outside the TSP. One indication was plugged because a circumferential indication was detected at the same TSP as the axial indication, referred to as a PWSCC mix mode indication.

In 2R12, 16 new axial PWSCC indications at dented TSPs were detected, sized by Plus Point, and applied to PWSCC ARC requirements. One indication was plugged because it was greater than 40 percent through-wall outside the TSP crevice. Two indications were plugged because they were located at the same TSP as the indication that exceeded 40-percent through-wall depth outside the TSP. One indication was plugged due to combined ID and OD cracking at the same TSP location.

The indications that were located outside the TSP region were reviewed to determine the need for in situ pressure testing in accordance with the criteria in WCAP-15128, Revision 1. Namely, if CM for axial PWSCC at dented TSPs predicts free span leakage or free span burst pressures less than 3NOdP, then in situ pressure testing is required. These conditions were not predicted by CM, and therefore no in situ pressure testing of axial PWSCC at dents was required nor performed.

In summary, 53 axial PWSCC indications at dented TSPs were returned to service in

2R12: 41 repeat indications and 12 new indications.

Growth rate distributions for indications used to establish the tube repair limits and for indications found in the inspection

The growth rate distribution used to establish the tube repair limits was based on prior outage growth data. The methodology for establishing the growth rate was established in WCAP-15573, Revision 1, as further explained in PG&E Letters DCL-02-023 and DCL-02-045. The methodology is summarized below:

- If there are at least 200 points in each of the last two cycles on the unit being inspected, the most conservative growth distribution from the last two cycles shall be used.

- If there are at least 200 points over the last two cycles on the unit being inspected, the growth distribution to be used is the more conservative of the combined data or either of the two cycles.

- If there are less than 200 points over the last two cycles on the unit being inspected, the growth distribution to be used shall contain data from both units over the last two (or three if necessary) cycles of each unit until 200 data points are obtained. The data from each cycle is compared for consistency in growth magnitude. If a given cycle has lower growth rates than other cycles, it is not included in the growth distribution.

In preparation for 2R12, the third bullet applied. Over 2R10 and 2R11, there are only 94 data points, less than the 200 points required for a unit-specific growth rate distribution. Therefore, the 2R10 and 2R11 data was supplemented by data from 1R11 and 1R12, resulting in a total of 428 data points over the last two cycles from each unit: 2R10 (45), 2R11 (49), 1R11 (119), 1R12 (215). The oldest growth data, that is, data from 1R8, 2R8, 1R9, 2R9, and 1R10, does not require evaluation and is excluded per the above methodology because over 200 data points are already available from the more recent inspections. For each remaining data set (2R10, 1R11, 2R11, and 1R12), cumulative growth distributions were developed and compared for length, maximum depth, and average depth. The prior cycle growth rate cumulative probability distributions (CPD) are provided in Table 2. Per the ARC methodology, these data sets were evaluated for exclusion. To bound the ARC method, PG&E chose to develop a conservative growth distribution based on the lower bound of the cumulative probability growth distributions from the combined data sets (2R10, 1R11, 2R11, 1R12). This lower bound growth distribution was separately developed for growth in length, maximum depth, and average depth. The lower bound growth rate CPD is provided in Table 2 and was used in the 2R12 Monte Carlo preliminary OA calculations for determining the need for tube repair.

In accordance with WCAP-15573, Revision 1, growth rates that could impact the upper tail of the growth distribution were evaluated during 2R12. The methodology requires that if new growth data causes the growth distribution above 90 percent probability to be more conservative, the new data are added to the growth distribution for the OA.

Sixty-one additional growth rate data points were established in 2R12, 48 from repeat indications and 13 from new indications. The CPD of the 2R12 growth data is provided in Table 2.

The final OA growth rate distribution that was used for determining the need for tube repair was developed in a similar method that was used to establish the growth rate distribution for the preliminary OA. PG&E developed a conservative growth distribution based on the lower bound of the cumulative probability growth distributions from the combined data sets including the 2R12 data set (i.e., 2R10, 1R11, 2R11, 1R12, 2R12). Once again, this lower bound growth distribution was separately developed for growth in length, maximum depth, and average depth. The lower bound growth rate CPD is provided in Table 2 and was used in the 2R12 Monte Carlo final OA calculations for determining the need for tube repair. For maximum depth, the final OA and preliminary OA growth distributions were identical. The final OA was slightly more conservative than the preliminary OA in the 0.06-inch and 0.07-inch-length bins, and in the 1 percent average depth bin.

Table 3 compares the 90 and 95 percentile growth values per EFPY at 604°F for 2R10, 1R11, 2R11, 1R12, and 2R12.

Plus Point confirmation rates for bobbin-detected indications when bobbin is relied upon for detection of axial PWSCC in less than or equal to 2 volt dents.

In 2R12, the bobbin coil was relied upon for detection of axial PWSCC in ≤ 2-volt dents. As identified in Table 4, there were 192 DIS indications detected by bobbin at less than or equal to 2-volt dented TSP intersections with non-repeat PWSCC indications. Tracking of Plus Point confirmation rates for repeat PWSCC indications tubes is not required because these known flaws are inspected by Plus Point regardless of the bobbin call.

All DIS indications were inspected by Plus Point. Only 1 of the 192 DIS indications were confirmed as PWSCC by Plus Point, for a Plus Point confirmation rate of less than 1 percent, or a 99 percent-bobbin overcall rate. The high bobbin overcall rate is greater than the approximately 90 percent overcall rate generated during the bobbin coil performance test documented in WCAP-15573, Revision 1. The high bobbin overcall rate is overly conservative to establish a high probability of detecting significant axial PWSCC indications in ≤ 2-volt dents.

For condition monitoring, an evaluation of any indications that satisfy burst margin requirements based on the Westinghouse burst pressure model, but do not satisfy burst margin requirements based on the combined Argonne National Laboratory (ANL) ligament tearing and through-wall burst pressure model.

This item is not applicable, because all indications satisfied CM burst margin requirements based on the combined ANL ligament tearing and EPRI through-wall burst pressure model as shown in Table 5. The total length CM burst requirement for EOC 12 was 3367 psi at 1.4 dPSLB, based on dPSLB of 2405 psi (pressurizer power

operated relief valve (PORV) setpoint plus uncertainty). The free span length CM burst requirement for EOC 12 was 4419 psi, based on 3NOdP.

Performance evaluation of the operational assessment (OA) methodology for prediction of flaw distributions as a function of flaw size.

Benchmarking was performed of the repeat PWSCC ARC indications that had been left in service in Unit 2 Cycle 12. The actual EOC 12 CM burst pressure of all repeat indications exceeded the default free span and total length burst pressure of 6100 psi using the ANL/EPRI model, and had no SLB leakage using the ANL ligament-tearing leakage model. With one exception (2R11 indication in SG 2-2 R19C17), all projected EOC 12 burst pressures exceeded the default free span and total length burst pressure of 6100 psi, using the ANL/EPRI model, and no SLB leakage was projected at EOC 12 using the ANL ligament-tearing leakage model. Based on this performance evaluation via benchmarking, the OA methodology is determined to be adequately conservative.

Evaluation results of number and size of previously reported versus new PWSCC indications found in the inspection, and the potential need to account for new indications in the operational assessment (OA) burst evaluation.

As discussed above, there were 64 axial PWSCC indications detected in 2R11: 48 repeat indications and 16 new indications. One of the new indications had no prior Plus Point inspection. Of the new indications, 15 had prior Plus Point inspections in 2R11, of which 13 were detectable based on a lookup of the 2R11 data. Because the number of new flaws is relatively small and all new indications have OA burst pressures well in excess of burst margin requirements, there is no need to account for new indications in the OA burst evaluation.

Identification of mixed mode (axial PWSCC and circumferential) indications found in the inspection and an evaluation of the mixed mode indications for potential impact on the axial indication burst pressures or leakage. In addition, performance of a trending analysis to assess the potential for increasing mixed mode affects (e.g., circumferential crack depths, burst pressure reductions, increased leakage rates) over time.

For PWSCC ARC, a mixed mode indication is defined as an axial PWSCC indication and a circumferential indication (either PWSCC or ODSCC) occurring at the same dented TSP intersection. One mixed mode indication (axial PWSCC and circumferential PWSCC) was detected during 2R12 (SG 2-2 R5C33 1H). Axial PWSCC was left in service in 2R11 at this location under PWSCC ARC. The circumferential PWSCC was detectable in the 2R11 data based on a lookup performed in 2R12. Table 6 provides the NDE measurements of all of the TSP circumferential indications detected in 2R12, including SG 2-2 R5C33 1H. The dent was measured as 20.74 volts.

For SG 2-2 R5C33 1H, the 2R12 null distance of 70 degrees (0.53 inch) was measured between the axial and circumferential indications using the 0.080 pancake coil technique at 600 Khz. The 0.53 inch null distance exceeds the 0.25 inch separation distance requirement, and therefore the flaw is not interacting. Even if the flaw was interacting, the NDE average depth of the circumferential flaw is 43.7 percent, including

95 percent NDE uncertainty, which is less than the 75 percent average depth threshold value for mixed mode affects. In addition, neither the axial nor circumferential indications are 100 percent through-wall at any point. The circumferential indication is 64 percent maximum depth, including 95 percent NDE uncertainty. The measured maximum depth of the axial indication is 35 percent (adjusted NDE), and has no predicted SLB leakage at 95/50 confidence for CM. The CM burst pressure of the axial indication is in excess of 6100 psi. Based on this mixed mode assessment, there is no potential impact on the axial PWSCC indication burst pressure or leakage.

There are several conditions that require evaluation to determine the need for corrective actions. These are discussed below:

- If an interacting mixed-mode indication is found to have led to a reduction in the axial indication burst pressure by more than 10 percent and to less than 4000 psi, or to have caused an indication to not satisfy burst margin requirements, the burst margin requirements for implementation in the OA at the next and subsequent outages must be increased by the percentage reduction in the burst pressure found for the mixed mode indication. As discussed above, because this condition did not occur, there are no corrective actions needed to adjust burst margin requirements for future operational assessments.

- If an interacting mixed-mode indication is found, and the axial indication condition monitoring predicts SLB leakage at 95/50, and the circumferential indication has > 50 percent average depth including NDE uncertainty, then the CM leak rate for the axial indication must be increased by a leakage factor. In addition, the OA SLB leak rate for each SG must be increased by a leakage factor. As discussed above, because this condition did not occur, there are no corrective actions needed to adjust SLB leak rates for CM or OA.

- If a previously Plus Point-inspected TSP intersection is found to have a circumferential indication with average depth > 80 percent after accounting for NDE uncertainty, then the OA SLB leak rate for each SG must be increased by a leakage factor. All of the TSPs with circumferential indications detected in 2R12 were previously Plus Point inspected in 2R11. The deepest 2R12 circumferential indication was 51.2 percent average depth, including NDE uncertainty, less than the 80 percent average depth threshold. Therefore, no corrective actions are needed to adjust the OA SLB leak rates.

In response to NRC request for additional information, PG&E Letter DCL-02-045 dated April 18, 2002, committed to perform a trending analysis in the 120-day report to assess the potential for increasing mixed mode affects (e.g., circumferential crack depths, burst pressure reductions, increased leakage rates) over time. Since no burst pressure reductions or leakage rate multipliers have been required, there is no data to trend for these parameters. Trending of circumferential depths and number of circumferential indications is provided in Figures 1, 2, and 3. Figure 1 provides all DCPP Units 1 and 2 TSP PWSCC and ODSCC circumferential indication measured "adjusted" average depths versus year detected. The adjustments do not include NDE uncertainty. The

average depths show a fairly flat trend line. Figure 2 data is a subset of Figure 1, showing the mixed mode circumferential indication average depths versus year detected. Only three circumferential indications have been detected at the same TSP with an axial PWSCC indication that had been returned to service (1R11 SG 1-2 R11C81, 1R12 SG 1-2 R36C53, and 2R12 SG 2-2 R5C33). The Figure 2 average depths show a decreasing trend line. Figure 3 provides the cumulative distribution of the number of DCPP Units 1 and 2 TSP PWSCC and ODSCC circumferential indications detected over time. The trend does not indicate a large increase in the numbers of circumferential indications in recent inspections.

This trending assessment does not indicate a need to modify any mixed mode evaluation criteria such as applying the criteria that could lead to an increase in the burst margin requirements.

Any corrective actions found necessary in the event that condition monitoring requirements are not met.

This item is not applicable, because all indications satisfied condition monitoring burst margin requirements and leakage margin requirements.

All calculated CM burst pressures, evaluated at 95 percent probability and 50 percent confidence (95/50), exceeded the default pressure of 6100 psi for total length and for free span, well in excess of the 3367 psi total length SLB burst margin requirement and the 4419 psi free span burst margin requirement, using both the Westinghouse model and the ANL/TW model.

CM single indication SLB leak rates were evaluated at 95 percent probability and 50 percent confidence (95/50), using the ANL ligament-tearing model. No free span leakage and no total length leakage were calculated.

Table 1
> 2-Volt Dent Population and Number Plus Point Inspected in 2R12

2 to 5-volt Dents (based on 2R11 dent analysis) and Number Inspected (shaded)

TSP	SG 2-1	SG 2-2	SG 2-3	SG 2-4	Total Inspected
1H	4	83	6	1	
2H	1	20	3	3	
3H	2	2	8	24	
4H	2	39	2	4	
5H	3	2	1	2	
6H	1	0	9	1	
7H	17	12	10	38	
Total dents	30	158	39	73	

Note: The above 2 to 5-volt dent Plus Point inspection plan was augmented by Plus Point inspection of 100% of 2 to 5-volt dented TSPs in the hot and cold legs that had never been inspected by Plus Point in any prior outage.

> 5-volt Dents (based on 2R11 dent analysis) and Number Inspected (shaded)

TSP	SG 2-1	SG 2-2	SG 2-3	SG 2-4	Total Inspected
1H	0	318	1	0	319
2H	0	7	0	1	8
3H	0	1	1	26	28
4H	0	85	1	1	87
5H	2	0	0	0	2
6H	0	0	0	0	0
7H	0	0	2	5	7
7C	0	0	1	0	1
6C	0	0	0	0	0
5C	0	0	0	0	0
4C	0	0	5	0	5
3C	0	0	0	0	0
2C	0	0	0	0	0
1C	0	0	0	1	1
Total dents	2	411	11	34	458

2R12 inspection criteria (same criteria used in 2R11):

- 100% of $\geq$ 5 volt dents, both hot leg and cold leg
- SG 21: 20% of > 2 and < 5-volt dents at 1H
- SG 22: 100% of > 2 and < 5-volt dents from 1H to 5H (critical area), 20% at 6H
- SG 23, 24: 100% of > 2 and < 5-volt dents from 1H to 3H (critical area), 20% at 4H
- All 20% samples shall contain a minimum of 50 dents. If the population of > 2 and < 5-volt dents at the TSP elevation is less than 50, then inspect 100% of > 2 and < 5-volt dents at the TSP.

Table 2 - Axial PWSCC Cumulative Probability Distribution (CPD) Growth Rates per EFPY 604°F

	2R10 data		1R11 data		2R11 data		1R12 data		2R12 Prelim OA	2R12 data		2R12 Final OA
Length (inch)	Freq	CPD	Freq	CPD	Freq	CPD	Freq	CPD	Lower bound CPD	Freq	CPD	Lower bound CPD
0	8	0.178	77	0.647	19	0.388	78	0.363	0.178	22	0.379	0.178
0.01	7	0.333	13	0.756	4	0.469	24	0.474	0.333	7	0.500	0.333
0.02	5	0.444	9	0.832	13	0.735	45	0.684	0.444	13	0.724	0.444
0.03	11	0.689	6	0.882	3	0.796	17	0.763	0.689	7	0.845	0.689
0.04	5	0.800	3	0.908	2	0.837	19	0.851	0.800	3	0.897	0.800
0.05	5	0.911	5	0.950	2	0.878	14	0.916	0.878	1	0.914	0.878
0.06	2	0.956	2	0.966	4	0.959	7	0.949	0.949	1	0.931	0.931
0.07	0	0.956	1	0.975	0	0.959	5	0.972	0.956	1	0.948	0.948
0.08	1	0.978	3	1.000	0	0.959	1	0.977	0.959	2	0.983	0.959
0.09	0	0.978	0	1.000	2	1.000	4	0.995	0.978	1	1.000	0.978
0.1	0	0.978	0	1.000	0	1.000	1	1.000	0.978	0	1.000	0.978
0.11	0	0.978	0	1.000	0	1.000	0	1.000	0.978	0	1.000	0.978
0.12	0	0.978	0	1.000	0	1.000	0	1.000	0.978	0	1.000	0.978
0.13	1	1.000	0	1.000	0	1.000	0	1.000	1.000	0	1.000	1.000
MD (%TW fraction)	Freq	CPD	Freq	CPD	Freq	CPD	Freq	CPD	Lower bound CPD	Freq	CPD	Lower bound CPD
0	14	0.311	59	0.496	30	0.612	63	0.293	0.293	20	0.345	0.293
0.01	1	0.333	9	0.571	1	0.633	8	0.330	0.330	0	0.345	0.330
0.02	2	0.378	12	0.672	2	0.673	20	0.423	0.378	6	0.448	0.378
0.03	2	0.422	9	0.748	0	0.673	16	0.498	0.422	2	0.483	0.422
0.04	0	0.422	4	0.782	2	0.714	19	0.586	0.422	8	0.621	0.422
0.05	3	0.489	5	0.824	3	0.776	28	0.716	0.489	1	0.638	0.489
0.06	1	0.511	4	0.857	3	0.837	7	0.749	0.511	7	0.759	0.511
0.07	4	0.600	5	0.899	3	0.898	11	0.800	0.600	3	0.810	0.600
0.08	6	0.733	2	0.916	1	0.918	7	0.833	0.733	2	0.845	0.733
0.09	3	0.800	4	0.950	2	0.959	9	0.874	0.800	4	0.914	0.800
0.1	1	0.822	3	0.975	0	0.959	10	0.921	0.822	0	0.914	0.822
0.11	2	0.867	1	0.983	2	1.000	2	0.930	0.867	1	0.931	0.867
0.12	1	0.889	0	0.983	0	1.000	7	0.963	0.889	2	0.966	0.889
0.13	1	0.911	1	0.992	0	1.000	1	0.967	0.911	1	0.983	0.911
0.14	1	0.933	1	1.000	0	1.000	1	0.972	0.933	0	0.983	0.933
0.15	1	0.956	0	1.000	0	1.000	2	0.981	0.956	0	0.983	0.956
0.16	0	0.956	0	1.000	0	1.000	2	0.991	0.956	1	1.000	0.956
0.17	0	0.956	0	1.000	0	1.000	0	0.991	0.956	0	1.000	0.956
0.18	1	0.978	0	1.000	0	1.000	0	0.991	0.978	0	1.000	0.978
0.19	0	0.978	0	1.000	0	1.000	0	0.991	0.978	0	1.000	0.978
0.2	1	1.000	0	1.000	0	1.000	2	1.000	1.000	0	1.000	1.000
AD (%TW fraction)	Freq	CPD	Freq	CPD	Freq	CPD	Freq	CPD	Lower bound CPD	Freq	CPD	Lower bound CPD
0	14	0.311	46	0.387	27	0.551	53	0.247	0.247	14	0.241	0.241
0.01	3	0.378	17	0.529	5	0.653	25	0.363	0.363	6	0.345	0.345
0.02	1	0.400	18	0.681	6	0.776	24	0.474	0.400	6	0.448	0.400
0.03	4	0.489	6	0.731	2	0.816	17	0.553	0.489	4	0.517	0.489
0.04	3	0.556	6	0.782	0	0.816	23	0.660	0.556	3	0.569	0.556
0.05	5	0.667	9	0.857	4	0.898	23	0.767	0.667	7	0.690	0.667
0.06	2	0.711	4	0.891	0	0.898	18	0.851	0.711	7	0.810	0.711
0.07	4	0.800	3	0.916	0	0.898	12	0.907	0.800	5	0.897	0.800
0.08	2	0.844	4	0.950	2	0.939	6	0.935	0.844	2	0.931	0.844
0.09	2	0.889	0	0.950	1	0.959	2	0.944	0.889	1	0.948	0.889
0.1	1	0.911	2	0.966	1	0.980	4	0.963	0.911	0	0.948	0.911
0.11	0	0.911	1	0.975	1	1.000	1	0.967	0.911	0	0.948	0.911
0.12	1	0.933	1	0.983	0	1.000	2	0.977	0.933	2	0.983	0.933
0.13	1	0.956	0	0.983	0	1.000	2	0.986	0.956	0	0.983	0.956
0.14	0	0.956	2	1.000	0	1.000	3	1.000	0.956	0	0.983	0.956
0.15	0	0.956	0	1.000	0	1.000	0	1.000	0.956	0	0.983	0.956
0.16	0	0.956	0	1.000	0	1.000	0	1.000	0.956	0	0.983	0.956
0.17	1	0.978	0	1.000	0	1.000	0	1.000	0.978	1	1.000	0.978
0.18	0	0.978	0	1.000	0	1.000	0	1.000	0.978	0	1.000	0.978
0.19	0	0.978	0	1.000	0	1.000	0	1.000	0.978	0	1.000	0.978
0.2	1	1.000	0	1.000	0	1.000	0	1.000	1.000	0	1.000	1.000

Table 3
Growth Rates per EFPY at 604°F

Cycle	Data points	Length inch		MD %		AD %	
		90%	95%	90%	95%	90%	95%
2R10	45	0.050	0.057	11.83	14.68	9.13	12.14
1R11	119	0.035	0.050	6.67	8.58	6.14	8.03
2R11	49	0.051	0.056	7.01	8.51	5.37	8.43
1R12	215	0.050	0.060	9.69	11.37	6.88	9.14
2R12	58	0.041	0.068	8.55	11.84	6.92	8.53

Table 4
DIS Confirmation Rates

	SG 2-1	SG 2-2	SG 2-3	SG 2-4	Total
Number of bobbin DIS in less than or equal to 2 volt dented TSP intersections (excludes repeat PWSCC indications)	28	40	60	64	192
Number of new PWSCC indications confirmed by Plus Point	0	0	0	1	1
Plus Point confirmation rate	0%	0%	0%	1.6%	<1%
Bobbin DIS overcall rate	100%	100%	100%	98.4%	>99%

Table 5 - 2R11 PWSCC ARC Summary of Analysis Results

								Unadjusted NDE			Adjusted NDE --						CM Westinghouse Model				OA ANL-TW Model			
SG	Row	Col	TSP	Crack No	Cal Num	New or Repeat	2R12 Plug Reason	Length (in.)	MD (%)	AD (%)	Length (in.)	MD (%)	AD (%)	Max Volt	From	To	FS Burst Pressure psi	FS Leakage gpm	Total Length Burst Press psi	Total Length Leakage gpm	FS Burst Pressure psi	FS Leakage gpm	Total Length Burst Press psi	Total Length Leakage gpm
2	2	19	01H	1	20	Repeat	>40% DOP	0.15	64	40.4	0.12	49.0	31.4	0.47	0.40	0.52	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	40	01H	1	32	New		0.10	40	23.9	0.10	23.0	13.7	0.34	-0.54	-0.44	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	41	01H	1	21	Repeat		0.20	45	31.6	0.20	33.0	23.2	0.56	0.45	0.65	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	4	28	01H	1	20	Repeat		0.26	35	25.8	0.26	32.0	23.5	0.82	-0.02	0.24	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	4	34	04H	1	20	Repeat		0.11	40	23.3	0.11	35.0	20.4	0.25	0.06	0.17	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	5	3	01H	1	21	Repeat		0.32	36	22.6	0.30	20.0	15.5	0.47	-0.20	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	5	26	01H	1	20	Repeat		0.18	55	33.5	0.15	29.0	16.4	0.69	-0.31	-0.16	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	5	33	01H	1	20	Repeat	Mix Mode	0.21	35	24.3	0.21	35.0	24.3	0.84	-0.33	-0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	6	24	01H	1	20	Repeat		0.23	46	31.5	0.23	35.0	24.0	0.60	-0.34	-0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	6	31	01H	1	20	Repeat		0.19	64	45.5	0.19	49.0	34.8	0.82	-0.36	-0.17	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	6	31	01H	2	20	New		0.13	32	24.0	0.13	29.0	21.7	0.41	-0.13	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	6	36	01H	1	20	Repeat		0.10	38	17.2	0.10	20.0	9.1	0.48	-0.20	-0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	6	49	01H	1	21	Repeat		0.07	48	33.2	0.07	48.0	33.2	0.27	-0.24	-0.17	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	7	5	01H	1	21	Repeat		0.17	42	28.9	0.14	39.0	27.6	0.38	-0.06	0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	7	27	01H	1	20	Repeat		0.17	38	28.8	0.17	35.0	26.5	0.46	0.14	0.31	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	7	32	01H	1	20	Repeat		0.17	61	34.3	0.15	38.0	25.4	0.82	-0.29	-0.14	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	36	01H	1	20	Repeat		0.44	38	29.9	0.46	38.0	29.3	0.94	-0.26	0.20	6100	0.000	6100	0.000	6100	0.000	5784	0.000
2	8	43	04H	1	21	Repeat		0.21	54	40.0	0.21	42.0	31.1	0.79	-0.10	0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	52	01H	1	21	Repeat	>40% DOP	0.36	70	43.1	0.29	54.0	37.8	1.42	0.34	0.63	6100	0.000	6100	0.000	5828	0.000	5704	0.000
2	9	32	01H	1	20	Repeat		0.15	40	23.4	0.13	29.0	15.9	0.64	-0.11	0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	21	04H	1	20	Repeat		0.40	61	29.4	0.23	35.0	19.5	0.50	-0.04	0.19	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	30	01H	1	27	New		0.11	57	35.0	0.11	38.0	23.3	0.50	-0.27	-0.16	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	32	01H	1	28	New		0.09	18	10.9	0.09	20.0	12.2	0.27	0.46	0.55	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	17	01H	1	24	New		0.12	30	19.7	0.12	30.0	19.7	0.41	-0.47	-0.35	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	30	01H	1	20	Repeat		0.17	46	28.3	0.17	35.0	21.6	0.55	-0.23	-0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	30	01H	2	20	New		0.13	64	40.8	0.08	40.0	28.0	0.74	-0.40	-0.32	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	30	01H	3	20	New		0.09	46	28.3	0.06	32.0	19.6	0.39	0.47	0.53	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	12	39	01H	1	21	Repeat		0.14	57	35.6	0.09	33.0	22.1	0.61	-0.15	-0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	13	25	03H	1	20	Repeat		0.29	49	36.6	0.26	35.0	25.1	0.68	-0.16	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	13	41	01H	1	21	Repeat		0.19	36	26.8	0.19	28.0	20.8	0.68	-0.19	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	14	45	01H	1	21	Repeat		0.12	33	17.4	0.09	20.0	12.2	0.44	-0.04	0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	15	22	01H	1	20	Repeat		0.17	38	24.9	0.17	35.0	22.9	0.53	-0.09	0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	15	42	01H	1	21	Repeat		0.20	33	21.1	0.20	28.0	17.9	0.43	-0.06	0.14	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	15	51	01H	1	21	Repeat		0.14	33	20.2	0.14	20.0	12.2	0.29	-0.23	-0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	30	02H	1	55	New	ID/OD	0.10	39	25.8	0.10	30.0	19.8	0.47	0.18	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	49	01H	1	21	Repeat		0.20	54	26.5	0.18	31.0	20.2	0.85	-0.16	0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	17	12	01H	1	20	Repeat		0.18	32	19.2	0.18	32.0	19.2	0.70	0.11	0.29	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	17	12	01H	2	20	Repeat		0.16	27	14.9	0.16	20.0	11.0	0.39	-0.15	0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	17	12	01H	3	20	New		0.06	32	17.7	0.06	32.0	17.7	0.24	-0.40	-0.34	6100	0.000	6100	0.000	6100	0.000	6100	0.000

Table 5 - 2R11 PWSCC ARC Summary of Analysis Results

								Unadjusted NDE			Adjusted NDE						CM Westinghouse Model				OA ANL-TW Model			
SG	Row	Col	TSP	Crack No	Cal Num	New or Repeat	2R12 Plug Reason	Length (in.)	MD (%)	AD (%)	Length (in.)	MD (%)	AD (%)	Max Volt	From	To	FS Burst Pressure psi	FS Leakage gpm	Total Length Burst Press psi	Total Length Leakage gpm	FS Burst Pressure psi	FS Leakage gpm	Total Length Burst Press psi	Total Length Leakage gpm
2	18	10	01H	1	25	New		0.13	33	20.8	0.13	28.0	17.7	0.41	-0.31	-0.18	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	19	15	01H	1	20	Repeat		0.13	32	18.0	0.09	20.0	11.8	0.45	0.00	0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	19	17	01H	1	20	Repeat	>40% DOP	0.26	61	47.4	0.17	58.0	43.1	1.12	-0.51	-0.34	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	19	17	01H	2	20	Repeat	>40% DOP	0.12	52	37.5	0.12	49.0	35.3	0.74	-0.26	-0.14	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	21	35	02H	1	20	Repeat		0.21	35	23.0	0.21	29.0	19.0	0.47	-0.16	0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	21	40	01H	1	21	Repeat		0.13	33	20.0	0.13	31.0	18.8	0.53	-0.26	-0.13	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	21	41	01H	1	21	Repeat		0.16	33	24.0	0.16	31.0	22.5	0.58	0.17	0.33	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	22	44	04H	1	21	Repeat		0.16	36	23.3	0.16	28.0	18.1	0.30	-0.32	-0.16	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	22	55	01H	1	21	Repeat		0.16	33	22.4	0.16	33.0	22.4	0.40	0.09	0.25	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	23	14	01H	1	24	New		0.11	44	29.8	0.11	38.0	25.7	0.47	0.45	0.56	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	25	44	05H	1	21	Repeat		0.44	33	20.1	0.27	20.0	11.7	0.52	-0.11	0.16	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	30	19	01H	1	33	New	>40% DOP	0.24	66	38.9	0.18	63.0	35.7	1.08	-0.52	-0.34	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	30	19	01H	2	33	New	>40% DOP	0.13	33	26.0	0.13	33.0	26.0	0.49	-0.16	-0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	30	19	01H	3	33	New	>40% DOP	0.11	36	22.9	0.08	26.5	19.2	0.41	0.41	0.49	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	38	01H	1	20	Repeat	>40% DOP	0.17	55	42.7	0.17	55.0	42.7	1.35	0.27	0.44	6100	0.000	6100	0.000	6100	0.000	6100	0.000
3	15	47	02H	1	67	New		0.09	54	30.8	0.09	26.0	14.8	0.22	-0.15	-0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
3	21	78	03H	1	28	Repeat		0.36	43	32.8	0.32	35.5	26.2	1.00	-0.29	0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
3	29	41	03H	1	28	Repeat		0.11	77	33.4	0.07	28.0	17.4	0.48	-0.08	-0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
3	45	56	01H	1	28	Repeat		0.12	64	32.8	0.08	28.0	19.1	0.51	0.16	0.24	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	3	12	03H	1	19	Repeat		0.18	67	44.6	0.16	49.0	33.5	0.97	-0.09	0.07	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	5	15	01H	1	19	Repeat		0.13	49	32.9	0.06	28.0	17.8	0.38	-0.05	0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	6	38	03H	1	19	Repeat	>40% DOP	0.17	87	45.7	0.14	46.0	32.6	0.73	0.36	0.50	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	8	20	01H	1	58	New		0.41	58	29.9	0.37	43.0	27.6	1.10	-0.28	0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	12	17	03H	1	19	Repeat		0.14	49	32.2	0.12	31.0	21.2	0.88	-0.15	0.27	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	14	53	03H	1	19	Repeat		0.18	97	43.0	0.18	49.0	26.4	0.41	-0.07	0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000

Note: DOP means depth outside plate (TSP). SG 2-2 R19C17 1H crack 2 and SG 2-2 R30C19 1H cracks 2 and 3 are plugged because crack 1 at same TSP is greater than 40% depth outside the TSP.

Table 6
2R12 Circumferential Indications at Dented Tube Support Plates

										Unadjusted NDE			Adjusted NDE			Adjusted for Upper 95% NDE Uncertainty			Growth Rate per EFPY		
SG	Row	Col	Crack	TSP	Circ Type	Flaw Volt	Mixed Mode	Stabilize	Dent Volt	Angle	Max Depth %	Avg Depth %	Angle	Max Depth %	Avg Depth %	Angle	Max Depth %	Avg Depth %	Angle	Max Depth %	Avg Depth %
22	5	33	1	1H	ID	0.51	Yes	Yes	20.74	23.2	38.0	28.4	23.2	40.0	26.3	77.0	64.2	43.7	NDD in lookup		
22	18	27	1	1H	OD	0.24		Yes	21.00	32.0	40.0	23.8	32.0	40.0	31.6	173.7	64.3	51.2	4.3	0.0	0.9
24	16	12	1	3H	ID	0.38			11.60	27.4	84.0	42.1	27.4	46.0	26.6	81.3	68.6	44.0	2.4	3.9	2.9

Note 1: SG 2-2 R5C33 1H has axial PWSCC and circumferential PWSCC at the same TSP intersection (PWSCC mixed mode).
Note 2: Growth rate is based on adjusted NDE, not adjusted for upper 95% NDE uncertainty.

Figure 1

Circumferential Average Depth Trending

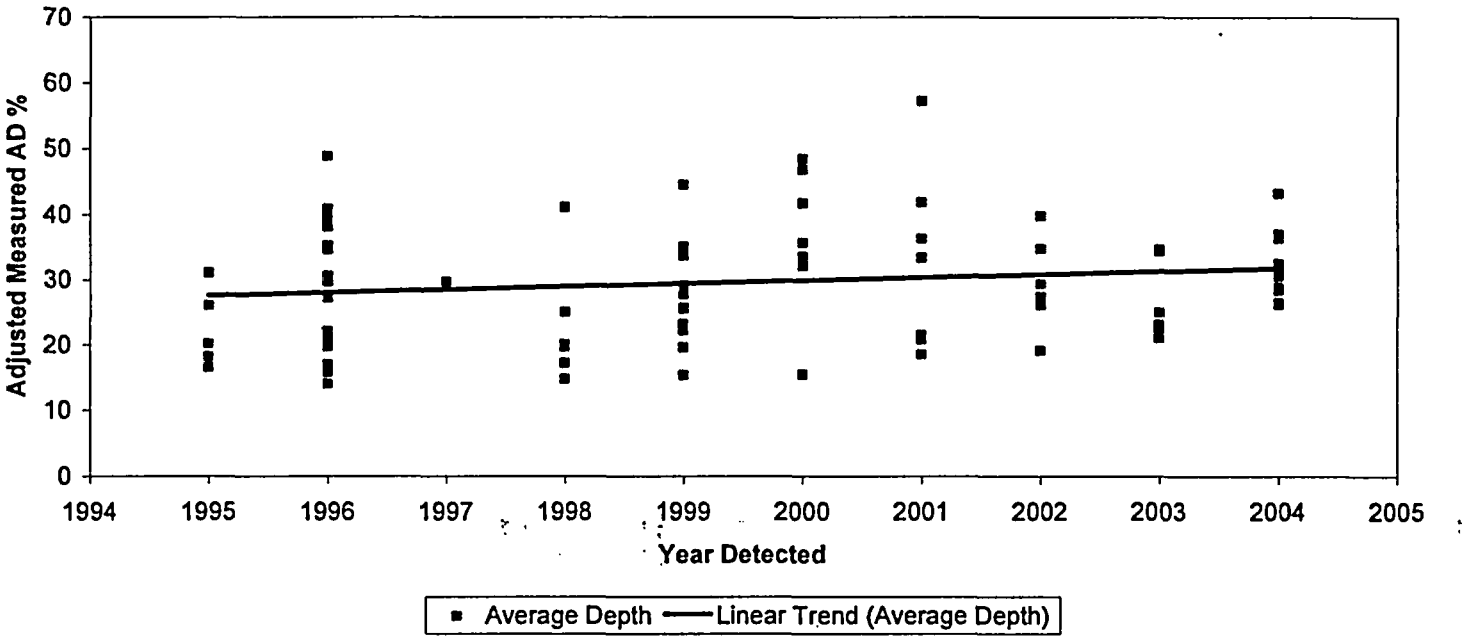


Figure 2

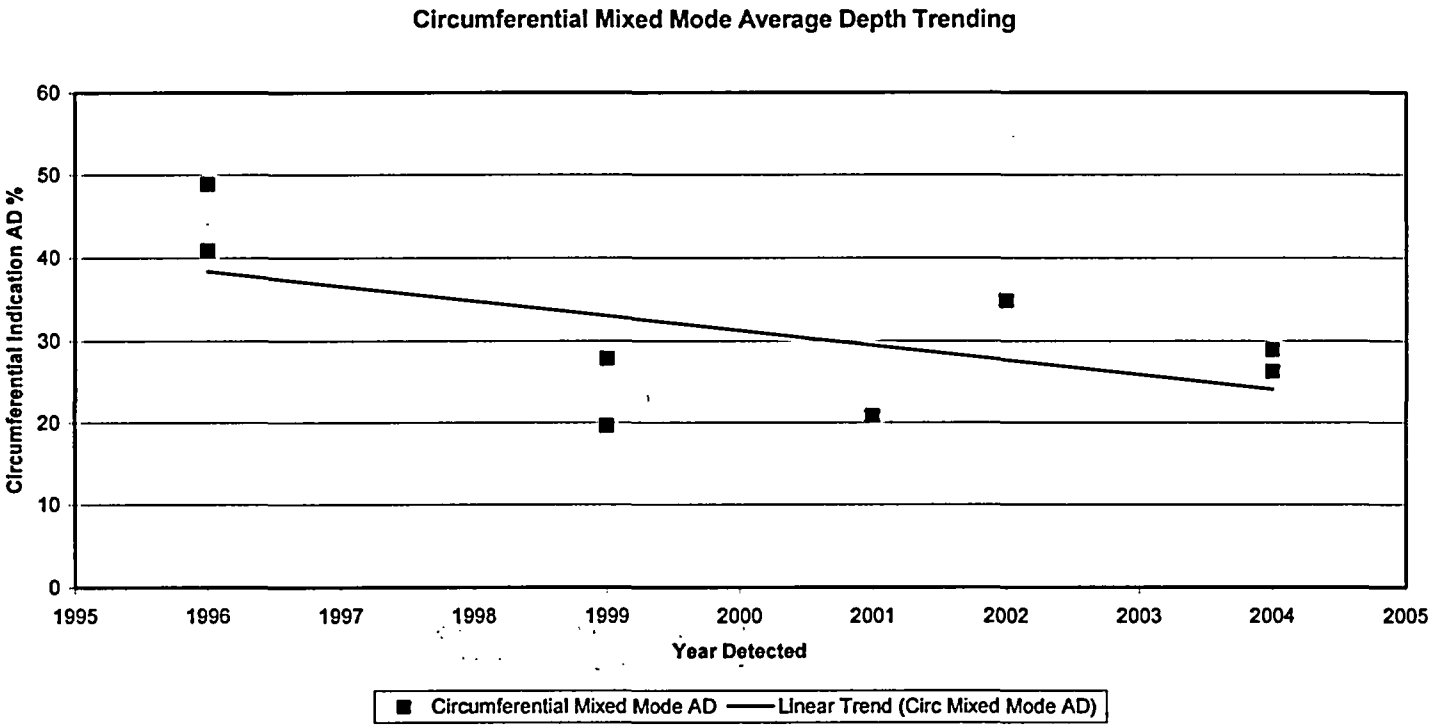
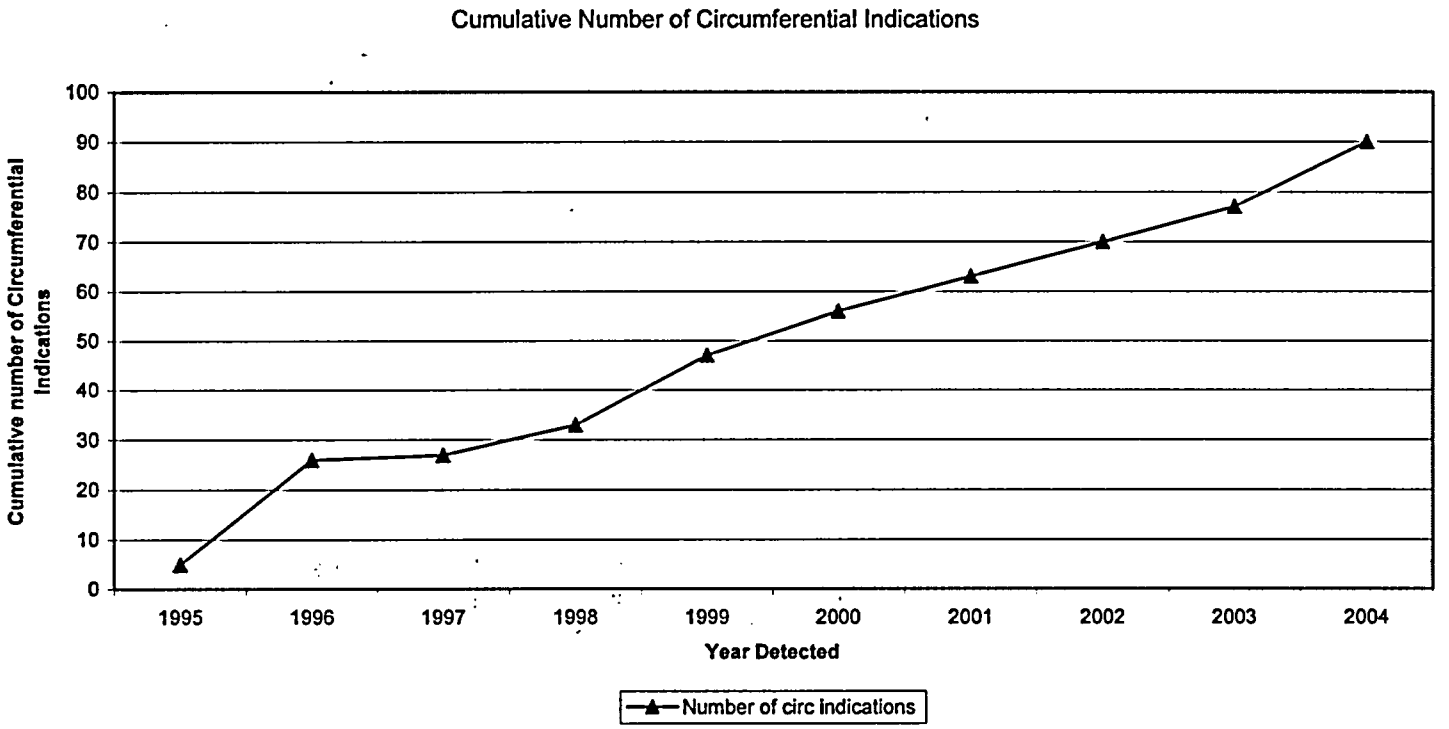

Circumferential Mixed Mode Average Depth Trending
Circumferential Indication AD %
60
50
40
30
20
10
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year Detected
Circumferential Mixed Mode AD
Linear Trend (Circ Mixed Mode AD)

Figure 3


Cumulative Number of Circumferential Indications
Cumulative number of Circumferential Indications
100
90
80
70
60
50
40
30
20
10
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Year Detected
Number of circ indications

Framatome ANP, Inc., an AREVA and Siemens company
DCPP Unit 2 Voltage-Based ARC 90-Day Report

Document Identifier 86 - 5059194 - 00