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PG&E Letter DCL-06-029

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Docket No. 50-275, OL-DPR-80
Diablo Canyon Unit 1
Special Report 06-01 - Results of Steam Generator (SG) Tube Inspections for Diablo Canyon Power Plant Unit 1 Thirteenth 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 1 steam generator (SG) Wstar (W*) alternate repair criteria (ARC) tubesheet inspections and calculated steam line break leakage from application of all ARC and non-ARC.

In accordance with TS 5.6.10.h, Enclosure 2 provides the 120-day reporting of results of Unit 1 SG primary water stress corrosion cracking ARC inspections at dented tube support plate (TSP) intersections.

Pursuant to NEI 97-06 Revision 2, "Steam Generator Program Guidelines," and Technical Specification Task Force (TSTF) 449 Revision 4, Enclosure 3 provides the 180-day reporting of condition monitoring for non-ARC degradation mechanisms. The operational assessment is also provided for information only.

In accordance with TS 5.6.10.i and Pacific Gas and Electric Company'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 4 provides the 90-day reporting of results of Unit 1 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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ddm1/469/R0248032
Enclosures

cc: Alan B. Wang, Project Manager NRR
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ENCLOSURE 1
SPECIAL REPORT 06-01

W* ALTERNATE REPAIR CRITERIA 90-DAY REPORT

DIABLO CANYON POWER PLANT UNIT 1 THIRTEENTH REFUELING OUTAGE

This report implements the Diablo Canyon Power Plant (DCPP) Technical Specification (TS) 5.6.10.e and 5.6.10.f steam generator (SG) tube inspection reporting criteria.

Wstar (W*) Alternate Repair Criteria (ARC) was implemented for the fifth time in DCPP Unit 1 during the Unit 1 Thirteenth Refueling Outage (1R13) SG inspections and repairs that were completed in November 2005. One hundred percent of the SG tubes were inspected by bobbin from tube end to tube end, except for Row 1 and 2 U-bends. 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.

<u>Technical Specification 5.6.10.e Reporting Requirements</u>

DCPP TS 5.6.10.e requires that the results of the inspection of W* tubes be reported to the Commission pursuant to 10 CFR 50.4 within 90 days following return to service of the SGs. This enclosure provides the specific TS reporting requirements, and Pacific Gas and Electric Company's (PG&E) description of compliance.

- *Identification of W* tube indications and indications that do not meet W* requirements and were plugged or repaired.*

  Table 1 provides a comprehensive list of axial primary water stress corrosion cracking (PWSCC) indications detected in the hot leg WEXTEX region during 1R13 Plus Point inspections. Table 1 column labeled "W* Cand" identifies 15 tubes (containing 18 single axial PWSCC indications [SAI] in the W* length) that are categorized as W* candidates (W* tubes) and left in service under W* ARC. There were no indications that did not meet W* requirements, and no indications were plugged because of failure to meet W* ARC.

  Not included in Table 1 is one additional W* tube (SG 1-4 R39C58) with Plus Point confirmed PWSCC in the plug expansion zone (PEZ) near the tube end. PWSCC in PEZ regions in deplugged tubes was previously noted in the Unit 1 Twelfth Refueling Outage (1R12) and fully discussed in the 1R12 90-day report, PG&E Letter DCL-04-112, and in response to NRC questions (DCL-05-017). SG 1-4 R39C58 was previously deplugged in the Unit 1 Ninth Refueling Outage (1R9) and returned to service at that time. In 1R13, this tube was inspected with Plus Point the full length of the hot leg tubesheet because of bobbin distorted tubesheet indications (DTS) located near the tube end, even though Plus Point inspection of DTS indications located below the flexible W* length is not required. Plus Point

confirmed the presence of multiple SAIs located near the tube end, in the PEZ region. These indications were previously detected in the prior outage, as reported in DCL-04-112 and DCL-05-017. The indications are located below the shop hard roll transition, as in 1R12. Because the indications are located below the flexible W* length, they were returned to service under W* ARC. As discussed in DCL-05-017, primary-to-secondary leakage from PEZ indications is very unlikely. Therefore, no steam line break (SLB) leakage is attributed to these 1R13 indications for condition monitoring (CM). For operational assessment, potential leakage from these indications is accounted for by use of the tube sever model, which is discussed later.

Also not included in Table 1 are circumferential outside diameter stress corrosion cracking (ODSCC) indications located at the top of tubesheet (in non-W* tubes) that were plugged because the crack type and location is excluded from application of W* ARC. Circumferential ODSCC indications located at the top of tubesheet are assessed in Enclosure 3.

- *Number of indications and location of the indications (relative to below the W* transition [BWT] and top of tubesheet [TTS]).*

  For each of the 18 indications in Table 1, the "LCT" and "UCT" columns in Table 1 provide the elevation (inch) of the upper crack tip and elevation of the lower crack tip relative to the TTS. The "Dist UCT to TTS" column in Table 1 provides the distance (inch) between the upper crack tip and the TTS, accounting for nondestructive examination (NDE) uncertainty on locating the crack tip relative to the TTS. The "Dist UCT to BWT" column in Table 1 provides the distance (inch) between the upper crack tip and the BWT, accounting for NDE uncertainty on locating the crack tip relative to the BWT.

- *Orientation (axial, circumferential, volumetric, inclined).*

  The "Ind" column in Table 1 provides the orientation of indication. All indications are SAI. No indications are circumferential, volumetric, or inclined.

- *Radial position of the tube within the tubesheet.*

  The "Tube Radial Position" column in Table 1 provides the radial position of the tube within the tubesheet.

- *W* Zone of the tube.*

  The "W*ZONE" column in Table 1 provides the W* zone of each indication.

- *Severity of each indication (estimated depth).*

  The "MD-adj" column in Table 1 provides the estimated maximum depth (MD) (percent through-wall) of each indication. The depth is the adjusted depth using the same techniques as PWSCC ARC depth sizing.

- *Side of the tube in which the indication initiated (inside or outside diameter [ID/OD]).*

  The "ID/OD" column in Table 1 provides the side of the tube in which the indication initiated. All indications are ID initiated (i.e., PWSCC).

- *W* inspection distance measured with respect to the BWT or TTS (whichever is lower).*

  For the one hundred percent Plus Point hot leg TTS exam, the inspection extent relative to the TTS was specified as plus +2/-8 inches. Assuming no degradation in the W* length, 8 inches below the TTS constitutes the W* inspection distance. 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. The distances are with respect to BWT because, in all cases, the BWT elevation was located lower than the TTS elevation. In all cases, the W* inspection distance was greater than or equal to the flexible W* length, as indicated by "Yes" in the "Insp Ext Satisfied" column.

- *Length of axial indications.*

  The "Crack Length" column in Table 1 provides the crack length of each axial indication. For tubes with multiple cracks, the "Total Length" column provides the total (summed) length of individual cracks within the flexible W* length.

- *Angle of inclination of clearly skewed axial cracks (if applicable).*

  No axial cracks were inclined, so this item is not applicable.

- *Updated 95 percent growth rate for use in operational assessment.*

  Of the 18 axial PWSCC indications in the hot leg WEXTEX region that were detected in 1R13 as listed in Table 1, two were new indications and sixteen were repeat W* indications that had been left in service in the prior inspection (1R12). All repeat indications were detected in 1R13. Based on 1R12 lookup reviews of the two new indications, one was detectable and one was not detectable. As a result, 17 additional length growth rate data points were available for evaluation, and their average growth rate was 0.00 inch per effective full power years (EFPY) at T_{hot} of 604 degrees, indicating negligible growth. After addition of the Unit 1 Cycle 13 data

points, the updated W* growth rate distribution now consists of 281 data points from DCPP Units 1 and 2 over 10 cycles. The updated growth rate at 95 percent cumulative probability is 0.107 inch per EFPY at 604 degrees. The W* methodology requires that, if the new growth data and deletion of the oldest cycle(s) of growth data results in a minimum of 200 data points, then the oldest cycle(s) of data is excluded. Exclusion of 31 data points in the oldest cycles (Unit 2 Eighth Refueling Outage [2R8], 1R9, Unit 2 Ninth Refueling Outage [2R9], Unit 1 Tenth Refueling Outage [1R10]) results in 233 data points before 1R13, and 250 data points after 1R13. A minimum of 200 data points is achieved in both cases, and the 31 data points are excluded. The 95 percent cumulative probability growth rate of the pre-1R13 data set (233 points) and post-1R13 data set (250 points) is 0.119 inch per EFPY and 0.116 inch per EFPY, respectively. For conservatism, the growth rate value used for both the preliminary operational assessment (OA) and final OA is 0.119 inch per EFPY at 604 degrees.

In support of growth rate evaluations and W* calculations, the actual length of Unit 1 Cycle 13 was 1.34 EFPY, and the projected length of Unit 1 Cycle 14 is 1.39 EFPY.

- *Cumulative number of indications detected in the tubesheet region as a function of elevation within the tubesheet.*

  Table 2 provides the cumulative number of indications detected in the tubesheet region as a function of elevation within the tubesheet. The table includes the distribution of Unit 1 indications before 1R13, the distribution of new 1R13 indications, updated Unit 1 distribution after 1R13, and the Unit 1 cumulative distribution and cumulative frequency after 1R13. In 1R13, two new indications were detected: one at 4.65 inch below the TTS (included in the minus 4 inch bin), and one at 1.31 inch below the TTS (included in the minus 1 inch bin).

- *Condition monitoring and operational assessment main steamline break leak rate for each indication and each SG in accordance with the leak rate methodology described in PG&E Letter DCL-05-018, dated March 11, 2005, as supplemented by PG&E Letter DCL-05-090 dated August 25, 2005.*

  Condition Monitoring SLB Leak Rate for Indications within Flexible W Length*

  CM leak rate for axial PWSCC indications detected within the flexible W* length is determined using the DENTFLO leak model in accordance with WCAP-14797-P, Revision 2. (Note: As discussed in DCL-05-090, the constrained crack leak model is not applicable for end of cycle [EOC] 13 condition monitoring.) The 95 percent leak rates for each indication, as well as each SG, are provided in Table 1 under column "DENTFLO CM Leak Rate." The total SG leak rates are repeated in Table 3.

For information only, applying the constrained crack leak model, the 95 percent prediction bound leak rates for each indication, as well as each SG, are provided in Table 1 under column "Constrained Crack Model CM Leak Rate."

Operational Assessment SLB Leak Rate for Indications within 12 inches from TTS

The OA leak rate for axial PWSCC indications detected within 12 inches from the TTS is determined by using the constrained crack leak model. The 95 percent prediction bound leak rates for each indication, as well as each SG, are provided in Table 1 under column "Constrained Crack Model OA Leak Rate." The total SG leak rates are repeated in Table 4.

The OA leak rate for undetected indications between 8 and 12 inches below the TTS is determined by multiplying the number of projected undetected indications between 8 and 12 inches below the TTS at the next inspection by a factor of 0.0033 gallons per minute (gpm). The leak rate value of 0.0033 gpm is the 95 percent prediction bound leak rate, applying the constrained crack model with a Zone B1 contact pressure at a depth of eight inches below the TTS. Twelve undetected indications are projected between 8 and 12 inches below the TTS based on the more conservative of the two methods described below. Therefore, the OA leak rate for undetected indications between eight and twelve inches below the TTS is 0.0396 gpm for each SG. These SG leak rates are repeated in Table 4.

Historical data projection method. The number of undetected PWSCC indications between 8 and 12 inches below the TTS would not be expected to be much greater than the number reported between 4 and 8 inches below the TTS, due to the trend of decreasing number of indications with distance below TTS. Of the 37 PWSCC indications in DCPP Unit 1, 11 percent were between 4 to 8 inches below the TTS, and 16 percent were between 8 to 12 inches below the TTS. Conservatively, 16 percent of the total historical plus EOC projected indication count will be assumed to be undetected between 8 and 12 inches below the TTS. Figure 1 illustrates the cumulative number of PWSCC indications versus EFPY in DCPP Unit 1. A linear regression analysis using only data from the last five outages shows that about 42 cumulative indications are projected at the next inspection (Unit 1 Fourteenth Refueling Outage [1R14]), such that about five new indications are anticipated in 1R14. Therefore, if the Plus Point inspection distance was increased from eight to 12 inches below the TTS in 1R14, an additional 7 indications (16 percent of 42) might be observed.

Ninety percent probability prediction method. Figure 2 presents a plot of the binned PWSCC elevation data for all DCPP Unit 1 historical indications located greater than 1 inch below the TTS. Excluding the expansion transition indications above 1 inch for Unit 1 would be expected to provide the best dataset for estimating indications at deeper depths. Figure 2 provides a best-fit regression of this data, an upper 90 percent probability prediction bound, and an upper 90 percent probability

cumulative prediction bound. The number of indications that could be present in the range of 8 to 12 inches below the top of tubesheet is obtained by summing the upper 90 percent probability prediction bound individual values at 8, 9, 10, and 11 inches (approximately 3 in each bin), for a total of about 12 indications. As a result, twelve indications will be applied for OA because it is slightly greater than seven indications from the historical data projection method.

Operational Assessment SLB Leak Rate for Indications Below 12 inches from TTS

The OA leak rate for indications located below 12 inches from the TTS is determined by the severed tube model. This model assumes all in-service tubes contain a 360° tube sever located 12 inches below the TTS and assigns a leak rate of 0.00009 gpm per tube. This value is the 90 percent prediction bound leak rate at 2560 pounds per square inch differential for a contact pressure representative of the 3 inch nominal crevice test specimen from the drilled hole crevice leak rate test data in WCAP-14797-P, Revision 2. The resulting leak rates for each SG are listed in Table 4, and are approximately 0.3 gpm for each SG.

- *Verification that the upper crack tip of W* indications returned to service in the prior cycle remain below the BWT by at least the 95 percent confidence NDE uncertainty on locating the crack tip relative to the BWT.*

As stated in DCL-05-090, for 1R13 90-day reporting, this reporting requirement is not applicable because the new, more conservative, W* repair criteria was not in effect in cycle 13. Therefore, for 1R13 90-day reporting, PG&E applies the prior cycle requirement, that is, verification that the upper crack tip of W* indications returned to service in the prior cycle remain below the TTS by at least the 95 percent confidence NDE uncertainty on locating the crack tip relative to the TTS.

The "Dist UCT to TTS" column in Table 1 provides the as-found 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 as-found upper crack tip for indications returned to service in the prior cycle 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 13.

- *Assessment of whether the results were consistent with expectations and, if not consistent, a description of the proposed corrective action.*

The CM leak rates were consistent with expectations. Table 1 column "Prior OA Leak Rate" provides the prior cycle projected operational assessment leak rates for each repeat indication using the DENTFLO model. This leak rate is compared to the condition monitoring leak rate under column "DENTFLO CM Leak Rate." For all repeat indications, the prior cycle OA leak rates are greater than or equal to the CM leak rates, and the "OA Underprediction" column reports no underpredictions. Two

new PWSCC indications were detected, which is less than the five new indications expected in 1R13 based on a linear regression analysis using data from the four prior inspections. The elevations of the two new indications were about 1 and 4 inches below the TTS. Since about 75 percent of the PWSCC indications have been detected within about 4 inches from the TTS, the elevations of the new indications are consistent with expectations.

Technical Specification 5.6.10.f Reporting Requirements

DCPP TS 5.6.10.f requires that the aggregate calculated steam line break leakage from application of all ARC and non-ARC be reported to the Commission pursuant to 10 CFR 50.4 within 90 days following return to service of the SGs.

Table 5 (for CM) and Table 6 (for OA) reports the calculated SLB leakage from application of each ARC in each SG, that is, W* ARC, Generic Letter 95-05 voltage-based ARC, and PWSCC ARC. SLB leakage from non-ARC degradation is also provided in these tables. The ARC and non-ARC leak rates are then summed to arrive at an aggregate SLB leakage for each SG.

No in-situ leak testing of indications was performed in 1R13, so there is no SLB leakage contribution from in-situ testing.

In order to meet the accident-induced leakage performance criteria (AILPC), the aggregate calculated steam line break leakage from application of all ARC and non-ARC must 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 in License Amendment (LA) 156/156. The aggregate calculated condition monitoring SLB leakage at EOC 13 is 0.55 gpm for the limiting SG (SG 1-1) as shown in Table 5. The aggregate calculated operational assessment SLB leakage at EOC 14 is 2.49 gpm for the limiting SG (SG 1-2) as shown in Table 6. In both assessments, SLB leakage is less than the allowable limit. Therefore, the AILPC has been satisfied for condition monitoring at EOC 13 and operational assessment at EOC 14.

Table 1
1R13 Indications in Hot Leg WEXTEX Tubesheet Region (Excluding Circumferential Indications and PWSCC at Tube End)

SG	Count	Row	Col	Tube Radial Position	Ind	Volts	ID/OD	Crack #	CAL	LCT	UCT	Crack Length	Total Length	MD-adj	Dist UCT to TTS	UCT below TTS	W*ZONE	W* Length	BWT	Dist UCT to BWT	UCT Below W* ?	UCT Below BWT?
1	1	2	41	9.02	SAI	0.34	ID	1	28	-1.42	-1.31	0.11	0.11	66	1.09	Yes	B1	7.12	-0.20	0.83	No	Yes
1	2	3	2	58.49	SAI	0.82	ID	1	11	-1.36	-1.10	0.26	0.26	61	0.88	Yes	A	5.32	-0.09	0.73	No	Yes
1	3	15	10	52.09	SAI	0.82	ID	1	19	-9.35	-9.16	0.19	0.46	42	8.94	Yes	A	5.32	-0.26	8.62	Yes	Yes
1	4	15	10	52.09	SAI	1.28	ID	2	19	-8.87	-8.60	0.27	0.46	54	8.38	Yes	A	5.32	-0.26	8.06	Yes	Yes
1	5	20	44	26.91	SAI	0.52	ID	1	11	-8.31	-8.21	0.10	0.10	35	7.99	Yes	B2	7.12	-1.85	6.08	No	Yes
2	1	1	87	50.65	SAI	2.66	ID	1	22	-9.71	-9.31	0.40	0.40	58	9.09	Yes	A	5.32	-0.28	8.75	Yes	Yes
2	2	7	33	21.04	SAI	1.49	ID	1	25	-2.00	-1.61	0.39	0.39	97	1.39	Yes	B2	7.12	-0.35	0.98	No	Yes
2	3	20	37	29.75	SAI	2.39	ID	1	24	-1.68	-1.48	0.20	0.20	100	1.26	Yes	B3	7.12	-0.13	1.07	No	Yes
3	1	10	20	37.81	SAI	0.36	ID	1	32	-2.35	-2.21	0.14	0.14	20	1.99	Yes	A	7.12	-0.11	1.82	No	Yes
3	2	30	45	30.47	SAI	0.31	ID	1	20	-2.24	-2.15	0.09	0.09	32	1.93	Yes	A	7.12	-0.19	1.66	No	Yes
3	3	31	36	43.21	SAI	0.42	ID	1	20	-3.00	-2.86	0.14	0.14	20	2.64	Yes	A	5.32	-0.21	2.37	No	Yes
3	4	33	37	45.23	SAI	0.44	ID	1	20	-5.84	-5.70	0.14	0.14	29	5.48	Yes	A	5.32	-0.40	5.02	No	Yes
3	5	39	46	50.91	SAI	0.64	ID	1	20	-2.84	-2.68	0.16	0.16	29	2.46	Yes	A	5.32	-0.25	2.15	No	Yes
4	1	23	7	60.12	SAI	0.32	ID	1	24	-7.51	-7.37	0.14	0.25	20	7.15	Yes	A	5.32	-0.19	6.90	Yes	Yes
4	2	23	7	60.12	SAI	0.3	ID	2	24	-4.76	-4.65	0.11	0.25	20	4.43	Yes	A	5.32	-0.19	4.18	No	Yes
4	3	28	57	38.74	SAI	0.24	ID	1	24	-2.94	-2.79	0.15	0.28	20	2.57	Yes	A	7.12	-0.33	2.18	No	Yes
4	4	28	57	38.74	SAI	0.38	ID	2	24	-7.13	-7.00	0.13	0.28	20	6.78	Yes	A	7.12	-0.33	6.39	No	Yes
4	5	39	58	52.62	SAI	0.4	ID	1	58	-6.05	-5.86	0.19	0.19	28	5.64	Yes	A	5.32	-0.04	5.54	Yes	Yes

Table 1 (continued)
1R13 Indications in Hot Leg WEXTEX Tubesheet Region (Excluding Circumferential Indications and PWSCC at Tube End)

SG	Count	Row	Col	Dist EOC (N+1) UCT to TTS g	Dist EOC (N+1) UCT to BWT	EOC (N+1) UCT Below BWT?	W*Cand	Inspect Extent	W* Insp Ext wrt BWT	Flex W* Length	Insp Ext Satisfied ?	DentFlo CM Leak Rate	Prior OA Leak Rate	OA Under Prediction
1	1	2	41	0.93	0.67	Yes	Yes	-10.16	9.87	7.25	Yes	0.021		NA
1	2	3	2	0.72	0.57	Yes	Yes	-8.41	8.23	5.60	Yes	0.020	0.027	
1	3	15	10	8.78	8.46	Yes	Yes	-13.90	13.55	5.32	Yes	0.000	0.000	
1	4	15	10	8.22	7.90	Yes	Yes	-13.90	13.55	5.32	Yes	0.000	0.000	
1	5	20	44	7.83	5.92	Yes	Yes	-12.45	10.51	7.24	Yes	0.001	0.001	
												0.041	0.028	
2	1	1	87	8.93	8.59	Yes	Yes	-11.93	11.56	5.32	Yes	0.000	0.000	
2	2	7	33	1.23	0.82	Yes	Yes	-8.14	7.70	7.53	Yes	0.019	0.020	
2	3	20	37	1.10	0.91	Yes	Yes	-8.22	8.00	7.34	Yes	0.017	0.021	
												0.036	0.041	
3	1	10	20	1.83	1.66	Yes	Yes	-10.04	9.84	7.28	Yes	0.006	0.008	
3	2	30	45	1.77	1.52	Yes	Yes	-8.78	8.50	7.23	Yes	0.007	0.011	
3	3	31	36	2.48	2.21	Yes	Yes	-8.64	8.34	5.48	Yes	0.003	0.005	
3	4	33	37	5.32	4.86	Yes	Yes	-9.01	8.52	5.48	Yes	0.000	0.001	
3	5	39	46	2.30	1.99	Yes	Yes	-9.20	8.86	5.50	Yes	0.004	0.006	
												0.021	0.031	
4	1	23	7	6.99	6.74	Yes	Yes	-9.35	9.07	5.32	Yes	0.000	0.000	
4	2	23	7	4.27	4.02	Yes	Yes	-9.35	9.07	5.61	Yes	0.001		NA
4	3	28	57	2.41	2.02	Yes	Yes	-8.92	8.50	7.42	Yes	0.005	0.006	
4	4	28	57	6.62	6.23	Yes	Yes	-8.92	8.50	7.44	Yes	0.000	0.000	
4	5	39	58	5.48	5.38	Yes	Yes	-9.38	9.25	5.32	Yes	0.000	0.000	
												0.006	0.006	

Table 1 (continued)
1R13 Indications in Hot Leg WEXTEX Tubesheet Region (Excluding Circumferential Indications and PWSCC at Tube End

SG	Count	Row	Col	Constrained Crack Model CM Leak rate	Constrained Crack Model OA Leak Rate	PREVW* Tube	Deplugged?	Tube Plugged
1	1	2	41	0.275	0.308	No		No
1	2	3	2	0.005	0.005	Yes		No
1	3	15	10	0.001	0.001	Yes		No
1	4	15	10	0.001	0.001	Yes		No
1	5	20	44	0.003	0.003	Yes		No
				0.285	0.319			
2	1	1	87	0.001	0.001	Yes		No
2	2	7	33	0.136	0.150	Yes	Yes	No
2	3	20	37	0.084	0.091	Yes	Yes	No
				0.221	0.243			
3	1	10	20	0.030	0.033	Yes		No
3	2	30	45	0.027	0.029	Yes		No
3	3	31	36	0.015	0.016	Yes		No
3	4	33	37	0.004	0.005	Yes		No
3	5	39	46	0.008	0.008	Yes		No
				0.084	0.090			
4	1	23	7	0.001	0.001	Yes		No
4	2	23	7	0.002	0.002	Yes		No
4	3	28	57	0.022	0.023	Yes		No
4	4	28	57	0.003	0.004	Yes		No
4	5	39	58	0.003	0.003	Yes	Yes	No
				0.031	0.033			

Column – Table 1	Legend and Notes for Table 1
SG	Steam generator
Count	Indication count per SG
Row	Tube Row
Col	Tube Column
Tube Radial Position	Tube radial position, inch.
Ind	Indication of degradation. SAI means single axial indication.
Volts	Peak voltage from Plus Point coil
ID/OD	Tube surface, either inside diameter (ID) or outside diameter (OD)
Crack #	Crack number
CAL	Plus Point calibration group number
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 all cracks (inch).
MD-adj	Maximum depth (% through-wall) from Plus Point coil. The depth is the adjusted depth using the same techniques as PWSCC ARC depth sizing.
Dist UCT to TTS	Distance (inch) between the UCT and 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 UCT (including NDE uncertainty) is located below TTS (i.e., a positive number in the "Dist UCT to TTS" column), then PC is satisfied for repeat indications.
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) between the UCT and BWT, including $\Delta NDE_{CT\text{-}BWT}$ (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.
Dist EOC (N+1) UCT to TTS	Distance (inch) between the UCT and TTS at the end of the next cycle including $\Delta NDE_{CT\text{-}TTS}$, based on growing the UCT at 0.119 inch/EFPY.
Dist EOC (N+1) UCT to BWT	Distance (inch) between the UCT and BWT at the end of the next cycle including $\Delta NDE_{CT\text{-}BWT}$, based on growing the UCT at 0.119 inch/EFPY.
EOC (N+1) UCT below BWT?	If the UCT (including NDE uncertainty) is located below BWT at the end of the next cycle (i.e., a positive number in the "Dist UCT (n+1) UCT to BWT" column), the tube is a W* candidate.
W* Cand?	W* candidate, also referred to as W* tube. A tube is a W* candidate (or W* tube) if the UCT is below BWT and the EOC (n+1) UCT is below BWT.
Inspect Extent	Elevation of Plus Point inspection relative to TTS (inch).
W* Insp Ext wrt BWT	W* inspection extent 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.
Flex W* Length	Flexible W* length relative to BWT (inch), equal to W* Length + $\sum CI_i$ (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 Ext Satisfied?	If the W* inspection distance is greater than or equal to the flexible W* length, then the inspection extent is satisfied.
DENTFLO CM Leak Rate	Condition monitoring (CM) SLB leak rate, gpm at room temperature, using DENTFLO leak model, based on distance of UCT to BWT, using Figure 6.4-3 of WCAP-14797-P Rev 2. No SLB leak rate is assigned to indications with UCT below W* length.
Prior OA Leak Rate	Prior cycle projected operational assessment (OA) leak rate, gpm at room temperature, using DENTFLO leak model.
OA Underprediction?	If the DENTFLO CM leak rate is greater than the prior cycle DENTFLO OA projected leak rate, then the OA would be underpredicted.
Constrained Crack Model CM Leak Rate	Condition monitoring (CM) SLB leak rate, gpm at room temperature, using Constrained Crack leak model, based on distance of UCT to TTS. No SLB leak rate is assigned to indications with UCT located below TTS minus 12 inches. Note: For 1R13, this leak rate is for information only and is not the CM leak rate of record.
Constrained Crack Model OA Leak Rate	Operational assessment (OA) SLB leak rate, gpm at room temperature, using Constrained Crack leak model, based on distance of EOC (n+1) UCT to TTS. No SLB leak rate is assigned to indications with EOC (n+1) UCT located below TTS minus 12 inches.
PREVW* Tube?	Previous W* Tube. If the indication was left in service in the prior cycle, it is classified as a previous W* tube (i.e., a repeat indication). Otherwise, the indication is new.
Deplugged?	If tube was de-plugged during a previous outage, then "yes" is indicated.
Tube Plugged?	If tube was plugged during the current outage, then "yes" is indicated.

Table 2

Cumulative Number of Unit 1 PWSCC Indications Detected in the Tubesheet Region as a Function of Tubesheet Elevation

Distance (inch) relative to TTS	Distribution Pre 1R13	Distribution of New Indications in 1R13	Distribution Post 1R13	Cumulative Distribution Post 1R13	Cumulative Frequency Post 1R13
-12	0		0	0	0.00
-11	0		0	0	0.00
-10	0		0	0	0.00
-9	2		2	2	0.05
-8	4		4	6	0.16
-7	0		0	6	0.16
-6	2		2	8	0.22
-5	1		1	9	0.24
-4	0	1	1	10	0.27
-3	2		2	12	0.32
-2	6		6	18	0.49
-1	5	1	6	24	0.65
0	13		13	37	1.00
1	0		0	37	1.00
Total	37	2	37	37	

Table 3
DCPP Unit 1 Condition Monitoring Steam Line Break Leak Rates for W* Alternate Repair Criteria

EOC 13 Condition Monitoring Leak Rate (gpm at room temperature)	SG 1-1	SG 1-2	SG 1-3	SG 1-4
Axial PWSCC within flexible W* length (DENTFLO model)	0.041	0.036	0.021	0.006

Table 4
DCPP Unit 1 Operational Assessment Steam Line Break Leak Rates for W* Alternate Repair Criteria

EOC 13 Condition Monitoring Leak Rate (gpm at room temperature)	SG 1-1	SG 1-2	SG 1-3	SG 1-4
Detected indications within TTS minus 12 inches	0.319	0.243	0.090	0.033
Undetected indications within 8 to 12 inches below TTS	0.0396	0.0396	0.0396	0.0396
Undetected indications below TTS minus 12 inches (Note 1)	0.284	0.277	0.297	0.288
Total	0.324	0.560	0.427	0.361

Note 1: Leak rates are based on 0.00009 gpm multiplied by the number of inservice tubes in Cycle 14 (3156, 3073, 3296, and 3202 tubes for SGs 1-1, 1-2, 1-3, and 1-4, respectively.)

Table 5
DCPP Unit 1 Aggregate Condition Monitoring Steam Line Break Leak Rates

EOC 13 Condition Monitoring Leak Rate (gpm at room temperature)	SG 1-1	SG 1-2	SG 1-3	SG 1-4
W* ARC	0.041	0.036	0.021	0.006
Voltage-Based ARC (Note 1)	0.31	0.14	0.11	0.06
PWSCC ARC (Note 2)	0	0	0	0
Non-ARC degradation (Note 3)	0	0	0	0
Aggregate	0.551	0.176	0.131	0.066

Note 1: Voltage-based ARC leak rates are described in Enclosure 4.
Note 2: PWSCC ARC leak rates are described in Enclosure 2.
Note 3: Non-ARC degradation leak rate of 0 gpm based on Enclosure 3.

Table 6
DCPP Unit 1 Aggregate Operational Assessment Steam Line Break Leak Rates

EOC 14 Operational Assessment Leak Rate (gpm at room temperature)	SG 1-1	SG 1-2	SG 1-3	SG 1-4
W* ARC	0.324	0.560	0.427	0.361
Voltage-Based ARC (Note 1)	1.83	0.58	0.41	0.26
PWSCC ARC (Note 2)	0	1.35	0	0
Non-ARC degradation (Note 3)	0	0	0	0
Aggregate	2.154	2.490	0.837	0.621

Note 1: Voltage-based ARC leak rates are described in Enclosure 4.
Note 2: PWSCC ARC leak rates are described in Enclosure 2.
Note 3: Non-ARC degradation leak rate of 0 gpm based on Enclosure 3.

Figure 1

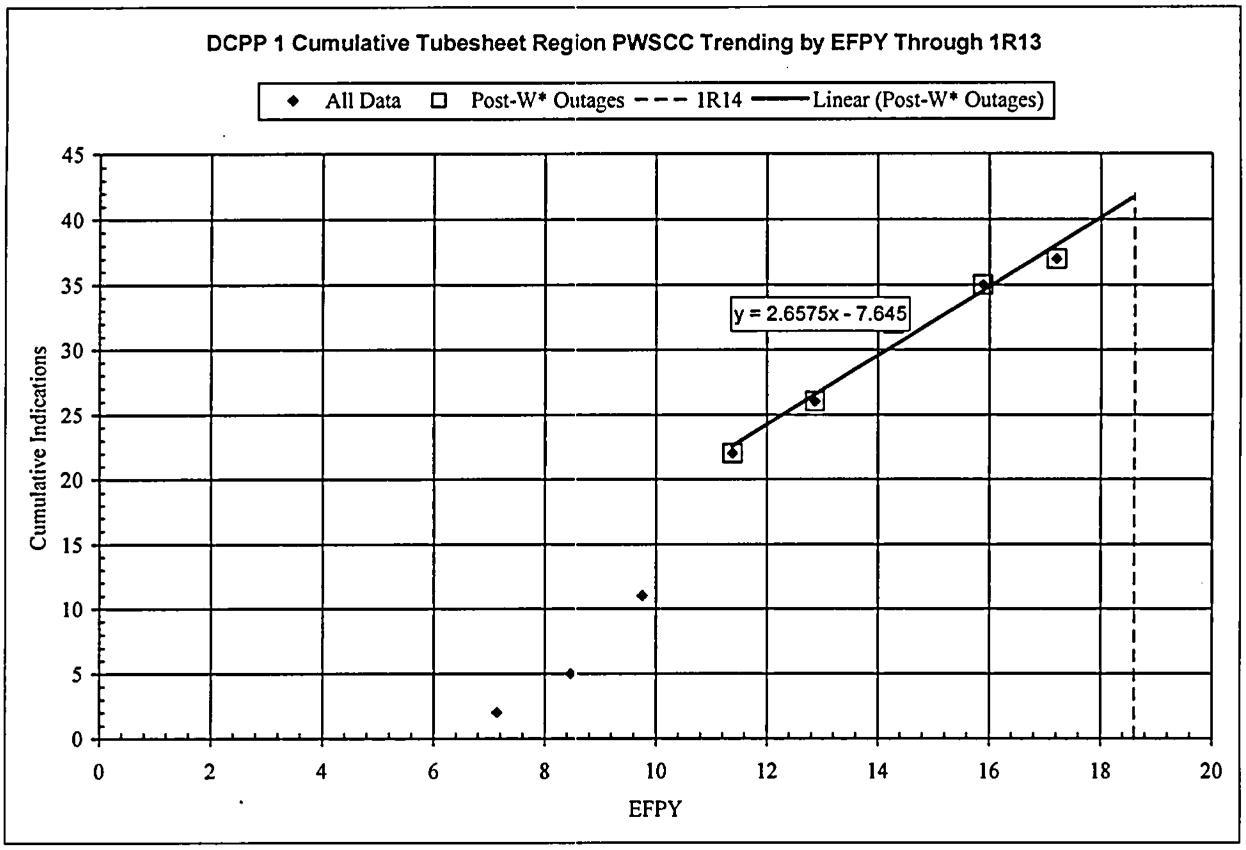
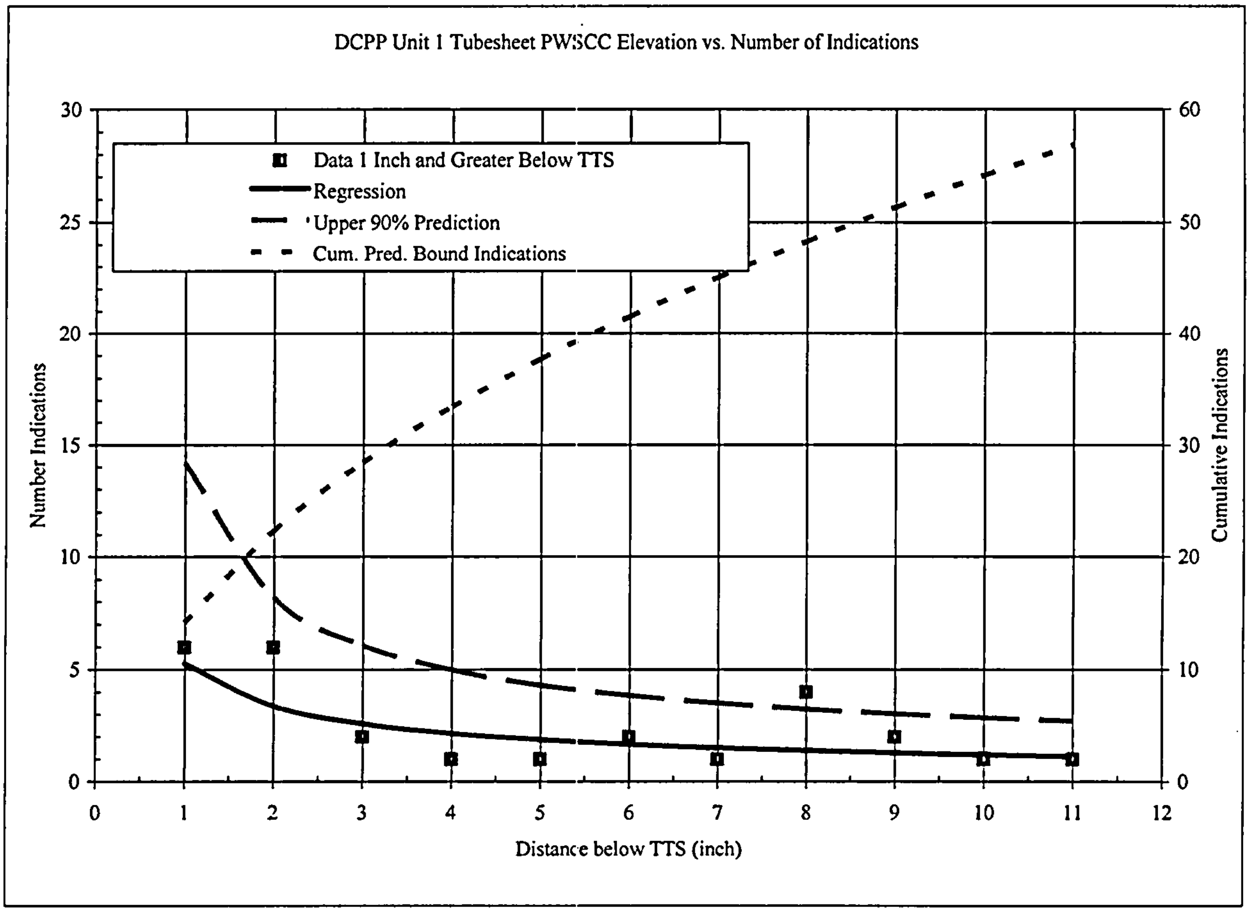

DCPP 1 Cumulative Tubesheet Region PWSCC Trending by EFPY Through 1R13
All Data
Post-W* Outages
1R14
Linear (Post-W* Outages)
y = 2.6575x - 7.645
Cumulative Indications
EFPY
0
5
10
15
20
25
30
35
40
45
0
2
4
6
8
10
12
14
16
18
20

Figure 2


DCPP Unit 1 Tubesheet PWSCC Elevation vs. Number of Indications
Data 1 Inch and Greater Below TTS
Regression
Upper 90% Prediction
Cum. Pred. Bound Indications
Number Indications
Cumulative Indications
Distance below TTS (inch)
0
5
10
15
20
25
30
40
50
60
1
2
3
4
6
7
8
9
11
12

ENCLOSURE 2
SPECIAL REPORT 06-01

TSP PWSCC ALTERNATE REPAIR CRITERIA 120-DAY REPORT

DIABLO CANYON POWER PLANT UNIT 1 THIRTEENTH REFUELING OUTAGE

NRC Reporting Requirements

Primary water stress corrosion cracking (PWSCC) alternate repair criteria (ARC) for axial PWSCC at dented tube support plates (TSP) was implemented for the third time in Diablo Canyon Power Plant (DCPP) Unit 1 during Unit 1 Thirteenth Refueling Outage (1R13). 1R13 steam generator (SG) inspections and repairs were completed in November 2005.

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 technical specification (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 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 EPRI through-wall (ANL/TW) burst pressure model.
- Performance evaluation of the operational assessment 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 Pacific Gas and Electric Company (PG&E) Letter 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.

Background: Dented TSP Plus Point Inspection Scope

The 1R13 Plus Point dent inspection scope for greater than 2 volt dents was based on greater than 2 volt dents called in the prior Unit 1 Twelfth Refueling Outage (1R12). The minimum scope for greater than 2 volt dents inspected by Plus Point in 1R13 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 1 Cycle 13. Two hundred seventeen axial PWSCC indications had been left in service in Cycle 13 under PWSCC ARC.

Plus Point inspection criteria for greater than or equal to (≥) 2 volt dented intersections

On a SG-specific basis, Plus Point inspections shall be conducted on 100 percent of ≥ 5 volt dented intersections up to and including the coldest TSP elevation where PWSCC (at any size dent), circumferential indications (at any size dent), or axial outside diameter stress corrosion cracking (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 colder 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 greater than (>) 2 and less than (<) 5 volt dented intersections up to and including the coldest 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 colder 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 coldest TSP where PWSCC, AONDB with ≥ 5 volt dent, or circumferential indications have been found in the prior two outages (Unit 1 Eleventh Refueling Outage [1R11] and 1R12) was 4H for SG 1-1, 7C for SG 1-2, and 6H for SG 1-4. In SG 1-3, no PWSCC, AONDB with ≥ 5 volt dent, or circumferential indications have been detected. In addition, all inferred bobbin voltages for AONDB indications have been less than 2 volts.

Plus Point inspection criteria for detection of circumferential indications at dents

On a SG-specific basis, if a circumferential indication or ≥ 2inferred 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 ≥ 2inferred 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.

In SG 1-1, the smallest dent in which a circumferential crack has been detected in the prior two outages (1R11 and 1R12) was 0.51 volts (in 1R12 at 1H). Thus, 100 percent of dents greater than 0.21 volts were required to be Plus Point inspected in SG 1-1 at 1H, and 20 percent at 2H (i.e., 0.51 – 0.3 = 0.21). Because there are no dents less than 0.21 volts at 1H in SG 1-1, the actual SG 1-1 Plus Point inspection plan became 100 percent of less than or equal to (≤) 2 volt dents at 1H, and 20 percent at 2H.

In SG 1-3, no circumferential cracking has ever been detected. In SG 1-2 and SG 1-4, the smallest dents in which a circumferential crack has been detected in the prior two outages (1R11 and 1R12) had voltages greater than 0.3 volts above the 2.0 volt dent threshold. Therefore, less than 2 volt dent Plus Point inspections were not required in the inspection plans for SG 1-2, 1-3, and 1-4.

Summary of Plus Point inspection plan of dented TSPs

Based on the Plus Point inspection criteria listed above, the following Plus Point dent inspection criteria were implemented. The numbers of dent inspections is summarized in Table 1.

- SG 1-1: 100% of ≤ 2 volt dents at 1H, 20% at 2H
  100% of > 2 and < 5 volt dents from 1H to 4H, 20% at 5H
  100% of ≥ 5 volt dents from 1H to 4H, 20% from 5H to 7H

- SG 1-2: 100% of > 2 and < 5 volt dents from 1H to 7C, 20% at 6C
  100% of ≥ 5 volt dents from 1H to 7C, 20% at 6C

- SG 1-3: 20% of > 2 and < 5 volt dents at 1H
  20% of ≥ 5 volt dents from 1H to 7H

- SG 1-4: 100% of > 2 and < 5 volt dents from 1H to 6H, 20% at 7H
  100% of ≥ 5 volt dents from 1H to 6H, 20% at 7H

- All 20 percent samples shall contain a minimum of 50 dents. If the population of dents at the TSP elevation is less than 50, then inspect 100 percent of the dents at the TSP.

In addition, as committed in PG&E Letter DCL-05-017 dated March 10, 2005, the above Plus Point inspection plan was augmented by Plus Point inspection of 100 percent of > 2 volt dented TSPs in the hot and cold legs that had never been inspected by Plus Point in any prior outage. The purpose of this inspection is to validate the Unit 1 SG critical areas. Table 1a provides the locations of these dents, which are located at TSPs outside of the defined critical areas and buffer zones.

Plus Point inspection of bobbin distorted indications at 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. If the bobbin coil detected a distorted ID support signal (DIS) at a dented TSP intersection, then Plus Point inspection was performed.

Summary of Inspection Results

Table 5 provides a list of all TSP axial PWSCC indications detected in 1R13. Table 7 provides a list of all TSP circumferential indications detected in 1R13.

No expansion of the Plus Point dent inspection program was required in 1R13, based on the following inspection results:

- No axial PWSCC, AONDB with ≥ 5 volt dent, or circumferential indications were detected in SG 1-3.
- No axial PWSCC, AONDB with ≥ 5 volt dent, or circumferential indications were detected above 4H in SG 1-1.
- No axial PWSCC, AONDB with ≥ 5 volt dent, or circumferential indications were detected below 7C in SG 1-2.
- No axial PWSCC, AONDB with ≥ 5 volt dent, or circumferential indications were detected above 6H in SG 1-4.
- All inferred bobbin voltages for AONDB indications were less than 2 volts.

- The dent voltages associated with TSP circumferential indications were greater than 0.3 volts above the 2.0 volt dent threshold for potential expansion, with one exception. SG 1-1 R24C59 TSP 1H circumferential indication had a 0.74 volt dent, but since 100 percent of less than 2 volt dents were already being Plus Point inspected at TSP 1H in SG 1-1, no expansion was required.
- No PWSCC was detected in the augmented inspection of greater than 2 volt dents with no prior Plus Point inspection, thus confirming that the defined critical areas are adequate.

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

Two hundred forty axial PWSCC indications at dented TSP intersections were detected in 1R13. Table 5 provides a tabulation of indications, including the following information:

- SG, row, column, TSP, crack number, calibration group number
- Identifies the indication as repeat, new, or merged. Merged indications are repeat indications that are sized as one indication in 1R13, but were sized as two indications in 1R12.
- For indications that were plugged in 1R13, the reason for plugging
- Adjusted nondestructive examination (NDE) measurements (length, maximum depth, and average depth), voltage, and adjusted NDE crack location relative to the TSP centerline.
- Burst pressures (free span and total length). For the operational assessment, the pressures are calculated using the ANL/TW burst model. For the condition monitoring assessment, the pressures are calculated using the Westinghouse burst model. A burst pressure of 6100 pounds per square inch (psi) 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.
- Steam line break (SLB) leak rates (free span and total length) using the ANL ligament tearing model, for condition monitoring and operational assessment.

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 ANL/TW model) exceeds $3\Delta P_{NO}$. The $3\Delta P_{NO}$ burst pressure is equal to 4419 psi.
- OA total length burst pressure (based on the ANL/TW model) exceeds $1.4\Delta P_{SLB}$. The $1.4\Delta P_{SLB}$ burst pressure is equal to 3367 psi, based on a ΔP_{SLB} 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 (0.72 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 gallons per minute (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 a different degradation mechanism.
- The indication is not located in a tube that contains another repairable indication.

Two hundred seventeen axial PWSCC indications at dented TSPs had been left in service following 1R12 under PWSCC ARC. Following 1R13 Plus Point inspection, sizing, and application of PWSCC ARC requirements, 17 of the repeat axial PWSCC indications were plugged, as described below:

- Four due to inside diameter or outside diameter (ID/OD) indications at the same TSP. In all cases, the OD indications were not detectable by bobbin (i.e., AONDB indications).
- Five due to the axial PWSCC indication being greater than or equal to 40 percent depth outside the tube support plate.
- Four preventively plugged due to axial PWSCC projected low OA burst pressures at the end of the next cycle, even though burst pressure margins were satisfied. SG 1-2 R31C47 2H was preventively plugged because the crack 1 total length OA burst pressure was 3930 psi using the ANL/TW model, which was the lowest burst pressure of all the indications. SG 1-2 R4C58 1H crack 3 was preventively plugged (along with cracks 1 and 2, which were smaller axial PWSCC indications at the same TSP) because it had a total length OA burst pressure of 4109 psi using the ANL/TW model, which was the second lowest burst pressure of all the indications.
- One due to the axial PWSCC indication located at a TSP with a single ligament crack indication.
- Three due to pluggable degradation at a different tube location.

In 1R13, 25 new axial PWSCC indications at dented TSPs were detected, sized by Plus Point, and applied to PWSCC ARC requirements. Five of these were plugged due to ID/OD degradation, and all others were allowed to remain in service under PWSCC ARC.

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-15573, Revision 1. Namely, if condition monitoring for axial PWSCC at dented TSPs predicts free span leakage or free span burst pressures less than $3\Delta P_{NO}$, then in-situ pressure testing is required. These conditions were not predicted by condition monitoring, and therefore no in-situ pressure testing of axial PWSCC at dents was required nor performed.

Two hundred eighteen axial PWSCC indications at dented TSPs were returned to service in 1R13: One hundred ninety six repeat indications, two repeat merged indications, and twenty new indications.

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

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 two hundred 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 two hundred 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 two hundred 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 1R13, the second bullet applies. As shown in Table 3, the number of growth rate data points in Cycle 11 and Cycle 12 are 119 and 215, respectively, such that there are 334 points over the last two cycles. Because there are a total of at least 200 points over the last two cycles on Unit 1, all other prior cycle growth rates did not require consideration. Per the ARC methodology, these data sets were evaluated for data exclusion. To bound the ARC method, for the preliminary Cycle 14 operational assessment, PG&E chose to conservatively use the lower bound Cumulative Probability Distribution (CPD) growth rates between Cycle 11 and Cycle 12. In actuality, the Cycle 12 growth rates are more conservative than Cycle 11 in all but one growth rate bin, so the preliminary cycle 14 OA growth rate distribution was essentially the Cycle 12 growth

rate distribution. The lower bound growth rate CPD is provided in Table 2 and was used in the Monte Carlo preliminary cycle 14 OA calculations for determining the need for tube repair.

In accordance with WCAP-15573, Revision 1, Unit 1 Cycle 13 growth rates that could impact the upper tail of the preliminary OA growth distribution were evaluated during 1R13. The methodology requires that if new growth data causes the growth distribution above 90 percent probability to be more conservative, the new data should be added to the growth distribution for the final OA.

Two hundred twenty six additional growth rate data points from Cycle 13 were established, 213 from repeat indications and 13 from new indications. All Cycle 13 growth rates are provided in Table 6, and the CPD of the growth data is provided in Table 2.

During 1R13, the Cycle 13 growth rates were compared to the 90 percentile growth rates used in the preliminary Cycle 14 OA (0.050 inch, 9.69 percent maximum depth [MD], 6.88 percent average depth [AD]). Many Cycle 13 growth rates exceeded these values, and the WCAP methodology required that these Cycle 13 data points be added to the growth distribution for the final OA. To bound the WCAP methodology, PG&E developed a conservative growth distribution based on the lower bound of the CPD from the combined Cycle 13 data set and the preliminary OA data set. 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 Monte Carlo final Cycle 14 OA calculations for determining the need for tube repair in 1R13. When comparing the final OA and preliminary OA growth distributions, the final OA was more conservative for maximum depth and length, and unchanged for average depth. For information, Table 3 compares the 90 and 95 percentile growth values per EFPY at 604 degrees for Cycles 11, 12, and 13.

Table 6 also notes whether the maximum voltage increased from less than or equal to 1 volt in 1R12 to greater than 1 volt in 1R13. As discussed in the 1R12 90-day report, in accordance with PWSCC ARC methods, the maximum depth for an indication less than 1 volt is determined by the depth from phase angle analysis at maximum volts (likely most reliable depth for low voltage indications) with a minimum of 20 percent, and the maximum depth for an indication greater than 1 volt is determined by direct phase angle analysis even though the location of maximum depth may not be at the location of maximum volts. This difference in sizing techniques for low voltage indications can lead to increased growth estimates. Of the ten maximum depth growth rates in the upper ninety percentile of the Cycle 13 growth distribution, seven were in this category. For conservatism, all of these data points were included in the growth distribution for the OA. No data was excluded.

In 1R12, the three axial PWSCC indications located at TSP 7C in SG 1-2 were detected by the 0.680 inch Plus Point probe (single coil probe) during the U-bend inspection

program, and were subsequently sized with data from the 0.680 Plus Point probe. No inspections were performed using the 0.720 inch Plus Point probe and, therefore, required sizing using 0.720 inch Plus Point data was not performed. This error was identified after SG inspections were completed, and the problem was entered into PG&E's corrective action program. In 1R13, these indications were inspected and sized using the 0.720 inch Plus Point probe as required, as well as the 0.680 inch Plus Point probe for comparison information. The sizing comparison showed that 1R13 adjusted NDE maximum depths were the same for both probes, with negligible differences in total crack lengths and total length condition monitoring burst pressures. The data provided in Table 5 reflects 1R13 sizing using the 0.720 inch Plus Point probe. The Cycle 13 growth rates and condition monitoring (CM) versus OA comparisons in Table 6 reflects 1R12 sizing results using 0.680 inch Plus Point data, and 1R13 sizing results using 0.720 inch Plus point data. Based on the negligible differences in sizing results based on the comparison study as discussed above, the Table 6 growth rates and condition monitoring operational assessment (CMOA) comparisons are valid for these three 7C indications.

<u>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.</u>

In 1R12, the bobbin coil was relied upon for detection of axial PWSCC in less than or equal to 2 volt dents. As identified in Table 4, there were 145 DIS indications detected by bobbin at 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 8 of the 145 DIS indications were confirmed as PWSCC by Plus Point, for a Plus Point confirmation rate of about 6 percent, or a 94 percent bobbin overcall rate. The high bobbin overcall rate is greater than the approximately 90 percent overall rate generated during the bobbin coil performance test documented in WCAP-15573, Revision 1. The high bobbin overcall rate establishes a very high probability of detecting significant axial PWSCC indications in less than or equal to 2 volt dents.

<u>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 ANL ligament tearing and through-wall burst pressure model.</u>

This item is not applicable. All indications satisfied CM burst margin requirements based on the combined ANL ligament tearing and EPRI through-wall (ANL/TW) burst pressure model, as well as the Westinghouse (WEC) burst pressure model. The CM Westinghouse model burst pressures are shown in Table 5 for both free span and total length. The ANL/TW model burst pressures for total length are shown in Table 6. The total length CM burst requirement was 3367 psi at 1.4 (differential pressure steam line

break (dPSLB), based on dPSLB of 2405 psi (pressurizer power operated relief valve (PORV) setpoint plus uncertainty). The free span length CM burst requirement was 4419 psi, based on $3\Delta P_{NO}$.

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

PG&E evaluated the performance of the PWSCC ARC OA methodology for prediction of flaw distributions as a function of flaw size. WCAP-15573, Revision 1, provides guidance for determining when corrective actions are needed when a single indication OA prediction significantly underestimates the burst pressure or leak rate when compared to the CM results. When comparing single indication projected leak and burst data with that obtained for the same indication from the inspection results, additional evaluations are to be performed and included in the 120-day report if: 1) the CM single indication burst pressure is < 5600 psi and more than 500 psi less than the projection obtained using the same burst model; or 2) the CM single indication leak rate is more than 0.2 gpm larger than the projected SLB leak rate.

Performance Evaluation of Single Indication SLB Leak Rates

Regarding CM single indication total length SLB leak rates, no CM single indication leakage was calculated in any SG, either from total length or free span. From the prior cycle OA, no CM single indication leakage was calculated in any SG, either from total length or free span. Therefore, the single indication OA leak rate methodology using the ANL ligament tearing model is determined to be adequately conservative, and no corrective actions are required.

Performance Evaluation of Single Indication Burst Pressures

The free span burst pressure for all indications exceeded the default value of 6100 psi for both the prior cycle OA and the CM assessment, using both burst models. Therefore, the single indication free span burst pressure methodology is determined to be adequately conservative, and no corrective actions are required.

A detailed total length burst pressure benchmarking analysis (CM versus prior cycle OA projections) was performed for the repeat indications that had been left in service in Unit 1 Cycle 13 under PWSCC ARC. As required by the PWSCC ARC, the OA burst pressures are 95/95 values, and the CM burst pressures are 95/50 values. Table 6 provides the results of the benchmarking. For both the Westinghouse model and the ANL/TW model, the total length burst pressures listed in the "prior cycle OA projection" columns were compared against the same model burst pressures in the "CM" columns, and the differences in CM versus OA burst pressures are listed.

For CM single indication burst pressures less than 5600 psi, the largest underpredictions were 152 psi using the Westinghouse model and 389 psi using the

ANL/TW model. Since these underpredictions are less than the 500 psi threshold value, the single indication total length burst pressure methodology is determined to be adequately conservative, and no corrective actions are required.

Since the CM of record uses the Westinghouse model and the OA of record uses the ANL/TW model, a comparison of the Westinghouse CM versus ANL/TW OA burst pressures is also provided in Table 6. This comparison shows no underpredictions.

Performance Evaluation of Total SG Monte Carlo SLB Leakage

Page 7-12 of WCAP-15573, Revision 1, requires the following: "If the results of the single indication analyses show leakage for condition monitoring or operational assessment for either free span or total length, then a total SG leak rate Monte Carlo operational assessment is required for each SG that shows leakage. A conservative probability of detection (POD) of 0.6 is used in the SG analysis."

The results of the 1R13 single indication analysis did not show CMOA leakage for free span and total length analyses. As a result, a total SG leak rate Monte Carlo OA was not required for any SG. Nonetheless, total SG leak rate analyses were performed for CM (using a POD of 1.0) and OA (using a POD of 0.6) for SG 1-1, 1-2, and 1-4, as a corrective action in response to a problem identified in September 2005. The problem and resolution is discussed below. The results of the total SG leak rate analyses show that no SG had any CMOA leakage, with the exception of SG 1-2 OA for which the 95/95 leak rate was 1.35 gpm. This 1.35 gpm leak rate value is greater than the 0 gpm value determined from the single indication Monte Carlo analysis, and is therefore considered to be the licensing basis OA leak rate for PWSCC ARC projections for SG 1-2 at end of cycle (EOC)-14.

In September 2005, PG&E determined that the above WCAP requirement was not satisfied during the prior inspections in 1R12. In 1R12, SG 1-2 R34C49 2H had a small leak rate using the single indication Monte Carlo analysis (0.063 gpm for condition monitoring and 0.339 gpm for operational assessment). The tube was preventively plugged in order to remove this indication from service, even though the indication satisfied OA burst and leakage margins. No other indication had any leakage in the CM and OA single indication analysis. These leak rates were reported to the NRC in Table 5 of Enclosure 2 of the 1R12 90-day PWSCC ARC report (PG&E Letter DCL-04-112 dated September 7, 2004). In 1R12, the WCAP requirement to perform a total SG leakage analysis if an indication leaks in the single indication analysis had been misinterpreted to be applicable only if the indication was returned to service. Therefore, no total SG leak rate Monte Carlo operational assessment was performed at that time.

As a corrective action, a total SG 1-2 leak rate Monte Carlo analysis was performed for EOC-13 OA as required by the WCAP. A 95/95 leak rate of 1.148 gpm was calculated. This value supersedes the 0 gpm leak rate reported in DCL-04-112 for PWSCC ARC.

The total SG 1-2 OA leak rate for all ARCs combined was therefore increased to 2.01 gpm, but significant margins to the 10.5 gpm limit were still retained. As a conservative check, total SG leak rate Monte Carlo OA analyses were also performed for SG 1-1 and 1-4, and no leakage was calculated. Because the 1R13 total SG 1-2 CM leak rate was 0 gpm and much less than the prior cycle projected total SG 1-2 leak rate of 1.148 gpm, the total SG leak rate Monte Carlo methodology is determined to be adequately conservative.

The WCAP does not require performance of a total SG leak rate Monte Carlo CM analysis in cases where single indication analysis results in leakage, on the assumption that "analysis with total SG leakage evaluated at 95 percent/50 percent confidence is a more accurate calculation and less conservative than summing all indications leakage values at their individual confidence levels." To determine the validity of this assumption, as another corrective action, total SG Monte Carlo CM EOC-12 analyses were conducted for SGs 1-1, 1-2, and 1-4. No leakage was calculated for SGs 1-1 and 1-4. For SG 1-2, a 95/50 leak rate of 0.138 gpm was calculated. This value was slightly larger than the SG 1-2 single indication CM analysis leak rate of 0.063 gpm reported in DCL-04-112, but significant margins to the 10.5 gpm limit were still retained.

The resolution of this problem concluded that total SG leak rate Monte Carlo analyses could be more conservative than the single indication analyses for both CM and OA. As a result, PG&E now requires that total SG Monte Carlo analyses be performed in each SG with axial PWSCC indications for CM and OA, regardless of the result of the single indication analyses. The more limiting analysis result will be used when comparing leak rates to the 10.5 gpm limit.

<u>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.</u>

As discussed above, there were 240 axial PWSCC indications detected in 1R13: 25 new indications and 215 repeat indications. The number of new indications continues to be a small fraction of the total number of indications. Of the 25 new indications, 11 had no prior Plus Point inspection. Of the 14 new indications with prior Plus Point inspection, 13 were detectable in 1R12 based on a lookup review, indicating a small growth rate progression. All of the new indications had CM and OA burst pressures in excess of 6100 psi using both the Westinghouse model and the ANL/TW model. Therefore, because the numbers of new flaws are relatively small, exhibited slow growth rates, and have CMOA 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. The indications are termed PWSCC mixed mode. No PWSCC mixed mode indications were detected in 1R13.

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

- If an interacting PWSCC 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 no mixed-mode indications were detected in 1R13, this condition did not occur and there are no corrective actions needed to adjust burst margin requirements for future operational assessments.
- If an interacting PWSCC 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 no mixed-mode indications were detected in 1R13, this condition did not occur and 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. There were 37 TSP circumferential indications detected in 1R13 (all were ODSCC). All of the TSPs with circumferential indications detected in 1R13 were previously Plus Point inspected in 1R12. The deepest 1R13 circumferential indication was 74.1 percent average depth, including 95 percent NDE uncertainty, less than the 80 percent average depth threshold. The maximum Plus Point amplitude for this flaw was only 0.14 volt, and it is expected that the flaw is very conservatively sized. 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 mean trend line shows a slight increase in average depths, attributed to the larger number of indications detected in 1R13. The frequency of larger depths tends to show an oscillating up and down pattern between outages, which may be a result of conservative sizing of low amplitude flaws.

Figure 2 data is a subset of Figure 1, showing the PWSCC mixed mode circumferential indication average depths versus year detected. A total of eight PWSCC mixed mode indications have been detected in DCPP Units 1 and 2. No PWSCC mixed mode indications were detected in 1R13, and Figure 2 average depths show a decreasing trend line.

Figure 3 provides the number of DCPP Units 1 and 2 TSP PWSCC and ODSCC circumferential indications detected over time. The trend line shows an increasing number of circumferential indications, due to the larger number of indications detected in 1R13.

Even though there are increasing trends in the number of circumferential indications and in circumferential average depths, there were no mixed mode indications detected in 1R13. In addition, of the eight PWSCC mixed mode indications, only three were associated 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). Therefore, there is not a significant potential for increasing mixed mode affects over time.

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

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

All CM burst pressures, evaluated at 95 percent probability and 50 percent confidence (95/50), exceeded 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 was calculated, and no total length leakage was calculated. In addition, total

SG leak rate Monte Carlo analyses were performed for each SG with indications, and no free span or total length leakage was calculated at 95/50 confidence levels using a POD of 1.0.

Table 1
1R13 Minimum Scope for Plus Point Inspection of Dented TSP Intersections

2-5 Volt Dents

TSP	SG 1-1	SG 1-2	SG 1-3	SG 1-4	TOTAL
1H	12	161	50	331	554
2H	56	139		141	336
3H	13	96		195	304
4H	6	117		123	246
5H	5	65		80	150
6H		18		211	229
7H		100		50	150
7C		24			24
6C		1			1
TOTAL	92	721	50	1131	1994

≥ 5 Volt Dents

TSP	SG 1-1	SG 1-2	SG 1-3	SG 1-4	TOTAL
1H	1	85	13	341	440
2H	18	62	4	46	130
3H	5	61	10	58	134
4H	2	72	5	89	168
5H	4	19	35	34	92
6H	1	1	16	236	254
7H	50	27	50	68	195
7C		5			5
6C		0			0
5C					
4C					
3C					
2C					
1C					
TOTAL	81	332	133	872	1418

≤ 2 Volt Dents

TSP	SG 1-1	SG 1-2	SG 1-3	SG 1-4	TOTAL
1H	199				199
2H	50				50
TOTAL	249				249

1R13 Plus Point dent inspection criteria:

- SG 1-1: 100% of ≤ 2 volt dents at 1H, 20% at 2H
  100% of > 2 and < 5 volt dents from 1H to 4H, 20% at 5H
  100% of ≥ 5 volt dents from 1H to 4H, 20% from 5H to 7H
- SG 1-2: 100% of > 2 and < 5 volt dents from 1H to 7C, 20% at 6C
  100% of ≥ 5 volt dents from 1H to 7C, 20% at 6C
- SG 1-3: 20% of > 2 and < 5 volt dents at 1H
  20% of ≥ 5 volt dents from 1H to 7H
- SG 1-4: 100% of > 2 and < 5 volt dents from 1H to 6H, 20% at 7H
  100% of ≥ 5 volt dents from 1H to 6H, 20% at 7H
- All 20% samples shall contain a minimum of 50 dents. If the population of dents at the TSP elevation is less than 50, then inspect 100% of the dents at the TSP.

Table 1a
Number of >2 Volt Dented TSPs in Augmented 1R13 Dent Inspection Program

TSP	SG 1-1	SG 1-2	SG 1-3	SG 1-4	TOTAL
7H				75	75
7C	2		1	36	39
6C	1			11	12
5C					
4C		1		2	3
3C		1			1
2C					
1C			1	2	3
TOTAL	3	2	2	126	133

Note: Augmented inspection performed to ensure that 100% of >2 volt dents have received at least one Plus Point inspection (Plus Point inspections were initially conducted in 1R7).

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

	Cycle 11		Cycle 12		1R14 Prelim OA	Cycle 13		1R14 Final OA
Length Bin (inch)	Frequency	CPD	Frequency	CPD	Lower Bound CPD from Cycle 11-12	Frequency	CPD	Lower Bound CPD from Cycle 11-12-13
0	77	0.647	78	0.363	0.363	58	0.257	0.257
0.01	13	0.756	24	0.474	0.474	27	0.376	0.376
0.02	9	0.832	45	0.684	0.684	24	0.482	0.482
0.03	6	0.882	17	0.763	0.763	34	0.633	0.633
0.04	3	0.908	19	0.851	0.851	19	0.717	0.717
0.05	5	0.950	14	0.916	0.916	14	0.779	0.779
0.06	2	0.966	7	0.949	0.949	21	0.872	0.872
0.07	1	0.975	5	0.972	0.972	7	0.903	0.903
0.08	3	1.000	1	0.977	0.977	3	0.916	0.916
0.09	0	1.000	4	0.995	0.995	4	0.934	0.934
0.1	0	1.000	1	1.000	1.000	4	0.951	0.951
0.11	0	1.000	0	1.000	1.000	1	0.956	0.956
0.12	0	1.000	0	1.000	1.000	2	0.965	0.965
0.13	0	1.000	0	1.000	1.000	1	0.969	0.969
0.14	0	1.000	0	1.000	1.000	0	0.969	0.969
0.15	0	1.000	0	1.000	1.000	6	0.996	0.996
0.16	0	1.000	0	1.000	1.000	0	0.996	0.996
0.17	0	1.000	0	1.000	1.000	0	0.996	0.996
0.18	0	1.000	0	1.000	1.000	1	1.000	1.000
MD Bin (%TW fraction)	Frequency	CPD	Frequency	CPD	Lower Bound CPD from Cycle 11-12	Frequency	CPD	Lower Bound CPD from Cycle 11-12-13
0	59	0.496	63	0.293	0.293	141	0.624	0.293
0.01	9	0.571	8	0.330	0.330	14	0.686	0.330
0.02	12	0.672	20	0.423	0.423	9	0.726	0.423
0.03	9	0.748	16	0.498	0.498	17	0.801	0.498
0.04	4	0.782	19	0.586	0.586	5	0.823	0.586
0.05	5	0.824	28	0.716	0.716	13	0.881	0.716
0.06	4	0.857	7	0.749	0.749	7	0.912	0.749
0.07	5	0.899	11	0.800	0.800	4	0.929	0.800
0.08	2	0.916	7	0.833	0.833	1	0.934	0.833
0.09	4	0.950	9	0.874	0.874	5	0.956	0.874
0.1	3	0.975	10	0.921	0.921	3	0.969	0.921
0.11	1	0.983	2	0.930	0.930	0	0.969	0.930
0.12	0	0.983	7	0.963	0.963	2	0.978	0.963
0.13	1	0.992	1	0.967	0.967	0	0.978	0.967
0.14	1	1.000	1	0.972	0.972	1	0.982	0.972
0.15	0	1.000	2	0.981	0.981	1	0.987	0.981
0.16	0	1.000	2	0.991	0.991	0	0.987	0.987
0.17	0	1.000	0	0.991	0.991	0	0.987	0.987
0.18	0	1.000	0	0.991	0.991	1	0.991	0.991
0.19	0	1.000	0	0.991	0.991	0	0.991	0.991
0.2	0	1.000	2	1.000	1.000	0	0.991	0.991
0.21	0	1.000	0	1.000	1.000	1	0.996	0.996
0.22	0	1.000	0	1.000	1.000	0	0.996	0.996
0.23	0	1.000	0	1.000	1.000	1	1.000	1.000

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

	Cycle 11		Cycle 12		1R14 Prelim OA	Cycle 13		1R14 Final OA
AD Bin (%TW fraction)	Frequency	CPD	Frequency	CPD	Lower Bound CPD from Cycle 11-12	Frequency	CPD	Lower Bound CPD from Cycle 11-12-13
0	46	0.387	53	0.247	0.247	112	0.496	0.247
0.01	17	0.529	25	0.363	0.363	33	0.642	0.363
0.02	18	0.681	24	0.474	0.474	19	0.726	0.474
0.03	6	0.731	17	0.553	0.553	23	0.827	0.553
0.04	6	0.782	23	0.660	0.660	12	0.881	0.660
0.05	9	0.857	23	0.767	0.767	10	0.925	0.767
0.06	4	0.891	18	0.851	0.851	7	0.956	0.851
0.07	3	0.916	12	0.907	0.907	3	0.969	0.907
0.08	4	0.950	6	0.935	0.935	2	0.978	0.935
0.09	0	0.950	2	0.944	0.944	0	0.978	0.944
0.1	2	0.966	4	0.963	0.963	1	0.982	0.963
0.11	1	0.975	1	0.967	0.967	1	0.987	0.967
0.12	1	0.983	2	0.977	0.977	1	0.991	0.977
0.13	0	0.983	2	0.986	0.983	0	0.991	0.983
0.14	2	1.000	3	1.000	1.000	2	1.000	1.000
0.15	0	1.000	0	1.000	1.000	0	1.000	1.000
0.16	0	1.000	0	1.000	1.000	0	1.000	1.000
0.17	0	1.000	0	1.000	1.000	0	1.000	1.000
0.18	0	1.000	0	1.000	1.000	0	1.000	1.000
0.19	0	1.000	0	1.000	1.000	0	1.000	1.000
0.2	0	1.000	0	1.000	1.000	0	1.000	1.000
Total	119		215			226		

Table 3
Unit 1 Growth Rates per EFPY at 604F

Cycle	Data Points	90 Percentile Growth per EFPY			95 Percentile Growth per EFPY		
		Length inch	Max Depth %	Average Depth %	Length inch	Max Depth %	Average Depth %
11	119	0.035	6.67	6.14	0.050	8.58	8.03
12	215	0.050	9.69	6.88	0.060	11.37	9.14
13	226	0.067	5.78	4.40	0.097	8.77	5.62

Table 4
DIS Confirmation Rates

	SG 1-1	SG 1-2	SG 1-3	SG 1-4	Total
Number of bobbin DIS in less than or equal to 2 volt dented TSP intersections (excludes repeat PWSCC indications)	28	85	21	11	145
Number of new PWSCC indications confirmed by Plus Point	1	7	0	0	8
Plus Point confirmation rate	4%	8%	0%	0%	6%
Bobbin DIS overcall rate	96%	92%	100%	100%	94%

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results

								1R13 Adjusted NDE						1R13 CM (WEC Model)				1R13 OA (ANL/TW Model)			
SG	R	C	TSP	Crack No.	Cal	Plug Reason	Ind Cat	Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
1	3	28	02H	1	11		Repeat	0.15	47.0	29.8	0.62	-0.22	-0.07	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	4	41	01H	1	11		Repeat	0.12	20.0	12.1	0.43	-0.06	0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	14	6	02H	1	57	ID/AONDB	New	0.17	51.0	31.9	1.01	-0.20	-0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	14	28	02H	1	11		Repeat	0.12	27.0	16.7	0.50	0.17	0.29	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	15	16	02H	1	11		Repeat	0.18	20.0	11.3	0.32	-0.19	-0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	15	24	02H	1	56	ID/OD	New	0.25	37.0	29.6	0.98	-0.22	0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	15	76	02H	1	11		Repeat	0.11	27.0	20.1	0.40	-0.16	-0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	17	16	02H	1	11		Repeat	0.22	35.0	27.4	0.94	-0.25	-0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	19	15	03H	1	11		Repeat	0.37	52.0	37.6	1.26	-0.19	0.18	6100	0.000	6100	0.000	6100	0.000	5594	0.000
1	20	28	02H	1	11		Repeat	0.21	27.0	19.2	0.92	-0.27	-0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	20	29	02H	1	11		Repeat	0.33	35.0	22.6	0.81	-0.03	0.30	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	20	33	01H	1	11		Repeat	0.09	20.0	5.7	0.30	-0.14	-0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	21	13	03H	1	11		Repeat	0.22	35.0	22.3	1.06	-0.14	0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	21	51	02H	1	11		Repeat	0.08	20.0	12.8	0.38	-0.14	-0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	21	54	01H	1	11		Repeat	0.10	38.0	28.6	0.82	-0.11	-0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	22	23	02H	1	11	>=40% DOP	Repeat	0.13	30.0	16.9	0.91	-0.24	-0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	22	23	02H	2	11	>=40% DOP	Repeat	0.15	30.0	18.7	0.70	0.02	0.17	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	22	23	02H	3	11	>=40% DOP	Repeat	0.21	50.0	33.9	1.05	0.26	0.47	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	23	14	03H	1	11		Repeat	0.14	38.0	25.7	0.66	-0.14	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	24	67	02H	1	11		Repeat	0.21	38.0	28.8	0.92	-0.15	0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	25	57	03H	1	11		Repeat	0.32	30.0	20.2	0.82	-0.11	0.21	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	27	75	02H	1	11		Repeat	0.10	30.0	22.7	0.88	-0.06	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	29	37	02H	1	11		Repeat	0.26	30.0	17.9	0.77	-0.10	0.16	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	30	21	02H	1	11		Repeat	0.17	30.0	17.9	0.55	-0.11	0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	30	59	02H	1	11		Repeat	0.16	32.0	23.7	0.66	-0.14	0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	30	67	02H	1	11		Repeat	0.29	52.0	25.3	1.01	-0.14	0.15	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	34	24	03H	1	11		Repeat	0.19	35.0	16.4	0.57	-0.07	0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	34	24	03H	2	11		Repeat	0.09	22.0	14.1	0.43	0.12	0.21	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	35	59	03H	1	11		Repeat	0.32	50.0	34.9	1.32	-0.21	0.11	6100	0.000	6100	0.000	6100	0.000	5935	0.000
1	38	41	04H	1	11		Repeat	0.25	44.0	24.0	1.15	-0.30	-0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results

								1R13 Adjusted NDE						1R13 CM (WEC Model)				1R13 OA (ANL/TW Model)			
SG	R	C	TSP	Crack No.	Cal	Plug Reason	Ind Cat	Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
1	38	54	02H	1	30	ID/AONDB	New	0.11	20.0	12.4	0.59	-0.21	-0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
1	39	57	02H	1	11		Repeat	0.10	24.0	16.5	0.60	-0.19	-0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	10	03H	1	25		Repeat	0.42	39.0	27.3	1.40	-0.23	0.19	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	28	03H	1	25		Repeat	0.35	39.0	25.6	0.89	-0.32	0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	76	02H	1	22		Repeat	0.20	20.0	12.3	0.46	-0.26	-0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	78	01H	1	22		Repeat	0.07	20.0	12.9	0.49	0.08	0.15	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	79	03H	1	22		Repeat	0.47	20.0	12.7	0.80	-0.16	0.31	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	90	03H	1	69		New	0.18	24.0	17.0	0.64	-0.10	0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	90	04H	1	22		Repeat	0.19	26.0	17.2	0.99	-0.44	-0.25	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	90	04H	2	22		Repeat	0.20	49.0	30.4	1.67	-0.16	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	92	05H	1	22		Repeat	0.08	20.0	10.3	0.35	-0.48	-0.40	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	92	05H	2	22		Repeat	0.10	20.0	12.2	0.58	-0.10	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	92	05H	3	22		Repeat	0.33	20.0	6.8	0.61	0.00	0.33	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	2	93	04H	1	22		Repeat	0.15	28.0	21.0	0.48	0.07	0.22	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	3	46	7C	1	61		Repeat	0.26	33.0	22.8	0.59	-0.13	0.13	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	4	54	02H	1	25		Repeat	0.25	36.0	25.9	0.98	-0.11	0.14	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	4	57	01H	1	25		Repeat	0.11	20.0	10.4	0.55	0.00	0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	4	58	01H	1	23	Prev Low BP	Repeat	0.08	36.0	25.2	0.81	-0.29	-0.21	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	4	58	01H	2	23	Prev Low BP	Repeat	0.69	50.0	35.8	1.27	-0.32	0.37	6100	0.000	6100	0.000	6100	0.000	5081	0.000
2	4	58	01H	3	23	Prev Low BP	Repeat	0.53	65.0	52.9	3.10	-0.18	0.35	6100	0.000	5031	0.000	6100	0.000	4109	0.000
2	4	84	01H	1	22		Repeat	0.19	23.0	12.1	0.59	-0.01	0.18	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	5	65	01H	1	23	ID/AONDB	Repeat	0.35	31.0	25.3	0.65	-0.30	0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	5	66	02H	1	23		Repeat	0.16	31.0	20.7	0.77	-0.16	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	5	77	05H	1	22		Repeat	0.24	40.0	29.2	0.94	-0.34	-0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	5	78	01H	1	22		Repeat	0.44	46.0	27.4	1.14	-0.05	0.39	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	5	93	01H	1	22		Repeat	0.38	43.0	28.4	1.28	-0.30	0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	6	55	7C	1	62		Repeat	0.30	33.0	23.1	0.66	-0.19	0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	6	74	03H	1	22		Repeat	0.07	20.0	14.3	0.38	-0.54	-0.47	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	6	74	03H	2	22		Repeat	0.30	24.5	12.5	0.84	-0.20	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results																					
								1R13 Adjusted NDE						1R13 CM (WEC Model)				1R13 OA (ANL/TW Model)			
SG	R	C	TSP	Crack No.	Cat	Plug Reason	Ind Cat	Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
2	7	17	04H	1	72		New	0.16	36.0	17.6	0.52	-0.04	0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	7	31	01H	1	25		Repeat	0.31	42.0	29.2	1.02	-0.03	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	7	31	7C	1	61		Repeat	0.58	56.0	43.7	1.63	-0.37	0.21	6100	0.000	5579	0.000	6100	0.000	4624	0.000
2	7	53	03H	1	25		Repeat	0.21	33.0	20.8	0.70	-0.04	0.17	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	7	68	03H	1	22		Repeat	0.14	34.0	23.9	0.99	0.14	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	4	05H	1	25		Repeat	0.32	45.0	34.5	1.24	-0.33	-0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	15	02H	1	25		Repeat	0.27	42.0	29.9	1.30	-0.15	0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	48	01H	1	25		Repeat	0.14	25.0	15.0	0.52	-0.23	-0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	55	01H	1	25		Repeat	0.26	51.0	36.5	1.53	-0.19	0.07	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	57	01H	1	25		Repeat	0.48	61.0	43.3	2.37	-0.33	0.15	6100	0.000	5682	0.000	6100	0.000	4823	0.000
2	8	61	02H	1	23		Merged	0.33	50.0	41.1	1.53	-0.30	0.03	6100	0.000	6100	0.000	6100	0.000	5522	0.000
2	8	61	02H	2	23		Repeat	0.20	36.0	21.4	0.78	0.08	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	66	02H	1	23		Repeat	0.13	42.0	29.6	0.56	-0.31	-0.18	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	82	04H	1	37		New	0.33	28.0	17.8	0.40	-0.09	0.24	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	8	93	01H	1	22		Repeat	0.21	46.0	26.6	1.04	-0.19	0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	9	27	03H	1	25		Repeat	0.12	20.0	11.9	0.30	-0.17	-0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	9	30	01H	1	25		Repeat	0.41	54.0	46.7	2.33	-0.22	0.19	6100	0.000	5709	0.000	6100	0.000	4889	0.000
2	9	38	02H	1	24		Repeat	0.48	54.0	44.3	2.80	-0.31	0.17	6100	0.000	5769	0.000	6100	0.000	4837	0.000
2	9	45	01H	1	24		Repeat	0.17	45.0	29.9	1.17	0.06	0.23	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	9	53	01H	1	25		Repeat	0.28	42.0	31.7	1.29	-0.14	0.14	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	9	56	01H	1	25		Repeat	0.21	51.0	34.4	1.24	-0.40	-0.19	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	9	82	03H	1	22		Repeat	0.24	40.0	22.7	1.41	0.12	0.36	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	49	03H	1	25		Repeat	0.39	20.0	12.6	0.63	-0.13	0.26	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	62	01H	1	23		Repeat	0.31	50.0	39.3	1.13	-0.10	0.21	6100	0.000	6100	0.000	6100	0.000	5645	0.000
2	10	67	01H	1	23		Repeat	0.25	23.0	13.3	0.86	-0.24	0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	68	01H	1	22		Repeat	0.26	40.0	32.3	1.67	-0.25	0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	69	02H	1	22		Repeat	0.14	23.0	11.3	0.53	-0.27	-0.13	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	80	01H	1	22	ODSCC SCI 5H	Repeat	0.26	37.0	19.8	0.91	-0.38	-0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	10	85	04H	1	22		Repeat	0.10	28.0	19.8	0.60	0.18	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	20	02H	1	25		Repeat	0.30	51.0	40.8	1.73	-0.10	0.20	6100	0.000	6100	0.000	6100	0.000	5615	0.000

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results

SG	R	C	TSP	Crack No.	Cal	Plug Reason	Ind Cat	1R13 Adjusted NDE Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	1R13 CM (WEC Model) FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	1R13 OA (ANL/TW Model) FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
2	11	45	01H	1	24		Repeat	0.50	45.0	20.1	1.05	-0.15	0.35	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	66	03H	1	23		Repeat	0.25	28.0	17.4	0.99	-0.20	0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	71	01H	1	22		Repeat	0.32	49.0	34.5	1.32	-0.40	-0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	71	01H	2	22		Repeat	0.07	23.0	12.9	0.51	0.02	0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	71	01H	3	22		Repeat	0.21	43.0	28.5	1.32	-0.21	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	71	01H	4	22		Repeat	0.39	26.0	12.2	0.44	-0.20	0.19	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	84	02H	1	22		Repeat	0.49	43.0	21.1	0.83	-0.29	0.20	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	11	87	01H	1	22		Repeat	0.43	75.0	51.7	2.20	-0.25	0.18	6100	0.000	5289	0.000	6100	0.000	4449	0.000
2	13	34	01H	1	24		Repeat	0.22	45.0	36.2	1.19	0.06	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	13	44	01H	1	24		Repeat	0.22	57.0	46.6	1.96	-0.09	0.13	6100	0.000	6100	0.000	6100	0.000	5496	0.000
2	13	60	02H	1	23		Repeat	0.30	53.0	35.8	1.44	-0.16	0.14	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	13	84	01H	1	22	ID/AONDB	Repeat	0.09	20.0	11.1	0.57	-0.05	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	13	84	01H	2	22	ID/AONDB	Repeat	0.09	25.0	14.4	0.36	-0.05	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	14	16	04H	1	25		Repeat	0.26	33.0	19.2	0.92	-0.14	0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	14	45	01H	1	24		Repeat	0.12	20.0	9.7	0.48	-0.02	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	14	58	04H	1	25		Repeat	0.11	20.0	10.6	0.45	0.17	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	14	68	01H	1	23		Repeat	0.44	20.0	15.0	0.73	-0.24	0.20	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	14	70	01H	1	22		Repeat	0.12	20.0	10.1	0.35	-0.15	-0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	14	74	01H	1	22		Repeat	0.27	26.0	15.0	1.01	-0.25	0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	12	05H	1	25		Repeat	0.10	20.0	10.5	0.52	-0.07	0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	59	02H	1	23		Repeat	0.21	50.0	39.7	2.27	-0.06	0.15	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	60	02H	1	23		Repeat	0.08	25.0	15.0	0.42	-0.19	-0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	82	01H	1	22		Repeat	0.23	20.0	10.6	0.68	-0.08	0.15	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	82	04H	1	22		Repeat	0.40	34.0	17.0	0.93	-0.16	0.24	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	85	02H	1	22		Repeat	0.29	34.0	19.8	0.67	-0.29	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	87	02H	1	22		Repeat	0.26	49.0	37.2	1.26	-0.09	0.17	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	88	02H	1	22		Repeat	0.28	43.0	31.7	1.24	-0.19	0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	16	88	02H	2	22		New	0.10	20.0	15.0	0.28	-0.31	-0.21	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	17	9	06H	1	25		Repeat	0.10	28.0	19.0	0.70	-0.11	-0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	17	54	01H	1	24		Repeat	0.36	54.0	46.1	1.85	-0.11	0.25	6100	0.000	5802	0.000	6100	0.000	5072	0.000

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results

								1R13 Adjusted NDE						1R13 CM (WEC Model)				1R13 OA (ANL/TW Model)			
SG	R	C	TSP	Crack No.	Cal	Plug Reason	Ind Cat	Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
2	17	59	01H	1	23		Repeat	0.31	48.0	38.6	1.70	-0.05	0.26	6100	0.000	6100	0.000	6100	0.000	5740	0.000
2	17	66	01H	1	23		Repeat	0.38	45.0	37.1	2.22	-0.24	0.14	6100	0.000	6100	0.000	6100	0.000	5608	0.000
2	17	67	01H	1	23		Repeat	0.22	31.0	20.5	1.00	-0.34	-0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	17	88	01H	1	71		New	0.40	37.0	25.4	0.65	-0.16	0.24	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	17	88	02H	1	22		Repeat	0.35	20.0	12.4	0.73	-0.10	0.25	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	18	64	03H	1	23		Repeat	0.22	25.0	18.2	0.64	-0.18	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	18	67	01H	1	71		New	0.16	48.0	30.6	0.83	-0.25	-0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	19	31	04H	1	24	>2 volt DOS 1H	Repeat	0.13	33.0	18.4	0.53	-0.07	0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	19	34	02H	1	24		Repeat	0.47	51.0	37.3	2.39	-0.17	0.30	6100	0.000	6100	0.000	6100	0.000	5380	0.000
2	19	74	02H	1	22		Repeat	0.18	28.0	17.0	0.59	-0.23	-0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	19	84	03H	1	71		New	0.12	39.0	27.7	0.73	-0.06	0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	20	48	03H	1	24		Repeat	0.33	39.0	22.5	0.69	-0.21	0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	20	77	01H	1	22		Repeat	0.33	40.0	30.8	1.10	-0.21	0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	21	38	01H	1	24		Repeat	0.28	54.0	44.7	2.18	-0.13	0.15	6100	0.000	6100	0.000	6100	0.000	5480	0.000
2	21	57	01H	1	23		Repeat	0.36	50.0	41.1	1.83	-0.16	0.20	6100	0.000	6100	0.000	6100	0.000	5421	0.000
2	21	60	02H	1	23		Repeat	0.28	20.0	12.8	0.71	-0.27	0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	21	65	02H	1	23		Repeat	0.44	50.0	38.8	1.98	-0.14	0.30	6100	0.000	6100	0.000	6100	0.000	5375	0.000
2	22	42	01H	1	24		Repeat	0.31	45.0	33.9	1.72	-0.02	0.29	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	22	55	03H	1	24		Repeat	0.27	54.0	38.6	1.28	-0.07	0.20	6100	0.000	6100	0.000	6100	0.000	5842	0.000
2	23	25	03H	1	25		Repeat	0.35	42.0	25.4	1.09	-0.37	-0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	23	54	01H	1	24		Repeat	0.18	28.0	17.2	0.51	0.03	0.21	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	23	79	01H	1	22		Repeat	0.06	31.0	20.7	0.37	-0.16	-0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	24	77	01H	1	22		Repeat	0.21	28.0	15.9	0.74	-0.25	-0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	25	17	02H	1	25		Repeat	0.26	51.0	33.6	1.06	-0.36	-0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	25	50	02H	1	24		Repeat	0.38	57.0	47.4	2.53	-0.20	0.18	6100	0.000	5617	0.000	6100	0.000	4842	0.000
2	25	55	02H	1	23		Repeat	0.08	36.0	19.0	0.37	0.15	0.23	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	25	74	01H	1	22	>=40% DOP	Repeat	0.38	55.0	41.3	1.69	-0.43	-0.05	6100	0.000	6100	0.000	6100	0.000	5218	0.000
2	25	79	02H	1	22		Repeat	0.21	26.0	10.4	0.66	-0.18	0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	25	85	04H	1	22		Repeat	0.27	26.0	14.7	0.69	-0.19	0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	25	87	04H	1	22		Repeat	0.25	52.0	42.6	1.25	-0.14	0.11	6100	0.000	6100	0.000	6100	0.000	5742	0.000

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results

								1R13 Adjusted NDE						1R13 CM (WEC Model)				1R13 OA (ANL/TW Model)			
SG	R	C	TSP	Crack No.	Cal	Plug Reason	Ind Cat	Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
2	26	22	04H	1	25		Repeat	0.29	42.0	35.1	1.65	-0.09	0.20	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	26	39	02H	1	24		Repeat	0.12	36.0	24.2	0.89	-0.07	0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	26	73	01H	1	22		Repeat	0.23	46.0	36.1	1.87	-0.15	0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	26	79	01H	1	22		Repeat	0.40	52.0	40.0	1.18	-0.24	0.16	6100	0.000	6100	0.000	6100	0.000	5363	0.000
2	27	55	01H	1	23		Repeat	0.09	28.0	18.3	0.57	0.23	0.32	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	27	56	01H	1	23		Repeat	0.15	20.0	8.4	0.71	-0.21	-0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	27	63	02H	1	23		Repeat	0.27	53.0	46.4	1.60	-0.28	-0.01	6100	0.000	6100	0.000	6100	0.000	5390	0.000
2	27	63	02H	2	23		Repeat	0.66	45.0	32.6	1.20	-0.32	0.34	6100	0.000	6100	0.000	6100	0.000	5307	0.000
2	27	64	03H	1	23		Repeat	0.11	25.0	19.2	0.65	-0.11	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	27	65	02H	1	23		Repeat	0.42	65.0	42.4	1.13	-0.22	0.20	6100	0.000	6100	0.000	6100	0.000	5134	0.000
2	27	67	01H	1	23		Repeat	0.54	53.0	37.4	1.96	-0.32	0.22	6100	0.000	5944	0.000	6100	0.000	5109	0.000
2	27	67	01H	2	23		New	0.16	28.0	20.2	0.72	0.59	0.75	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	27	67	04H	1	23		Repeat	0.34	28.0	16.0	0.74	-0.24	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	27	69	01H	1	22		Repeat	0.36	65.0	49.1	2.66	-0.28	0.08	6100	0.000	5545	0.000	6100	0.000	4801	0.000
2	27	69	01H	2	22		Repeat	0.20	23.0	12.4	0.80	-0.02	0.18	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	27	72	02H	1	32		New	0.13	25.0	16.3	0.73	-0.33	-0.20	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	27	72	02H	2	32		New	0.13	20.0	10.8	0.49	0.13	0.26	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	28	47	03H	1	24		Repeat	0.23	33.0	21.1	0.83	0.05	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	28	66	02H	1	23		Repeat	0.07	28.0	15.8	0.43	0.02	0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	29	24	03H	1	24	>=40% DOP	Repeat	0.31	48.0	38.0	1.35	0.10	0.41	6100	0.000	6100	0.000	6100	0.000	5736	0.000
2	29	51	02H	1	24		Repeat	0.23	30.0	18.3	0.74	-0.16	0.07	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	29	66	01H	1	23		Repeat	0.25	53.0	34.4	1.58	-0.06	0.19	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	30	56	01H	1	23		Repeat	0.53	71.0	51.6	3.14	-0.38	0.15	6100	0.000	5161	0.000	6100	0.000	4253	0.000
2	30	62	01H	1	23		Repeat	0.13	20.0	13.0	0.55	-0.17	-0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	30	62	01H	2	23		Repeat	0.08	20.0	11.8	0.40	0.03	0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	30	67	02H	1	23		Repeat	0.29	65.0	53.2	2.58	-0.36	-0.07	6100	0.000	5405	0.000	6100	0.000	4737	0.000
2	31	37	03H	1	24		Repeat	0.22	25.0	17.4	0.66	-0.12	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	31	47	02H	1	24	Prev Low BP	Repeat	0.49	64.0	55.5	3.22	-0.28	0.21	6100	0.000	4816	0.000	6100	0.000	3930	0.000
2	31	53	02H	1	24		Repeat	0.27	64.0	47.2	2.60	-0.28	-0.01	6100	0.000	6100	0.000	6100	0.000	5294	0.000
2	31	66	01H	1	70	ID/AONDB	New	0.16	22.0	14.4	0.34	-0.17	-0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results

								1R13 Adjusted NDE						1R13 CM (WEC Model)				1R13 OA (ANL/TW Model)			
SG	R	C	TSP	Crack No.	Cat	Plug Reason	Ind Cat	Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
2	31	66	04H	1	23	ID/AONDB 1H	Repeat	0.29	36.0	24.5	1.19	-0.05	0.24	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	31	68	01H	1	23		Repeat	0.45	31.0	21.5	0.93	-0.22	0.23	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	32	30	02H	1	24		Repeat	0.32	51.0	40.9	0.97	-0.29	0.03	6100	0.000	6100	0.000	6100	0.000	5564	0.000
2	32	37	03H	1	24		Repeat	0.16	22.0	11.9	0.53	0.02	0.18	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	32	44	04H	1	24		Repeat	0.27	51.0	32.7	1.14	-0.25	0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	32	47	03H	1	24		Repeat	0.22	51.0	39.1	1.64	-0.22	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	32	59	04H	1	29		New	0.10	23.0	16.7	0.31	-0.13	-0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	32	62	01H	1	23		Repeat	0.10	28.0	19.0	0.59	-0.06	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	33	57	02H	1	23		Repeat	0.15	42.0	27.0	0.98	0.04	0.19	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	33	68	02H	1	23	ID/AONDB	Repeat	0.07	40.5	26.0	0.59	0.04	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	33	69	02H	1	33		New	0.14	42.0	28.8	0.31	-0.11	0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	33	71	02H	1	33		New	0.10	20.0	13.0	0.34	0.14	0.24	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	33	72	04H	1	22		Repeat	0.15	37.0	21.4	0.86	-0.07	0.08	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	26	02H	1	72	ID/AONDB	New	0.10	31.0	22.1	0.79	-0.01	0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	36	03H	1	24		Repeat	0.24	30.0	20.4	0.89	-0.15	0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	42	02H	1	24		Repeat	0.14	20.0	11.2	0.43	0.04	0.18	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	47	02H	1	24		Repeat	0.13	42.0	28.0	1.12	0.02	0.15	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	51	06H	1	24		Repeat	0.09	36.0	23.9	0.62	0.06	0.15	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	53	02H	1	24		Repeat	0.45	73.0	50.9	2.59	-0.29	0.16	6100	0.000	5206	0.000	6100	0.000	4354	0.000
2	34	53	02H	2	24		Repeat	0.21	28.0	17.8	0.97	-0.15	0.06	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	55	01H	1	24		Repeat	0.31	60.0	44.3	2.44	-0.35	-0.04	6100	0.000	6100	0.000	6100	0.000	5354	0.000
2	34	58	02H	1	23		Repeat	0.31	68.0	50.2	2.03	-0.23	0.08	6100	0.000	5656	0.000	6100	0.000	4944	0.000
2	34	59	02H	1	23		Repeat	0.13	33.0	25.1	0.77	-0.03	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	34	65	02H	1	23		Repeat	0.10	23.0	15.8	0.46	-0.06	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	35	49	02H	1	24		Repeat	0.27	48.0	38.7	1.95	-0.15	0.12	6100	0.000	6100	0.000	6100	0.000	5879	0.000
2	35	52	03H	1	24		Repeat	0.25	28.0	17.3	0.98	-0.16	0.09	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	35	56	02H	1	24		Repeat	0.20	39.0	28.3	0.76	-0.01	0.19	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	35	70	02H	1	22		Repeat	0.25	46.0	27.3	1.15	-0.14	0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	36	60	04H	1	23		Repeat	0.09	53.0	33.4	1.28	-0.14	-0.05	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	37	53	02H	1	24		Repeat	0.59	64.0	49.2	2.38	-0.32	0.27	6100	0.000	5185	0.000	6100	0.000	4197	0.000

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results

								1R13 Adjusted NDE						1R13 CM (WEC Model)				1R13 OA (ANL/TW Model)			
SG	R	C	TSP	Crack No.	Cal	Plug Reason	Ind Cat	Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
2	37	68	03H	1	33		New	0.08	31.0	21.6	0.43	-0.10	-0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	37	69	01H	1	22		Merged	0.42	46.0	25.9	1.04	-0.26	0.16	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	37	69	01H	2	22		Repeat	0.31	40.0	28.2	1.61	0.05	0.36	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	37	69	03H	1	22		Repeat	0.29	31.0	18.2	0.77	-0.02	0.27	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	37	70	01H	1	22		Repeat	0.38	58.0	45.6	2.43	-0.21	0.17	6100	0.000	5767	0.000	6100	0.000	4994	0.000
2	37	73	03H	1	22		Repeat	0.24	26.0	17.2	0.85	-0.13	0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	37	74	03H	1	22		Repeat	0.40	43.0	31.7	1.55	-0.18	0.22	6100	0.000	6100	0.000	6100	0.000	5611	0.000
2	38	66	01H	1	23		Repeat	0.21	53.0	32.7	1.07	-0.03	0.18	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	39	73	02H	1	78		New	0.31	33.0	18.0	0.73	-0.35	-0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	39	73	02H	2	78		New	0.28	48.0	34.8	1.42	-0.02	0.26	6100	0.000	6100	0.000	6100	0.000	6100	0.000
2	43	49	03H	1	24		Repeat	0.26	51.0	34.6	1.46	-0.22	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	17	24	01H	1	24		Repeat	0.09	39.0	26.0	0.33	0.32	0.41	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	20	25	01H	1	24		Repeat	0.15	20.0	7.3	0.22	-0.72	-0.57	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	21	67	05H	1	24		Repeat	0.18	51.0	35.0	0.75	-0.21	-0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	21	76	01H	1	24		Repeat	0.19	34.0	21.8	0.64	-0.17	0.02	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	21	84	01H	1	24		Repeat	0.18	37.0	28.3	0.68	-0.03	0.15	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	26	37	06H	1	25		Repeat	0.12	26.0	19.5	0.88	0.05	0.17	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	28	58	02H	1	29		New	0.07	20.0	11.5	0.28	0.04	0.11	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	35	36	02H	1	24		Repeat	0.22	20.0	7.7	0.37	0.08	0.30	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	35	56	02H	1	29		New	0.11	20.0	14.5	0.31	0.04	0.15	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	35	56	03H	1	25		Repeat	0.10	20.0	7.2	0.25	-0.30	-0.20	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	35	56	03H	2	25		Repeat	0.13	20.0	10.1	0.42	-0.01	0.12	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	35	61	02H	1	24		Repeat	0.12	29.0	13.6	0.28	-0.11	0.01	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	35	68	03H	1	24	ID with LIC	Repeat	0.27	52.0	36.8	0.51	-0.24	0.03	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	38	46	06H	1	50		New	0.10	20.0	13.5	0.26	-0.06	0.04	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	38	46	06H	2	50		New	0.09	20.0	11.4	0.36	0.17	0.26	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	38	69	02H	1	30		Repeat	0.13	33.0	24.6	0.55	-0.03	0.10	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	38	72	01H	1	24		Repeat	0.12	38.0	26.3	0.48	0.25	0.37	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	39	48	03H	1	24		Repeat	0.21	29.0	13.6	0.33	0.07	0.28	6100	0.000	6100	0.000	6100	0.000	6100	0.000
4	39	58	01H	1	46		Repeat	0.22	53.0	33.8	1.24	0.09	0.31	6100	0.000	6100	0.000	6100	0.000	6100	0.000

Table 5 - 1R13 PWSCC ARC Summary of Analysis Results																					
								1R13 Adjusted NDE						1R13 CM (WEC Model)				1R13 OA (ANL/TW Model)			
SG	R	C	TSP	Crack No.	Cal	Plug Reason	Ind Cat	Length (in.)	Max. Depth (%)	Avg. Depth (%)	Max. Volt	From	To	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm	FS Burst psi	FS Leak gpm	Total Length Burst psi	Total Length Leak gpm
4	46	42	01H	1	24		Repeat	0.30	27.0	13.9	0.40	-0.30	0.00	6100	0.000	6100	0.000	6100	0.000	6100	0.000

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections

						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)				
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
1	3	28	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	2.99	-0.58	0.03	
1	4	41	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	0.00	0.23	0.00	
1	14	6	02H	1	New	6100	6100										
1	14	28	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	-2.99	-5.23	0.06	
1	15	16	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.06	0.00	0.21	-0.04	
1	15	24	02H	1	New	6100	6100										
1	15	76	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	-5.22	0.77	-0.04	
1	17	16	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	-1.49	0.79	-0.02	
1	19	15	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.08	4.48	5.34	0.08	
1	20	28	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-0.75	0.07	0.02	
1	20	29	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.12	-3.73	-5.21	0.05	
1	20	33	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	0.00	-6.44	0.01	
1	21	13	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	6.72	6.13	0.05	yes
1	21	51	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	0.00	-1.01	-0.01	
1	21	54	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	-2.24	0.33	0.12	
1	22	23	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.02	-2.99	-4.29	0.01	
1	22	23	02H	2	Repeat	6100	6100	6100	6100	0	0	0	0.04	-0.75	-0.52	0.01	
1	22	23	02H	3	Repeat	6100	6100	6100	6100	0	0	0	0.05	20.15	13.96	0.36	yes
1	23	14	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-1.49	0.77	0.07	
1	24	67	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	0.75	1.11	0.09	
1	25	57	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.06	-2.99	-2.67	0.10	
1	27	75	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	-2.99	1.09	-0.01	
1	29	37	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	-2.99	-4.47	0.04	
1	30	21	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	1.49	0.73	-0.04	
1	30	59	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	0.75	-0.51	0.07	
1	30	67	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	8.96	-2.55	-0.04	
1	34	24	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	-1.49	-1.22	0.02	
1	34	24	03H	2	Repeat	6100	6100	6100	6100	0	0	0	0.00	-2.99	0.61	-0.01	

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections

						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)					
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
1	35	59	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	5.22	6.58	0.16	
1	38	41	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	9.70	7.08	0.12	yes
1	38	54	02H	1	New	6100	6100						0.03	0.00	0.73	0.13	
1	39	57	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	2.99	2.60	0.06	
2	2	10	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	-2.24	-1.54	0.14	
2	2	28	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.10	-2.24	-1.97	0.10	
2	2	76	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	0.00	-0.68	-0.02	
2	2	78	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	0.00	2.13	-0.03	
2	2	79	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.06	0.00	0.50	0.07	
2	2	90	03H	1	New	6100	6100										
2	2	90	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	-14.18	-9.92	-0.09	
2	2	90	04H	2	Repeat	6100	6100	6100	6100	0	0	0	-0.04	-4.48	-0.43	0.00	
2	2	92	05H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-9.70	-7.46	0.10	
2	2	92	05H	2	Repeat	6100	6100	6100	6100	0	0	0	0.01	0.00	2.45	0.09	
2	2	92	05H	3	Repeat	6100	6100	6100	6100	0	0	0	0.15	0.00	-6.08	0.05	
2	2	93	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	0.75	3.93	0.04	
2	3	46	7C	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	1.49	2.76	-0.22	
2	4	54	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	6.34	7.44	0.13	
2	4	57	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	0.00	-1.42	0.10	
2	4	58	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	5.97	5.41	0.02	
2	4	58	01H	2	Repeat	6100	5637	6100	5557	0	80	543	0.04	3.73	4.29	0.12	
2	4	58	01H	3	Repeat	5031	4729	5154	4906	-124	-176	125	0.09	8.21	5.14	0.19	
2	4	84	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	-7.46	-7.04	0.06	
2	5	65	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	-3.73	0.81	-0.01	
2	5	66	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-1.49	-2.02	0.00	
2	5	77	05H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	-3.73	1.22	0.01	
2	5	78	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.07	-5.97	-2.67	-0.01	
2	5	93	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.07	11.94	10.82	0.36	yes
2	6	55	7C	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	-1.49	-2.50	-0.06	

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections																	
						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)				
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
2	6	74	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	0.00	2.35	0.04	
2	6	74	03H	2	Repeat	6100	6100	6100	6100	0	0	0	0.07	3.36	-0.20	0.12	
2	7	17	04H	1	New	6100	6100										
2	7	31	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	6.72	2.64	0.13	yes
2	7	31	7C	1	Repeat	5579	5223	5140	4892	439	330	687	0.07	0.00	0.84	-0.33	
2	7	53	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	2.24	2.67	0.00	
2	7	68	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	0.75	0.35	0.01	
2	8	4	05H	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	2.24	1.84	0.13	
2	8	15	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	-2.24	-3.21	0.19	
2	8	48	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	-0.75	-2.24	-0.03	
2	8	55	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	2.24	1.05	0.14	
2	8	57	01H	1	Repeat	5682	5413	5186	4915	496	498	767	0.03	0.75	-1.49	0.15	
2	8	61	02H	1	Merged	6100	6100										
2	8	61	02H	2	Repeat	6100	6100	6100	6100	0	0	0	0.00	0.00	1.92	0.01	
2	8	66	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	2.24	-0.77	0.06	
2	8	82	04H	1	New	6100	6100						0.01	3.73	1.24	-0.04	
2	8	93	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.06	9.70	4.90	0.11	yes
2	9	27	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-2.99	-2.98	0.00	
2	9	30	01H	1	Repeat	5709	5491	5066	4854	643	637	855	0.03	-3.73	-1.94	0.02	
2	9	38	02H	1	Repeat	5769	5431	5338	5077	431	354	692	0.05	-3.73	0.21	0.13	
2	9	45	01H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	0.00	1.05	-0.04	
2	9	53	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	2.24	1.03	0.02	
2	9	56	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-1.12	0.64	0.16	
2	9	82	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-3.73	-5.23	0.01	
2	10	49	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.14	-2.99	-0.79	0.01	
2	10	62	01H	1	Repeat	6100	6100	6100	5775	0	325	325	-0.01	-0.75	2.10	0.01	
2	10	67	01H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.04	0.75	-0.54	0.03	
2	10	68	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	-3.73	-1.58	0.16	
2	10	69	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	2.24	-3.19	0.04	

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections																	
						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)				
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
2	10	80	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.07	5.22	-0.09	0.22	
2	10	85	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-5.97	-3.33	0.05	
2	11	20	02H	1	Repeat	6100	6100	6100	5892	0	208	208	0.04	-2.99	0.41	0.09	
2	11	45	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.07	-5.22	0.90	0.03	
2	11	66	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	2.24	0.72	0.02	
2	11	71	01H	1	Repeat	6100	6100	6100	5795	0	305	305	0.01	0.75	-2.54	-0.10	
2	11	71	01H	2	Repeat	6100	6100	6100	6100	0	0	0	-0.01	-3.73	-1.91	-0.02	
2	11	71	01H	3	Repeat	6100	6100	6100	6100	0	0	0	0.07	17.16	11.34	0.66	yes
2	11	71	01H	4	Repeat	6100	6100	6100	6100	0	0	0	0.14	0.75	-1.46	0.04	
2	11	84	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	-1.49	2.69	0.01	
2	11	87	01H	1	Repeat	5289	5063	4979	4784	310	279	506	0.04	9.70	1.52	0.11	
2	13	34	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-5.22	-1.34	0.00	
2	13	44	01H	1	Repeat	6100	6100	5408	5303	693	797	797	-0.01	-3.73	-2.88	0.19	
2	13	60	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	3.73	2.59	0.07	
2	13	84	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-1.49	-3.48	0.06	
2	13	84	01H	2	Repeat	6100	6100	6100	6100	0	0	0	0.02	-1.49	1.78	0.07	
2	14	16	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.10	4.48	2.12	0.17	
2	14	45	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	0.00	-2.05	0.04	
2	14	58	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	0.00	-1.10	-0.04	
2	14	68	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	0.00	-0.15	0.02	
2	14	70	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	-5.97	-1.29	0.07	
2	14	74	01H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	0.75	-0.83	0.00	
2	16	12	05H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	-1.49	-3.11	0.04	
2	16	59	02H	1	Repeat	6100	6100	5572	5415	528	685	685	-0.05	-9.70	-3.46	-0.01	
2	16	60	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.03	3.73	2.69	-0.02	
2	16	82	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	0.00	0.65	0.04	
2	16	82	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.14	-3.73	-3.61	0.07	
2	16	85	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-8.21	-6.10	0.04	
2	16	87	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	-4.48	0.53	0.13	

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections

						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)				
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
2	16	88	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	0.75	0.59	0.04	
2	16	88	02H	2	New	6100	6100										
2	17	9	06H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-8.21	0.29	0.04	
2	17	54	01H	1	Repeat	5802	5640	5593	5390	209	251	412	-0.01	2.24	3.93	0.07	
2	17	59	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	0.00	2.59	0.01	
2	17	66	01H	1	Repeat	6100	6100	6100	5700	0	400	400	-0.01	-4.48	1.24	-0.05	
2	17	67	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	2.24	2.14	0.09	
2	17	88	01H	1	New	6100	6100										
2	17	88	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	0.00	1.49	0.09	
2	18	64	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.10	2.24	4.54	0.07	
2	18	67	01H	1	New	6100	6100										
2	19	31	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-4.48	-3.84	0.12	
2	19	34	02H	1	Repeat	6100	5928	5421	5159	679	769	941	0.01	-0.75	-2.27	-0.11	
2	19	74	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.07	-3.73	-5.19	0.03	
2	19	84	03H	1	New	6100	6100										
2	20	48	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	4.48	2.52	0.04	
2	20	77	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-1.49	-2.04	-0.01	
2	21	38	01H	1	Repeat	6100	6100	5875	5781	225	319	319	0.03	1.49	1.59	0.15	
2	21	57	01H	1	Repeat	6100	6100	5764	5516	336	584	584	0.00	-2.99	0.92	-0.14	
2	21	60	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	0.00	-0.02	0.04	
2	21	65	02H	1	Repeat	6100	5933	6100	6100	0	-167	0	0.04	5.97	5.31	0.04	
2	22	42	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	-2.99	0.05	0.05	
2	22	55	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	4.48	3.87	0.00	
2	23	25	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	6.72	3.91	0.08	yes
2	23	54	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	4.48	3.46	0.04	
2	23	79	01H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	5.22	4.37	-0.01	
2	24	77	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.06	0.00	-3.03	0.10	
2	25	17	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	13.43	6.47	0.10	yes
2	25	50	02H	1	Repeat	5617	5433	5416	5207	201	226	410	0.01	4.48	2.89	0.04	

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections

						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)				
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
2	25	55	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.02	2.24	-4.00	-0.07	
2	25	74	01H	1	Repeat	6100	5797	6100	6100	0	-303	0	0.14	-3.73	-0.72	0.35	
2	25	79	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.09	4.48	-1.91	0.16	
2	25	85	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	4.48	2.90	0.05	
2	25	87	04H	1	Repeat	6100	6100	5325	5186	775	914	914	-0.03	-5.22	-4.35	0.13	
2	26	22	04H	1	Repeat	6100	6100	5948	5782	152	318	318	0.02	-14.93	-4.57	-0.03	
2	26	39	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	0.00	-0.50	0.08	
2	26	73	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	-1.49	-1.25	0.01	
2	26	79	01H	1	Repeat	6100	5910	6100	6100	0	-190	0	0.12	0.75	1.29	0.07	
2	27	55	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-5.97	-3.05	0.06	
2	27	56	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	0.00	-2.24	-0.08	
2	27	63	02H	1	Repeat	6100	6100	5914	5771	186	329	329	-0.01	1.49	5.38	0.37	
2	27	63	02H	2	Repeat	6100	5867	6100	5558	0	309	542	0.05	-4.48	0.92	0.09	
2	27	64	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	2.24	3.37	0.09	
2	27	65	02H	1	Repeat	6100	5711	6100	6100	0	-389	0	0.01	22.39	13.40	0.11	yes
2	27	67	01H	1	Repeat	5944	5675	5720	5549	224	126	395	0.17	1.49	-2.58	0.16	
2	27	67	01H	2	New	6100	6100						0.04	0.00	2.32	0.18	
2	27	67	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.10	-1.49	-1.92	0.16	
2	27	69	01H	1	Repeat	5545	5416	5082	4883	463	533	662	0.01	1.49	-0.21	0.22	
2	27	69	01H	2	Repeat	6100	6100	6100	6100	0	0	0	-0.01	-3.73	-2.79	0.03	
2	27	72	02H	1	New	6100	6100						0.04	1.49	1.11	0.20	
2	27	72	02H	2	New	6100	6100						0.01	0.00	0.69	0.11	
2	28	47	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-2.24	-1.90	0.07	
2	28	66	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.03	-5.97	-4.46	0.05	
2	29	24	03H	1	Repeat	6100	6100	6100	5902	0	198	198	-0.01	0.75	1.66	0.10	
2	29	51	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.06	1.49	-0.13	0.01	
2	29	66	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-0.75	2.43	0.12	
2	30	56	01H	1	Repeat	5161	4881	4661	4356	500	525	805	0.02	5.97	0.30	0.32	
2	30	62	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	-5.97	-2.60	0.05	

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections																		
						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)					
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
2	30	62	01H	2	Repeat	6100	6100	6100	6100	0	0	0	-0.01	0.00	-1.07	0.04	
2	30	67	02H	1	Repeat	5405	5325	5032	4922	373	404	483	0.03	-5.97	-1.27	0.31	
2	31	37	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-6.72	-3.84	0.16	
2	31	47	02H	1	Repeat	4816	4536	4442	4181	373	355	635	0.06	-1.49	-0.51	0.23	
2	31	53	02H	1	Repeat	6100	5874	5670	5598	430	277	502	0.04	-1.49	0.30	0.34	
2	31	66	01H	1	New	6100	6100										
2	31	66	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.08	4.48	4.86	0.16	yes
2	31	68	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.13	-5.97	-5.32	0.07	
2	32	30	02H	1	Repeat	6100	6100	6100	5871	0	229	229	0.01	1.49	2.62	0.07	
2	32	37	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	-12.69	-7.59	0.02	
2	32	44	04H	1	Repeat	6100	6100	6100	6100	0	0	0	0.04	4.48	3.94	0.09	
2	32	47	03H	1	Repeat	6100	6100	6100	5938	0	162	162	0.00	-5.22	-2.98	0.13	
2	32	59	04H	1	New	6100	6100						0.00	2.24	2.94	0.00	
2	32	62	01H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.02	0.00	-0.72	0.04	
2	33	57	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	0.00	-1.70	0.07	
2	33	68	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	-5.60	-3.00	0.03	
2	33	69	02H	1	New	6100	6100						0.01	4.48	3.80	0.01	
2	33	71	02H	1	New	6100	6100						0.01	0.00	-0.71	0.01	
2	33	72	04H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.02	-3.73	-2.45	0.10	
2	34	26	02H	1	New	6100	6100										
2	34	36	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	-2.24	0.42	0.11	
2	34	42	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-2.99	-3.28	0.01	
2	34	47	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	2.24	0.44	0.17	yes
2	34	51	06H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	-2.24	-0.85	0.15	
2	34	53	02H	1	Repeat	5206	4974	5358	5193	-152	-219	14	0.10	11.94	3.01	0.42	
2	34	53	02H	2	Repeat	6100	6100	6100	6100	0	0	0	0.06	4.48	5.80	0.28	
2	34	55	01H	1	Repeat	6100	5913	6100	5885	0	28	215	0.03	8.96	4.31	0.29	
2	34	58	02H	1	Repeat	5656	5524	5088	4911	568	613	745	0.00	-3.73	-0.39	0.22	
2	34	59	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	-4.48	-1.18	0.10	

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections

						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)				
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
2	34	65	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	-5.22	-0.36	0.02	
2	35	49	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.02	0.00	3.75	0.34	
2	35	52	03H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	0.00	0.44	0.10	
2	35	56	02H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.01	8.21	5.69	0.10	
2	35	70	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.02	7.46	4.15	0.12	yes
2	36	60	04H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.06	-5.22	1.41	0.15	
2	37	53	02H	1	Repeat	5185	4821	5049	4701	136	120	484	0.04	2.99	3.71	0.09	
2	37	68	03H	1	New	6100	6100						-0.05	4.48	4.43	0.06	
2	37	69	01H	1	Merged	6100	6100										
2	37	69	01H	2	Repeat	6100	6100	6100	6100	0	0	0	0.01	0.75	2.05	0.11	
2	37	69	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	-8.21	-8.91	-0.02	
2	37	70	01H	1	Repeat	5767	5590	5362	5200	405	390	567	0.04	-1.49	-0.08	0.37	
2	37	73	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	-5.22	-4.95	0.02	
2	37	74	03H	1	Repeat	6100	6100	6100	5894	0	206	206	0.06	-1.49	-3.56	0.13	
2	38	66	01H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.03	8.21	4.80	0.10	yes
2	39	73	02H	1	New	6100	6100										
2	39	73	02H	2	New	6100	6100										
2	43	49	03H	1	Repeat	6100	6100	6100	5869	0	231	231	0.00	-2.99	-3.98	0.10	
4	17	24	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	14.18	9.87	0.06	
4	20	25	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	0.00	-2.41	-0.02	
4	21	67	05H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	0.75	2.53	0.00	
4	21	76	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.03	-0.75	-2.57	0.02	
4	21	84	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.07	-2.99	0.43	-0.01	
4	26	37	06H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-5.22	-1.44	-0.11	
4	28	58	02H	1	New	6100	6100						0.00	0.00	-2.05	0.00	
4	35	36	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	0.00	-3.16	-0.01	
4	35	56	02H	1	New	6100	6100						0.01	0.00	4.86	-0.07	
4	35	56	03H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.02	0.00	-2.42	-0.05	
4	35	56	03H	2	Repeat	6100	6100	6100	6100	0	0	0	0.02	-9.70	-5.88	0.07	

Table 6 – PWSCC ARC Cycle 13 Growth Rates and Comparison of Condition Monitoring versus Prior Cycle OA Projections

						Total length Burst Pressure CM versus OA Comparison							Growth Rate per EFPY (1.34 EFPY)				
SG	Row	Col	TSP	Crack No.	Ind Cat	CM (WEC) psi	CM (ANL/TW) psi	Prior Cycle OA Projection (WEC) psi	Prior Cycle OA Projection (ANL/TW) psi	CM - OA (WEC)	CM - OA (ANL/TW)	WEC CM - ANL/TW OA	Length (in)	MD (%)	AD (%)	Volt	Max volt change from <=1v to >1v?
4	35	61	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.01	-0.37	-4.78	-0.04	
4	35	68	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.07	-5.22	-2.34	0.02	
4	38	46	06H	1	New	6100	6100						0.02	0.00	3.10	0.01	
4	38	46	06H	2	New	6100	6100						-0.01	0.00	-1.00	-0.01	
4	38	69	02H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	-1.49	-0.48	0.03	
4	38	72	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.00	-4.48	-4.03	0.02	
4	39	48	03H	1	Repeat	6100	6100	6100	6100	0	0	0	0.05	5.60	-0.76	0.02	
4	39	58	01H	1	Repeat	6100	6100	6100	6100	0	0	0	-0.05	0.00	1.84	0.14	
4	46	42	01H	1	Repeat	6100	6100	6100	6100	0	0	0	0.15	-5.97	-8.62	0.00	

Notes:
Merged indications: 1R13 SG 1-2 R8C61 crack 1 was previously crack 1 and 2 in 1R12. 1R13 SG 1-2 R37C69 crack 1 was previously crack 1 and 2 in 1R12. No CMOA comparison is performed.

Table 7 – 1R13 TSP Circumferential Indications																							
											Unadjusted NDE			Adjusted NDE			Adjusted for Upper 95% NDE Uncertainty			Growth Rate per EFPY			
SG	Row	Col	TSP	Crack	Axial Elevation (inch)	Flaw Volt	Dent Volt	ID or OD	Stabilize	Mixed Mode	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Volt
11	24	59	1H	1	-0.04	0.29	0.74	OD			23.5	56	40.1	23.5	54.5	38.6	170.2	74.9	55.5	-0.9	2.6	-0.1	0.08
11	29	68	2H	1	0.26	0.2	14.7	OD			53.1	28	14.4	53.1	40	31.6	182.4	64.3	51.2	2.5	0.0	-1.0	0.04
12	6	78	1H	1	0.29	0.17	8.96	OD			20.2	1	0.8	20.2	40	29.7	168.8	64.3	50.1	NDD	NDD	NDD	NDD
12	7	77	5H	1	0.31	0.25	18.45	OD			44.5	15	3.8	44.5	40	29.5	178.8	64.3	49.9	2.7	-17.2	-14.8	0.12
12	7	81	4H	1	0.29	0.16	10.41	OD			44.5	73	27.5	44.5	40	27.4	178.8	64.3	48.6	NDD	NDD	NDD	NDD
12	8	56	1H	1	0.29	0.28	25.5	OD			79.1	63	40.3	79.1	47	36.5	193.1	69.5	54.2	-2.5	-1.1	-0.4	0.07
12	8	88	2H	1	0.22	0.26	3.13	OD			24.2	39	23.1	24.2	40	26.4	170.5	64.3	48.0	1.6	-14.9	-13.5	0.13
12	10	80	5H	1	0.31	0.23	9.13	OD			64.7	49	25.9	64.7	40	25.4	187.2	64.3	47.3	31.6	-29.9	-25.3	0.08
12	12	79	1H	1	0.25	0.2	26.95	OD			36.5	19	4.6	36.5	40	28.7	175.5	64.3	49.4	2.3	0.0	-0.5	0.05
				2	0.32	0.21		OD			52.5	25	5.3	52.5	40	33.6	182.1	64.3	52.4	3.2	0.0	0.4	0.07
12	12	86	1H	1	-0.26	0.25	11.06	OD	Yes		32.4	55	25.8	32.4	40	28.9	173.9	64.3	49.5	7.9	-1.5	-1.7	0.06
				2	0.17	0.15		OD			20.2	74	46.3	20.2	61.5	45.3	168.8	80.1	59.8	1.5	-13.8	-11.7	0.04
				3	0.26	0.21		OD			40.5	30	13.6	40.5	40	29.7	177.2	64.3	50.0	3.1	0.0	0.1	0.04
12	12	92	1H	1	0.27	0.14	15.67	OD			44.5	99	63.0	44.5	79	68.5	178.8	92.9	74.1	3.1	4.9	5.8	0.00
12	13	70	1H	1	0.31	0.28	24.25	OD			56.7	44	13.5	56.7	40	28.6	183.9	64.3	49.4	-2.5	0.0	-3.3	0.10
12	13	79	1H	1	0.07	0.17	18.3	OD			48.6	27	4.2	48.6	40	29.3	180.5	64.3	49.8	5.5	0.0	-2.4	0.03
12	14	77	1H	1	0.29	0.13	9.69	OD	Yes		28.3	59	39.4	28.3	55	39.7	172.2	75.3	56.3	NDD	NDD	NDD	NDD
				2	0.29	0.15		OD			44.5	50	26.6	44.5	40	28.7	178.8	64.3	49.4	NDD	NDD	NDD	NDD
12	14	83	1H	1	0.29	0.28	17.88	OD			53.2	34	17.7	53.2	40	32.5	182.4	64.3	51.8	5.8	0.0	-1.0	0.11
12	15	79	1H	1	0.35	0.28	5.66	OD			32	84	61.2	32.0	70.5	56.3	173.7	86.6	66.6	-3.8	-4.9	-3.0	0.04
12	15	81	1H	1	0.28	0.1	3.86	OD			20	91	58.7	20.0	81.5	62.0	168.7	94.7	70.1	1.1	-9.3	-8.3	0.00
12	16	38	1H	1	0.29	0.2	19.57	OD			93.9	78	54.9	93.9	52.7	43.3	199.2	73.6	58.5	13.5	2.0	5.6	0.04
12	16	84	5H	1	0.31	0.17	22.31	OD			24.6	50	27.0	24.6	44	33.1	170.6	67.3	52.1	NDD	NDD	NDD	NDD
12	18	38	1H	1	0.28	0.36	16.51	OD			62.1	54	30.8	62.1	54	36.4	186.1	74.6	54.2	6.8	-6.0	-7.9	0.11
12	19	40	1H	1	0.02	0.2	5.91	OD			63.3	19	8.4	63.3	40	31.2	186.6	64.3	51.0	6.6	0.0	1.7	0.04
12	21	84	4H	1	-0.1	0.15	10.79	OD			24.2	34	19.3	24.2	40	28.9	170.5	64.3	49.6	-1.6	0.0	1.2	0.02
14	2	34	1H	1	0.26	0.13	14.89	OD			66.5	46	15.5	66.5	44	30.7	187.9	67.3	50.6	1.6	-18.7	-18.1	-0.01

Table 7 – 1R13 TSP Circumferential Indications

											Unadjusted NDE			Adjusted NDE			Adjusted for Upper 95% NDE Uncertainty			Growth Rate per EFPY			
SG	Row	Col	TSP	Crack	Axial Elevation (inch)	Flaw Volt	Dent Volt	ID or OD	Stabilize	Mixed Mode	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Volt
14	2	70	1H	1	-0.23	0.66	17.26	OD	Yes		130.2	90	54.2	130.2	46	30.5	214.2	68.7	50.5	63.3	4.5	0.1	0.34
14	5	17	1H	1	0.27	0.13	27.75	OD			54.2	97	71.8	54.2	68	55.8	182.8	84.8	66.2	2.9	-0.4	-2.3	0.01
14	5	90	2H	1	0.18	0.14	6.81	OD			47.5	79	33.7	47.5	40	27.0	180.1	64.3	48.3	1.2	-7.5	-7.0	0.02
14	25	49	1H	1	-0.22	0.1	9.99	OD			23	6	1.8	23.0	40	28.7	170.0	64.3	49.4	0.0	-2.2	-2.8	-0.03
14	34	65	1H	1	0.1	0.14	19.81	OD			19.3	1	0.8	19.3	40	26.2	168.5	64.3	47.8	NDD	NDD	NDD	NDD
14	39	64	1H	1	0.27	0.17	30.83	OD	Yes		36.8	76	64.8	36.8	73	55.2	175.7	88.5	65.9	NDD	NDD	NDD	NDD
				2	0.28	0.14		OD			45	45	27.8	45.0	40	30.0	179.1	64.3	50.2	NDD	NDD	NDD	NDD
				3	-0.08	0.16		OD			40.9	35	21.6	40.9	40	30.3	177.4	64.3	50.4	NDD	NDD	NDD	NDD
14	43	58	1H	1	0.29	0.16	12.15	OD	Yes		55.4	59	42.2	55.4	43	34.2	183.3	66.5	52.8	1.7	2.2	5.0	0.01
14	43	59	1H	1	-0.3	0.25	13.64	OD			42.5	51	16.0	42.5	40	27.9	178.0	64.3	48.9	9.1	-1.5	-3.9	0.01

Note 1: Growth rate based on adjusted NDE, not the uncertainty adjusted NDE.
Note 2: Location (inch) is relative to the centerline of the tube support plate.
Note 3: Tube stabilization determined per evaluation by Westinghouse.
Note 4: NDD means prior outage lookup did not detect any degradation, so no growth rate can be assigned for indication.
Note 5: There were no mixed mode indications (combined circumferential and axial indications at same TSP).

Figure 1

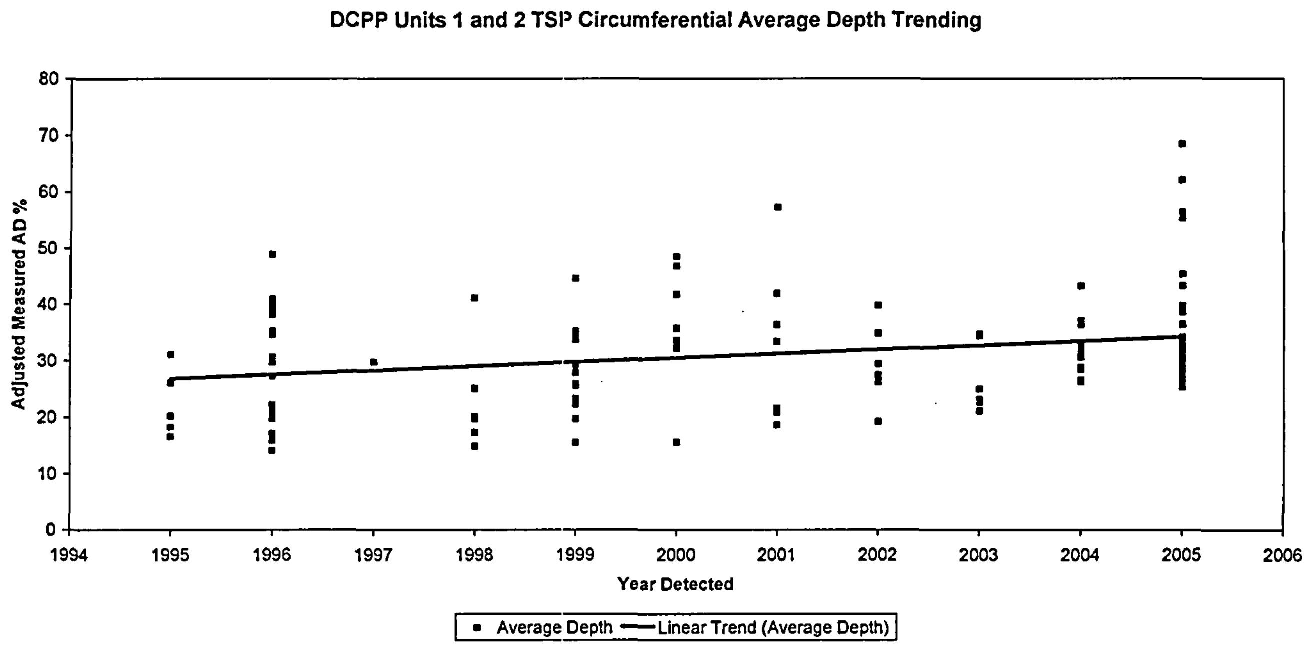

DCPP Units 1 and 2 TSP Circumferential Average Depth Trending
Adjusted Measured AD %
80
70
60
50
40
30
20
10
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year Detected
Average Depth
Linear Trend (Average Depth)

Figure 2

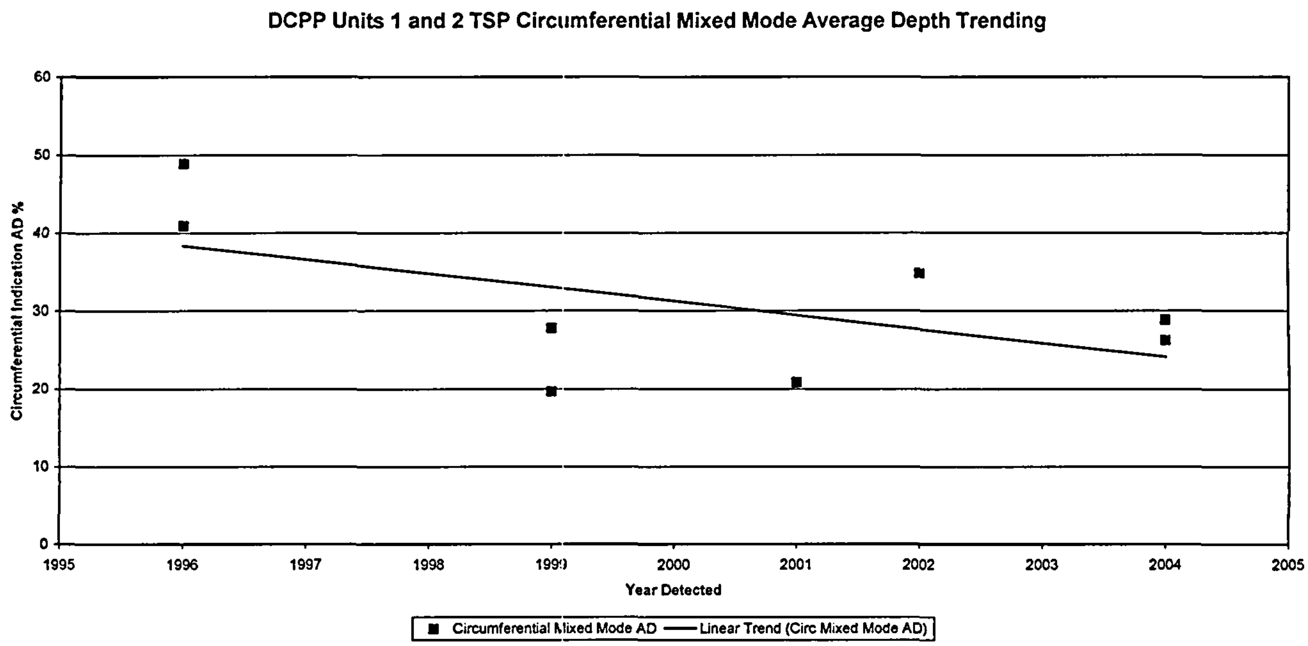
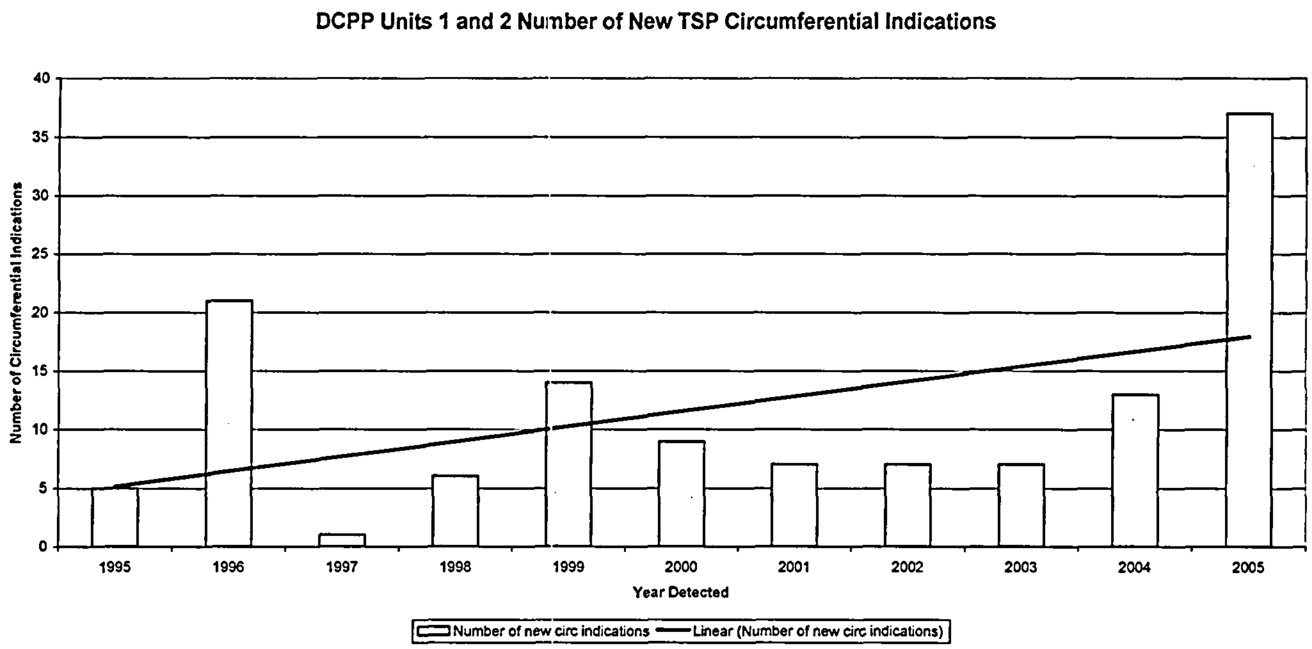

DCPP Units 1 and 2 TSP Circumferential Mixed Mode Average Depth Trending
Circumferential Indication AD %
0
10
20
30
40
50
60
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year Detected
Circumferential Mixed Mode AD
Linear Trend (Circ Mixed Mode AD)

Figure 3


DCPP Units 1 and 2 Number of New TSP Circumferential Indications
Number of Circumferential Indications
40
35
30
25
20
15
10
5
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year Detected
Number of new circ indications
Linear (Number of new circ indications)

ENCLOSURE 3
SPECIAL REPORT 06-01

STEAM GENERATOR CONDITION MONITORING AND OPERATIONAL ASSESSMENT REPORT DIABLO CANYON POWER PLANT UNIT 1 THIRTEENTH REFUELING OUTAGE

1.0 TSTF 449 Reporting Requirements

Pursuant to Nuclear Energy Institute (NEI) 97-06, Revision 2, "Steam Generator Program Guidelines," submittal of reports consistent with Technical Specification Task Force (TSTF) 449, Revision 4, is required. Pursuant to TSTF-449, a report shall be submitted within 180 days after initial entry into Mode 4 following completion of an inspection performed in accordance with Technical Specification (TS) 5.5.9. This enclosure provides the specific TSTF-449 reporting requirement, and Pacific Gas and Electric Company's (PG&E) description of compliance.

- *The scope of inspections performed on each steam generator (SG).*

  Table 1 provides a summary of eddy current inspections performed in each SG.

- *Active damage mechanisms found.*

  The following active alternate repair criteria (ARC) damage mechanisms were found:

  - Axial primary water stress corrosion cracking (PWSCC) in hot leg WEXTEX tubesheet region
  - Axial PWSCC at hot leg dented tube support plates (TSP) intersections
  - Axial outside diameter stress corrosion cracking (ODSCC) at hot leg TSP intersections

  The following active non-ARC damage mechanisms were found:

  - Combined axial ODSCC and axial PWSCC at hot leg TSP intersections inside or outside diameter (ID/OD)
  - Circumferential ODSCC at hot leg dented TSP intersections
  - Circumferential ODSCC in hot leg WEXTEX top of tubesheet region
  - Axial ODSCC in hot leg WEXTEX top of tubesheet region
  - Cold leg thinning at cold leg TSP intersections
  - Antivibration bar (AVB) wear in U-bend region
  - TSP ligament cracking

- *Nondestructive examination techniques utilized for each degradation mechanism.*

  Table 1 provides the nondestructive examination (NDE) techniques (bobbin and Plus Point probes) utilized for each inspection category. The degradation-specific analyses in this enclosure provide more detailed discussion of the probes used to identify and size the degradation mechanism.

- *Location, orientation (if linear), and measured sizes (if available) of service induced indications.*

  The degradation-specific condition monitoring (CM) analysis provides a discussion of the location, orientation, and measured sizes of service induced indications.

- *Number of tubes plugged during the inspection outage for each active degradation mechanism.*

  Table 2 provides the number of tubes plugged during Unit 1 Thirteenth Refueling Outage (1R13) for each active degradation mechanism. The cumulative number of tubes plugged for each degradation mechanism is shown in Table 3 (by SG) and Table 4 (by outage).

  A total of 116 tubes were plugged. Framatome-ANP alloy 690 roll plugs were used in both legs. Tubes with circumferential indications were evaluated for stabilization prior to plugging. Westinghouse stabilization analysis determined that five tubes required stabilization, and tubesheet stabilizers were inserted in these tubes before plugging.

- *Total number and percentage of tubes plugged (or repaired) to date.*

  Table 2 provides the total number and percentage of tubes plugged to date, by SG and overall. No tubes have been repaired by sleeving.

- *The results of condition monitoring, including the results of tube pull and in-situ testing.*

  There were no tube pulls or in-situ testing in 1R13, so these items are not applicable.

  This enclosure provides the degradation-specific results of condition monitoring for all active non-ARC damage mechanisms, as listed below. In addition, the operational assessment results are provided for information only. (Note: Enclosure 1 provides condition monitoring operational assessment (CMOA) for axial PWSCC in hot leg WEXTEX tubesheet region per W* ARC. Enclosure 2 provides CMOA for axial PWSCC at hot leg dented TSP intersections per PWSCC ARC.

Enclosure 4 provides CMOA for axial ODSCC at hot leg TSP intersections per voltage-based ARC.)

- Circumferential degradation at hot leg dented TSP intersections
- Combined Axial PWSCC/ODSCC (ID/OD) at hot leg TSP intersections
- Circumferential ODSCC in hot leg top of tubesheet region
- Axial ODSCC in hot leg top of tubesheet region
- Cold leg thinning
- AVB wear in U-bend region
- TSP ligament thinning/cracking

This enclosure also provides the results of 1R13 inspections and operational assessment (for information only) for potential degradation mechanisms that were not detected in 1R13, as listed below.

- Axial PWSCC and circumferential PWSCC in Row 1 and 2 U-bends
- Circumferential PWSCC in Rows 3 through 10 U-bends
- Circumferential PWSCC in hot leg WEXTEX top of tubesheet region
- TSP ODSCC mixed mode indications
- Secondary side integrity and potential tube damage due to loose parts and foreign objects

Lastly, this enclosure provides the results of 1R13 inspections for degradation mechanisms that are considered as potential, but have never been detected at Diablo Canyon Power Plant (DCPP) Units 1 and 2, as listed below.

- Axial PWSCC in high row U-bends
- Stress corrosion cracking at free span dings

Three tubes were preventively plugged in 1R13, and an assessment is not required for these tubes.

2.0 Background

Steam Generator Description

The commercial operation dates for Units 1 and 2 are May 1985 and March 1986, respectively. DCPP Units 1 and 2 use Westinghouse Model 51 SGs with explosively expanded (WEXTEX) transitions. The SGs contain Alloy 600 Mill Annealed tubing. The nominal outside diameter of the tubing is 0.875 inch with a 0.050-inch nominal wall thickness. DCPP Unit 1 and 2 SGs currently operate with a nominal hot leg temperature (T_{hot}) of about 604 degrees. The cycle lengths vary to support a nominal 20-month operation period. Unit 1 Cycle 13 had an actual duration of 1.34 effective full power years (EFPY). Unit 1 Cycle 14 has a projected duration of 1.39 EFPY.

PG&E has implemented several initiatives to minimize PWSCC and ODSCC. Primary side initiatives include U-bend heat treatment, WEXTEX tubesheet shotpeening, and zinc injection. Secondary chemistry initiatives include: copper removal program; ethanol amine to control pH; increased hydrazine levels; molar ratio control program to prevent excess alkalinity; boric acid addition program (including boric acid soaks at startup to mitigate denting and ODSCC at TSPs); periodic tube sheet sludge lancing; SG blowdown is maintained at one percent of the main steam flow rate; condensate polishers were installed and emergency (plant curtailment) procedures issued to protect against seawater condenser tube leaks; chemical cleaning in Unit 1 Twelfth Refueling Outage (1R12) and Unit 2 Twelfth Refueling Outage (2R12).

Technical Specification Repair Criteria

DCPP TS require plugging of any tube that has degradation greater than or equal to 40 percent of the nominal tube wall thickness, unless ARC are implemented. Other than degradation subject to ARC, all crack-like indications are required to be plugged on detection by a rotating coil probe, regardless of depth measurements. Cold leg thinning and AVB wear are sized by bobbin and allowed to remain in service if less than 40 percent.

Several ARC are implemented in DCPP Units 1 and 2:

- In March 1998, the DCPP TS were revised to allow implementation of ARC for ODSCC at TSPs pursuant to NRC Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking." ODSCC ARC was implemented starting in Unit 2 Eight Refueling Outage (2R8) for Unit 2 and Unit 1 Ninth Refueling Outage (1R9) for Unit 1. The ODSCC ARC TS changes were granted by the NRC in License Amendment (LA) 124/122 dated March 12, 1998, in response to License Amendment Request (LAR) 97-03. Use of an improved POD method, referred to as probability of prior cycle detection, was approved by NRC for both units in LA 177/179 dated October 28, 2004, in response to LAR 04-01.
- In February 1999, the DCPP TS were revised to allow implementation of Wstar (W*) ARC for axial PWSCC in the WEXTEX tubesheet region. W* ARC was implemented starting in 1R9 and Unit 2 Ninth Refueling Outage (2R9). The W* ARC TS for Cycles 10 and 11 were granted by the NRC in LA 129/127 dated February 19, 1999 (in response to LAR 97-04). The W* ARC TS for Cycles 12 and 13 were granted by the NRC in LA 151 dated April 29, 2002 (in response to LAR 01-03). Use of W* ARC on a permanent basis beyond Cycle 13 was granted by the NRC in LA 182/184 dated October 28, 2005 (in response to LAR 05-01).
- In May 2002, the DCPP TS were revised to allow implementation of ARC for axial PWSCC at dented TSPs. The PWSCC ARC TS changes were granted by the NRC in LA 152 dated May 1, 2002 (in response to LAR 00-06 Supplement 3). PWSCC ARC was implemented starting in Unit 2 Eleventh Refueling Outage (2R11) and Unit 1 Eleventh Refueling Outage (1R11). Validated depth sizing of axial PWSCC

at dented TSP intersections was previously implemented in 1R9 and Unit 1 Tenth Refueling Outage (1R10) for Unit 1; and 2R9 and Unit 2 Tenth Refueling Outage (2R10) for Unit 2, such that axial PWSCC less than the TS limit of 40 percent maximum depth limit was allowed to remain in service.

NRC Reporting for Category C-3 Reporting

During 1R13, greater than one percent of inspected tubes in SG 1-1 and SG 1-2 were defective and required plugging, thus the results of the SG tube inspections were classified as Category C-3. To satisfy DCPP Technical Specification TS 5.5.9, "Steam Generator (SG) Tube Surveillance Program," Table 5.5.9-2, PG&E notified the NRC in accordance with 10 CFR 50.72. In addition, PG&E submitted Licensee Event Report (LER) 1-2005-001 to the NRC via letter DCL-05-138 dated November 25, 2005 to report this condition as required by TS 5.6.10.c.

3.0 Condition Monitoring and Operational Assessment Summary

NEI 97-06, Revision 2, provides structural integrity performance criteria (SIPC), accident induced leakage integrity performance criteria (AILPC), and operational leakage performance criteria. These performance criteria were satisfied at the end of Unit 1 Cycle (EOC) 13 based on a condition monitoring assessment, and are projected to be satisfied at EOC 14 based on an operational assessment. This conclusion is based on assessing the conditions of the SG tubing on a degradation-specific basis.

Structural integrity performance criteria (SIPC):

$3\Delta P_{NO}$ and $1.4\Delta P_{SLB}$ are the burst margin requirements for free span degradation and degradation confined to the tube support plate (TSP) crevice, respectively. These criteria are satisfied at EOC 13 and EOC 14. (Note: See Enclosure 1, 2, and 4 for discussion of W* ARC, PWSCC ARC, and GL 95-05 voltage-based ARC, respectively).

Accident-induced leakage integrity performance criteria (AILPC):

- For degradation subject to ARC, the maximum allowable steam line break (SLB) induced leak rate limit is 10.5 gpm in a faulted SG, based on an analysis which uses current licensing basis assumptions and is approved by the NRC. As described in Enclosure 1, the aggregate SLB leak rate from ARC degradation and non-ARC degradation in the limiting SG is 0.55 gpm (at EOC 13) and 2.49 gpm (at EOC 14). These leak rates are less than the 10.5 gpm acceptance limit. Therefore, AILPC for ARC degradation are satisfied at EOC 13 and EOC 14
- For degradation not subject to ARC, the maximum allowable SLB-induced leak rate is 1 gpm in a faulted SG per NEI 97-06. The DCPP-specific non-ARC SLB-induced leak rate limit is 0.72 gpm at room temperature. There is no SLB leakage attributed to any non-ARC degradation at EOC 13 and EOC 14. Therefore, AILPC for non-ARC degradation are satisfied at EOC 13 and EOC 14.

Operational leakage performance criterion: Primary-to-secondary leakage through any one SG must be limited to 150 gallons per day (gpd). This limit is reflected in DCPP TS. In Unit 1 Cycle 13 in June 2005, a small leak (0.01 gpd) was detected and measured in the steam jet air ejector, due to the presence of Argon 41. Subsequent weekly sampling showed no detectable primary to secondary leakage. No operational leakage is projected for Cycle 14 based on plugging of all free span indications greater than or equal to 40 percent. ARC indications confined to the TSP crevice and WEXTEX tubesheet and left inservice in Cycle 14 have a low probability to contribute to operational leakage due to the tight TSP and tubesheet constraints.

4.0 Degradation-Specific Condition Monitoring and Operational Assessment for Active Non-ARC Damage Mechanisms

4.1 Circumferential Indications at Dented TSP Intersections

Condition Monitoring

Thirty-seven circumferential ODSCC indications (in 31 tubes) were detected by Plus Point at dented hot leg TSP intersections, as listed in Table 5. All the circumferential indications (SCI) were plugged. All the of the dent voltages at which circumferential cracking was detected were greater than 3 volts, except for SG 1-1 R24C59 1H, which was located at a 0.74 volt dented TSP.

In 1R13, as in 1R12, no circumferential PWSCC at dented TSPs was detected by Plus Point, so this damage mechanism is considered non-active for Unit 1 Cycle 13. TSP circumferential PWSCC is evaluated for operational assessment along with TSP circumferential ODSCC.

Circumferential PWSCC and ODSCC indications at dented TSPs are capable of being detected by Plus Point using EPRI ETSS 20510.1 and 22842.3, respectively.

The circumferential ODSCC indications were sized by Plus Point using the technique described in Appendix B of WCAP-15573, Revision 1. The depth profiles were then processed for corrections in accordance with the depth adjustment rules in Section 4.10.4 of WCAP-15573, Revision 1. The adjusted NDE results were corrected for 95 percentile NDE uncertainty using the NDE uncertainty regression parameters in Tables 4-19 to 4-21 in WCAP-15573, Revision 1. The adjusted NDE and adjusted NDE with uncertainty results are listed in Table 5.

The $3\Delta P_{NO}$ structural limit for a straight leg SCI is 265 degrees, assuming a 100 percent through-wall defect. From Table 5, the longest NDE length was 130.2 degrees, and is adjusted to 214.2 degrees after applying large 95 percentile NDE uncertainties. This length is less than the 265 degree structural limit. Therefore, structural integrity was satisfied at EOC 13.

The maximum Plus Point voltage of the 1R13 TSP circumferential ODSCC indications was 0.66 volts, much less than the 1.31 volt threshold for leak testing of circumferential ODSCC indications at explosive expansions (approximately equivalent to a dented TSP) documented in Revision 2 of the EPRI In-Situ Pressure Test Guidelines.

The NDE maximum depth of this worst-case voltage indication was 68.7 percent, including 95 percent NDE uncertainty. Therefore, no SLB leakage should be postulated for circumferential indications at EOC 13.

Operational Assessment

All 31 TSP intersections containing circumferential ODSCC were also inspected by Plus Point in 1R12. Twenty eight of the thirty-seven indications were detectable in 1R12 data based on a lookup. The growth rates were very small as noted in Table 5. Adding these 1R13 ODSCC data points to the existing database from WCAP-15573, Revision 1, plus data points from 1R11, 2R11, 1R12, and 2R12, results in the following growth rates.

Post-1R13 95 Percentile Growth Rates per EFPY for TSP Circumferential Indications

	PWSCC	ODSCC
Average Depth	10.6%	6.7%
Maximum Depth	17.1%	7.2%
Length	12.8 deg	22.1 deg
Number of DCPP data points in growth distribution	25	44

The limited data would indicate that PWSCC depth growth rates are larger than ODSCC. ODSCC growth is conservatively assumed to be the same as PWSCC.

The average depth (AD) growth data at 95% cumulative probability can be combined with the estimated detection thresholds derived from destructive examination (25 percent and 35 percent AD detection thresholds estimated for PWSCC and ODSCC, respectively, per WCAP-15573, Revision 1, Section 4.11, no NDE uncertainty is necessary) to obtain a deterministic projection of expected EOC 14 average depths for circumferential indications, as given in the following table.

Average Depth EOC Projected TSP Circumferential Indications

	PWSCC (non active)	ODSCC
Detection threshold for Average Depth	25%	35%
+95% AD growth over 1.39 EFPY cycle	15%	15%
Projected EOC 14 Average Depth	40%	50%

Assuming that the worst case projected flaw is 50 percent average depth over 360 degrees results in a conservative EOC 14 projection of 50 percent degraded

area (PDA). This conservative projection is less than the straight leg circumferential indication structural limit of 73.5 PDA. Since the largest circumferential crack angle at 1R13 was 214.2 degrees including adjustment for angle uncertainty at 95 percent probability, the assumption that the projected EOC 14 indication is 360 degrees is very conservative.

Similar to above, the maximum depth (MD) growth data at 95 percent cumulative probability can be combined with the estimated detection thresholds derived from destructive examination (45 percent MD detection threshold estimated for ODSCC and PWSCC per WCAP-15573, Revision 1, Section 4.11, no NDE uncertainty is necessary) to obtain a deterministic projection of expected EOC 14 maximum depths, as given in the following table.

Maximum Depth EOC Projected TSP Circumferential Indications

	PWSCC (non active)	ODSCC
Detection threshold for Maximum Depth	45%	45%
+95% MD growth over 1.39 EFPY cycle	24%	24%
Projected EOC 14 Maximum Depth	69%	69%

The projected ODSCC EOC 14 maximum depth of 69 percent presents no challenge to SLB leakage integrity.

Using this operational assessment (OA) method, the prior cycle OA projected a worst case TSP circumferential ODSCC EOC 13 average depth of 54 percent and maximum depth of 72 percent, based on the above detection thresholds and 14 percent growth rate per EFPY. These projections resulted in a small number of underpredictions. Fourteen percent (five of thirty-seven) of the 1R13 indications had an average depth greater than 54 percent (with no NDE uncertainty added). Ten percent (three of thirty-seven) of the 1R13 indications had a maximum depth greater than 72 percent (with no NDE uncertainty added). No adjustments to the OA method are deemed necessary for the following reasons: The underpredicted indications have small maximum Plus Point voltages (less than or equal to 0.28 volts) which could result in overly-conservative depth estimates at small amplitudes; the measured crack angles for these deeper (underpredicted) indications range from 20 degrees to 54 degrees, which are much too small to challenge structural integrity; the projected average depth is assumed to apply to a 360 degree indication for the operational assessment; and only a small percentage of TSP circumferential ODSCC indications detected to date in DCPP Units 1 and 2 have been underpredicted using this OA method (5 underpredictions out of 68 indications detected).

Based on the comprehensive inspection of dented TSP intersections during 1R13, the slow rate of circumferential degradation growth, acceptably low detection threshold, limited maximum angular extent associated with circumferential cracks, and the large structural margin associated with circumferential indications, no TSP circumferential indications are expected that would challenge structural performance criteria at

EOC 14. Since the largest projected maximum depth is not near through-wall, it is also unlikely that TSP circumferential indications will tear ligaments and pop through over the next cycle. Therefore, no leakage is postulated in a faulted SG following a SLB at EOC 14.

4.2 Combined Axial PWSCC and Axial ODSCC at Dented TSP intersections (ID/OD Indications)

Condition Monitoring

Table 8 provides a list of all tubes with combined axial PWSCC and axial ODSCC (ID/OD) indications through 1R13. In 1R13, eight tubes were identified by Plus Point with ID/OD indications located at the same dented TSP intersection. These tubes were plugged because this type of flaw combination is excluded from both PWSCC ARC and ODSCC ARC application. Three of these intersections had axial PWSCC indications that were left inservice in the prior inspection (1R12) using the PWSCC ARC. Two of these intersections had axial ODSCC indications that were left inservice in 1R12 using the ODSCC ARC.

PG&E letter to the NRC dated August 22, 2002 (letter DCL-02-098), derived a bounding conservative hoop direction ligament length of 0.1 inch (two times the tube wall thickness of 0.050 inch), such that if this separation distance is met or exceeded, there is no interaction relative to either burst pressure or leak rate.

Based on review of the eddy current data and terrain maps for all 1R13 ID/OD intersections, the axial PWSCC and axial ODSCC components are separated by hoop direction ligament gaps. Table 8 provides the separation gap distances (angles) between the ID and OD indications detected in 1R13, as well as all prior inspections. For TSPs with multiple ID or OD indications, the smallest (minimum) separation angle is provided. The shortest 1R13 gap is 36 degrees (about 0.27 inch). This separation distance exceeds the required hoop direction ligament thickness of 0.1 inch. Therefore, for condition monitoring, the flaws are treated independently under their respective ARC for structural and leakage integrity.

Operational Assessment

Extent of Inspection at Dented TSP Intersections

All ID and OD bobbin indications in any size dent were Plus Point inspected. In addition, as discussed in the PWSCC ARC report in Enclosure 2, a detailed Plus Point inspection program of dented intersections was conducted, which included 100 percent inspection of greater than 2 volt dents up to coldest TSP elevation with any PWSCC indication, plus 20 percent at the next coldest TSP elevation.

Based on the extent of the inspection and repair of all detected combined ID/OD indications, any potential combined PWSCC and ODSCC indications left in service at dented TSP intersections would have one of the indications below the detection threshold of the Plus Point coil or both of the ID/OD indications would be new indications. The Plus Point detection threshold would be expected to be less than 30 percent and 20 percent maximum depth for ODSCC and PWSCC axial indications, respectively. As a consequence of the low detection thresholds and modest crack depth and length growth rates for both axial PWSCC and ODSCC (see PWSCC ARC report and ODSCC ARC report in Enclosures 2 and 4), deep new indications would not be expected at EOC 14.

Number of Occurrences of Combined Axial PWSCC and ODSCC Indications

All data on combined ID/OD indications through 1R13 are given in Table 8. A total of 97 TSP intersections have been identified with combined ID/OD indications, 10 for Unit 2 and 87 for Unit 1. Fifty of these TSP intersections were in tubes that were previously inactive, i.e., tubes that were de-plugged and then re-plugged in the same outage. Therefore, only 47 TSP intersections were in active tubes at the time the ID/OD indications were detected.

Dependence of Combined Axial PWSCC and ODSCC Indications on Dent Voltage

The vast majority of the ID/OD intersections have small dents, less than 5 volts. Only two intersections have greater than 5 volt dents, and these are in deplugged tubes.

The dominance of axial ODSCC at non-dented TSP intersections or intersections with small dents is expected based upon experience in eddy current examination of greater than (>) 5 volt dents as part of ODSCC ARC applications. Few indications have been reported in > 5 volt dents under ARC applications for many plants. For DCPP Units 1 and 2, axial ODSCC has been detected in only twenty two intersections with > 5 volt dents, with the first occurrences in 1R9 and 2R9, none in 2R11, six in 1R12, one in 2R12, and four in 1R13. This number is small when compared to the large number of Plus Point inspections of greater than 5 volt dents, and also small when compared to the number of ODSCC signals detected in both units (greater than 1000 indications in each unit since 1R11/2R11). When the intersection is highly dented, corrodents can be expected to have increased difficulty in concentrating within the crevice, and axial ODSCC is very infrequent in large dents. Consequently, the potential occurrence of combined ID/OD indication can be expected to be dominantly limited to dents less than (<) 5 volts as supported by DCPP Units 1 and 2 inspection results. This limits the potential population of TSP intersections with significant potential for combined ID/OD indications, and also increases the likelihood of bobbin detection in less than 5 volt dents.

Crack Sizes for Combined Axial PWSCC and ODSCC Indications

The Plus Point sizing of all PWSCC indications at TSP intersections with ODSCC indications are given in Table 8. Table 8 also provides the Plus Point and bobbin voltages for the ODSCC indications. The listed bobbin voltage is either the bobbin distorted OD signal (DOS) indication voltage or, if the bobbin indication was not detectable, an inferred voltage based on the square root of the sum of squares of the all the Plus Point ODSCC voltages. The largest maximum and average depths for the PWSCC indications in previously active tubes at these intersections are shallow, only 60 percent and 48 percent, respectively. New PWSCC indications are also small as discussed below. The largest voltages for the ODSCC indications at intersections with PWSCC in active tubes are 4.58 bobbin DOS volts, which is influenced by both the PWSCC and ODSCC axial cracks, and 2.66 Plus Point volts (2R11 SG 2-2 R22C67). The 4.58 bobbin voltage is well below the ODSCC ARC structural limit of about 9 volts, and would have less than a 50 percent probability of leaking as a free span indication, per the ODSCC ARC correlations. The 2.66 Plus Point volts is less than the 2.75 volt threshold applied for amplitude sizing of ODSCC indications that has been found to result in good agreement with DCPP pulled tube through-wall lengths. The other ID/OD indications are small, and it can be expected that all indications found to date at TSP intersections with combined ID/OD cracks have large structural margins and no leakage.

New Indication Crack Sizes and Growth Rates

New indication crack sizes are of interest for assessing potential interaction between the ID and OD indications, because one or both indications must be a new indication. Both the ID and OD new indications are small. The largest maximum and average depths for all new PWSCC indications at any TSP intersection in 1R13 are 51 percent and 34.8 percent, respectively. The largest new ODSCC indication at any TSP intersection in 1R13 has a bobbin coil voltage of 2.01 volt. The average ODSCC bobbin voltage for new indications in 1R13 is 0.48 volts, excluding axial ODSCC not detectable by bobbin (AONDB) indications. The largest new ODSCC indication at a TSP with ID/OD indications had a bobbin DOS voltage of 1.29 volts, which is influenced by both the PWSCC and ODSCC indications, and a largest Plus Point voltage of 0.38 volts. The largest new PWSCC indication at a TSP with ID/OD indications had a maximum depth of 51 percent. Since both the new PWSCC and ODSCC indications are small, the structural influence of a new ID or OD indication interacting with an indication left in service would be small even under the very low likelihood of closely spaced indications.

The PWSCC maximum depth, average depth, and length growth rate distributions from Unit 1 Cycle 13 are provided in Enclosure 2, and are small. The upper 95 percent growth rate for new and repeat ODSCC indications in Unit 1 Cycle 13 is 0.21 volts/EFPY and 0.28 volts/EFPY, respectively, showing that new indication growth is smaller than growth for prior indications. Based on the modest growth rates for new

PWSCC and ODSCC indications, any new indications occurring to obtain combined ID and OD flaws at the same intersection would continue to be small indications.

Separation Distances Between Axial PWSCC and ODSCC Indications

Based on review of the eddy current data and terrain maps for DCPP Units 1 and 2 intersections with combined ID/OD indications, the axial PWSCC and axial ODSCC components are separated by hoop direction ligament gaps in excess of about 30 degrees (0.23 inch). The angles separating the PWSCC and ODSCC indications are given in Table 8. For TSP with multiple indications, the reported angle is the minimum separation distance. The separation distances are measured as distances between the peak amplitude responses, which is preferred given the width of an rotating pancake coil response. The lowest separation angle found in DCPP Units 1 and 2 is 34 degrees (0.26 inch), found at 1R11. The separation angles between axial PWSCC and ODSCC indication are predominantly in the 40 to 90 degree range. This range of separation angles can be expected based upon the separation distances between the locations of maximum hoop stress on the tube ID and OD at dented TSP intersections, as previously discussed in DCL-02-098.

Conclusions Relative to Closely Spaced Axial PWSCC and ODSCC Indications at Dented TSP Intersections

Based on the assessments provided in DCL-02-98, the potential for closely spaced axial PWSCC and ODSCC macrocracks at the same dented TSP intersection is negligible due to the high compressive OD hoop stresses near the minor axis of dent ovalization where the PWSCC occurs. Even the potential for shallow ODSCC microcracks is negligible unless formed prior to the denting, which occurred in the first cycle of operation for the Diablo Canyon SGs. Consequently, combined PWSCC and ODSCC indications at the same dented TSP intersection would have no impact on the operational assessment, and separate operational assessments for the individual indications are appropriate.

4.3 Circumferential ODSCC at Top of Tubesheet Region

Condition Monitoring

Twenty two circumferential ODSCC indications (SCI) in the hot leg top of tubesheet WEXTEX transition region were detected by Plus Point in 1R13. The Plus Point data are listed in Table 6.

Circumferential ODSCC indications at the top of tubesheet are capable of being detected by Plus Point using EPRI ETSS 21410.1.

The SCI were sized using the technique described in Appendix B of WCAP-15573, Revision 1. The depth profiles were then processed for corrections in accordance with

the depth adjustment rules in Section 4.10.4 of WCAP-15573, Revision 1. The adjusted NDE results were corrected for 95 percent NDE uncertainty using the NDE uncertainty regression parameters in Tables 4-19 to 4-21 in WCAP-15573, Revision 1. The unadjusted NDE, adjusted NDE and adjusted NDE with uncertainty results are listed in Table 6.

As noted in Table 6, the locations of the SCI were very close to the top of tubesheet elevation, within the WEXTEX expansion transition region. The SCI were located in the center bundle region of the top of tubesheet (WEXTEX Zone 4 and Zone 3), where the largest tube scale buildup existed prior to chemical cleaning in 1R12.

The $3\Delta P_{NO}$ structural limit for an SCI is 265 degrees, assuming a 100 percent through-wall defect, and 73.5 PDA. The longest measured length in 1R13 was 98.2 degrees, and adjusted to 201 degrees after applying large 95 percent NDE uncertainties. This length is less than the 265 degree structural limit under the very conservative assumption that the indication is uniformly through-wall. Therefore, structural integrity was satisfied at EOC 13.

The largest measured Plus Point voltage was 0.47 volts, much less than the 1.31 volt threshold for leak testing of circumferential ODSCC in transitions as documented in EPRI report 1007904. Based on this voltage, the SCI were shallow and no SLB leakage should be postulated for this degradation at EOC 13. Several indications have NDE adjusted maximum depths approaching 100 percent through-wall. However, maximum depth measurements in low voltage circumferential indications are not realistic due to difficulties in sizing circumferential indications below about 0.5 volts.

Operational Assessment

Fourteen of the twenty two WEXTEX transition circumferential ODSCC indications could be detected and sized in the prior outage data based on a lookup analysis. The lookup sizing used the same WCAP-15573, Revision 1, sizing techniques. The growth rates per EFPY are provided in Table 6. There are 21 DCPP Units 1 and 2 growth data for WEXTEX transition circumferential ODSCC using the WCAP-15573, Revision 1, sizing techniques. The as-found maximum voltages of this data set are all less than 0.5 volts, so depth sizing may not be reliable at these small voltages. Nonetheless, the 95 percent growth rates per EFPY for this data set are 27.5 degrees, 35 percent maximum depth, 23.5 percent average depth, and 0.21 volts.

Assuming the same average depth detection thresholds as for TSP circumferential ODSCC (35 percent for average depth), the projected EOC 14 average depth would be 68 percent, less than the 73.5 PDA structural limit. Alternatively, assuming the worst case length of an undetected circumferential indication is equal to the longest indication detected in 1R13 (98.2 degrees), the projected EOC 14 length would be 136 degrees, less than the 265 degree structural limit.

Because maximum depth measurements in low voltage circumferential indications are not realistic due to difficulties in sizing circumferential indications below about 0.5 volts, maximum voltage is applied for determining leakage integrity at EOC 14 conditions. Assuming the worst case maximum voltage of an undetected circumferential indication is equal to the largest maximum voltage detected in 1R13 (0.47 volts), the projected EOC 14 voltage would be 0.76 volt, much less than the 1.31 volt threshold for leak testing of circumferential ODSCC in transitions as documented in EPRI report 1007904.

Based on the 100 percent Plus Point inspection of the hot leg WEXTEX region, observations of small numbers of circumferential indications, very small growth rates, and large structural margin, there is a low probability that ODSCC circumferential indications located in the WEXTEX transition zone will challenge the $3\Delta P_{NO}$ structural integrity performance criteria through EOC 14. Likewise, based on the small maximum voltages associated with circumferential ODSCC indications located in the WEXTEX transition zone, along with very small voltage growth rates, there is a low probability that circumferential ODSCC indications would grow through-wall in a cycle, and no leakage should be postulated in a faulted SG following a SLB at EOC 14.

4.4 Axial ODSCC at Top of Tubesheet Region

Condition Monitoring

Axial ODSCC at the top of tubesheet (TTS) is typically related to sludge pile accumulation at the TTS, and was identified as a potential degradation mechanism in the 1R13 degradation assessment because of the industry incidence of this damage in similarly designed SGs. A large sludge pile height does not exist at DCPP Units 1 and 2, due to periodic sludge lancing cleanings. Chemical cleaning was performed in 1R12 to further reduce accumulated sludge at the TTS.

For the first time at DCPP Units 1 and 2, axial ODSCC was detected at the hot leg TTS region in DCPP Unit 1 in 1R13 during the 100 percent Plus Point hot leg TTS examination. A total of 12 indications were detected (some in each SG) and were plugged. The Plus Point coil can reliably detect axial ODSCC at the TTS per ETSS 21409.1. In addition, the bobbin coil is capable of detecting axial ODSCC at the TTS per ETSS 96008.1, although none of the 1R13 indications were detected by bobbin due to the small amplitude response and short lengths of the indications.

Table 7 provides the tube locations and Plus Point data for the 12 indications. The indications were located near the TTS region, either within or slightly above the WEXTEX transition. The affected tubes are located in the center of the tube bundle (tubesheet Zone 4 and Zone 3) where most of the sludge accumulates. The largest peak Plus Point voltage was 0.23 volts, less than the 0.5 volt threshold to perform in-situ test screening, and much less than the 1.89 volt threshold for leakage, based on Revision 2 of the EPRI In-Situ Pressure Test Guidelines. Therefore, there is significant margin for SLB leakage integrity.

Plus Point maximum depth and length estimates are provided in Table 7 and are based on application of ETSS 21409.1 phase angle sizing techniques. The deepest reported maximum depth based on phase angle measurements was 78 percent, not including NDE uncertainty. Based on amplitude sizing correlations for TSP axial ODSCC documented in Addendum 6 of the EPRI ODSCC Database report, a more reasonable nominal maximum depth for the largest 0.23 volt indication is about 52 percent, which supports the conclusion of significant margin for SLB leakage integrity.

The longest length of 0.37 inch is shorter than the $3\Delta P_{NO}$ structural limit of 0.43 inch. The NDE length is not adjusted for NDE uncertainty for comparison to the structural limit because the limit assumes 100 percent through-wall penetration the entire length of the degradation.

In conclusion, because the maximum voltages have significant margins to tube integrity threshold values, and indicated lengths have sufficient margin to the structural limit, condition monitoring is satisfied for these indications for both AILPC and SIPC. No SLB leakage should be postulated at EOC 13.

Operational Assessment

Lookups of the prior outage Plus Point data was performed to determine the growth rate of the indications. As indicated in Table 7, only four of the indications could be detected and sized in 1R12 data. Of these 4 indications, the largest growth rates are 0.1 volts per EFPY, 11.9 percent maximum depth per EFPY, and 0.11 inch per EFPY, indicating small growth.

Assuming the largest indication left inservice is bounded by the voltage of the largest indication detected in 1R13 (0.23 volts), and adding the largest voltage growth rate of 0.1 volt per EFPY, results in a bounding EOC 14 indication of 0.37 volts. This voltage is less than the 0.5 volt lower bound threshold for indications that will not leak at SLB conditions or burst at $3\Delta P_{NO}$ margins.

In 1R12, chemical cleaning was performed after eddy current inspections in SG 1-3 and SG 1-4, and before eddy current inspections in SG 1-1 and SG 1-2. Because about 40 percent (three out of eight) of the prior outage lookup no detectable degradation (NDD) calls were in SGs inspected after chemical cleaning, it is concluded that chemical cleaning did not affect the detection capability of axial ODSCC at the TTS.

4.5 Cold Leg Thinning (CLT)

Condition Monitoring

Cold Leg Thinning (CLT) indications at cold leg TSP intersections are detected by bobbin probes, applying EPRI ETSS 96001.1, as part of the 100 percent full-length

bobbin inspection. In outage inspections prior to 1R12, CLT indications were sized by bobbin (phase based depth sizing) also using EPRI ETSS 96001.1, and CLT indications were plugged if bobbin indicated a depth greater than or equal to 40 percent through-wall.

PG&E and Westinghouse had determined that field indications sized by phase angle analysis were found to have deep indicated depths for low voltage indications, resulting in unnecessary tube plugging of low voltage CLT indications. Therefore, a project was undertaken to develop improved bobbin coil sizing techniques to support tube repair decisions, and to develop burst correlations to support tube integrity analyses for CLT indications in Westinghouse Model 51 SGs. The initial work was documented in Westinghouse report SG-SGDA-02-41, "Cold Leg Thinning Database for Tube Integrity Assessments and NDE Depth Sizing," October 31, 2002. In addition, to support implementation of the improved sizing techniques, a performance demonstration was conducted in 2004 to incorporate analyst uncertainty into the correlations, and the results were documented in Westinghouse report SG-SGDA-04-17, "Diablo Canyon Performance Test Based NDE Sizing Uncertainties for Cold Leg Thinning Indications," April 15, 2004. The performance tests were conducted by 14 NDE analyst teams based upon "blind" analyses of 201 cold leg thinning samples that included noise additions that applied DCPP noise data to the laboratory simulations of cold leg thinning indications.

Report SG-SGDA-04-17 concluded that amplitude sizing of CLT indications is appropriate to establish the percent through-wall, with 4.5 volts as the upper limit for amplitude sizing. Above 4.5 volts, phase sizing is used to establish the percent through-wall. The 4.5 volt cutoff superseded the preliminary recommended cutoff of 1.9 volts provided in report SG-SGDA-02-41 based on the conclusion that amplitude sizing is more reliable than phase sizing below 4.5 volts for indications with high noise levels.

In 1R13 (as in 1R12), this new CLT sizing technique was used, in conjunction with the previously established repair limit of 40 percent through-wall. In 1R13, 100 percent of bobbin indications at cold leg TSPs were also Plus Point inspected to re-establish and validate the cold leg thinning region. Volumetric indications confirmed by Plus Point were sized by bobbin as cold leg thinning. If Plus Point did not confirm the indication, the indication was left in service as a DOS.

In 1R13, 164 CLT indications were detected and sized by bobbin, of which two were greater than or equal to 40 percent and were plugged. All indications were limited to 1C and 2C TSPs. No indications exceeded the 4.5 volt cutoff, so all indications were sized by amplitude analysis.

The deepest indication identified in 1R13 was 42 percent through-wall. Applying the regression equation from SG-SGDA-04-17 to correct the NDE measurement to the actual depth for 95 percent NDE uncertainty based on the analyst performance

test {$\%TW_{Actual} = (\%TW_{Measured}*1.09 + 7.51) + (1.64*$ standard deviation of 5.73)}, results in a CLT flaw of 63 percent. Applying the lower 95 percent CLT burst correlation from Figure 8-7 of SG-SGDA-02-41 (correlation of burst pressure with actual maximum depth, where actual depth conservatively obtained from the NDE sizing correlation with application of the 95 percent uncertainty on the NDE measurement) yields a CLT burst pressure of 7546 pounds per square inch (psi), much greater than the 3367 psi burst pressure margin requirement for $1.4\Delta P_{SLB}$, where SLB differential pressure is 2405 psi. Therefore, the structural integrity performance criteria were satisfied for this bounding indication at EOC 13. Applying the lower 95 percent CLT ligament tearing correlation from Figure 8-16 of SG-SGDA-02-41 (correlation of ligament tearing pressure with actual maximum depth, where actual depth conservatively obtained from the NDE sizing correlation with application of the 95 percent uncertainty on the NDE measurement) yields a CLT ligament tearing pressure of 6839 psi, much greater than the 2405 psi SLB differential pressure and 3367 psi burst pressure margin requirement. Therefore, no SLB leakage is postulated for this bounding indication at EOC 13.

Operational Assessment

Eighteen new CLT indications were detected in 1R13, all were present in the prior outage lookup data, and were added to the growth distribution. NDE uncertainties were applied to estimate the mean actual depth for both the 1R12 and 1R13 indications prior to calculating the growth rates for the cycle, using the mean regression equation. One hundred sixty four indications are in the Cycle 13 growth distribution, and the 95 percent growth rate per EFPY is 3.96 percent.

The largest beginning of cycle flaw left in service (39 percent), corrected for 95 percent NDE uncertainty, plus 3.96 percent/EFPY growth rate, results in a projected EOC 14 flaw size of 65 percent through-wall. Applying the lower 95 percent CLT burst correlation yields a CLT burst pressure of 7419 psi, much greater than the 3367 psi burst pressure margin requirement. Therefore, the structural integrity performance criteria were satisfied for this bounding indication at EOC 14. Applying the lower 95 percent CLT ligament tearing correlation yields a CLT ligament tearing pressure of 6545 psi, much greater than the 2405 psi SLB differential pressure and 3367 psi burst pressure margin requirement. Therefore, no SLB leakage is postulated for this bounding indication at EOC 14.

4.6 Antivibration Bar (AVB) Wear

Condition Monitoring

AVB wear indications are detected by bobbin probes during the 100 percent full-length bobbin inspection. AVB wear indications are sized by bobbin using EPRI ETSS 96004.1. AVB wear indications are plugged if bobbin indicates a depth greater than or equal to 40 percent through-wall. The $3\Delta P_{NO}$ structural limit for the worst case tube with

AVB wear is 71 percent for Row 16 and higher, and 65 percent for Row 15 and lower. The AVB wear repair limit of 40 percent allows for NDE uncertainty and flaw growth progression.

In 1R13, the bobbin coil inspection identified 293 AVB wear indications, of which none were greater than or equal to 40 percent. The deepest indication identified in 1R13 was 39 percent.

In accordance with EPRI ETSS 96004.1, sizing of AVB wear with bobbin coil has an NDE regression correlation (0.97* percent TW+ 3.49 percent) with a standard error of 4.49 percent. Additionally, the standard error for analyst uncertainty is conservatively assumed as 7.04 percent (reference "Appendix G Generic NDE Information from CM/OA," extracted from "Capabilities of Eddy Current Analysts to Detect and Characterize Defects in SG Tubes," Doug Harris, presented at November 1996 EPRI NDE workshop.) These uncertainties (technique and analyst) were combined (8.17 percent NDE uncertainty using the method in "The Use and Misuse of ETSS and Analyst Uncertainty", Bob Keating, presented at February 2003 EPRI SG Integrity Workshop) and applied at 95/50 confidence to the limiting flaw detected at 1R13 (39 percent), resulting in a 55 percent AVB wear flaw, which is less than the AVB wear structural limit of 65 percent. Therefore, the structural integrity performance criteria were satisfied for this bounding indication at EOC 13. Because AVB wear was too shallow to consider ligament tearing (pop through), no leakage is postulated in a faulted SG following a SLB at EOC 13.

Operational Assessment

Thirty-eight new AVB wear indications were detected in 1R13, and 31 were present in the prior outage lookup data and were added to the growth distribution. As a result, 286 indications are in the Cycle 13 growth distribution, and the 95 percent growth rate per EFPY is 4.48 percent.

Application of growth to the largest AVB wear indication left inservice results in a projected EOC 14 flaw size of 61 percent through-wall. This value is less than the AVB wear structural limit of 65 percent.

In conclusion, no AVB wear indications are expected to challenge structural integrity performance criteria through EOC 14. In addition, no leakage should be postulated in a faulted SG following a SLB at EOC 14 due to the extremely low probability that AVB wear indications would tear ligaments and pop through in one cycle.

4.7 Tube Support Plate (TSP) Ligament Thinning/Cracking

Starting in Unit 1 Eight Refueling Outage (1R8) and 2R8, PG&E implemented an inspection program to detect degradation of steam generator TSPs. A summary of this program was reported to the NRC in response to GL 97-06 (PG&E Letter DCL-98-046

dated March 27, 1998). Visual inspections performed in 1R8 confirmed several missing TSP ligaments. Westinghouse has concluded that the missing TSP ligaments are related to TSP drilled hole manufacturing anomalies. The TSP manufacturing practices employed at the time that the DCPP steam generators were produced used a stacked drilling procedure. Several TSPs were clamped together and drilled simultaneously. A review of the eddy current suspect ligament crack (SLC) locations indicates distinct location patterns, indicative of manufacturing anomalies of the automatic drilling equipment.

Condition Monitoring

The 1R13 eddy current inspection program consists of several steps: 100 percent bobbin inspection to detect SLC at TSPs; Plus Point inspection of preexisting Plus Point confirmed indications (referred to as "baseline" indications); and Plus Point inspection of newly detected bobbin SLC indications. Plus Point indications are characterized as either single indication ligament cracks (LIC), or indications exhibiting a missing TSP ligament, referred to as ligament gaps (LIG). LIG indications are further assessed using Plus Point probe data to determine the gap extent.

Only missing TSP ligaments are a threat to tube integrity, as a gap could permit a tube burst under normal operating conditions, assuming tube cracking coincident with the location of the gap.

In 1R13, Plus Point confirmed all of the 265 TSPs with baseline ligament indications. In addition, Plus Point confirmed 20 new bobbin SLC indications, and also detected one new LIC indication that was not detected by bobbin. Thus, a total of 286 TSPs were identified to have indications, as shown in Table 9. Several TSPs contain multiple indications (combination of two LICs, two LIGs, or LIC and LIG).

A total of twenty three new indications were detected (six LIG and seventeen LIC). New indications were detected in each SG. In addition, six indications changed from LIC to LIG in SG 1-3 and SG 1-4. These two SGs were chemically cleaned in 1R12 after eddy current inspections had been performed, such that the signals may have become clearer in the 1R13 inspections.

The largest measured LIG gap was 119 degrees. For the TSP with two LIG indications, the combined gap was 45 degrees, assuming that the gaps were connected. Of the six new LIG indications and six LIG indications that were previously LIC, the largest gap size was 54 degrees. These bounding gaps are less than the 146 degree threshold gap for preventive tube repair. As such, no additional tube plugging was required as a consequence of TSP ligament indications.

One repeat axial PWSCC ARC indication in SG 14 R35C68 at 3H required plugging due to a new LIC indication at the same TSP, based on the conservative exclusion of

ARC indications at both LIC and LIG locations. This was the first time that an ARC indication was located at the same TSP with a ligament indication.

Operational Assessment

The preservice inspection (PSI) data was reviewed for twenty two of the twenty three new indications, and eight were traceable to the PSI data. Of the 14 new indications not traceable to the PSI data, a lookup of the 1R12 bobbin data was performed, and 12 were traceable to the 1R12 data, including the LIC at SG 14 R35C68 at 3H. Therefore, the vast majority of new indications were traceable to at least the prior outage.

There were 152 back to back LIG calls. For these repeat LIG indications, the gap measurements were compared to the prior outage gap measurements, and little change was indicated. The largest gap increase was 23 degrees. For the new LIG indications (largest gap of 54 degrees), no quantitative gap change assessment can be made, and potential changes will be monitored in the next inspection. For the limiting LIG of 119 degrees, the gap size has not increased since the initial sizing of this indication in 1R8.

The slow progression of ligament gaps indicates an insignificant change in the material condition of the TSPs. It is expected that the gap sizes of repeat and new LIG indications will not extend beyond the 146 degree threshold gap for tube repair at EOC 14.

5.0 Degradation-Specific Operational Assessment for Non-Active Potential Damage Mechanisms

5.1 Potential Axial and Circumferential PWSCC in Row 1 and 2 U-Bends

SG tubes in Rows 1 and 2 U-bends were heat treated following one cycle of operation for Unit 2 and two cycles of operation for Unit 1 to relieve stresses and mitigate the potential for PWSCC in this location. One hundred percent of Rows 1 and 2 U-bends have been inspected each refueling outage. Bobbin probes were used in the first refueling outage inspection. Since then, these inspections were conducted with a single coil rotating probe. Starting in Unit 2 Seventh Refueling Outage (2R7) and 1R8, a Plus Point probe was used to inspect Rows 1 and 2 U-bends for detection of PWSCC.

PWSCC has been detected in the U-bend region of Row 1 tubes in all Unit 1 and Unit 2 SGs. The majority of Row 1 PWSCC has been axial, with a small number of circumferential. Axial PWSCC has also been detected in Row 2 in SG 1-4 (1R8) and SG 2-3 (2R8). Starting in 2R11 and 1R12, 100 percent of Rows 1 to 10 have been Plus Point inspected. The 2R11 inspection included 100 percent inspection to Row 46. No axial PWSCC indications have been detected in greater than Row 3 in these inspections. The last occurrence of Row 1 or 2 U-bend axial and circumferential PWSCC indications in Unit 1 have been 1R8 and 1R10, respectively.

ETSS 96511.2 is the Plus Point technique that is applied for detection of PWSCC. In 1R13, 100 percent of Rows 1 and 2 U-bends were Plus Point inspected, and no indications were detected.

Operational Assessment

Due to the degradation-free Row 1 and 2 U-bend region for Unit 1 for the last three cycles of operation based on 100 percent Plus Point inspection, PWSCC in Rows 1 and 2 U-bends is not an active damage mechanism. An OA is provided for information only.

Growth rates for axial and circumferential PWSCC in Rows 1 and 2 are based on similar degradation mechanisms at dented TSPs. There is a large database of growth rates for axial PWSCC at dented TSPs, as discussed in Enclosure 2 for PWSCC ARC. For the growth rate data set used in the PWSCC ARC operational assessment, the 95 percentile growth rates per EFPY are bounded by 0.09 inch for length, 12 percent for maximum depth, and 10 percent per EFPY for average depth. There is small growth rate database for circumferential PWSCC at dented TSPs. As discussed earlier in this enclosure, the 95 percentile growth rates per EFPY for circumferential PWSCC at dented TSPs are about 13 degrees, 17 percent maximum depth, and 11 percent average depth.

Assuming that an axial PWSCC indication with a 100 percent through-wall length of 0.38 inch is the largest undetected Row 1 or Row 2 flaw and was left in service (0.38 inch based on the length of the longest Row 1 axial PWSCC indication detected in 2R11), and adding a growth rate of 0.09 inch per EFPY, the resulting EOC 14 indication would be about 0.5 inch. This flaw length is less than the bounding Rows 1 and 2, 100 percent through-wall structural limit length of 0.64 inch for $3\Delta P_{NO}$ conditions, thereby demonstrating that structural integrity would be satisfied at EOC 14. Accounting for NDE uncertainty is not required since the indication is assumed to be through-wall and the length will be overestimated under the through-wall depth assumption due to coil lead-in and lead-out affects.

Assuming that a circumferential PWSCC indication with a 100 percent through-wall length of 15.7 degrees is the largest undetected Row 1 or Row 2 flaw and was left in service (15.7 degrees based on the length of the Row 1 circumferential PWSCC indication detected in 2R11), and adding a growth rate of 13 degrees per EFPY, the resulting EOC 14 indication would be about 34 degrees. This flaw length is much less than the Rows 1 and 2 100 percent through-wall structural limit length of 265 degrees, thereby assuring structural integrity is satisfied at EOC 14. The large margin between the projected EOC flaw length and the structural limit allows for large NDE uncertainties.

The Plus Point detection threshold for TSP circumferential PWSCC maximum depth is about 45 percent. This detection threshold is assumed to be applicable for axial and

circumferential PWSCC in Rows 1 and 2 U-bends. Adding 17 percent per EFPY maximum depth growth results in an EOC maximum depth of 69 percent for axial and circumferential PWSCC in Rows 1 and 2 U-bends. Therefore, no leakage should be postulated in a faulted SG following a SLB at EOC 14.

In conclusion, no axial or circumferential PWSCC indications in Row 1 and 2 U-bends are expected that would challenge structural integrity performance criteria through EOC 14. In addition, no leakage should be postulated in a faulted SG following a SLB at EOC 14 due to the extremely low probability that indications would tear ligaments and pop through in one cycle.

5.2 Potential Circumferential PWSCC in Row 3 to Row 10 U-Bends

Background

In 2R11, a secondary side pressure test in SG 2-4 identified leakage in the R5C62 U-bend region. Subsequent Plus Point inspection detected several short circumferential crack-like indications on the ID of the Row 5 U-bend, extending from the hot leg tangent point to the cold leg tangent point. Because industry had never performed extensive high row U-bend inspections with a rotating probe, and this was a first of a kind degradation mechanism in both domestic and foreign plants, a critical area could not be immediately determined to limit the Plus Point inspection scope. As a result, the U-bend Plus Point inspection program was expanded to include 100 percent of the U-bend regions of all rows (Rows 3 through 46) in each SG. A total of 12 tubes were identified to have similar circumferential indications, ranging from Row 3 to Row 10. Each SG had at least one indication. The indications were located on the flanks of the tube. Video probe inspections confirmed the presence of circumferential ID cracking. The tubes were in-situ leak and proof tested, and only R5C62 exhibited leakage at SLB differential pressure (about 0.003 gpm at room temp). There were no tube bursts at 3 times normal operating differential pressure ($3\Delta P_{NO}$).

The root cause of the indications was attributable to circumferential PWSCC due to high residual stresses inherent to the tube bending process, as documented in a formal root cause report issued by PG&E.

Following the 2R11 experience, the Westinghouse Owner's Group (WOG) issued a report on September 15, 2003, which defined a critical area for this damage mechanism and provided inspection and expansion recommendations for similar Model 51 SGs. The WOG report demonstrates that U-bend circumferential flaw development is related to longitudinal residual stress, which is dependent on row (bend radius). Based on finite element analysis, longitudinal stress is reduced by a factor of four from Row 5 to Row 10, and a factor of two from Row 10 to Row 15. Figure 10 of the WOG report plots longitudinal strain as a function of row, and shows similar results (e.g., longitudinal strain, and hence stress, is reduced by a factor of about two from Rows 9 and 10 to

Row 16). Figure 10 of the WOG report is used to define the expansion plans because it provides more conservative results than the WOG finite element analysis.

All Westinghouse SGs with Alloy 600 mill annealed tubing have completed the initial U-bend inspections per the WOG inspection guidelines, and several have completed their second time inspections. For plants that had circumferential indications detected in the first inspection, the number of indications in their second inspection was dramatically reduced, illustrating the Plus Point inspection transient associated with this damage mechanism.

For DCPP Unit 2, the first time inspections in 2R11 identified twelve tubes with circumferential PWSCC, and the second time inspections in 2R12 identified two tubes with circumferential PWSCC. Most of the indications were in Rows 5 and 6.

For DCPP Unit 1, the first time inspections in 1R12 identified 85 tubes with circumferential PWSCC indications, with Row 8 being the highest row affected and most of the indications occurred in Rows 5 and 6. A total of nine tubes with U-bend circumferential PWSCC indications had Plus Point voltages in excess of 1.73 volts, and were in-situ pressure tested. Four of the tubes leaked slightly at pressures in excess of 3750 psi, well above SLB pressure of 2405 psi. At $3\Delta P_{NO}$, no burst occurred and very small leak rates were measured. Based on these 1R12 results, no SLB accident-induced leakage was attributed to U-bend circumferential PWSCC, and structural margins were maintained. It was believed that the SG 1-4 prior cycle operational leakage of 1 gpd may have been due to leakage from one or all of these 4 tubes even though no leakage was identified in the in-situ tests at normal operating pressure and SLB differential pressures.

For PWSCC data limited to DCPP SGs, Unit 1 is limited to Row 8 and Unit 2 is limited to Row 10. For Model 51 SG data not including DCPP, PWSCC is limited to Row 9, consistent with DCPP experience. The peak voltages of the DCPP indications also decrease with increasing row. The combination of smaller numbers and smaller voltages with increasing row validates the information on Figure 10 of the WOG report which shows decreasing strain with increasing row.

Condition Monitoring

The 1R13 inspection plan consisted of inspection of 100 percent of the Row 3 to Row 10 U-bend region by 0.680 inch diameter mid range Plus Point in each SG, applying ETSS 96511.2 techniques. An expansion plan was also developed, but implementation was not required. The inspection plan was as follows: If circumferential PWSCC is detected in Rows 9 to 10, then inspect 100 percent of Rows 11 to 20 in the affected SGs. If circumferential PWSCC is detected in Rows 11 to 14, then redefine the critical area (CA) and buffer zone and inspect 100 percent of the CA and buffer zone in the affected SGs. If circumferential PWSCC is detected in Row 15 or higher, then inspect 100 percent of all remaining rows in the affected SGs.

Figure 10 and Sections 11.6 and 11.8 of the WOG report provide the basis for the inspection and expansion criteria. The WOG report reflected the DCPP Unit 2 experience and was a conservative generic recommendation to all plants. The WOG report defined the CA as Rows 3 to 8, and the buffer zone as Rows 9 and 10. Defining the CA as Rows 3 to 8 and buffer zone as Rows 9 and 10 meets the definition of the CA and buffer zone in section F.1 of the EPRI Examination Guidelines. For the buffer zone, the population of tubes in Rows 9 and 10 exceeds 20 percent of the population tubes in Rows 3 to 8. Because Row 10 is the first row bent using the large radius bending process, the inclusion of Row 10 in the buffer zone is also recommended in the WOG report. Also, inclusion of 100 percent inspection of Rows 9 and 10 in the initial plan helps avoid a scope expansion if circumferential PWSCC is detected in Rows 3 to 8.

No PWSCC indications were detected in the 1R13 U-bend inspections, validating that the previous outage Plus Point inspection results were a transient associated with this damage mechanism. Therefore, condition monitoring is not required.

Operational Assessment

The $3\Delta P_{NO}$ structural limit for 100 percent through-wall circumferential cracking in Rows 1 to 10 U-bends is 265 degrees, not accounting for NDE uncertainty.

The growth rate of circumferential PWSCC in rows greater than three cannot be quantified because there is only one back-to-back Plus Point inspection for these indications in DCPP Units 1 and 2 (2R11 to 2R12). For this one indication, the length change was 10.9 degrees, indicating a small growth rate. The maximum voltage change was 0.24 volts, indicating a small growth in depth. Even though the bobbin coil cannot reliably detect circumferential indications, a historical bobbin data lookup review of prior inspections was performed for some of the larger U-bend indications, and demonstrated that the indications had slow growth. Moreover, the analytical and test information indicates that cracks should remain short, i.e., once away from the flanks of the tube, the residual stresses become compressive and crack growth in the hoop direction would be expected to stop.

There is a large database of growth rates for axial PWSCC at dented TSPs, as discussed in Enclosure 2 for PWSCC ARC. For the growth rate data set used in the PWSCC ARC operational assessment, the 95 percentile growth rates per EFPY are bounded by 0.09 inch for length, 12 percent for maximum depth, and 10 percent for average depth. There is a smaller growth rate database for circumferential PWSCC at dented TSPs. As discussed earlier in this enclosure, the 95 percentile growth rates per EFPY for circumferential PWSCC at dented TSPs are about 13 degrees, 17 percent maximum depth, and 11 percent average depth. These numbers are similar to axial PWSCC at dents, and are therefore used in the operational assessment for circumferential PWSCC in U-bends.

The assumed detection threshold for circumferential PWSCC in Rows 3 and higher is 41 degrees, corresponding to the maximum length of the 1R12 indications. Adding an arc length growth of 13 degrees per EFPY to the detection threshold results in a projected EOC 14 circumferential PWSCC indication of about 59 degrees. This length is much less than the 265 degree structural limit, thus allowing large margins for NDE length measurement uncertainty. In addition, the axial stress field in the flanks of the U-bends is very limited in circumferential extent, which is consistent with the short flaw lengths found for previously uninspected tubes. Consequently, the potential circumferential extent is much less than the structural limit. Therefore, structural margins would be maintained at EOC 14.

The possibility of circumferential PWSCC in Rows 11 and higher U-bends at EOC 14 is unlikely, given the decreasing residual stresses in higher rows and the 1R12 and 1R13 Plus Point NDD condition for Rows 9 and 10 U-bends.

The Plus Point detection threshold for circumferential PWSCC maximum depth is estimated at about 45 percent, similar to TSP circumferential PWSCC discussed earlier in this enclosure. Adding 17 percent per EFPY maximum depth growth results in an EOC 14 maximum depth of about 69 percent. Therefore, leakage integrity would be maintained for Cycle 14.

In conclusion, no circumferential PWSCC indications in U-bends are expected that would challenge structural integrity performance criteria through EOC 14. In addition, no leakage should be postulated in a faulted SG following a SLB at EOC 14 due to the extremely low probability that indications would tear ligaments and pop through in one cycle. This conclusion is validated based on the results of in-situ pressure testing performed in 1R12, which demonstrated structural integrity at $3\Delta P_{NO}$ conditions and no leakage at SLB differential pressure for Plus Point indications up to about 3.5 volts.

5.3 <u>Potential Circumferential PWSCC in WEXTEX Tubesheet Region</u>

No circumferential PWSCC was detected in the hot leg WEXTEX transition region by Plus Point in 1R13, based on 100 percent Plus Point inspection of the hot leg top of tubesheet region. One circumferential PWSCC was detected in the prior outage (1R12). An OA is conservatively performed for this degradation mechanism.

Circumferential PWSCC indications in the tubesheet region are capable of being detected by Plus Point using EPRI ETSS 20510.1.

Operational Assessment

There is very limited DCPP Units 1 and 2 growth data for WEXTEX transition circumferential PWSCC using the WCAP-15573, Revision 1, sizing techniques. In addition, growth rates for DCPP top of tubesheet circumferential indications may not be reliable due to the small voltages of the indications. Because of this limited growth

data, the growth rates per EFPY for circumferential PWSCC in the WEXTEX transition region are conservatively assumed to be the same as the 95 percent growth rates for TSP circumferential PWSCC (17 percent MD, 11 percent AD, 13 degree length). Conservatively assuming a detection threshold of 45 percent for maximum depth and 35 percent for average depth (based on TSP circumferential degradation), the projected EOC 14 average depth and maximum depth would be 50 percent and 69 percent, respectively. Circumferential indications of this size present no challenge to structural and leakage integrity. The $3\Delta P_{NO}$ structural limit for an SCI is 265 degrees, assuming a 100 percent through-wall defect.

Based on the 100 percent Plus Point inspection of the hot leg WEXTEX region, no detected PWSCC circumferential indications, very small growth rates, and large structural margin, there is a low probability that PWSCC circumferential indications located in the WEXTEX transition zone will challenge the $3\Delta P_{NO}$ structural integrity performance criteria through EOC 14. Also, there is a low probability that circumferential PWSCC indications in the WEXTEX transition zone would grow through-wall in a cycle, and no leakage should be postulated in a faulted SG following a SLB at EOC 14.

5.4 Potential TSP ODSCC Mixed Mode Indications

If a dented TSP intersection contains an axial ODSCC indication and a circumferential indication (either ODSCC or PWSCC), this degradation is termed ODSCC mixed mode indication. Since axial ODSCC indications detected by bobbin at dented locations must be inspected with Plus Point, 100 percent of the susceptible population of ODSCC mixed mode indications would be detected at each inspection. No ODSCC mixed mode indications were detected in 1R13. However, two indications were detected in 1R12 (which were determined to be non-interacting), and one indication was detected in 1R11.

(Note: If a dented TSP intersection contains an axial PWSCC indication and a circumferential indication [(either ODSCC or PWSCC]), this degradation is termed PWSCC mixed mode indication. There were no PWSCC mixed mode indications detected in 1R13. Enclosure 2 provides an assessment of the potential affect of TSP circumferential indications and PWSCC mixed mode indications on PWSCC ARC methods.)

An OA is performed for ODSCC mixed mode indications because this degradation mechanism has increasing potential for occurrence due to the increasing population of TSP axial ODSCC indications returned to service every inspection under ODSCC ARC.

Operational Assessment

In Unit 1 Cycle 14, there is a low likelihood of interacting ODSCC mixed mode indications developing that could affect leakage or burst margins of the axial ODSCC

flaw, based on the following assessment. Potential TSP circumferential cracking should mainly occur in greater than 2 volt dents. There have only been two circumferential indications observed at a dent less than 2 volts (one in 1R12 and one in 1R13). Nonetheless, potential circumferential indications at all dent sizes are considered. There were 410 intersections returned to service that contained Plus Point confirmed axial ODSCC at dented intersections. Two hundred ninety three of these intersections contained dents less than or equal to (≤) 2.0 volt and 117 of these intersections contained dents > 2.0 volt. All of these intersections were inspected by Plus Point to verify that no axial PWSCC or circumferential indications were detectable. Of these ODSCC indications at dented TSPs that were returned to service, the largest bobbin amplitude was 1.92 volt with a maximum Plus Point amplitude of 0.38 volt. The largest Plus Point amplitude from ODSCC indications returned to service at dented TSPs was 1.18 volt with a corresponding bobbin amplitude of 1.45 volt.

The upper 95 percent growth rate per EFPY for axial ODSCC in Cycle 13 is bounded by about 0.3 volts/EFPY in each SG. Adding this growth rate to the largest bobbin indication left in service at a dented TSP (1.45 volts) results in an EOC 14 flaw of about 1.9 volts.

Assuming the largest projected EOC 14 TSP circumferential indication (50 percent average depth) interacts with a projected EOC 14 axial ODSCC indication of 1.9 volts:

- The axial ODSCC indication burst margin would not be affected because the 50 percent circumferential average depth is less than the 75 percent average depth threshold for mixed mode burst affects developed in WCAP-15573, Revision 1. In addition, a 1.9 bobbin volt ODSCC indication has a large margin against burst compared to the approximate 9 volt structural limit.
- The axial ODSCC indication SLB leak rate margin would not be affected because a 1.9bobbin volt ODSCC indication has a very small probability of leaking as a free span indication, per the ODSCC ARC correlations. In addition, the largest ODSCC Plus Point amplitude of 1.18 volt found at a dented TSP returned to service would be expected to remain below the 2.75 volts typical of a through-wall indication for axial ODSCC.

5.5 Secondary Side Integrity and Potential Tube Damage from Loose Parts and Foreign Objects

In 1R13, no SG upper internals inspections or repairs were conducted, and the upper secondary side manways were not removed. Sludge lancing and foreign object search and removal (FOSAR) inspections were conducted at the top of tubesheet in each SG. Sludge lancing removed about 56 lbs of sludge (14, 17, 11, and 14 pounds in SGs 1-1 through 1-4, respectively). The small amount removed is attributed to the success of the prior outage chemical cleaning process, which had removed about 19,000 pounds of sludge and scale.

During the 100 percent full length bobbin examination, the bobbin data was reviewed for possible loose part (PLP) indications. In addition, an in-depth bobbin analysis is performed to identify PLP indications in Rows 1 and 2 and the outer two peripheral tubes. Also, during the 100 percent hot leg top of tubesheet Plus Point examination, the Plus Point data was reviewed for PLP at the top of tubesheet. In addition, several prior cycle PLP indications were addressed, as discussed below.

FOSAR visual examinations of the tube sheet annulus and blowdown lane regions were performed to identify loose parts following sludge lancing. The locations of PLP signals detected by eddy current are provided to FOSAR personnel for search and retrieval. When foreign objects are detected by FOSAR, the objects are evaluated for potential impact to tube integrity.

No PLP indications or foreign object tube wear were detected by bobbin and Plus Point inspections. Three fine wires were detected and removed by FOSAR in the annulus and tube lane areas in SG 1-2. The mass of the wires were insignificant, such that there is no impact to tube integrity.

As discussed in PG&E Letter DCL-04-112 (1R12 90-day report), several PLPs detected by Plus Point in 1R12 were not detected during 1R12 FOSAR, and therefore were being tracked for continued evaluation in 1R13. The following discussion provides the resolution of these prior cycle PLPs and foreign objects.

In 1R11, a foreign object was detected by eddy current and FOSAR in SG 1-3 between tubes R1C49 and R1C50 at the hot leg top of tubesheet. The object appeared to be metallic, was about 0.4 inch by 0.75 inch, and was tightly lodged between the two tubes. Multiple attempts to dislodge the object were unsuccessful. The signal was traced to 1R9 and 1R10 based on Plus Point data review, and had not changed. Continued operation during Unit 1 Cycle 12 was determined to be acceptable because no 1R11 tube wear was detected by eddy current and because the loose part was adhered to the tubesheet. In 1R12, prior to chemical cleaning and sludge lancing, this location was again Plus Point inspected, and once again a PLP signal was detected between these two tubes. Unit 1 Twelfth Refueling Outage FOSAR was conducted after chemical cleaning and sludge lancing, and this location was specifically reviewed in detail. No foreign object was found. Therefore, it was assumed that the foreign object had likely been removed as part of the 1R12 chemical cleaning and sludge lancing operation. In 1R13, bobbin and Plus Point inspections of this location did not detect any PLP indications, thus validating this assumption.

In 1R12, a repeat PLP indication (from 1R8 through 1R11) was again detected by bobbin and confirmed by Plus Point between SG 1-1 R30C78 and R31C78, 3 inches above the cold leg top of tubesheet. No tube wear was detected. The signal was traceable to 1R7. FOSAR was not able to detect the foreign object in any prior outage. Continued operation during these prior cycles was evaluated by Westinghouse to be acceptable because no tube wear was detected by eddy current, and the object

(assumed to be metallic) appeared to be lodged between two tubes. Following 1R12 chemical cleaning and sludge lancing, FOSAR attempts to find the foreign object were finally successful. The tubesheet was more completely drained than in prior outages, which improved the effectiveness of FOSAR detection of the object, located about 3 inches above the top of tubesheet. Water surface reflections from the video probe light source likely prevented the observation of the object during previous FOSAR attempts. Based on FOSAR videos, the metallic object was cylindrical, about 0.4 inch in diameter and 0.75 inch long, with a 0.1 to 0.2 inch diameter hole through its center. The object was lodged tightly between two tubes, about 3 inches above the cold leg top of tubesheet. Westinghouse performed a very conservative engineering assessment of the foreign object and concluded that continued SG operation with the object present in the secondary side will not affect SG tube integrity for at least one fuel cycle. Therefore, attempts to dislodge the object and cause a potential loose part were discontinued, and the lodged object was left in place for Cycle 13. In 1R13, bobbin and Plus Point inspections of this location did not detect any PLP indications. No foreign objects were detected during FOSAR of SG 1-3, and no objects were found in sludge lance strainers. Therefore, it is likely that the foreign object was dislodged during cycle 13 operation and removed from the SGs via blowdown.

In conclusion, no tube wear from foreign objects were detected in 1R13, such that there were no challenges to structural integrity and leakage integrity performance criteria through EOC 13. No leakage should be postulated in a faulted SG following a SLB at EOC 13.

Operational Assessment

If it is conservatively assumed that the SG 1-3 foreign object that had been lodged between R30C78 and R31C78 remains in the SG during Cycle 14, the assumed condition is bounded by the prior Westinghouse analysis. The analysis assumed that if the object migrates to a worst case location, tube integrity is maintained for an additional cycle as long as no tube wear is detected by eddy current. Since no tube wear was detected by eddy current, the Westinghouse analysis remains applicable.

Further review of historical foreign objects removed from the DCPP Units 1 and 2 SGs identified two small machine curls that had been removed from SG 1-2 in 1R8. This machine curl matched the FOSAR pictures of the unretrieved object that had been lodged in SG 1-3 since 1R7. Therefore, the unretrieved object is likely another machine curl that entered the SG, possibly during 1R6 modifications to the feedwater nozzle thermal sleeve. The mass of the machine curls are very small, thus validating the assumptions that no tube damage would occur from an un-retrieved machine curl.

In conclusion, no foreign objects are expected that would challenge structural integrity performance criteria through EOC 14. In addition, no leakage should be postulated in a faulted SG following a SLB at EOC 14.

6.0 Inspection Results for Non-Active Potential Damage Mechanisms Never Previously Detected

6.1 Potential Axial PWSCC in High Row U-Bends

Westinghouse WOG evaluation SG-SGDA-03-33 ("Generic Evaluation of U-Bend PWSCC Susceptibility for Model 51 SGs with Mill Annealed Alloy 600 Tubing") states that significant ovality could be experienced in large radius bends (Rows 10 and higher) that could have resulted in significant residual stresses in the tubes. These residual stresses could lead to axial PWSCC in large radius U-bends. Figure 5 of the WOG report graphs tube ovality by row, which are from DCPP Unit 2 SG tubing manufactured in Blairsville. This data suggests that Rows 13 to 15 ovality could exceed Rows 3 to 9 ovality. This is mostly likely due to changes in the Blairsville bending process starting in Row 13, where the bending die most likely changed from being radiused to being flat, as discussed in section 7.4.1 of the WOG report. The WOG reports indicates that this change of bending technique could also have occurred starting in Row 10; however, for the DCPP Unit 2 data set plotted in Figure 5 of the WOG report, it appears that the process changed at Row 13.

Figure 7 of the WOG report provides a plot of total strain percentage by row, combining the effect of longitudinal strain (from WOG report Figure 10 residual bending stresses) and hoop strain (from WOG report Figure 5 ovality data). This figure shows that the average strain in Rows 3 to 7 exceeds the average strain in any higher row, including Rows 13 to 15.

In 2R11, PG&E performed a first time Unit 2 Plus Point inspection of large radius (Rows 10 and higher) U-bends, consisting of 100 percent of U-bends to Row 46. In 1R12, PG&E performed a first time Unit 1 Plus Point inspection of large radius U-bends, consisting of 20 percent of U-bends in Rows 13 to 17. No axial PWSCC degradation was detected in these exams, or in the 100 percent Plus Point inspection of Rows 3 to 10 U-bends. This confirmed that axial PWSCC in high row U-bends is not an active damage mechanism at DCPP Units 1 and 2.

In 1R13, the following inspection plan was implemented to detect potential axial PWSCC in high row U-bends:

- In each SG, Plus Point inspection was conducted on 100 percent of U-bends in Rows 3 to 8. The CA for axial PWSCC is defined as Rows 3 to 7, with a buffer zone defined as Row 8. Thus, 100 percent of the CA and buffer were inspected in each SG. Axial PWSCC indications in U-bends are capable of being detected by Plus Point using EPRI ETSS 96511.2.

- For greater than Row 10 U-bends, as a defense in depth approach (non-EPRI Appendix H), the bobbin coil was credited for detection of axial PWSCC in U-bends.

The following expansion plan was developed, but was not required to be implemented:

- If axial PWSCC is detected in Rows 3 to 8 with NDD in Rows 9 and 10, then in the affected SGs, inspect (Plus Point or equivalent) 100 percent of Rows 11 to 16, 50 percent of Row 17, and 20 percent of Row 18.
- If axial PWSCC is detected in Rows 9 to 10, then inspect (Plus Point or equivalent) 100 percent of Rows 11 to 25 in the affected SGs.
- If axial PWSCC is detected in Rows 11 to 25, then review Figure 5 of the WOG U-Bend report to define a critical area and buffer zone based on tube ovality data, and inspect (Plus Point or equivalent) 100 percent of the CA and buffer zone in the affected SGs.
- If axial PWSCC is detected in greater than Row 25, then inspect (Plus Point or equivalent) 100 percent of all rows in the affected SGs.

The basis for the inspection plan and expansion plan was documented in the degradation assessment.

In 1R13, axial PWSCC was not detected in the Plus Point inspection of 100 percent of Rows 3 to 10. Also, bobbin did not detect any U-bend signals that are indicative of potential axial cracking and that would require Plus Point inspection. These inspection results once again confirmed that axial PWSCC in high row U-bends in not active, and OA is not required.

6.2 <u>Potential Stress Corrosion Cracking at Free Span Dings</u>

No occurrences of stress corrosion cracking at free span dings has been observed at DCPP Units 1 and 2, based on Plus Point sampling of free span dings every outage starting in 2R7 and 1R8. The Plus Point detection technique is in accordance with EPRI ETSS 21409.1.

In 1R13, Plus Point inspection was performed on 20 percent of greater than 5 volt free span dings in the straight legs and U-bends to verify that no PWSCC or ODSCC is occurring in free span dings. In addition, 20 percent of greater than or equal to 2 volt dings that are coincident with AVB structures in the U-bend region were Plus Point inspected, to address the potential masking effects of AVBs on bobbin coil flaw detection. In these exams, the Plus Point extent consisted of the entire length of free span between the support structures.

Bobbin coil was credited for detection of potential stress corrosion cracking in less than 5 volt free span dings per EPRI ETSS 24013.1.

No Plus Point indications were detected in free span dings, and one bobbin indication ding with possible indication (DNI) was called. The DNI was in the U-bend region of SG 1-3 R29C84, at a 0.88 volt ding. Subsequent Plus Point inspection of this location

did not identify any degradation. Nonetheless, this tube was preventively plugged as a precautionary measure.

Due to no Plus Point confirmed degradation in free span tubing in Unit 1 for all prior cycles of operation based on Plus Point inspection of free span dings, stress corrosion cracking in free span dings is not an active damage mechanism, and OA is not required for this damage mechanism.

Table 1 – 1R13 Eddy Current Inspection and Expansion Plan

Item	Area	Probe	Inspection Criteria	Expansion Criteria
1	Full Length	Bobbin	100% (Except Rows 1 and 2 U-bend)	N/A
2	WEXTEX TTS Region	+Point	100% of hot leg TTS	If a C-3 condition is identified in the hot leg TTS inspection, inspect 20% of the cold leg TTS region in the affected SG in the current or subsequent outage. The 20% inspection should be biased to an area where degradation has the greatest potential to occur.
				If cold leg TTS cracking is detected, then either: Inspect 100% of the cold leg TTS region in the affected SG, plus 20% cold leg sample in the other SGs. If cracking is detected in the 20% sample, then inspect 100% of the cold leg TTS in the affected SGs. OR Define a critical area (CA) and buffer zone and inspect 100% of the tubes in the CA and buffer zone in the affected SG, plus 20% of the cold leg CA sample in the other SGs.
				If cold leg TTS non-crack-line indications are detected, then either: Define a critical area (CA) and buffer zone and inspect 100% of the tubes in the CA and buffer zone in the affected SG, plus 20% cold leg CA sample in the other SGs. OR For Category C-2 cold leg results, inspect an additional 20% cold leg sample in the affected SG. For Category C-3 cold leg results, inspect 100% of the cold leg TTS region in the affected SG, plus 20% cold leg sample in the other SGs.
3	WEXTEX TTS Region	+Point	Hot leg WEXTEX inspection extent is from +2" to -8". Cold leg WEXTEX region extent is +2" to -8.5'.	If initial inspection extent is less than flexible W* length, increase inspection extent.
4		+Point	100% of hot leg WEXTEX anomalies (NTE anomaly extent is +2" to tube end)	N/A
5		+Point	100% of previous W* indications within the W* length	N/A
6		+Point	100% of bobbin distorted tubesheet signals (DTS) in the W* length	N/A
7	Low Row U-bends	+Point	100% of Rows 1 and 2	N/A
8	High Row U-bends for Circumferential PWSCC	+Point	100% of Rows 3 to 10	If circumferential PWSCC detected in Rows 9 or 10, expand to Row 20 at 100%.
				If circumferential PWSCC detected in Rows 11 through 14, redefine critical area (CA) and buffer zone based on review of Figure 10 of WOG U-Bend report and application of a factor of two reduction in longitudinal strain, and inspect 100% of the new CA and buffer zone in the affected SGs.
				If circumferential PWSCC detected in Rows 15 through 20, expand to 100% of all remaining rows in the affected SGs.
9	High Row U-bends for Axial PWSCC	+Point	100% of Rows 3 to 10	If axial PWSCC is detected in Rows 3 to 8 with NDD in Rows 9 and 10, then in the affected SG inspect 100% of Rows 11 to 16, 50% of Row 17, and 20% of Row 18.
				If axial PWSCC is detected in Rows 9 to 10, then inspect 100% of Rows 11 to 25 in the affected SGs.
				If axial PWSCC is detected in Rows 11 to 25, then review Figure 5 of the WOG U-Bend report to define a critical area and buffer zone based on tube ovality data, and inspect 100% of the CA and buffer zone in the affected SGs.
				If axial PWSCC is detected in greater than Row 25, then inspect 100% of all rows in the affected SGs.

Table 1 – 1R13 Eddy Current Inspection and Expansion Plan

Item	Area	Probe	Inspection Criteria	Expansion Criteria
10	≥ 5 Volt Dented TSP	+Point	• SG 1-1: 100% 1H to 4H; 20% 5H to 7H • SG 1-2: 100% 1H to 7C; 20% 6C • SG 1-3: 20% 1H to 7H • SG 1-4: 100% 1H to 6H; 20% 7H For any 20% 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% of the ≥ 5 volt cents at that TSP shall be inspected.	If PWSCC (at any size dent), circumferential indications (at any size dent), or AONDB (at ≥5 volt dent) are detected at a TSP elevation where 100% inspections were not required, expand the Plus Point inspections (in a step-wise manner, 100% to affected TSP and 20% at next TSP) up through the hot leg side of the SG and down the cold leg side until a 20% sample is obtained that is free from PWSCC, circumferential cracking, or AONDB at ≥5 volt dent.
11	> 2 Volt and <5 Volt Dented TSP	+Point	• SG 1-1: 100% 1H to 4H; 20% 5H • SG 1-2: 100% 1H to 7C; 20% 6C • SG 1-3: 20% 1H • SG 1-4: 100% 1H to 6H; 20% 7H For any 20% sample, a minimum of 50 > 2 volt and < 5 volt dents shall be inspected. If the population of > 2 volt and < 5 volt dents at that TSP elevation is less than 50, then 100% of the > 2 volt and < 5 volt dents at that TSP shall be inspected.	If PWSCC (at any size dent), circumferential indications (at any size dent), or ≥ 2 inferred volt AONDB (at >2 and <5 volt dent) are detected at a TSP elevation where 100% inspections were not required, expand the Plus Point inspections (in a step-wise manner, 100% to affected TSP and 20% at next TSP) up through the hot leg side of the SG and down the cold leg side until a 20% sample is obtained that is free from PWSCC, circumferential cracking, or ≥ 2 inferred volt AONDB.
12	≤ 2 Volt Dented TSP	+Point	SG 1-1: 100% at 1H, 20% at 2H. Note: Bobbin is used for detection of axial PWSCC in ≤2 volt dents. +Point inspection of ≤ 2 volt dents is not required in SGs 1-2, 1-3, and 1-4, unless dictated by expansion requirements.	Generic criteria: On a SG-specific basis, if a circumferential indication or ≥2 inferred volt AONDB is detected in a dent less than or equal to "x" volts, then expand Plus Point inspections to include 100% of dents greater than "x - 0.3" volts up to the affected TSP, plus 20% of dents greater than "x – 0.3" volts at the next higher TSP. For 1R13, "x" equals 2.3 volts. Note: For any 20% 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% of the "x – 0.3" volt dents at that TSP shall be inspected. Specific criteria for 1R13: If a circumferential indication or >2 inferred volt AONDB is detected in a dent less than 2.3 volts in SG 1-1 (at 2H or higher), or any TSP elevation in SGs 1-2, 1-3, or 1-4, then expansion to less than 2 volt dents would be required.
13	>2 volt dents never inspected by Plus Point	+Point	100%	N/A
14	Repeat PWSCC ARC Indications at Dents	+Point	100%	N/A
15	DIS	+Point	100% of distorted ID support plate bobbin signals (DIS) at dented TSP	N/A

Table 1 – 1R13 Eddy Current Inspection and Expansion Plan				
Item	Area	Probe	Inspection Criteria	Expansion Criteria
16	TSP Inspection for ODSCC ARC	+Point	100% of bobbin distorted OD support signals (DOS) at dented intersections (no lower voltage cutoff)	N/A
17		+Point	100% of DOS ≥ 1.7 volt	N/A
18		+Point	100% of cold leg DOS	N/A
19		+Point	DOS with suspected TSP ligament cracking (SLC)	N/A
20		+Point	Any bobbin indication in the wedge region exclusion zone	N/A
21		+Point	DOS at 7th TSP exclusion zone	N/A
22		+Point	DOS that extend outside the TSP crevice	N/A
23		+Point	100% of hot leg intersections with >2.3 volt SPR (mixed residual signal), and minimum of 5 largest hot leg SPR per SG.	N/A
24		+Point	TSP with copper signals	N/A
25		+Point	100% of prior cycle AONDB (bounds commitment to inspect 100% of AONDB that continue to be NDD by bobbin in current inspection)	N/A
26		+Point	100% of prior cycle TSP SAI-OD that are NDD by bobbin in current inspection	N/A
27	TSP Ligament Cracking	+Point	100% of existing baseline Plus Point confirmed TSP ligament cracking (LIC or LIG) indications.	N/A
28		+Point	100% of new bobbin SLC indications.	N/A
29	Free Span Dings	+Point	20% of >5 volt dings in U-bend 20% of >5 volt dings in straight legs, biased to lower hot leg elevations. Note: Bobbin is credited for detection of SCC in ≤5 volt dings	If ODSCC is detected at > 5 volt dings, inspect 100% of > 5 volt dings up/down to the coldest elevation at which degradation has been reported, plus 20% at next elevation.
30		+Point	20% of ≥ 2 volt dings in the U-bend that are coincident with AVB location	If ODSCC is detected at dings in the U-bend coincident with AVB locations, then inspect 100% of ≥ 2 volt ding indications coincident with AVB structures.
31	Free span bobbin indications (MBI, FSI, DNI)	+Point	100% of free span bobbin indications that are new or exhibit growth or change.	N/A
32	Cold leg thinning at TSP	+Point	New CLT indications (performed as part of 100% Plus Point inspection of cold leg DOS)	N/A
33	Loose parts	Bobbin or +Point	If possible loose part (PLP) indication is detected by eddy current, or if a loose part is detected by FOSAR, perform eddy current inspection to bound the loose part.	N/A

Table 2
Tubes Plugged in 1R13

LOCATION	MECHANISM	ORIENT	11	12	13	14	Total
WEXTEX Region	PWSCC ARC	Axial					
	PWSCC	Circ					
	ODSCC	Circ	13	2	6	1	22
	ODSCC	Axial	2	3	4	2	11
Hot Leg TSP	PWSCC ARC	Axial	1	4		1	6
	PWSCC	Circ					0
	ODSCC ARC	Axial	16	7	4	5	32
	ODSCC	Circ	2	20		9	31
	PWSCC Mix Mode	Ax/Circ					
	ODSCC Mix Mode	Ax/Circ					
	PWSCC/ODSCC	Axial	3	5			8
	PWSCC/ODSCC	Circ					
	Volumetric			1			1
Cold Leg TSP	Cold Leg Thinning		1	1			2
Rows 1 and 2 U-bend	PWSCC	Axial					
	PWSCC	Circ					
Row 3 to 8 U-bend	PWSCC	Circ					
U-bend	AVB Wear						
Preventive	Data Quality/Stall/Ding				2	1	3
Tubes Plugged			38	43	16	19	116
% Plugged 1R13			1.12%	1.27%	0.47%	0.56%	0.86%
% Plugged Cumulative			6.85%	9.30%	2.72%	5.49%	6.09%

Note: Some tubes may be plugged for multiple degradation mechanisms. In these cases, the tube is listed in only one degradation mechanism category.

Table 3
DCPP Unit 1 Historical Tube Plugged by Mechanism and SG

LOCATION	MECHANISM	ORIENT	11	12	13	14	Total
WEXTEX Region	PWSCC	Axial	2	3	0	2	7
	PWSCC	Circ	5	4	0	1	10
	ODSCC	Circ	22	2	15	2	41
	ODSCC	Axial	2	3	4	2	11
	Volumetric		3	0	5	4	12
Hot Leg TSP	PWSCC	Axial	39	41	0	16	96
	PWSCC	Circ	1	8	0	0	9
	ODSCC	Axial	71	52	25	30	178
	ODSCC	Circ	2	31	0	12	45
	PWSCC Mix Mode	Ax/Circ	0	5	0	0	5
	ODSCC Mix Mode	Ax/Circ	1	2	0	0	3
	PWSCC/ODSCC	Axial	15	74	0	0	89
	PWSCC/ODSCC	Circ	0	1	0	0	1
	Volumetric		1	3	1	3	8
Cold Leg TSP	Cold Leg Thinning		18	28	1	8	55
	Volumetric		2	1	1	1	5
Rows 1 and 2 U-bend	PWSCC	Axial	6	17	2	1	26
	PWSCC	Circ	7	5	0	1	13
	Preventive Data Quality		8	10	4	9	31
Row 3 to 8 U-bend	PWSCC	Circ	0	0	11	74	85
U-bend	AVB Wear		5	14	18	17	54
Preventive			0	7	2	1	10
Factory Plug			0	1	0	0	1
Restriction			0	3	0	0	3
Free span	SVI or SAI scratch		1	0	2	2	5
Fatigue (88-02)	Preventive		5	0	1	0	6
Implant Tubes			16	0	0	0	16
Tubes Plugged			232	315	92	186	825
% Plugged cumulative			6.85%	9.30%	2.72%	5.49%	6.09%

Note: Some tubes may be plugged for multiple degradation mechanisms. In these cases, the tube is listed in only one degradation mechanism category.

Table 4 - DCPP Unit 1 Tubes Plugged by Mechanism and Outage

LOCATION	MECHANISM	ORIENT	Pre	1R1	1R2	1R3	1R4	1R5	1R6	1R7	1R8	1R9	1R10	1R11	1R12	1R13	UnPlug	Total
				1.25	2.27	3.45	4.49	5.86	7.14	8.46	9.75	11.37	12.86	14.27	15.88	17.22		
Cycle EFPY				1.25	1.02	1.18	1.04	1.37	1.28	1.32	1.29	1.62	1.49	1.41	1.61	1.34		
WEXTEX Tubesheet	PWSCC	Axial							2	2	1	1	2	1	0	0	-2	7
	PWSCC	Circ								1	4		2	2	1	0		10
	ODSCC	Circ										2	9	5	3	22		41
	ODSCC	Axial														11		11
	Volumetric	SVI								1	5	5	1	0	0	0		12
Hot Leg TSP	PWSCC	Axial							31	72	124	20	13	5	3	6	-178	96
	PWSCC	Circ								4	1	2	1	1	0	0		9
	ODSCC	Axial							7	8	44	10	18	37	74	32	-52	178
	ODSCC	Circ											5	3	6	31		45
	PWSCC Mix Mode	Ax/Circ										1		3	1	0		5
	ODSCC Mix Mode	Ax/Circ												1	2	0		3
	PWSCC/ODSCC	Axial									1	3	13	58	6	8		89
	PWSCC/ODSCC	Circ											1	0	0	0		1
	Volumetric	SVI									2	1		4	0	1		8
Cold Leg TSP	Thinning								10	14	2	11	12	4	0	2		55
	Volumetric	SVI									1	4			0	0		5
Row 1-2 Ubend	PWSCC	Axial				4		13	4		5				0	0		26
	PWSCC	Circ						4		1	4		4		0	0		13
	UB Data Quality				1								23	9	0	0	-2	31
Row 3-8 Ubend	PWSCC	Circ													85	0		85
U-bend	AVB Wear					2	1	12	8	12	3	1	3	6	6	0		54
Preventive													1		6	3		10
Factory Plug			1												0	0		1
Probe restriction						1			1					1	0	0		3
Free Span	SVI or scratch								1			4			0	0		5
Fatigue (88-02)	Preventive					5					1				0	0		6
Implant Tubes									4	2	1	9			0	0		16
Tubes Plugged			1	0	1	12	1	29	68	117	199	74	108	140	193	116		1059
Tubes Unplugged						-1						-40	-43	-150			-234	-234
Cum Tubes Plugged			1	1	2	13	14	43	111	228	427	461	526	516	709	825		825
Cum Tubes Plugged (%)			0.01	0.01	0.01	0.10	0.10	0.32	0.82	1.68	3.15	3.40	3.88	3.81	5.23	6.09		6.09

Note: Some tubes may be plugged for multiple degradation mechanisms. In these cases, the tube is listed in only one degradation mechanism category.

Table 5 – 1R13 Tube Support Plate Circumferential ODSCC Indications

											Unadjusted NDE			Adjusted NDE			Adjusted for Upper 95% NDE Uncertainty			Growth Rate per EFPY			
SG	Row	Col	TSP	Crack	Axial Elevation (inch)	Flaw Volt	Dent Volt	ID or OD	Stabilize	Mixed Mode	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Volt
11	24	59	1H	1	-0.04	0.29	0.74	OD			23.5	56	40.1	23.5	54.5	38.6	170.2	74.9	55.5	-0.9	2.6	-0.1	0.08
11	29	68	2H	1	0.26	0.2	14.7	OD			53.1	28	14.4	53.1	40	31.6	182.4	64.3	51.2	2.5	0.0	-1.0	0.04
12	6	78	1H	1	0.29	0.17	8.96	OD			20.2	1	0.8	20.2	40	29.7	168.8	64.3	50.1	NDD	NDD	NDD	NDD
12	7	77	5H	1	0.31	0.25	18.45	OD			44.5	15	3.8	44.5	40	29.5	178.8	64.3	49.9	2.7	-17.2	-14.8	0.12
12	7	81	4H	1	0.29	0.16	10.41	OD			44.5	73	27.5	44.5	40	27.4	178.8	64.3	48.6	NDD	NDD	NDD	NDD
12	8	56	1H	1	0.29	0.28	25.5	OD			79.1	63	40.3	79.1	47	36.5	193.1	69.5	54.2	-2.5	-1.1	-0.4	0.07
12	8	88	2H	1	0.22	0.26	3.13	OD			24.2	39	23.1	24.2	40	26.4	170.5	64.3	48.0	1.6	-14.9	-13.5	0.13
12	10	80	5H	1	0.31	0.23	9.13	OD			64.7	49	25.9	64.7	40	25.4	187.2	64.3	47.3	31.6	-29.9	-25.3	0.08
12	12	79	1H	1	0.25	0.2	26.95	OD			36.5	19	4.6	36.5	40	28.7	175.5	64.3	49.4	2.3	0.0	-0.5	0.05
				2	0.32	0.21		OD			52.5	25	5.3	52.5	40	33.6	182.1	64.3	52.4	3.2	0.0	0.4	0.07
12	12	86	1H	1	-0.26	0.25	11.06	OD	Yes		32.4	55	25.8	32.4	40	28.9	173.9	64.3	49.5	7.9	-1.5	-1.7	0.06
				2	0.17	0.15		OD			20.2	74	46.3	20.2	61.5	45.3	168.8	80.1	59.8	1.5	-13.8	-11.7	0.04
				3	0.26	0.21		OD			40.5	30	13.6	40.5	40	29.7	177.2	64.3	50.0	3.1	0.0	0.1	0.04
12	12	92	1H	1	0.27	0.14	15.67	OD			44.5	99	63.0	44.5	79	68.5	178.8	92.9	74.1	3.1	4.9	5.8	0.00
12	13	70	1H	1	0.31	0.28	24.25	OD			56.7	44	13.5	56.7	40	28.6	183.9	64.3	49.4	-2.5	0.0	-3.3	0.10
12	13	79	1H	1	0.07	0.17	18.3	OD			48.6	27	4.2	48.6	40	29.3	180.5	64.3	49.8	5.5	0.0	-2.4	0.03
12	14	77	1H	1	0.29	0.13	9.69	OD	Yes		28.3	59	39.4	28.3	55	39.7	172.2	75.3	56.3	NDD	NDD	NDD	NDD
				2	0.29	0.15		OD			44.5	50	26.6	44.5	40	28.7	178.8	64.3	49.4	NDD	NDD	NDD	NDD
12	14	83	1H	1	0.29	0.28	17.88	OD			53.2	34	17.7	53.2	40	32.5	182.4	64.3	51.8	5.8	0.0	-1.0	0.11
12	15	79	1H	1	0.35	0.28	5.66	OD			32	84	61.2	32.0	70.5	56.3	173.7	86.6	66.6	-3.8	-4.9	-3.0	0.04
12	15	81	1H	1	0.28	0.1	3.86	OD			20	91	58.7	20.0	81.5	62.0	168.7	94.7	70.1	1.1	-9.3	-8.3	0.00
12	16	38	1H	1	0.29	0.2	19.57	OD			93.9	78	54.9	93.9	52.7	43.3	199.2	73.6	58.5	13.5	2.0	5.6	0.04
12	16	84	5H	1	0.31	0.17	22.31	OD			24.6	50	27.0	24.6	44	33.1	170.6	67.3	52.1	NDD	NDD	NDD	NDD
12	18	38	1H	1	0.28	0.36	16.51	OD			62.1	54	30.8	62.1	54	36.4	186.1	74.6	54.2	6.8	-6.0	-7.9	0.11
12	19	40	1H	1	0.02	0.2	5.91	OD			63.3	19	8.4	63.3	40	31.2	186.6	64.3	51.0	6.6	0.0	1.7	0.04
12	21	84	4H	1	-0.1	0.15	10.79	OD			24.2	34	19.3	24.2	40	28.9	170.5	64.3	49.6	-1.6	0.0	1.2	0.02
14	2	34	1H	1	0.26	0.13	14.89	OD			66.5	46	15.5	66.5	44	30.7	187.9	67.3	50.6	1.6	-18.7	-18.1	-0.01
14	2	70	1H	1	-0.23	0.66	17.26	OD	Yes		130.2	90	54.2	130.2	46	30.5	214.2	68.7	50.5	63.3	4.5	0.1	0.34

Table 5 – 1R13 Tube Support Plate Circumferential ODSCC Indications

											Unadjusted NDE			Adjusted NDE			Adjusted for Upper 95% NDE Uncertainty			Growth Rate per EFPY			
SG	Row	Col	TSP	Crack	Axial Elevation (inch)	Flaw Volt	Dent Volt	ID or OD	Stabilize	Mixed Mode	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Angle deg	MD %	AD %	Volt
14	5	17	1H	1	0.27	0.13	27.75	OD			54.2	97	71.8	54.2	68	55.8	182.8	84.8	66.2	2.9	-0.4	-2.3	0.01
14	5	90	2H	1	0.18	0.14	6.81	OD			47.5	79	33.7	47.5	40	27.0	180.1	64.3	48.3	1.2	-7.5	-7.0	0.02
14	25	49	1H	1	-0.22	0.1	9.99	OD			23	6	1.8	23.0	40	28.7	170.0	64.3	49.4	0.0	-2.2	-2.8	-0.03
14	34	65	1H	1	0.1	0.14	19.81	OD			19.3	1	0.8	19.3	40	26.2	168.5	64.3	47.8	NDD	NDD	NDD	NDD
14	39	64	1H	1	0.27	0.17	30.83	OD	Yes		36.8	76	64.8	36.8	73	55.2	175.7	88.5	65.9	NDD	NDD	NDD	NDD
				2	0.28	0.14		OD			45	45	27.8	45.0	40	30.0	179.1	64.3	50.2	NDD	NDD	NDD	NDD
				3	-0.08	0.16		OD			40.9	35	21.6	40.9	40	30.3	177.4	64.3	50.4	NDD	NDD	NDD	NDD
14	43	58	1H	1	0.29	0.16	12.15	OD	Yes		55.4	59	42.2	55.4	43	34.2	183.3	66.5	52.8	1.7	2.2	5.0	0.01
14	43	59	1H	1	-0.3	0.25	13.84	OD			42.5	51	16.0	42.5	40	27.9	178.0	64.3	48.9	9.1	-1.5	-3.9	0.01

Note 1: Growth rate based on adjusted NDE, not the uncertainty adjusted NDE.
Note 2: Location (inch) is relative to the centerline of the tube support plate.
Note 3: Tube stabilization determined per evaluation by Westinghouse.
Note 4: NDD means prior outage lookup did not detect any degradation, so no growth rate can be assigned for indication.
Note 5: There were no mixed mode indications (combined circumferential and axial indications at same TSP).

Table 6 – 1R13 Tubesheet Circumferential ODSCC Indications

SG	Row	Col	Support	Axial Elevation (inch)	Crack	Max Volt	Tubesheet Zone	Unadjusted NDE			Adjusted NDE			Adjusted for Upper 95% NDE Uncertainty			Growth Rate per EFPY			
								Angle deg	Max Depth %	Avg Depth %	Angle deg	Max Depth %	Avg Depth %	Angle deg	Max Depth %	Avg Depth %	Angle deg	Max Depth %	Avg Depth %	Volt
11	6	46	TSH	-0.03	1	0.18	4	34.5	29	8.7	34.5	40.0	32.6	174.7	64.3	51.9	NDD	NDD	NDD	NDD
11	6	47	TSH	-0.02	1	0.47	4	90	100	77.8	90.0	92.7	81.3	197.6	100.0	82.1	22.8	36.3	31.1	0.21
11	11	69	TSH	-0.04	1	0.18	4	50.3	95	51.5	50.3	72.0	58.6	181.2	87.7	68.0	27.5	5.6	2.8	0.07
11	13	47	TSH	0.06	1	0.17	4	18.9	1	0.8	18.9	40.0	31.3	168.3	64.3	51.0	4.6	-33.1	-25.3	0.08
11	14	63	TSH	0.02	1	0.27	4	23.2	71	48.9	23.2	58.8	48.7	170.1	78.1	61.8	5.7	17.8	15.4	0.09
11	16	65	TSH	-0.06	1	0.09	4	46.5	88	57.3	46.5	87.0	74.5	179.7	98.7	77.9	20.2	16.1	12.8	0.01
11	16	66	TSH	-0.01	1	0.18	4	50.3	95	64.2	50.3	85.0	73.3	181.2	97.2	77.1	NDD	NDD	NDD	NDD
11	17	55	TSH	-0.01	1	0.13	4	46.4	95	26.1	46.4	40.0	30.4	179.6	64.3	50.5	9.2	10.1	5.6	0.01
11	18	59	TSH	-0.01	1	0.26	4	38.8	41	16.5	38.8	40.0	33.2	176.5	64.3	52.2	15.4	-26.0	-20.6	0.14
11	19	56	TSH	-0.04	1	0.31	4	73.5	98	67.1	73.5	85.4	74.0	190.8	97.6	77.6	13.5	14.4	13.3	0.09
11	19	59	TSH	0	1	0.26	4	30.7	100	74.3	30.7	72.0	60.5	173.2	87.7	69.2	10.7	5.6	5.1	0.13
11	21	57	TSH	-0.02	1	0.21	4	23.7	5	2.0	23.7	40.0	32.1	170.3	64.3	51.5	NDD	NDD	NDD	NDD
11	27	59	TSH	-0.01	1	0.18	4	27.1	96	71.2	27.1	82.0	62.6	171.7	95.0	70.5	10.1	8.1	4.3	0.05
12	2	21	TSH	-0.01	1	0.18	4	31.7	76	52.9	31.7	65.3	54.7	173.6	82.9	65.6	NDD	NDD	NDD	NDD
12	30	42	TSH	-0.05	1	0.18	4	24	96	66.1	24.0	88.0	66.4	170.4	99.4	72.8	7.4	35.0	23.5	0.07
13	9	72	TSH	-0.05	1	0.13	4	29.4	87	69.2	29.4	78.5	62.9	172.6	92.5	70.7	NDD	NDD	NDD	NDD
13	10	78	TSH	-0.01	1	0.29	3	26	100	81.6	26.0	93.0	76.9	171.2	100.0	79.4	NDD	NDD	NDD	NDD
13	11	74	TSH	-0.04	1	0.29	4	22.2	100	82.3	22.2	99.0	79.6	169.6	100.0	81.1	NDD	NDD	NDD	NDD
13	22	33	TSH	-0.02	1	0.21	4	18.5	96	73.1	18.5	92.0	69.3	168.1	100.0	74.7	6.4	18.1	15.5	0.02
13	25	36	TSH	-0.03	1	0.42	4	98.2	98	85.4	98.2	87.7	73.9	201.0	99.2	77.5	22.8	21.8	14.5	0.23
13	27	45	TSH	-0.07	1	0.31	4	78.1	98	83.7	78.1	86.5	69.4	192.7	98.3	74.7	31.4	18.6	12.1	0.17
14	17	71	TSH	0.02	1	0.24	3	39.1	99	81.6	39.1	88.6	78.0	176.6	99.9	80.1	NDD	NDD	NDD	NDD

Note 1: Growth rate based on adjusted NDE, not the NDE uncertainty adjusted NDE.
Note 2: Location (inch) is relative to the top of tubesheet (TSH).
Note 3: No tubes required stabilization per evaluation by Westinghouse.
Note 4: NDD means prior outage lookup did not detect any degradation, so no growth rate can be assigned for indication.

Table 7 – 1R13 Tubesheet Axial ODSCC Indications

										Growth Rate per EFPY		
SG	Row	Col	Crack	Location	Axial Elevation (inch)	Tubesheet Zone	Max Volts	Max Depth %	Length Inch	Max Volts	Max Depth %	Length Inch
11	4	44	1	TSH	-0.04	4	0.18	57	0.20	NDD	NDD	NDD
11	19	48	1	TSH	1.79	4	0.18	30	0.37	0.04	0.0	0.11
12	5	27	1	TSH	-0.02	4	0.12	66	0.19	0.04	11.9	0.07
12	20	78	1	TSH	-0.04	3	0.23	53	0.20	NDD	NDD	NDD
12	25	65	1	TSH	-0.09	4	0.16	78	0.19	NDD	NDD	NDD
13	27	44	1	TSH	0.09	4	0.16	39	0.14	NDD	NDD	NDD
13	27	47	1	TSH	0.13	4	0.18	67	0.22	NDD	NDD	NDD
13	28	38	1	TSH	0.38	4	0.13	53	0.19	NDD	NDD	NDD
13	28	38	2	TSH	0.61	4	0.07	64	0.19	NDD	NDD	NDD
13	32	51	1	TSH	0.11	3	0.17	64	0.16	0.02	-11.9	0.01
14	7	54	1	TSH	-0.11	4	0.18	41	0.16	0.10	-6.0	0.00
14	30	56	1	TSH	-0.14	4	0.16	57	0.24	NDD	NDD	NDD

Note 1: NDD means prior outage lookup did not detect any degradation, so no growth rate can be assigned for indication.

Table 8 - DCPP Units 1 and 2 Axial ODSCC and Axial PWSCC at Same TSP Intersection (ID/OD Flaws)

									PWSCC NDE Data						ODSCC NDE Data				
Insp	SG	Row	Col	TSP	Dent Volt	Minimum ID/OD Separation Angle (Deg.)	Deplug	Active tube when ID/OD detected?	Crack No.	PWSCC New?	Length (in.)	MD (%)	AD (%)	Max. Volt	No. OD Cracks	ODSCC New?	DOS Bobbin Voltage	Inferred Bobbin Voltage	Largest +Point Volts
1R13	11	14	6	2H	0.61	55			1	New	0.17	51	31.9	1.01	1	New	NA	0.53	0.23
1R13	11	15	24	2H	0.59	36			1	New	0.25	37	29.6	0.98	1		0.65	NA	0.26
1R13	11	38	54	2H	2.99	56			1	New	0.11	20	12.4	0.59	1		NA	0.55	0.25
1R13	12	34	26	2H	0.75	83			1	New	0.1	31	22.1	0.79	1	New	NA	0.47	0.17
1R13	12	5	65	1H	0.72	77	1R10		1		0.35	31	25.3	0.65	1	New	NA	0.44	0.14
1R13	12	31	66	1H	0.33	63	1R11		1	New	0.16	22	14.4	0.34	1	New	NA	0.44	0.14
1R13	12	33	68	2H	0.85	44			1		0.07	40.5	26	0.59	2	New	NA	0.62	0.17
1R13	12	13	84	1H	0.93	64			1		0.09	20	11.1	0.57	1	New	NA	0.57	0.27
									2		0.09	25	14.4	0.36					
2R12	22	16	30	2H	1.61	78			1	New	0.1	30	19.8	0.47	1		0.59	NA	0.19
1R12	11	26	25	1H	1.95	55			1		0.28	49	33.2	1.31	1	New	NA	0.52	0.22
1R12	11	28	27	1H	2.29	67			1		0.34	52	33.1	1.22	2	New	NA	0.78	0.3
1R12	12	5	39	2H	0.69	86	1R11		1		0.19	36	28.5	1	1	New	0.36	NA	0.24
1R12	12	12	77	1H	1.5	55	1R11		1		0.4	54	36.4	1.4	2	New	NA	0.68	0.2
1R12	12	22	54	2H	2.14	60	1R11		1		0.33	60	48.1	2.43	1	New	NA	0.54	0.24
1R12	12	23	82	1H	1.47	66			1		0.08	27	17.7	0.49	2	New	0.26	NA	0.26
2R11	22	12	71	1H	4.63	61			1	New	0.11	37	24.6	0.39	1		NA	0.46	0.16
2R11	22	22	67	2H	0.63	53			1	New	0.23	38	24.8	0.91	2		4.58	NA	2.66
2R11	22	24	58	2H	2.02	147			1	New	0.07	20	12.8	0.29	1	New	NA	0.52	0.22
2R11	22	28	38	1H	1.56	55			1		0.16	33	17.6	0.44	2	New	0.86	NA	0.15
2R11	23	8	66	1H	1.42	78			1	New	0.11	20	14.5	0.43	1		0.62	NA	0.24
2R11	24	16	11	3H	1.27	83	2R9		1		0.26	30	17.2	0.72	1	New	0.63	NA	0.18
2R11	24	34	43	3H	4.63	63			1	New	0.39	36	22.8	0.65	3		1.73	NA	0.72
1R11	11	14	87	2H	0.51	71			1	New	0.09	30	20.8	0.29	1		0.62	NA	0.63
1R11	11	15	81	2H	1.2	82			1	New	0.19	21.5	12.4	0.5	1		0.75	NA	0.36
1R11	11	16	45	2H	1.32	71			1	New	0.14	34	22.1	0.84	2	New	1.29	NA	0.16
1R11	11	22	71	2H	0.83	81			1		0.11	40	28.6	0.67	1	New	NA	0.46	0.16

Table 8 - DCPP Units 1 and 2 Axial ODSCC and Axial PWSCC at Same TSP Intersection (ID/OD Flaws)

Insp	SG	Row	Col	TSP	Dent Volt	Minimum ID/OD Separation Angle (Deg.)	Deplug	Active tube when ID/OD detected?	PWSCC NDE Data						ODSCC NDE Data				
									Crack No.	PWSCC New?	Length (in.)	MD (%)	AD (%)	Max. Volt	No. OD Cracks	ODSCC New?	DOS Bobbin Voltage	Inferred Bobbin Voltage	Largest +Point Volts
1R11	11	24	20	2H	1.43	49			1		0.07	43	22.7	0.71	1	New	0.81	NA	0.22
1R11	11	33	40	2H	0.86	59			1	New	0.26	45	28.7	1.13	2	New	1.26	NA	0.25
1R11	11	36	30	2H	0.56	46			1		0.17	43	30.5	1.34	2	New	NA	0.71	0.22
1R11	12	5	59	1H	1.02	49	1R11	No	1		0.34	43	32.4	1.3	2		NA	0.71	0.22
1R11	12	6	70	2H	1.54	71	1R11	No	1		0.11	36	25.8	0.79	2		NA	0.75	0.25
1R11	12	7	28	2H	2.33	64	1R11	No	1		0.07	20	12.4	0.31	1		NA	0.47	0.17
									2		0.1	24	14.9	0.55					
1R11	12	7	56	1H	1.13	90	1R11	No	1		0.26	43	34.3	2.2	1		NA	0.50	0.2
1R11	12	7	84	1H	2.19	53	1R11	No	1		0.34	45	35.6	3.06	1		NA	0.58	0.28
1R11	12	8	67	1H	1.2	64			1		0.2	29	16.9	0.88	1	New	NA	0.44	0.14
1R11	12	8	51	1H	1.48	76	1R11	No	1		0.18	32	19.2	0.69	1		0.51	NA	0.19
1R11	12	9	28	1H	2.53	71	1R11	No	1		0.16	47	30.3	1.47	2		NA	0.72	0.27
1R11	12	9	77	1H	2.45	95	1R11	No	1		0.23	39	23.4	1.34	1		0.62	NA	0.29
1R11	12	10	35	1H	1.34	80	1R11	No	1		0.11	51	33.4	1.65	1		NA	0.49	0.19
1R11	12	10	83	1H	6.72	60	1R11	No	1		0.27	64	37.5	1.15	2		NA	0.72	0.25
1R11	12	11	27	1H	2.13	49	1R11	No	1		0.5	29	18.7	0.86	1		NA	0.51	0.21
1R11	12	11	47	2H	2.32	73	1R11	No	1		0.21	36	26.7	1.06	1		NA	0.50	0.2
1R11	12	12	66	2H	2.21	80	1R11	No	1		0.13	45	30.9	1.51	1		NA	0.57	0.27
1R11	12	12	80	1H	1.04	49	1R11	No	1		0.07	20	12.9	0.6	1		0.45	NA	0.24
1R11	12	12	84	2H	0.73	64	1R11	No	1		0.29	42	31.1	1.5	1		0.55	NA	0.35
1R11	12	13	81	1H	3.18	49	1R11	No	1		0.13	23	16.5	0.88	1		0.43	NA	0.33
1R11	12	13	89	1H	2.33	57	1R11	No	1		0.4	53	41.3	2.97	1		0.56	NA	0.44
1R11	12	16	73	1H	18.03	47	1R10		1		0.12	21	15.2	0.64	1	New	NA	0.49	0.19
									2		0.15	20	12.3	0.5					
1R11	12	16	76	2H	0.52	64	1R10		1		0.18	20	9.7	0.39	1	New	0.05	NA	0.2
1R11	12	17	8	6H	2.95	75	1R11	No	1		0.23	24	15.6	0.81	1		NA	0.55	0.25
1R11	12	19	14	2H	1.34	84	1R11	No	1		0.18	44	35	1.73	1		NA	0.52	0.22
1R11	12	19	51	1H	1.21	76	1R11	No	1		0.57	54	44	3.24	1		NA	0.62	0.32
1R11	12	20	52	2H	2.55	83	1R11	No	1		0.23	43	28.3	0.91	1		NA	0.50	0.2

Table 8 - DCPP Units 1 and 2 Axial ODSCC and Axial PWSCC at Same TSP Intersection (ID/OD Flaws)

Insp	SG	Row	Col	TSP	Dent Volt	Minimum ID/OD Separation Angle (Deg.)	Deplug	Active tube when ID/OD detected?	PWSCC NDE Data: Crack No.	PWSCC NDE Data: PWSCC New?	PWSCC NDE Data: Length (in.)	PWSCC NDE Data: MD (%)	PWSCC NDE Data: AD (%)	PWSCC NDE Data: Max. Volt	ODSCC NDE Data: No. OD Cracks	ODSCC NDE Data: ODSCC New?	ODSCC NDE Data: DOS Bobbin Voltage	ODSCC NDE Data: Inferred Bobbin Voltage	ODSCC NDE Data: Largest +Point Volts
1R11	12	20	58	1H	0.65	55	1R11	No	1		0.54	57	40.3	2.09	1		NA	0.49	0.19
									2		0.19	54	44.4	2.23					
1R11	12	21	37	4H	2.25	80	1R11	No	1		0.25	34.5	24.2	0.88	1		NA	0.46	0.16
1R11	12	21	50	1H	2.38	56	1R11	No	1		0.76	57	47.1	2.04	1		NA	0.95	0.64
									2		0.56	64	39	1.65					
1R11	12	21	53	6H	2.52	56	1R11	No	1		0.62	64	50.7	1.97	1		NA	0.51	0.21
1R11	12	22	32	2H	1.44	51	1R11	No	1		0.27	54	42.1	2.28	2		NA	0.71	0.23
1R11	12	22	34	2H	0.69	51	1R11	No	1		0.18	42	31.3	1.03	3		NA	0.84	0.23
1R11	12	22	38	1H	4.7	65	1R11	No	1		0.08	30	22	0.58	2		NA	0.74	0.22
									2		0.61	48	38.7	2.19					
1R11	12	25	72	1H	2.06	77			1	New	0.09	24	17.3	0.48	1	New	NA	0.45	0.15
1R11	12	26	71	2H	1.4	75	1R11	No	1		0.42	42	30.5	1.68	1		NA	0.48	0.18
1R11	12	26	77	2H	0.71	68	1R11	No	1		0.44	50	38.9	1.87	1		0.81	NA	0.36
1R11	12	26	78	1H	1.29	68	1R11	No	1		0.32	50	38.6	2.43	1		NA	0.63	0.33
1R11	12	27	50	1H	1.95	34			1		0.11	27	17.4	0.88	1	New	NA	0.49	0.19
1R11	12	27	36	2H	0.54	58	1R11	No	1		0.09	20	12.5	0.77	1		NA	0.42	0.12
1R11	12	28	56	2H	0.75	79	1R11	No	1		0.25	40	29.2	1.12	1		NA	0.41	0.11
1R11	12	28	58	1H	1.67	72	1R11	No	1		0.6	60	44.9	3.05	1		NA	0.52	0.22
1R11	12	28	68	6H	1.26	57	1R11	No	1		0.08	21	10.9	0.56	1		0.32	NA	0.11
1R11	12	29	43	2H	1.34	69	1R11	No	1		0.24	39	31.1	1.86	2		0.62	NA	0.42
1R11	12	29	56	2H	1.34	106	1R11	No	1		0.25	34	24.6	1.82	1		NA	0.52	0.22
1R11	12	29	67	2H	3.02	83	1R11	No	1		0.36	48	36.9	2.11	1		NA	0.55	0.25
1R11	12	30	16	1H	0.9	48			1		0.15	41	28	0.7	1	New	NA	0.62	0.32
1R11	12	31	32	3H	1.67	69	1R11	No	1		0.11	20	9.7	0.32	1		NA	0.39	0.09
									2		0.34	48	40.6	1.67					
1R11	12	35	45	2H	1.82	95	1R11	No	1		0.29	48	35.7	1.41	1		0.43	NA	0.27
1R11	12	35	65	2H	2.36	46	1R11	No	1		0.31	48	37.4	1.88	3		NA	0.90	0.23
1R11	12	37	72	1H	1.65	76	1R11	No	1		0.17	34	24.5	0.93	1		NA	0.55	0.25
1R11	12	38	70	1H	2.42	61	1R11	No	1		0.09	20	15.6	0.52	1		NA	0.61	0.31

Table 8 - DCPP Units 1 and 2 Axial ODSCC and Axial PWSCC at Same TSP Intersection (ID/OD Flaws)

Insp	SG	Row	Col	TSP	Dent Volt	Minimum ID/OD Separation Angle (Deg.)	Deplug	Active tube when ID/OD detected?	PWSCC NDE Data						ODSCC NDE Data				
									Crack No.	PWSCC New?	Length (in.)	MD (%)	AD (%)	Max. Volt	No. OD Cracks	ODSCC New?	DOS Bobbin Voltage	Inferred Bobbin Voltage	Largest +Point Volts
1R11	12	40	63	1H	0.87	83	1R11	No	1		0.11	21	9.9	0.46	1		NA	0.67	0.36
1R11	12	42	28	2H	1.41	69			1		0.11	32	20.1	0.88	1	New	NA	0.58	0.28
1R10	11	28	50	1H	0.35	47	1R10	No	1		0.09	29	19.1	0.64	2		0.96	NA	0.81
1R10	12	9	34	2H	2.02	44			1	New	0.09	21	13.3	0.41	2		0.76	NA	0.26
1R10	12	14	72	2H	2.92	58	1R10	No	1		0.42	38	16.3	1.04	1		NA	0.51	0.21
									2		0.07	20	12	0.58					
1R10	12	14	82	1H	1.55	61	1R10	No	1		0.05	20	10	0.39	1		NA	0.53	0.23
1R10	12	15	10	1H	1.76	90			1		0.21	24	14	0.48	1	New	0.44	NA	0.27
1R10	12	17	60	2H	2.92	51	1R10	No	1		0.17	22	7.2	0.56	1		NA	0.54	0.24
1R10	12	24	72	1H	1.24	82	1R10	No	1		0.26	22	15.5	0.4	1		0.27	NA	0.14
1R10	12	26	43	2H	2.12	70	1R10	No	1		0.26	30	15.4	0.81	1		NA	0.56	0.26
1R10	12	27	71	1H	1.86	74			1		0.23	39	25.4	1.12	2	New	NA	0.77	0.3
1R10	12	33	37	1H	2.01	79			1	New	0.11	20	12	0.38	1	New	NA	0.50	0.2
1R10	12	38	63	1H	2.35	79			1	New	0.14	22	13.9	0.78	1	New	NA	0.68	0.37
1R10	12	41	62	1H	0.82	109			1	New	0.21	27	17	0.54	1	New	NA	0.54	0.24
1R9	11	9	6	1H	0.95	79			1	New	0.13	37	27.2	0.38	1	New	0.35	NA	0.27
1R9	12	6	47	1H	0.77	44			1	New	0.12	26	16.7	0.35	1	New	0.34	NA	0.11
1R9	12	13	75	2H	2.23	53			1	New	0.11	20	11	0.42	1	New	0.37	NA	0.14
2R7	24	9	12	3H	1.84	89			1	New	0.32	23	17.8	1.64	1	New	1.25	NA	0.38
2R8	24	34	34	3H	2.96	57			1	New	0.16	35.5	26.4	0.38	1	New	NA	0.62	0.32

Table 9
1R13 LIC/LIG Indications in Tubes Support Plates

Indication Configuration	SG 1-1	SG 1-2	SG 1-3	SG 1-4
LIC	49	37	19	14
LIG	29	43	74	7
LIC/LIG	4	1	1	0
LIC/LIC	6	1	0	0
LIG/LIG	0	1	0	0
Total TSPs	88	83	94	21

ENCLOSURE 4
SPECIAL REPORT 06-01

FRAMATOME-ANP REPORT 86-9011354-000
"DCPP 1R13 BOBBIN VOLTAGE ARC 90-DAY SUMMARY REPORT"

AREVA

CALCULATION SUMMARY SHEET (CSS)

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PURPOSE AND SUMMARY OF RESULTS:

This report summarizes the Diablo Canyon Unit 1 – 1R13 inspection of the steam generator tubing with respect to the implementation of the voltage-based repair criteria as specified in NRC Generic Letter 95-05. This document provides the projected probability of burst and leak rate calculations needed for submittal to the NRC. This report provides a non-proprietary summary of the results. The supporting proprietary calculations and necessary code verifications required for safety-related calculations are contained in Reference 23.

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THE DOCUMENT CONTAINS ASSUMPTIONS THAT MUST BE VERIFIED PRIOR TO USE ON SAFETY-RELATED WORK

☐ YES

☒ NO

RECORD OF REVISIONS

Revision Number	Affected Page(s)	Description of Change(s)
0	All	Original Release

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LIST OF TABLES AND FIGURES

Glossary of Acronyms

Term	Definition
AONDB	Axial ODSCC Not Detected by Bobbin
ARC	Alternate Repair Criteria
BOC	Beginning of Cycle
CDS	Computer Data Screening
CPDF	Cumulative Probability Distribution Function
CFR	Code of Federal Regulations
CLT	Cold-Leg Thinning
DCPP	Diablo Canyon Power Plant
DIS	Distorted ID Support Signal with possible Indication
DOS	Distorted OD Support Signal with possible Indication
DNF	Degradation Not Found
EFPD	Effective Full Power Day
EFPY	Effective Full Power Year
ECT	Eddy Current Test
EOC	End of Cycle
FS	Free Span
FANP	Framatome Advanced Nuclear Power
GL	NRC Generic Letter 95-05
GPM	Gallons per Minute
INR	Indication Not Reportable
ISI	In-service Inspection
LRL	Lower Repair Limit
LU	Lookup
MSLB	Main Steam Line Break
NDE	Non Destructive Examination
NDD	No Degradation Detected
NRC	Nuclear Regulatory Commission
ODSCC	Outside Diameter Stress Corrosion Cracking
PG&E	Pacific Gas and Electric Company
POB	Probability of Burst
POD	Probability of Detection
POPCD	Probability of Prior Cycle Detection
POL	Probability of Leak
PWSCC	Primary Water Stress Corrosion Cracking
RPC	Rotating Pancake Coil
RSS	Retest Support Plate Signal
RTS	Return to Service
SG	Steam Generator
SER	Safety Evaluation Report
TS	Technical Specification
TSP	Tube Support Plate
VDG	Voltage Dependent Growth

1.0 Introduction

The Diablo Canyon Power Plant (DCPP) Unit 1 completed the thirteenth cycle of operation and subsequent steam generator ISI in November 2005. The unit employs four Westinghouse-designed Model 51 SGs with ⅞-inch OD mill annealed alloy 600 tubing and ¾-inch carbon steel drilled-hole tube support plates.

In accordance with the Generic Letter 95-05, ARC implementation requires a pre-startup assessment (Ref. 1) and a 90-day post-startup tube integrity assessment. The NRC Generic Letter 95-05, Reference 2, outlines an alternate repair criterion (ARC) for allowing tubes containing ODSCC indications to remain in service if the indications are contained within the TSP structure and the measured Bobbin voltage is ≤2.0 volts. A complete list of criteria for excluding TSP intersections from ARC application is provided in section 1.b of Reference 2 and in Reference 3. The NRC has approved implementation of the voltage-based repair criteria at both DCPP units per Reference 3. The steam generator TSP inspection results and the postulated MSLB leak rate and tube burst probabilities are summarized in this report. FANP uses Monte Carlo codes, as described in References 4 and 5, to provide the burst and leak rate analysis simulations. These evaluations are based on the methods in Reference 6 (for burst) and the slope sampling method for calculating the leak rate as defined in Section 9.5 of Reference 8. These evaluations also use the voltage-dependent POPCD (Probability of Prior Cycle Detection) and the new growth methods as defined in References 16, 25, and 28, and approved by the NRC in Reference 29.

2.0 Executive Summary

During the 1R13 inspection, a total of 1693 DOS indications were detected with the bobbin coil. There were an additional 157 support plate intersections that were identified as containing AONDB (axial ODSCC not detected by bobbin). Since there were no DOS indications at these intersections, a bobbin voltage was inferred from the +Point™ results per the methodology provided in Reference 8.

There were 23 DOS indications greater than the lower repair limit of 2.0 volts. All of these indications were confirmed as axial ODSCC with +Point™ and were subsequently plugged. An additional 47 DOS and AONDB indications less than or equal to 2 volts were also plugged for other reasons, such as preventive plugging, ODSCC in the wedge region, ID/OD at same TSP, AONDB at dent >5 volts, or pluggable indications at another location in the same tube.

A review of the growth rates over the previous cycle shows that axial ODSCC at support plates is most active in SG 1-4. SG 1-4 had the highest average growth rate and the highest percentage growth rate during Cycle 13. SG 1-1, however, had the highest individual growth points of the entire population. Voltage dependent growth was clearly evident in SGs 1-1 and 1-4. SGs 1-2 and 1-3 showed no effects of voltage dependent growth. Following the DCPP Unit 2 2R11 inspection in 2003, a significant amount of analysis and evaluation was performed on voltage growth for ODSCC at TSPs (Reference 14). The evaluations primarily involved statistical breakpoint analyses to determine where the data suggests a change in the slope of the regression curve that defines the growth data. These efforts led to the development of guidelines for determining the breakpoints and growth distributions. These guidelines were

provided to the NRC via Reference 24, and were used to determine the breakpoints and growth distributions for the current OA.

The POB and leak rate projections for EOC-14 provided in this report use the DCPP-specific POPCD. The use of the voltage-dependent POPCD was approved in Reference 29. The updated POPCD correlation is provided in Section 6. Using the DCPP-specific POPCD and the conservative growth rate analyses discussed in Section 3.2, the projected POB at EOC-14 for the limiting steam generator (SG 1-1) was determined to be 2.32×10^{-3}. The projected leak rate for the limiting generator (SG 1-1) was 1.83 gpm. Both of these results are below the acceptance criteria of 1×10^{-2} and 10.5 gpm, respectively.

Section 5 provides the as-found EOC-13 condition monitoring results and results of a benchmarking study that compares the projected EOC-13 conditions to the as-found conditions. The as-found leak rate and POB at EOC-13 for the limiting steam generator (SG 1-1) were determined to be 0.306 gpm and 1.64×10^{-4}, respectively, and are both below the acceptance criteria of 10.5 gpm and 1×10^{-2}. Additionally, the prior cycle operation assessment was recalculated using the actual cycle length and new Addendum 6 database values for proper comparison. As shown in Section 6, the recalculated EOC-13 POB, leak rate, and number of indications were conservative in all cases compared to EOC-13 actuals.

3.0 EOC-13 Inspection Results and Voltage Growth Rates

3.1 EOC-13 Inspection Results

The DCPP 1R13 bobbin coil inspection consisted of a 100% full-length bobbin coil examination of in-service tubes in all four steam generators except for Rows 1 and 2 U-bends which were inspected with +Point™. All in-service TSP intersections in the hot and cold legs were inspected with 0.720" replaceable feet bobbin probes, except for one tube in SG 1-4, R7C89 at 7H, which was inspected with a 700 probe at 7H due to a restriction (dent). +Point™ was also used in this TSP to confirm no degradation present. This restriction is not new and has been present for a number of inspections.

Special interest +Point™ examinations were conducted as follows in support of the voltage-based ARC, and in accordance with the Degradation Assessment (Ref. 9) and Surveillance Test Procedure STP M-SGTI (Ref. 12).

- 100% of DOS ≥ 1.7 volts
- 100% of DOS in dented intersections
- 100% of DIS (distorted ID support signal at dented intersection)
- 100% of hot leg SPR (Support Plate Residual) ≥ 2.3 volts; minimum of five largest hot leg SPRs in each steam generator
- 100% of prior cycle AONDB indications
- 100% of cold leg DOS
- Dented TSP examinations
- Other Special Interest or test programs that may test TSP intersections

Based upon the bobbin inspection of all steam generators, a total of 1693 DOS indications were identified. The results of the inspections are summarized as follows:

1) Voltage Dependent Growth was evident in SGs 1-1 and 1-4, and none occurring in SGs 1-2 and 1-3.
2) 23 DOS indications were greater than the lower repair limit (LRL-2.0 volts). Each of the indications confirmed as ODSCC, required repair by plugging, and distributed as follows: 14 in SG 1-1, and 3 each in SGs 1-2, 1-3 and 1-4. Table 3-1 lists the DOS indications that were above the LRL (2.0 volts).
3) No indications were identified that exceeded the upper repair limit of 5.81 volts.
4) No less than or equal to 2.0 volt bobbin indications exceeded the 1.9 volt +Point™ threshold for preventive plugging, although several less than or equal to 2.0 volt bobbin indications were preventively plugged as a precautionary measure, as discussed later.
5) 174 indications at 157 TSP intersections were identified as AONDB (axial ODSCC not detected by bobbin). Table 3-2 lists the indications that were identified as AONDB. These are +Point™ indications of axial ODSCC that have no signal present in the bobbin coil data (no DOS signal). These locations are typically smaller voltage ODSCC, by +Point™, and can be accompanied by a dent that masks the bobbin voltage. Per Reference 8, a methodology has been developed to assign a bobbin voltage based on a correlation to the +Point™ voltage. Once the calculated voltages are obtained per Reference 17, the

locations are subjected to exclusion criteria defined in Reference 12. All inferred voltages were small, less than or equal to about 1.0 equivalent bobbin volts.

6) Overall, 70 DOS/AONDB indications were in tubes that were repaired during 1R13. The breakdown is: 33 in SG 1-1, 20 in SG 1-2, 12 in SG 1-3, and 5 in SG 1-4. This population was used in computing the BOC-14 distributions for the preliminary OA calculations.

The average voltage was 0.66 volts, including AONDB indications. The 1R12 average was 0.71 volts. The average voltage for new DOS indications, excluding prior AONDB indications, was 0.48v. The majority of the largest voltages were detected in SG 1-1, but SG 1-3 had the highest overall average voltage of 0.69 volts. Table 3-3 summarizes the voltage distributions for the as-found condition of the indications, the repaired indications, indications returned to service that were either confirmed by +Point™ or not inspected with +Point™ and the total indications returned to service. 23 confirmed DOS had to be repaired because they exceeded the 2-volt repair limit. The main reasons for repair of the other 47 DOS/AONDB included DOS < 2.0 volts (preventively, as discussed below), wedge exclusion criterion, AONDB at >5 volt dent, combined ID/OD degradation at the same intersection, or other pluggable tube degradation.

Reference 8 provides guidelines for preventive tube repair of less than or equal to 2.0 volt bobbin indications to reduce the potential for finding large voltage growth rates for indications left in service. PG&E committed to implement the guideline by performing +Point™ inspection of 100% of greater than 1.7 volt bobbin indications, and to repair any +Point™ confirmed ODSCC with +Point™ amplitude greater than 1.9 volts, as this could be near throughwall and potentially result in a large voltage growth rate in the next cycle. 25 less than 2.0 volt bobbin indications were therefore +Point™ inspected in 1R13 (that would not have been inspected otherwise) to meet this commitment. All of the indications were confirmed as ODSCC, and all +Point™ amplitudes were less than 1.9 volts, so none required preventive plugging per the guideline. Nonetheless, as an additional precautionary measure, the +Point™ and bobbin voltages were reviewed for all confirmed ODSCC with less than or equal to 2 volt DOS, see Figures 3-40 to 3-43. Only one less than 2 volt DOS indication in SG 1-1, with +Point™ amplitude of 1.65 volts, was preventively plugged, thereby removing from service all tubes with ODSCC +Point™ amplitudes exceeding about 1.3 volts. Therefore, it is concluded that the preventive plugging program used at 1R13 is more conservative than PG&E's commitment to the NRC.

The largest +Point™ amplitude found in 1R13 was 2.59 volts and the largest bobbin voltage growth rate was 1.05 v/EFPY.

The +Point™ inspections required for DOS indications were accomplished as a part of the special interest exams. 387 +Point™ inspections were performed where DOS indications were called by bobbin, excluding the AONDB intersections. Of these inspections, 330 were confirmed yielding an overall confirmation rate of about 86%.

The 1R13 +Point™ TSP inspection scope also included intersections with signals that could potentially mask or cause a flaw to be missed or misread. These inspections included dented intersections based on the criteria in the degradation assessment (Ref. 9) and hot leg intersections with support plate residuals (SPR) ≥ 2.3 volts. Per GL 95-05, a large mixed residual is one that could cause a 1.0 volt bobbin signal to be missed or misread. In Reference

9, DCPP determined that a 2.3 volt SPR is the upper 95th value that could potentially mask bobbin indications ≥ 1.0 volt. Per the inspection requirements specified in References 9 and 12, all hot leg intersections with SPRs with voltages ≥ 2.3 volts were inspected with +Point™. In addition, References 9 and 12 require that, if there are less than five hot leg SPRs ≥ 2.3 volts in a given steam generator, the five largest hot leg SPRs in that steam generator should be inspected with +Point™. A total of 4 hot leg SPRs ≥ 2.3 volts were identified and inspected, with no indications detected. Since none of the steam generators contained five SPRs ≥ 2.3 volts, the five largest hot leg SPRs were inspected in each steam generator resulting in a total of 20 inspected with +Point™. One confirmed ODSCC indication (AONDB) was detected from these +Point™ inspections in R10C68 in SG 1-3. The +Point™ voltage was very small (0.21 v) and there was also a 1.81 volt dent at the TSP, in addition to the 2.17 volt SPR. The inferred bobbin signal was 0.514, less than the conservative 1 volt plugging criteria.

Figures 3-1 and 3-2 show the as-found voltage distribution (including AONDB) for all indications detected during the 1R13 inspection. Figures 3-3 and 3-4 show the indications removed from service at 1R13. Figures 3-5 and 3-6 illustrate the indications returned to service that were confirmed as axial ODSCC or were not inspected with RPC. Figures 3-7 and 3-8 illustrate all of the indications returned to service following the 1R13 ECT inspection. Table 3-1 shows all of the indications greater than the 2.0-volt lower repair limit. As previously stated, all of these indications were confirmed as axial ODSCC and were removed from service by plugging.

Of all the DOS indications returned to service, the largest bobbin voltage was 1.99 volts. This indication confirmed as three axial ODSCC indications with +Point™ voltages of 0.54, 0.38 and 0.33 v. The single largest +Point™ voltage indication returned to service was 1.27 v, with a corresponding DOS bobbin voltage of 1.75 volts.

There were 410 intersections returned to service that contained confirmed axial ODSCC at dented intersections. 144 were AONDB intersections and 266 were confirmed bobbin DOS indications. 293 of these intersections contained dents ≤2.0 v, 117 of these intersections contained dents between 2 and 5 volts , and no intersections contained >5 volt dent. The largest bobbin voltage indication returned to service with a dent at the same TSP was 1.92 volts and confirmed as a 0.38v SAI. The largest +Point™ indication with at dent at the same TSP returned to service is 1.18 v, and has a corresponding DOS of 1.45 volts.

The DOS voltage distribution as a function of TSP elevation is provided in Table 3-5. Table 3-5 and Figure 3-9 show that the ODSCC mechanism is most active at the lower hot leg TSPs and the number of indications tends to decrease as a function of higher TSP elevations. This distribution shows the typical temperature dependence of ODSCC.

Table 3-5 and Figure 3-9 include a small number of cold leg DOS indications that were NDD by +Point™ based on the 100% +Point™ inspection of cold leg DOS performed in 1R13. 100% of cold leg DOS were +Point™ inspected to validate the cold leg thinning region. No cold leg ODSCC has been confirmed by +Point™ to date at DCPP. Non-confirmed bobbin DOS indications in the cold leg are conservatively retained in the ODSCC ARC calculations.

3.2 *Voltage Growth Rates*

For projection of leak rates and tube burst probabilities at EOC-14, voltage growth rates were developed from the 1R12 and 1R13 inspection data. Cycle 13 was 1.34 EFPY in length per Reference 12. For repeat indications reported as DOS in both inspections, growth rates were determined based on comparison of the voltages called in 1R12 and 1R13. For indications not reported during the 1R12 inspection (i.e. new at 1R13), the indications were sized using the 1R12 ECT signals based on a lookup review. Lookups were also performed for all of the 1R13 DOS locations that were previously reported as DIS. In both of these cases, an OD component could not be always found in the bobbin lookup results, and these intersections were excluded from the growth distributions.

As discussed in Section 3.2.1 below, the Cycle 13 growth rates for each SG were less than Cycle 12 growth rates. There were 441 newly reported DOS indications in 1R13, the largest of which was 2.01 volts. These values exclude those intersections which had DIS indications reported in 1R12. 431 of these new indications were detected during the 1R12 lookup and were assigned a voltage and subsequently included in the growth distributions. There were 10 new DOS indications that were not detected during the lookup and were, therefore, not included in the growth rate analyses. The largest of these new indications not present in the look up was 0.80v in SG 1-1 R17C27 3H. The upper 95% growth rates of all new and repeat indications were 0.21 and 0.28 v/EFPY, respectively. The average growth rates for new and repeat indications excluding prior AONDB were both 0.06 v/EFPY. These data indicate that the new indications are growing at a slower rate than the previously detected indications, which is consistent with prior inspection results at DCPP.

Table 3-4 provides a summary of indications with the largest growth during Cycle 13. Table 3-5 provides the maximum and average voltage growth distribution by TSP. Table 3-6 provides the average BOC voltage, average growth rate data and average percent growth for the last five cycles at DCPP-1. Figure 3-13 depicts this information graphically.

Table 3-7 shows the voltage independent growth distributions for each SG, the composite distribution for all four SGs, and the cumulative probability distribution function for each distribution. Figures 3-10 and 3-11 show the voltage growth distributions depicted in bar charts. Reviewing the Table 3-5 average and maximum voltage growth for all indications for each SG as well as the number of new indications in each SG shows that the ODSCC mechanism is most active in SG 1-1. This phenomenon of a leading SG in plants affected by ODSCC is common in the industry. Reviewing Table 3-6 and Figures 3-10 and 3-11 also supports this conclusion.

3.2.1 *Selection of Limiting Growth Distribution for Each Steam Generator*

In June 2004, PG&E received a set of RAIs from the NRC on their submittal for a permanent POPCD approval. The responses to these RAIs were provided in Reference 25. In response to one of the questions, PG&E prepared a guideline for determining the appropriate growth distribution to use for the operational assessments. This guideline was used for the determination of the growth rates used for the EOC-14 projections

provided in this document. This guideline either meets, or is more conservative than the guidance provided in References 2 and 6 and Enclosure 3 of Reference 24.

The first step in determining the most conservative growth distribution for each steam generator is to compare the SG-specific and the composite growth distributions for each of the last two cycles. These comparisons are initially done without considering the impact of voltage dependent growth. In order to determine which growth distribution to use for each steam generator in the next operational assessment, four different growth curves must be compared (SG-specific for Cycle 12, SG-specific for Cycle 13, composite for Cycle 12, and composite for Cycle 13).

Figures 3-19 through 3-22 provide graphical comparisons of growth for each steam generator. All of the Figures consistently show that the bounding curve comes from the Cycle 12 growth data (either SG-specific or composite). For SG 1-1, the Cycle 12 SG-specific curve is clearly bounding. For SGs 1-2 and 1-3, the Cycle 12 composite curve is clearly bounding. For SG 1-4, however, it is not clear from Figure 3-22 which curve is bounding. The SG-specific and composite curves for Cycle 12 are similar. During the preparation of the 1R12 90-Day Report (Ref. 27), calculations were performed using both of these curves to determine which growth curve was bounding. These calculations showed that the Cycle 12 composite curve bounded the Cycle 12 SG-specific curve for SG 1-4. A review of the "Delta Volts Adjustments" applied for the EOC-13 projection shows that this conclusion should still hold true for the EOC-14 projection.

In SG 1-3, the Cycle 12 and 13 SG-specific growths are essentially the same. However, any differences are not of particular interest since the composite growth from Cycle 12 is much more conservative and must be used in the operational assessment.

3.2.2 Voltage-Dependent Growth Analyses for Cycle 13

Even though the Cycle 12 growth rates were determined to be bounding, the voltage-dependent growth analyses for the Cycle 13 data are documented in this report for future reference. For Cycle 13, growth rates were plotted against the BOC voltage for all steam generators, including a composite curve. Their data are shown in Figures 3-14 through 3-18. As demonstrated by the figures, a positive slope exists only in SGs 1-1 and 1-4. The slope is negative and zero in SGs 1-2 and 1-3. A threshold slope of 0.1 was defined in Reference 25 as the point at which voltage-dependent growth should be considered in the operational assessment. The slope of the curve for SG 1-1 is slightly below this value and only slightly more in SG 1-4 (0.109). Only SG 1-4 slope meets the criteria. However, for these reasons and based on past experience, it is considered prudent to model voltage-dependent growth in all four steam generators. As shown in Figures 3-30 through 3-34, the growth rates for subsequent VDG bins bound the prior bins, indicating it would be conservative to apply voltage dependent growth in EOC-14 projections, even if Cycle 13 growth was used.

Voltage-dependent growth is not a new concept, and has been documented by the operators of European steam generators affected by ODSCC. Because of their higher repair limits, their data encompass a much broader and higher range of data than at DCPP and the US plants and provides significant basis for the VDG approach.

A significant amount of analysis and evaluation was performed following the 2R11 inspection on voltage growth for ODSCC at TSPs. The evaluations primarily involved statistical breakpoint analysis to determine where the data suggests a change in the slope of the regression curve that defines the growth data. These efforts led to the development of a guidelines document for determining the breakpoints. This document was transmitted to the NRC via Enclosure 3 of Reference 24 and currently resides in Reference 8. These methods were used to determine breakpoints for the Cycle 13 growth data.

Cycle 13 VDG breakpoint analyses were performed for each steam generator and for a composite growth distribution (including all steam generators), even though the slope may not indicate VDG as discussed above. Figures 3-23 through 3-27 show the scatter charts and the resulting breakpoints for all of these analyses. The analyses for SGs 1-2, 1-3, and 1-4 each yielded one breakpoint at 1.25v, 0.60v, and 1.00v, respectively. The SG 1-1 analysis yielded two breakpoints at 0.50v and 0.98v. The composite analysis yielded two breakpoints at 0.50v and 0.99v, indicating that SG 1-1 is leading the others in VDG, as well as independent growth. Tables 3-10 through 3-14 provide the growth distributions for the Cycle 13 VDG analysis, for information only.

3.2.3 *Voltage-Dependent Growth Analyses for Cycle 12*

As discussed in Section 3.2.1, the Cycle 12 growth rates were determined to bound the Cycle 13 growth rates. This section provides the VDG breakpoint analyses for the growth curves used in the EOC-14 Monte Carlo analyses.

From the 1R12 90 day report, the Cycle 12 growth curves include a SG-specific curve for SGs 1-1, and the composite curve which was used for all other SGs. Figures 3-28 and 3-29 provide the results of the breakpoint analyses for the 1R12 data set. As shown in the figures, SG 1-1 yielded two breakpoints at 0.5 and 0.99v, very similar to the Cycle 13 breakpoints. The composite data set yielded two breakpoints of 0.5 and 1.02v, again very similar to the composite growth VDG evaluation for Cycle 13.

3.2.4 *Delta Volts Adjustment*

Another part of the growth guideline provided in Reference 25 involves implementation of a "delta volts adjustment" when implementing POPCD in operational assessment calculations. The purpose of this adjustment is to account for the possibility that the growth rates may increase over the next operating cycle. The intent of the adjustment procedure is to increase growth in a specific VDG bin when a comparison between cycle N and cycle N-1 indicates such. The growth rate guidelines that PG&E committed to utilize in combination with POPCD do not specifically address the case where growth

rates decrease over subsequent cycles. The guidelines were written on the premise that once VDG is experienced, increasing growth would likely continue to occur. This is not the case in comparing Cycles 12 and 13. However, PG&E conservatively interprets the adjustment procedure applicable to this analysis, even though Cycle 12 is bounding.

The amount of the adjustment would be determined by comparing the average growth from Cycle 13 to the average growth from Cycle 12 for each VDG bin. Tables 3-8 and 3-9 provide the details for the Cycle 13 and Cycle 12 breakpoints, respectively. Per the Reference 25 guideline, if the Cycle 13 data has a higher average growth rate than the Cycle 12 data, then the difference between the average growth rates would be added to each growth rate value in the distribution being used prior to binning the data. Per Table 3-8, even if Cycle 13 growth rates were being used in the Cycle 14 operational assessment, no growth adjustment would be required. Table 3-9 shows a slight increase in the average growth rate for Bin 1 in SG 1-3. However, the SG-specific curve is not being used for SG 1-3 operational assessment. Therefore, no adjustment is required for any of the EOC-14 projections documented in this report.

3.2.5 Growth Summary

As discussed in Section 3.2.1, in all cases Cycle 12 bounds Cycle 13 growth. Based on the Cycle 12 SG-specific versus composite growth evaluations, a composite curve should be used for SGs 1-2, 1-3 and 1-4 and a SG-specific curve should be used for SG 1-1, for EOC-14 projections. The only difference between the Cycle 13 operational assessment growth distribution and the Cycle 14 operational assessment growth distribution was the need for a delta volts adjustment in the EOC-13 projections, based on Reference 27 growth results. The adjustments were removed for EOC-14 projections.

Tables 3-15 and 3-16 show the Cycle 12 growth distributions that were used in the Monte Carlo analyses for EOC-14. These curves are shown graphically in Figures 3-35 and 3-36. As required by Generic Letter 95-05, the negative growth values were included as zero growth rates in the ARC calculations.

3.3 Voltage Distributions Used for Monte Carlo Analyses

Now that the breakpoints for the growth bins have been defined, the voltage distributions to be used in the Monte Carlo simulations can be defined. Table 3-3 shows the voltage distributions for the as-found and repaired indications. Additional voltage bins must be inserted at the value of the VDG breakpoints: an additional voltage bin at 0.99v was inserted into the SG 1-1 voltage distribution and an additional voltage bin at 1.02v were inserted into the voltage distributions for SGs 1-2, 1-3, and 1-4 (See Table 3-17). Adding these additional voltage bins forces the Monte Carlo simulation codes to apply each growth bin to the correct number of indications.

3.4 Probe Wear Criteria

In order to maintain consistent detection and sizing capabilities throughout the inspection, probe wear is monitored by following the requirements of Reference 15. The first NRC requirement regarding probe wear is to minimize the potential for tubes to be inspected with a probe that had failed the probe wear check. This was accomplished by implementing the bobbin Examination Technique Specification Sheet (ETSS) #1 (Ref. 11), which required the probe have its feet replaced when failing the probe wear check, or in the case of non-changeable feet probes, the probe discarded. Review of the probe wear log sheets and the eddy current test results indicate that no tubes were inspected with a probe known to have failed the probe wear check.

If the DOS voltage is at or above the retest threshold (1.5 volts or higher) and the cal is designated as "ARC Out" on the cal board, the indication code is changed from a DOS to a RSS (retest support plate signal) indicating that a retest is required with a new probe. No new indications were detected in the tubes when retested with the new probe.

The 1R13 eddy current inspection resulted in 46 bobbin indications in excess of 1.5 volts that were inspected with a worn probe. These indications are shown in Table 3-18. Figure 3-37 shows a comparison of the worn probe and good probe voltages. The final acceptable DOS voltage values compare reasonably well with the RSS voltages in all cases except one. R42C36 in SG 1-1 had RSS voltages of 1.51 and 1.62v, with a DOS voltage of 1.82v. The average change between DOS and RSS voltages in 1R13 was 0.7%. Therefore, continued use of the 1.5-volt retest threshold is justified (Ref. 13).

The next requirement involves monitoring tubes that contain new DOS indications that were inspected with probes that failed the wear check in the previous outage. This evaluation is intended to look for "new" large indications or a non-proportionately large percentage of "new" indications in tubes that failed the check in the previous outage. Table 3-19 shows the new 1R13 DOS indications that were ≥0.5 volts and were inspected on cal groups that failed the probe wear check in 1R12.

Overall, 1693 DOS indications were reported during the 1R13 inspection of the active tube population and no tubes were deplugged during this outage. Only 441 or 26% of the DOS indications were new indications. In order to assess the number of new indications against the probe wear requirements, Tables 3-20 is presented. Of the 441 new indications, 187 (~42%) were in tubes inspected with a worn probe in 1R12 and 254 were in tubes inspected with a good probe in 1R12. The number of new indications $\geq$ 0.5 volts was determined to be 172. Of these, about 39% were in tubes that were inspected with a worn probe in 1R12. This confirms that a tube tested with a worn probe in 1R12 is no more likely to contain a large DOS in 1R13 than a tube tested with a good probe in 1R12.

Additionally, based on a review of Table 3-21, the number of tubes inspected during 1R12 that were ARC out was 5763, compared to 8060 inspections that were made with an ARC in probe. This total number of examinations is greater than the number of tubes in service because several tubes have multiple examinations. The ratio of ARC out tubes inspected to the total number of bobbin inspections is about 0.42. This ratio compares well with the ratio of the

number of new DOSs inspected with a worn probe in 1R12 (also 0.42), and new ≥ 0.5 volt DOSs inspected with a worn probe in 1R12 (0.39). This demonstrates that the number of new indications is not biased towards the tubes that were inspected with worn probes in 1R12.

In summary, the NRC analysis requirements regarding probe wear monitoring were met during the 1R13 bobbin coil inspection and a more stringent wear tolerance is not required at DCPP.

3.5 Upper Voltage Repair Limit

Per Generic Letter 95-05, the upper repair limit must be calculated prior to each outage. The more conservative of the plant-specific average growth rate per EFPY or 30 percent per EFPY should be used as the anticipated growth rate input for this calculation. Since the average growth rate for Cycle 12 was 24.3% (Ref. 27 and Table 3-6), the required 30%/EFPY was used for the upper repair limit calculation. The structural limit used for this calculation was taken from Reference 27 and is based on the Addendum 6 database. Based on the following formula, the upper repair limit was calculated to be 5.81v.

$$V_{URL} = \frac{V_{SL}}{1 + \frac{\% V_{NDE}}{100} + \frac{\% V_{CG}}{100}}$$

where: V_{URL} = upper voltage repair limit,
V_{NDE} = NDE voltage measurement uncertainty = 20%,
V_{CG} = voltage growth anticipated between inspections = 30%/EFPY x 1.39 EFPY = 41.7%,
V_{SL} = voltage structural limit from the burst pressure – Bobbin voltage correlation, where the limit of 9.40 volts was used based on Reference 8.

3.6 NDE Uncertainty Distributions

NDE uncertainties must be taken into account when projecting the end-of-cycle voltages for the next operating cycle. The NDE uncertainties used in the calculations of the EOC-13 voltages are described in Reference 6. The acquisition uncertainty was sampled from a normal distribution with a mean of zero, a standard deviation of 7%, and a cutoff limit of 15% based on the use of the probe wear standard. The analyst uncertainty was sampled from a normal distribution with a mean of zero, a standard deviation of 10.3%, and no cutoff limit. These uncertainty distributions are shown in Table 3-22 and Figure 3-38.

3.7 +Point™ to Bobbin Voltage Correlation

In Reference 28, PG&E committed to providing an assessment in each 90-day report to ensure that the bobbin voltages assigned to AONDB indications continue to be conservative. That is, for those prior cycle AONDB indications that become detectable by bobbin (DOS), this assessment was to include a review of the current cycle bobbin voltages against the expected bobbin voltages assuming that all of these indications grew at the average growth rate for the DOS population.

In 1R13, 21 of the 1R12 returned to service AONDB indications were detected with bobbin and were reported as DOS. Table 3-23 provides the comparison of assigned voltages to bobbin voltages. Comparing the 1R12 inferred voltage to the 1R13 DOS voltage, results in an average increase of 0.096 v/EFPY, which is only slightly larger than the average growth rate for DOS indications detectable in both inspections, 0.063 v/EFPY. There are a few exceptions that have a higher change between 1R12 inferred versus 1R13 DOS voltage, but Level III review of the inspection data indicated significant dent influence in the 1R13 DOS voltages. In the case of this small population of indications, comparing inferred to inferred voltages between the two inspections is more appropriate, since they are from the same technique (+Point™) and are not as suspect to influence from the dent signal that exists at these TSPs. In this case the change is less than the average Cycle 13 growth rate.

In order to determine if the inferred voltages of 1R12 were conservatively assigned for the prior cycle operational assessment, the actual bobbin coil DOS voltage in 1R13 was reduced by the average cycle 13 voltage change for DOS indications in each SG, to arrive at a "1R12 postulated AONDB bobbin voltage." This voltage is then compared to the 1R12 inferred bobbin voltage used in the prior cycle OA. The inferred AONDB voltages in 1R12 are noted to be generally overestimated based on most of the values in the Table 3-23 column "Voltage Difference from 1R12 Inferred to 1R12 Postulated" being positive. There were a few instances of under prediction using this method comparison. However, experience in performing the lookups for growth rates at dented TSP intersections at DCPP, has shown instances of bobbin coil voltage influence by the dent signal, resulting in higher than expected voltage. When comparing the inferred voltages that are from +Point™ from both inspections, the differences are minimized, because dent signal influence is eliminated.

As a prudent measure, the bobbin to +Point™ voltage correlation continues to be assessed by comparing the inferred bobbin voltages against the measured bobbin voltages for all of the intersections that had both bobbin DOS indications and +Point™ indications of axial ODSCC. The 1R13 +Point™ indications were assigned bobbin voltages based on the following equation from Reference 17.

$$V_{Bobbin-95UCL} = V_{+PT} * 1.0161 + 0.2835 + \sqrt{0.00024 + 0.0011(V_{+PT} - 0.45)^2}$$

For cases where more than one +Point™ indication was reported at the same intersection, each indication was assigned an inferred voltage. These multiple voltages were then combined via the square root of the sum of the squares method (SRSS) to obtain a single inferred bobbin voltage for those intersections.

These inferred bobbin voltages were then compared to the measured bobbin voltages to ensure that the inferred voltages are generally conservative relative to the measured bobbin voltages. There were a total of 330 intersections with DOS indications that were confirmed as containing axial ODSCC with +Point™. In 161 of these 330 cases (about 49%), the inferred voltage was over predicted relative to the measured bobbin voltage. The average difference between the inferred voltages and the measured voltages was a -0.09v under-prediction.

In 1R13, the largest inferred voltage for an AONDB indication was 1.03v. Since the +Point™ to bobbin voltage correlation was only used for intersections with inferred voltages less than 1.03v, this is the voltage range of interest for this comparison. When only the inferred voltages less than 1.03v are considered, 146 of 279 (about 52%) inferred voltages were over predicted relative to the measured voltage. The average difference between the inferred voltages and the measured bobbin voltages for this population was a -0.06v under-prediction.

Figure 3-39 shows this comparison graphically. This figure shows the inferred voltages plotted against the measured bobbin voltages. The linear regression fit shows that, in the region of interest (<1.03 inferred volts), the inferred bobbin voltage is comparable to the measured bobbin voltage. Based on the facts that about 52% of the voltages are over predicted and the average difference in voltages is a small -0.06v under-prediction in the range of interest, the +Point™ to bobbin voltage correlation is shown to provide reasonable results.

Table 3-1: 1R13 DOS >2 Volts

SG	Row	Col	Ind	Elev	Volts
SG 1-1	12	70	DOS	1H	2.59
SG 1-1	8	57	DOS	1H	2.43
SG 1-1	26	63	DOS	1H	2.37
SG 1-1	14	80	DOS	1H	2.30
SG 1-1	25	52	DOS	1H	2.22
SG 1-1	27	52	DOS	1H	2.21
SG 1-1	27	42	DOS	1H	2.16
SG 1-1	30	44	DOS	1H	2.08
SG 1-1	5	66	DOS	1H	2.06
SG 1-1	17	74	DOS	1H	2.05
SG 1-1	42	45	DOS	3H	2.03
SG 1-1	5	72	DOS	1H	2.02
SG 1-1	17	56	DOS	1H	2.02
SG 1-1	30	35	DOS	1H	2.01
SG 1-2	35	60	DOS	1H	2.82
SG 1-2	19	31	DOS	1H	2.23
SG 1-2	15	74	DOS	1H	2.06
SG 1-3	10	47	DOS	2H	2.30
SG 1-3	9	61	DOS	1H	2.15
SG 1-3	9	63	DOS	4H	2.03
SG 1-4	18	50	DOS	1H	2.21
SG 1-4	3	47	DOS	1H	2.06
SG 1-4	11	46	DOS	1H	2.01

Table 3-2: 1R13 AONDB Indications

SG	Row	Col	Elev	Dent Voltage	+Point™ Voltage	Inferred Bobbin Voltage	
						Indication	Intersection
SG 1-1	2	26	2H	1.85	0.15	0.454	0.756
SG 1-1	2	26	2H	1.85	0.30	0.605	
SG 1-1	5	91	2H	2.41	0.16	0.464	0.464
SG 1-1	6	67	1H	0.45	0.14	0.444	0.444
SG 1-1	7	68	1H	0.4	0.36	0.665	0.906
SG 1-1	7	68	1H	0.4	0.31	0.615	
SG 1-1	9	43	1H	1.11	0.18	0.484	0.484
SG 1-1	11	15	3H	2.19	0.29	0.595	0.595
SG 1-1	14	6	2H	0.61	0.23	0.534	0.534
SG 1-1	16	58	1H	3.17	0.17	0.474	0.474
SG 1-1	16	69	2H	0.84	0.15	0.454	0.454
SG 1-1	17	13	2H	1.02	0.23	0.534	0.534
SG 1-1	17	28	2H	3.87	0.27	0.574	0.574
SG 1-1	17	80	2H	2.38	0.16	0.464	0.464
SG 1-1	18	31	2H	1.57	0.29	0.595	0.595
SG 1-1	18	76	1H	0.71	0.17	0.474	0.636
SG 1-1	18	76	1H	0.71	0.12	0.424	
SG 1-1	20	40	3H	0.6	0.15	0.454	0.643
SG 1-1	20	40	3H	0.6	0.15	0.454	
SG 1-1	20	62	2H	3.45	0.24	0.544	0.544
SG 1-1	21	31	2H	0.4	0.13	0.434	0.434
SG 1-1	21	77	2H	1.21	0.19	0.494	0.494
SG 1-1	23	38	2H	4.25	0.24	0.544	0.544
SG 1-1	23	54	1H	1.69	0.18	0.484	0.484
SG 1-1	24	12	2H	0.41	0.15	0.454	0.454
SG 1-1	25	60	1H	0.89	0.19	0.494	0.665
SG 1-1	25	60	1H	0.89	0.14	0.444	
SG 1-1	26	28	1H	4.39	0.31	0.615	0.615
SG 1-1	26	41	2H	0.95	0.18	0.484	0.644
SG 1-1	26	41	2H	0.95	0.12	0.424	
SG 1-1	27	35	1H	0.94	0.24	0.544	0.544
SG 1-1	27	44	2H	3.87	0.15	0.454	0.643
SG 1-1	27	44	2H	3.87	0.15	0.454	
SG 1-1	28	36	1H	0.94	0.13	0.434	0.614
SG 1-1	28	36	1H	0.94	0.13	0.434	
SG 1-1	33	34	1H	1.54	0.31	0.615	0.615
SG 1-1	36	42	2H	0.85	0.18	0.484	0.484
SG 1-1	37	56	2H	1.36	0.24	0.544	0.544
SG 1-1	38	49	2H	0.58	0.20	0.504	0.504
SG 1-1	38	54	2H	2.99	0.25	0.554	0.554
SG 1-1	42	46	1H	0.48	0.14	0.444	0.444
SG 1-2	1	56	2H	0.17	0.21	0.514	0.514
SG 1-2	4	72	1H	0.52	0.16	0.464	0.464
SG 1-2	5	20	6H	2.62	0.14	0.444	0.444

Table 3-2: 1R13 AONDB Indications

SG	Row	Col	Elev	Dent Voltage	+Point™ Voltage	Inferred Bobbin Voltage	
						Indication	Intersection
SG 1-2	5	65	1H	0.72	0.14	0.444	0.444
SG 1-2	5	91	5H	2.8	0.20	0.504	0.504
SG 1-2	6	14	1H	3.01	0.34	0.645	0.645
SG 1-2	6	49	1H	2.49	0.24	0.544	0.544
SG 1-2	6	81	1H	3.5	0.23	0.534	0.534
SG 1-2	6	92	1H	3.31	0.16	0.464	0.464
SG 1-2	7	54	1H	3.56	0.19	0.494	0.494
SG 1-2	7	65	2H	1.21	0.30	0.605	0.605
SG 1-2	8	17	1H	3.25	0.21	0.514	0.514
SG 1-2	9	33	1H	2.34	0.18	0.484	0.484
SG 1-2	9	55	1H	1.73	0.13	0.434	0.434
SG 1-2	10	43	1H	1.73	0.33	0.635	0.635
SG 1-2	10	45	2H	1.47	0.17	0.474	0.474
SG 1-2	11	18	2H	3.32	0.26	0.564	0.564
SG 1-2	11	40	1H	4.11	0.35	0.655	0.655
SG 1-2	11	75	2H	3.71	0.25	0.554	0.554
SG 1-2	11	91	1H	3.12	0.20	0.504	0.504
SG 1-2	12	76	1H	3.45	0.12	0.424	0.424
SG 1-2	13	66	2H	3.78	0.20	0.504	0.504
SG 1-2	13	84	1H	0.93	0.27	0.574	0.574
SG 1-2	14	7	2H	3.29	0.19	0.494	0.494
SG 1-2	14	79	4H	2.84	0.18	0.484	0.484
SG 1-2	15	81	4H	2.63	0.17	0.474	0.474
SG 1-2	15	85	2H	2.92	0.14	0.444	0.444
SG 1-2	17	22	1H	10.61	0.33	0.635	0.635
SG 1-2	17	37	2H	2.17	0.13	0.434	0.434
SG 1-2	17	38	1H	7.13	0.23	0.534	0.534
SG 1-2	17	70	1H	2.72	0.19	0.494	0.494
SG 1-2	18	14	1H	1.18	0.18	0.484	0.484
SG 1-2	18	22	1H	2.64	0.12	0.424	0.424
SG 1-2	19	57	2H	2.01	0.37	0.675	0.880
SG 1-2	19	57	2H	2.01	0.26	0.564	
SG 1-2	20	83	1H	2.43	0.21	0.514	0.756
SG 1-2	20	83	1H	2.43	0.25	0.554	
SG 1-2	20	89	4H	1.93	0.24	0.544	0.544
SG 1-2	21	72	4H	1.14	0.25	0.554	0.554
SG 1-2	21	87	1H	1.6	0.25	0.554	0.554
SG 1-2	22	62	1H	1.11	0.34	0.645	0.645
SG 1-2	22	79	2H	1.21	0.14	0.444	0.444
SG 1-2	22	83	1H	2.41	0.18	0.484	0.484
SG 1-2	23	52	1H	4.66	0.14	0.444	0.444
SG 1-2	23	71	2H	1.57	0.17	0.474	0.657
SG 1-2	23	71	2H	1.57	0.15	0.454	
SG 1-2	25	85	2H	1.78	0.36	0.665	0.665
SG 1-2	27	19	1H	4.35	0.26	0.564	0.564

Table 3-2: 1R13 AONDB Indications

SG	Row	Col	Elev	Dent Voltage	+Point™ Voltage	Inferred Bobbin Voltage	
						Indication	Intersection
SG 1-2	27	44	1H	2.06	0.14	0.444	0.444
SG 1-2	27	44	2H	1.16	0.19	0.494	0.494
SG 1-2	27	66	2H	2.27	0.17	0.474	0.650
SG 1-2	27	66	2H	2.27	0.14	0.444	
SG 1-2	28	36	2H	1.98	0.15	0.454	0.454
SG 1-2	28	71	2H	2.44	0.25	0.554	0.554
SG 1-2	29	48	1H	0.54	0.16	0.464	0.464
SG 1-2	29	49	3H	2.44	0.14	0.444	0.444
SG 1-2	29	69	1H	3.95	0.15	0.454	0.454
SG 1-2	31	44	4H	2.1	0.09	0.395	0.395
SG 1-2	31	63	1H	3.18	0.37	0.675	0.814
SG 1-2	31	63	1H	3.18	0.15	0.454	
SG 1-2	31	66	1H	0.33	0.14	0.444	0.444
SG 1-2	31	80	4H	3.96	0.17	0.474	0.474
SG 1-2	32	59	3H	0.92	0.19	0.494	0.494
SG 1-2	33	40	1H	0.49	0.26	0.564	0.564
SG 1-2	33	68	2H	0.85	0.17	0.474	0.617
SG 1-2	33	68	2H	0.85	0.09	0.395	
SG 1-2	33	71	4H	4.91	0.13	0.434	0.434
SG 1-2	34	26	2H	0.75	0.17	0.474	0.474
SG 1-2	34	66	1H	4.05	0.19	0.494	0.494
SG 1-2	35	50	1H	0.73	0.19	0.494	0.494
SG 1-2	36	60	1H	3.82	0.21	0.514	0.514
SG 1-2	37	45	5H	1.48	0.12	0.424	0.424
SG 1-2	39	49	2H	1.65	0.25	0.554	0.554
SG 1-2	39	70	1H	2.11	0.29	0.595	0.595
SG 1-2	42	38	4H	6.23	0.31	0.615	0.615
SG 1-2	45	42	1H	1.85	0.27	0.574	0.574
SG 1-2	45	52	2H	2.33	0.20	0.504	0.504
SG 1-3	5	20	1H	2.89	0.25	0.554	0.554
SG 1-3	6	36	1H	2.82	0.19	0.494	0.494
SG 1-3	6	79	1H	3.7	0.32	0.625	0.625
SG 1-3	7	93	2H	1.61	0.16	0.464	0.464
SG 1-3	10	68	2H	1.81	0.21	0.514	0.514
SG 1-3	10	79	3H	1.2	0.17	0.474	0.474
SG 1-3	19	80	1H	3.46	0.38	0.685	0.685
SG 1-3	21	34	1H	2.5	0.30	0.605	0.605
SG 1-3	22	55	1H	2.34	0.27	0.574	0.574
SG 1-3	23	31	2H	2.39	0.30	0.605	0.605
SG 1-3	25	82	1H	2.66	0.11	0.414	0.414
SG 1-3	26	41	1H	2.12	0.17	0.474	0.474
SG 1-3	27	49	1H	1.26	0.15	0.454	0.454
SG 1-4	5	72	2H	3.59	0.17	0.474	0.474
SG 1-4	7	30	1H	3.74	0.16	0.464	0.464
SG 1-4	7	38	1H	4.71	0.12	0.424	0.424

Table 3-2: 1R13 AONDB Indications

SG	Row	Col	Elev	Dent Voltage	+Point™ Voltage	Inferred Bobbin Voltage	
						Indication	Intersection
SG 1-4	10	13	3H	3.72	0.14	0.444	0.444
SG 1-4	10	35	1H	2.34	0.14	0.444	0.444
SG 1-4	10	44	1H	16.63	0.16	0.464	0.464
SG 1-4	10	93	1H	2.18	0.19	0.494	0.494
SG 1-4	12	31	3H	1.58	0.18	0.484	0.484
SG 1-4	12	32	1H	2.88	0.29	0.595	0.780
SG 1-4	12	32	1H	2.88	0.20	0.504	
SG 1-4	12	43	1H	2.41	0.14	0.444	0.444
SG 1-4	13	10	2H	1.47	0.14	0.444	0.444
SG 1-4	13	31	1H	2.37	0.24	0.544	0.544
SG 1-4	13	51	1H	2.17	0.20	0.504	0.504
SG 1-4	14	7	2H	2.11	0.15	0.454	0.874
SG 1-4	14	7	2H	2.11	0.44	0.746	
SG 1-4	14	19	3H	2.56	0.15	0.454	0.454
SG 1-4	15	7	1H	6.05	0.15	0.454	0.454
SG 1-4	15	29	1H	2.41	0.47	0.777	0.777
SG 1-4	15	36	1H	4.69	0.26	0.564	0.564
SG 1-4	15	52	1H	1.93	0.12	0.424	0.424
SG 1-4	16	51	1H	4.53	0.19	0.494	0.494
SG 1-4	16	65	2H	2.71	0.11	0.414	0.414
SG 1-4	16	69	2H	2.89	0.11	0.414	0.414
SG 1-4	17	32	1H	1.93	0.45	0.756	0.756
SG 1-4	19	32	1H	3.88	0.72	1.033	1.033
SG 1-4	19	40	1H	3.49	0.15	0.454	0.454
SG 1-4	19	45	2H	1.83	0.22	0.524	0.524
SG 1-4	19	47	1H	0.8	0.13	0.434	0.434
SG 1-4	21	51	1H	3.36	0.24	0.544	0.544
SG 1-4	22	43	1H	3.09	0.20	0.504	0.504
SG 1-4	24	62	1H	1.82	0.28	0.584	0.584
SG 1-4	24	68	1H	1.78	0.10	0.404	0.404
SG 1-4	25	36	1H	3.43	0.23	0.534	0.534
SG 1-4	30	59	1H	2.57	0.30	0.605	0.605
SG 1-4	32	70	1H	4.11	0.25	0.554	0.554
SG 1-4	33	58	1H	3.73	0.64	0.951	0.951
SG 1-4	36	20	1H	2.41	0.16	0.464	0.464
SG 1-4	36	47	1H	4.02	0.34	0.645	0.645
SG 1-4	38	21	1H	2.23	0.21	0.514	0.514
SG 1-4	40	27	1H	4.02	0.14	0.444	0.718
SG 1-4	40	27	1H	4.02	0.26	0.564	
SG 1-4	42	54	1H	3.52	0.20	0.504	0.504

Table 3-3: Summary of Inspection and Repair for Tubes Affected by ODSCC at TSPs

	SG 1-1				SG 1-2				SG 1-3			
Voltage Bin	As-Found EOC-13	Repaired Tubes	Returned to Service		As-Found EOC-13	Repaired Tubes	Returned to Service		As-Found EOC-13	Repaired Tubes	Returned to Service	
			Conf. ODSCC or Not Insp w/ +Pt	Total			Conf. ODSCC or Not Insp w/ +Pt	Total			Conf. ODSCC or Not Insp w/ +Pt	Total
0.1	0	0	0	0	0	0	0	0	0	0	0	0
0.2	23	1	22	22	10	0	10	10	6	0	6	6
0.3	79	1	78	78	48	0	46	48	28	1	23	27
0.4	128	0	127	128	73	1	70	72	34	0	29	34
0.5	116	1	115	115	104	6	94	98	47	1	43	46
0.6	85	4	80	81	91	5	84	86	30	3	24	27
0.7	86	7	79	79	76	3	71	73	24	0	20	24
0.8	41	2	37	39	49	1	48	48	16	2	14	14
0.9	47	1	46	46	39	0	37	39	23	0	20	23
1	34	0	34	34	26	0	25	26	12	1	10	11
1.1	42	0	42	42	18	0	17	18	11	0	10	11
1.2	19	1	18	18	16	0	16	16	8	0	8	8
1.3	16	0	16	16	6	0	6	6	4	0	4	4
1.4	11	0	11	11	7	0	7	7	4	0	4	4
1.5	23	0	23	23	7	0	7	7	4	0	4	4
1.6	2	0	2	2	3	1	2	2	6	0	6	6
1.7	5	0	5	5	0	0	0	0	2	1	1	1
1.8	7	0	7	7	1	0	1	1	3	0	3	3
1.9	4	0	4	4	1	0	1	1	2	0	2	2
2	2	1	1	1	1	0	1	1	3	0	3	3
2.1	7	7	0	0	1	1	0	0	1	1	0	0
2.2	1	1	0	0	0	0	0	0	1	1	0	0
2.3	3	3	0	0	1	1	0	0	1	1	0	0
2.4	1	1	0	0	0	0	0	0	0	0	0	0
2.5	1	1	0	0	0	0	0	0	0	0	0	0
2.6	1	1	0	0	0	0	0	0	0	0	0	0
2.7	0	0	0	0	0	0	0	0	0	0	0	0
2.8	0	0	0	0	0	0	0	0	0	0	0	0
2.9	0	0	0	0	1	1	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
3.1	0	0	0	0	0	0	0	0	0	0	0	0
3.2	0	0	0	0	0	0	0	0	0	0	0	0
3.3	0	0	0	0	0	0	0	0	0	0	0	0
3.4	0	0	0	0	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0	0	0	0	0
3.6	0	0	0	0	0	0	0	0	0	0	0	0
3.7	0	0	0	0	0	0	0	0	0	0	0	0
3.8	0	0	0	0	0	0	0	0	0	0	0	0
3.9	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
>7	0	0	0	0	0	0	0	0	0	0	0	0
Total	784	33	747	751	579	20	543	559	270	12	234	258
>1V	145	16	129	129	63	4	58	59	50	4	45	46
>2V	14	14	0	0	3	3	0	0	3	3	0	0
>4V	0	0	0	0	0	0	0	0	0	0	0	0

Table 3-3 (cont): Summary of Inspection and Repair for Tubes Affected by ODSCC at TSPs

	SG 1-4				Composite of All SGs			
Voltage Bin	As-Found EOC-13	Repaired Tubes	Returned to Service		As-Found EOC-13	Repaired Tubes	Returned to Service	
			Conf. ODSCC or Not Insp w/ +Pt	Total			Conf. ODSCC or Not Insp w/ +Pt	Total
0.1	0	0	0	0	0	0	0	0
0.2	5	0	4	5	44	1	42	43
0.3	21	0	18	21	176	2	165	174
0.4	27	0	24	27	262	1	250	261
0.5	49	2	47	47	316	10	299	306
0.6	29	0	29	29	235	12	217	223
0.7	14	0	12	14	200	10	182	190
0.8	22	0	22	22	128	5	121	123
0.9	2	0	2	2	111	1	105	110
1	17	0	17	17	89	1	86	88
1.1	9	0	9	9	80	0	78	80
1.2	4	0	4	4	47	1	46	46
1.3	2	0	2	2	28	0	28	28
1.4	3	0	3	3	25	0	25	25
1.5	6	0	6	6	40	0	40	40
1.6	2	0	2	2	13	1	12	12
1.7	1	0	1	1	8	1	7	7
1.8	1	0	1	1	12	0	12	12
1.9	0	0	0	0	7	0	7	7
2	0	0	0	0	6	1	5	5
2.1	2	2	0	0	11	11	0	0
2.2	0	0	0	0	2	2	0	0
2.3	1	1	0	0	6	6	0	0
2.4	0	0	0	0	1	1	0	0
2.5	0	0	0	0	1	1	0	0
2.6	0	0	0	0	1	1	0	0
2.7	0	0	0	0	0	0	0	0
2.8	0	0	0	0	0	0	0	0
2.9	0	0	0	0	1	1	0	0
3	0	0	0	0	0	0	0	0
3.1	0	0	0	0	0	0	0	0
3.2	0	0	0	0	0	0	0	0
3.3	0	0	0	0	0	0	0	0
3.4	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0
3.6	0	0	0	0	0	0	0	0
3.7	0	0	0	0	0	0	0	0
3.8	0	0	0	0	0	0	0	0
3.9	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
>7	0	0	0	0	0	0	0	0
Total	217	5	203	212	1850	70	1727	1780
>1V	31	3	28	28	289	27	260	262
>2V	3	3	0	0	23	23	0	0
>4V	0	0	0	0	0	0	0	0

Table 3-4: Summary of Largest Voltage Growth Rates per EFPY

SG	Row	Col	Elev	Volts	Prev Volts (1R12)	Growth/ EFPY	+Point™ Results	New?
SG 1-1	25	52	1H	2.22	0.810	1.052	SAI	Repeat
SG 1-1	8	57	1H	2.43	1.310	0.836	SAI	Repeat
SG 1-1	12	70	1H	2.59	1.500	0.813	SAI	Repeat
SG 1-1	12	2	1H	1.86	0.870	0.739	SAI	Repeat
SG 1-2	35	60	1H	2.82	1.850	0.724	SAI	Repeat
SG 1-3	10	47	2H	2.30	1.450	0.634	SAI	Repeat
SG 1-2	21	82	1H	1.37	0.600	0.575	Not Insp	Repeat
SG 1-1	24	17	1H	1.33	0.560	0.575	Not Insp	Repeat
SG 1-4	3	47	1H	2.06	1.320	0.552	SAI	Repeat
SG 1-3	16	49	1H	1.73	1.030	0.522	SAI	Repeat
SG 1-3	4	77	1H	1.92	1.230	0.515	SAI	Repeat
SG 1-2	18	40	5H	0.99	0.320	0.500	Not Insp	New

Table 3-5: DOS/AONDB Voltage and Growth Distribution by TSP

Tube Support Plate	SG 1-1					Tube Support Plate	SG 1-2				
	No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY		No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY
1H	485	2.59	0.75	1.05	0.08	1H	268	2.82	0.66	0.72	0.05
2H	203	1.62	0.56	0.38	0.06	2H	166	1.95	0.62	0.49	0.02
3H	58	2.03	0.59	0.46	0.06	3H	69	1.54	0.60	0.39	0.05
4H	28	0.96	0.47	0.27	0.04	4H	41	1.54	0.56	0.20	0.06
5H	1	0.32	0.32	-0.14	-0.14	5H	19	1.11	0.60	0.50	0.09
6H	4	0.49	0.42	0.14	-0.01	6H	9	0.78	0.53	0.21	0.08
7H	1	0.22	0.22	-0.06	-0.06	7H	0	0.00	0.00	0.00	0.00
CL	4	0.71	0.58	0.10	0.05	CL	7	1.04	0.55	0.25	0.04
All Inds	784	2.59	0.67	1.05	0.07	All Inds	579	2.82	0.63	0.72	0.04

Tube Support Plate	SG 1-3					Tube Support Plate	SG 1-4				
	No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY		No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY
1H	133	2.15	0.72	0.52	0.06	1H	122	2.21	0.69	0.55	0.09
2H	62	2.30	0.64	0.63	0.04	2H	46	1.38	0.58	0.31	0.06
3H	21	1.99	0.93	0.31	0.09	3H	23	1.47	0.69	0.33	0.10
4H	19	2.03	0.66	0.46	0.12	4H	13	1.50	0.52	0.18	0.03
5H	16	1.78	0.63	0.34	0.03	5H	6	0.72	0.50	0.23	0.10
6H	7	0.72	0.48	0.23	0.09	6H	2	0.40	0.34	0.07	0.04
7H	1	0.67	0.67	0.10	0.10	7H	0	0.00	0.00	0.00	0.00
CL	11	0.87	0.54	0.21	0.08	CL	5	0.66	0.37	0.16	0.04
All Inds	270	2.30	0.69	0.63	0.06	All Inds	217	2.21	0.64	0.55	0.08

Tube Support Plate	Composite of All Four SGs				
	No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY
1H	1008	2.82	0.71	1.05	0.07
2H	477	2.30	0.59	0.63	0.04
3H	171	2.03	0.65	0.46	0.06
4H	101	2.03	0.55	0.46	0.06
5H	42	1.78	0.59	0.50	0.06
6H	22	0.78	0.48	0.23	0.06
7H	2	0.67	0.45	0.10	0.02
CL	27	1.04	0.51	0.25	0.06
All Inds	1850	2.82	0.66	1.05	0.06

Table 3-6: Voltage Growth for Cycles 9 through 13

		SG 1-1	SG 1-2	SG 1-3	SG 1-4	All
Cycle 9	Avg BOC Volts	0.281	0.307	0.457	0.327	0.343
	Average Growth Per EFPY	0.113	0.072	0.127	0.151	0.102
	Average Percent Growth Per EFPY	40.2%	23.3%	27.8%	46.0%	29.6%
Cycle 10	Avg BOC Volts	0.350	0.405	0.602	0.546	0.437
	Avg Growth Per EFPY	0.171	0.135	0.123	0.108	0.143
	Average Percent Growth Per EFPY	49.0%	33.3%	20.4%	19.8%	32.8%
Cycle 11	Avg BOC Volts	0.440	0.548	0.653	0.500	0.515
	Avg Growth Per EFPY	0.127	0.091	0.066	0.085	0.102
	Average Percent Growth Per EFPY	28.8%	16.6%	10.1%	17.0%	19.8%
Cycle 12	Avg BOC Volts	0.488	0.565	0.664	0.484	0.535
	Avg Growth Per EFPY	0.178	0.091	0.068	0.132	0.130
	Average Percent Growth Per EFPY	36.4%	16.0%	10.6%	27.2%	24.3%
Cycle 13	Avg BOC Volts	0.589	0.589	0.621	0.555	0.590
	Avg Growth Per EFPY	0.070	0.043	0.061	0.079	0.062
	Average Percent Growth Per EFPY	11.9%	7.3%	9.8%	14.2%	10.5%

Table 3-7: Summary of Independent Cycle 13 Voltage Growth per EFPY

Delta Volts	SG 1-1		SG 1-2		SG 1-3		SG 1-4		Total	
	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF
<=0.0	192	0.258	170	0.338	73	0.286	44	0.251	479	0.286
0.1	321	0.690	213	0.761	104	0.694	70	0.651	708	0.708
0.2	159	0.903	86	0.932	46	0.875	33	0.840	324	0.901
0.3	50	0.970	21	0.974	20	0.953	22	0.966	113	0.968
0.4	11	0.985	6	0.986	5	0.973	4	0.989	26	0.984
0.5	6	0.993	5	0.996	4	0.988	1	0.994	16	0.993
0.6	1	0.995	1	0.998	2	0.996	1	1.000	5	0.996
0.7	0	0.995	0	0.998	1	1.000	0	1.000	1	0.997
0.8	1	0.996	1	1.000	0	1.000	0	1.000	2	0.998
0.9	2	0.999	0	1.000	0	1.000	0	1.000	2	0.999
1	0	0.999	0	1.000	0	1.000	0	1.000	0	0.999
1.1	1	1.000	0	1.000	0	1.000	0	1.000	1	1.000
1.2	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
1.3	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
1.4	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
1.5	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
1.6	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
1.7	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
1.8	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
1.9	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.1	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.2	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.3	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.4	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.5	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.6	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.7	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.8	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.9	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.1	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.2	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.3	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.4	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.5	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
>3.5	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
Total	744	NA	503	NA	255	NA	175	NA	1677	NA
Upper 95% Growth	0.246		0.216		0.288		0.269		0.246	

Table 3-8: Delta Volts Adjustments Based on Cycle 13 Breakpoints

SG	Cycle	Breakpoint(s)	Average Growth (Volts per EFPY)		
			Bin1	Bin2	Bin3
1-1	Cycle 12	0.50 / 0.98	0.119	0.206	0.542
	Cycle 13		0.049	0.072	0.146
	Delta		<0	<0	<0
1-2	Cycle 12	1.25	0.074	0.392	NA
	Cycle 13		0.042	0.062	
	Delta		<0	<0	
1-3	Cycle 12	0.60	0.060	0.080	NA
	Cycle 13		0.060	0.063	
	Delta		0	<0	
1-4	Cycle 12	1.00	0.111	0.357	NA
	Cycle 13		0.065	0.170	
	Delta		<0	<0	
Composite	Cycle 12	0.50 / 0.99	0.095	0.133	0.331
	Cycle 13		0.052	0.063	0.095
	Delta		<0	<0	<0

Table 3-9: Delta Volts Adjustments Based on Cycle 12 Breakpoints

SG	Cycle	Breakpoint(s)	Average Growth (Volts per EFPY)		
			Bin1	Bin2	Bin3
1-1	Cycle 12	0.50 / 0.99	0.119	0.202	0.578
	Cycle 13		0.049	0.072	0.148
	Delta		<0	<0	<0
1-2	Cycle 12	1.16	0.076	0.309	NA
	Cycle 13		0.045	0.011	
	Delta		<0	<0	
1-3	Cycle 12	1.05	0.056	0.133	NA
	Cycle 13		0.065	0.040	
	Delta		+0.009	<0	
1-4	Cycle 12	0.82	0.110	0.297	NA
	Cycle 13		0.067	0.131	
	Delta		<0	<0	
Composite	Cycle 12	0.50 / 1.02	0.095	0.133	0.331
	Cycle 13		0.052	0.063	0.095
	Delta		<0	<0	<0

Table 3-10: Cycle 13 Voltage Dependent Growth for SG 1-1 (Information Only)

Growth (volts/EFPY)	Cycle 13 Data		
	Bin1 (<=0.5v)	Bin2 (0.5v-0.98v)	Bin3 (>0.98v)
<0	107	70	15
0.1	198	94	29
0.2	68	62	29
0.3	12	20	18
0.4	3	4	4
0.5	1	0	5
0.6	0	1	0
0.7	0	0	0
0.8	0	1	0
0.9	0	0	2
1	0	0	0
1.1	0	1	0
1.2	0	0	0
1.3	0	0	0
1.4	0	0	0
1.5	0	0	0
1.6	0	0	0
1.7	0	0	0
1.8	0	0	0
1.9	0	0	0
2	0	0	0
>2	0	0	0
Total	389	253	102

Table 3-11: Cycle 13 Voltage Dependent Growth for SG 1-2 (Information Only)

Growth (volts/EFPY)	Cycle 13 Data	
	Bin1 (<=1.25v)	Bin2 (>1.25v)
<0	162	8
0.1	209	4
0.2	83	3
0.3	17	4
0.4	5	1
0.5	5	0
0.6	1	0
0.7	0	0
0.8	0	1
0.9	0	0
1	0	0
1.1	0	0
1.2	0	0
1.3	0	0
1.4	0	0
1.5	0	0
1.6	0	0
1.7	0	0
1.8	0	0
1.9	0	0
2	0	0
>2	0	0
Total	482	21

Table 3-12: Cycle 13 Voltage Dependent Growth for SG 1-3 (Information Only)

Growth (volts/EFPY)	Cycle 13 Data	
	Bin1 (<=0.6v)	Bin2 (>0.6v)
<0	39	34
0.1	72	32
0.2	27	19
0.3	12	8
0.4	3	2
0.5	0	4
0.6	0	2
0.7	0	1
0.8	0	0
0.9	0	0
1	0	0
1.1	0	0
1.2	0	0
1.3	0	0
1.4	0	0
1.5	0	0
1.6	0	0
1.7	0	0
1.8	0	0
1.9	0	0
2	0	0
>2	0	0
Total	153	102

Table 3-13: Cycle 13 Voltage Dependent Growth for SG 1-4 (Information Only)

Growth (volts/EFPY)	Cycle 13 Data	
	Bin1 (<=1v)	Bin2 (>1v)
<0	41	3
0.1	64	6
0.2	30	3
0.3	16	6
0.4	1	3
0.5	0	1
0.6	0	1
0.7	0	0
0.8	0	0
0.9	0	0
1	0	0
1.1	0	0
1.2	0	0
1.3	0	0
1.4	0	0
1.5	0	0
1.6	0	0
1.7	0	0
1.8	0	0
1.9	0	0
2	0	0
>2	0	0
Total	152	23

Table 3-14: Cycle 13 Voltage Dependent Growth for All SGs (Information Only)

Growth (volts/EFPY)	Cycle 13 Data		
	Bin1 (<=0.5v)	Bin2 (0.5v-0.99v)	Bin3 (>0.99v)
<0	234	183	62
0.1	431	219	58
0.2	152	125	47
0.3	33	47	33
0.4	8	9	9
0.5	3	7	6
0.6	0	2	3
0.7	0	0	1
0.8	0	1	1
0.9	0	0	2
1	0	0	0
1.1	0	1	0
1.2	0	0	0
1.3	0	0	0
1.4	0	0	0
1.5	0	0	0
1.6	0	0	0
1.7	0	0	0
1.8	0	0	0
1.9	0	0	0
2	0	0	0
>2	0	0	0
Total	861	594	222

Table 3-15: Cycle 12 Voltage Dependent Growth for SG 1-1 (Used for SG 1-1 EOC-14 Projections)

Growth in Volts/EFPY	BOC Voltage		
	<=0.5V	0.5V to 0.99V	>0.99V
0	57	27	10
0.1	139	40	1
0.2	92	31	5
0.3	44	20	5
0.4	24	20	1
0.5	6	8	5
0.6	5	7	4
0.7	0	3	2
0.8	0	2	1
0.9	0	2	1
1	0	1	1
1.1	0	0	2
1.2	0	0	0
1.3	0	0	1
1.4	0	0	0
1.5	0	1	0
1.6	0	0	0
1.7	0	1	0
1.8	0	0	0
1.9	0	0	1
2	0	0	0
2.1	0	0	0
2.2	0	0	0
2.3	0	0	0
2.4	0	0	1
2.5	0	0	2
2.6	0	0	0
2.7	0	0	0
2.8	0	0	0
2.9	0	0	0
3	0	0	0
3.1	0	0	1
3.2	0	0	0
3.3	0	0	0
3.4	0	0	0
3.5	0	0	0
Total	367	163	44

Table 3-16: Cycle 12 Voltage Dependent Growth for All SGs (Used for SGs 1-2, 1-3, and 1-4 EOC-14 Projections)

Growth in Volts/EFPY	BOC Voltage		
	<=0.5V	0.5V to 1.02V	>1.02V
0	133	99	29
0.1	340	132	18
0.2	163	84	26
0.3	60	39	10
0.4	32	31	5
0.5	10	11	7
0.6	5	9	8
0.7	0	4	3
0.8	0	2	2
0.9	0	2	1
1	0	2	2
1.1	0	0	3
1.2	0	1	1
1.3	0	0	2
1.4	0	0	0
1.5	0	1	0
1.6	0	0	1
1.7	0	1	0
1.8	0	0	0
1.9	0	0	1
2	0	0	0
2.1	0	0	0
2.2	0	0	0
2.3	0	0	0
2.4	0	0	1
2.5	0	0	2
2.6	0	0	0
2.7	0	0	0
2.8	0	0	0
2.9	0	0	0
3	0	0	0
3.1	0	0	1
3.2	0	0	0
3.3	0	0	0
3.4	0	0	0
3.5	0	0	0
Total	743	418	123

Table 3-17: BOC-14 Voltage Distributions

	SG 1-1			SG 1-2		SG 1-3		SG 1-4	
Bin	As-Found	Repaired	Bin	As-Found	Repaired	As-Found	Repaired	As-Found	Repaired
0.1	0	0	0.1	0	0	0	0	0	0
0.2	23	1	0.2	10	0	6	0	5	0
0.3	79	1	0.3	48	0	28	1	21	0
0.4	128	0	0.4	73	1	34	0	27	0
0.5	116	1	0.5	104	6	47	1	49	2
0.6	85	4	0.6	91	5	30	3	29	0
0.7	86	7	0.7	76	3	24	0	14	0
0.8	41	2	0.8	49	1	16	2	22	0
0.9	47	1	0.9	39	0	23	0	2	0
0.99	30	0	1	26	0	12	1	17	0
1	4	0	1.02	5	0	3	0	0	0
1.1	42	0	1.1	13	0	8	0	9	0
1.2	19	1	1.2	16	0	8	0	4	0
1.3	16	0	1.3	6	0	4	0	2	0
1.4	11	0	1.4	7	0	4	0	3	0
1.5	23	0	1.5	7	0	4	0	6	0
1.6	2	0	1.6	3	1	6	0	2	0
1.7	5	0	1.7	0	0	2	1	1	0
1.8	7	0	1.8	1	0	3	0	1	0
1.9	4	0	1.9	1	0	2	0	0	0
2	2	1	2	1	0	3	0	0	0
2.1	7	7	2.1	1	1	1	1	2	2
2.2	1	1	2.2	0	0	1	1	0	0
2.3	3	3	2.3	1	1	1	1	1	1
2.4	1	1	2.4	0	0	0	0	0	0
2.5	1	1	2.5	0	0	0	0	0	0
2.6	1	1	2.6	0	0	0	0	0	0
2.7	0	0	2.7	0	0	0	0	0	0
2.8	0	0	2.8	0	0	0	0	0	0
2.9	0	0	2.9	1	1	0	0	0	0
3	0	0	3	0	0	0	0	0	0
Total	**784**	**33**		**579**	**20**	**270**	**12**	**217**	**5**

Table 3-18: Re-tested DOSs ≥ 1.5 Volts that Failed the Probe Wear Check

SG	Row	Col	Ind	Elev	Volts	Probe	Cal No.	ARC Out 1R13	% Difference
SG 1-1	8	57	RSS	1H	2.63	720RF	CL-35	Yes	
			DOS	1H	2.43	720RF	CL-41		-7.6%
	10	39	RSS	1H	1.59	720RF	CL-24	Yes	
			DOS	1H	1.48	720RF	CL-41		-6.9%
	12	2	RSS	1H	1.81	720RF	CL-21	Yes	
			DOS	1H	1.86	720RF	CL-36		2.8%
	14	80	RSS	1H	2.3	720RF	CL-31	Yes	
			DOS	1H	2.3	720RF	CL-41		0%
	17	56	RSS	1H	2.06	720RF	CL-28	Yes	
			DOS	1H	2.02	720RF	CL-41		-1.9%
	17	74	RSS	1H	1.92	720RF	CL-30	Yes	
			DOS	1H	2.05	720RF	CL-41		6.8%
	20	47	RSS	1H	1.7	720RF	CL-14	Yes	
			RSS	1H	1.6	720RF	CL-27	Yes	
			DOS	1H	1.69	720RF	CL-36		-0.6% / 5.6%
	22	69	RSS	1H	1.97	720RF	CL-29	Yes	
			DOS	1H	1.96	720RF	CL-41		-0.5%
	23	41	RSS	1H	1.57	720RF	CL-15	Yes	
			DOS	1H	1.43	720RF	CL-27		-8.9%
	23	51	RSS	1H	1.57	720RF	CL-29	Yes	
			DOS	1H	1.45	720RF	CL-41		-7.6%
	25	44	RSS	1H	1.78	720RF	CL-15	Yes	
			RSS	1H	1.62	720RF	CL-27	Yes	
			DOS	1H	1.77	720RF	CL-36		-0.6% / 9.3%
	25	52	RSS	1H	2.08	720RF	CL-29	Yes	
			DOS	1H	2.22	720RF	CL-41		6.7%
	26	32	RSS	1H	1.63	720RF	CL-13	Yes	
			RSS	1H	1.75	720RF	CL-27	Yes	
			DOS	1H	1.75	720RF	CL-36		7.4% / 0%
	26	46	RSS	1H	1.6	720RF	CL-11	Yes	
			RSS	1H	2	720RF	CL-27	Yes	
			DOS	1H	1.78	720RF	CL-36		11.3% / -11%
	27	42	RSS	1H	2.06	720RF	CL-11	Yes	
			RSS	1H	2.2	720RF	CL-27	Yes	
			DOS	1H	2.16	720RF	CL-36		4.9% / -1.8%
	28	32	RSS	1H	1.64	720RF	CL-13	Yes	
			RSS	1H	1.75	720RF	CL-27	Yes	
			DOS	1H	1.79	720RF	CL-36		9.1% / 2.3%
	29	29	RSS	2H	1.54	720RF	CL-14	Yes	
			RSS	2H	1.62	720RF	CL-27	Yes	
			DOS	2H	1.62	720RF	CL-36		5.2% / 0%
	30	44	RSS	1H	1.84	720RF	CL-11	Yes	
			RSS	1H	2.06	720RF	CL-27	Yes	
			DOS	1H	2.08	720RF	CL-36		13% / 1%
	33	55	RSS	1H	1.59	720RF	HL-8	Yes	
			DOS	1H	1.45	720RF	CL-27		-8.8%
	38	36	RSS	1H	1.52	720RF	CL-11	Yes	
			RSS	1H	1.51	720RF	CL-27	Yes	
			DOS	1H	1.49	720RF	CL-36		-2% / -1.3%
	42	36	RSS	1H	1.51	720RF	CL-11	Yes	
			RSS	1H	1.62	720RF	CL-27	Yes	
			DOS	1H	1.83	720RF	CL-36		21.2% / 13%

Table 3-18 (cont): Retested DOSs ≥1.5 Volts that Failed the Probe Wear Check

SG	Row	Col	Ind	Elev	Volts	Probe	Cal No.	ARC Out 1R13	% Difference
SG 1-2	5	20	RSS	2H	1.54	720RF	HL-3	Yes	
			DOS	2H	1.41	720RF	HL-20		-8.4%
	7	49	RSS	1H	1.89	720RF	CL-24	Yes	
			RSS	1H	1.77	720RF	CL-31	Yes	
			DOS	1H	1.72	720RF	CL-33		-9% / -2.8%
	15	74	RSS	1H	1.84	720RF	CL-28	Yes	
			DOS	1H	2.06	720RF	CL-33		12%
	19	31	RSS	1H	2.26	720RF	CL-18	Yes	
			RSS	1H	2.21	720RF	CL-31	Yes	
			DOS	1H	2.23	720RF	CL-33		-1.3% / 0.9%
	26	52	RSS	2H	1.97	720RF	HL-9	Yes	
			DOS	2H	1.95	720RF	CL-33		-1%
	30	42	RSS	1H	1.51	720RF	CL-14	Yes	
			DOS	1H	1.52	720RF	CL-33		0.7%
	32	43	RSS	4H	1.63	720RF	CL-15	Yes	
			DOS	4H	1.54	720RF	CL-33		-5.5%
	35	60	RSS	1H	3.18	720RF	HL-13	Yes	
			DOS	1H	2.82	720RF	CL-33		-11.3%
SG 1-3	10	10	RSS	2H	1.56	720RF	CL-56	Yes	
			DOS	2H	1.55	720RF	CL-68		-0.6%
	16	49	RSS	1H	1.68	720RF	CL-19	Yes	
			DOS	1H	1.73	720RF	CL-33		3%
	19	90	RSS	1H	1.81	720RF	CL-64	Yes	
			DOS	1H	1.96	720RF	CL-68		8.3%
SG 1-4	19	45	RSS	1H	1.59	720RF	CL-40	Yes	
			DOS	1H	1.51	720RF	CL-51		-5%
	32	28	RSS	1H	1.79	720RF	CL-19	Yes	
			DOS	1H	1.7	720RF	CL-34		-5%

Table 3-19: New 1R13 DOSs >=0.5 Volts In Tubes Inspected With A Worn Probe In 1R12

SG	Row	Col	Ind	Elev	Volts	Cal	New?	ARC Out 1R13	ARC Out 1R12
SG 1-1	26	46	DOS	1H	1.78	CL-36	New		Yes
	30	38	DOS	1H	0.88	CL-12	New		Yes
	16	12	DOS	1H	0.84	CL-15	New	Yes	Yes
	36	48	DOS	2H	0.82	CL-13	New	Yes	Yes
	17	27	DOS	3H	0.8	CL-13	New	Yes	Yes
	24	54	DOS	1H	0.8	CL-29	New	Yes	Yes
	19	68	DOS	3H	0.73	CL-29	New	Yes	Yes
	17	18	DOS	1H	0.69	CL-15	New	Yes	Yes
	17	24	DOS	2H	0.67	CL-17	New	Yes	Yes
	30	30	DOS	1H	0.66	CL-13	New	Yes	Yes
	18	30	DOS	2H	0.66	CL-14	New	Yes	Yes
	44	52	DOS	2H	0.62	HL-8	New	Yes	Yes
	36	62	DOS	4H	0.6	HL-8	New	Yes	Yes
	18	31	DOS	1H	0.59	CL-14	New	Yes	Yes
	20	65	DOS	3H	0.59	CL-29	New	Yes	Yes
	17	72	DOS	1H	0.52	CL-30	New	Yes	Yes
	46	49	DOS	2H	0.51	CL-12	New		Yes
	40	63	DOS	1H	0.51	HL-9	New	Yes	Yes
	26	39	DOS	2H	0.5	CL-11	New	Yes	Yes
	14	20	DOS	1H	0.5	CL-16	New	Yes	Yes
	8	32	DOS	3H	0.5	CL-24	New	Yes	Yes
	15	71	DOS	1H	0.5	CL-30	New	Yes	Yes
	7	51	DOS	1H	0.5	CL-35	New	Yes	Yes
SG 1-2	34	76	DOS	3H	1.11	HL-15	New		Yes
	29	72	DOS	1H	1.08	HL-15	New		Yes
	40	68	DOS	1H	1.07	HL-15	New		Yes
	32	42	DOS	1H	0.91	CL-14	New	Yes	Yes
	25	87	DOS	2H	0.89	HL-17	New	Yes	Yes
	27	83	DOS	2H	0.84	HL-16	New	Yes	Yes
	28	41	DOS	1H	0.75	CL-15	New	Yes	Yes
	28	40	DOS	4H	0.73	CL-14	New	Yes	Yes
	12	86	DOS	4H	0.72	CL-30	New	Yes	Yes
	38	42	DOS	6H	0.69	CL-14	New	Yes	Yes
	36	42	DOS	4H	0.67	CL-14	New	Yes	Yes
	35	37	DOS	2H	0.67	CL-14	New	Yes	Yes
	2	64	DOS	2H	0.67	HL-20	New		Yes
	34	77	DOS	1H	0.66	HL-15	New		Yes
	21	23	DOS	6H	0.6	CL-18	New	Yes	Yes
	15	33	DOS	3H	0.58	CL-18	New	Yes	Yes
	28	40	DOS	5H	0.57	CL-14	New	Yes	Yes
	32	42	DOS	3H	0.56	CL-14	New	Yes	Yes
	27	68	DOS	1H	0.56	HL-15	New		Yes
	29	32	DOS	1H	0.55	CL-16	New		Yes
	41	54	DOS	1H	0.55	HL-11	New		Yes
	34	27	DOS	1H	0.54	CL-16	New		Yes
	30	47	DOS	1H	0.5	CL-14	New	Yes	Yes

Table 3-19 (cont): New 1R13 DOSs >=0.5 Volts In Tubes Inspected With a Worn Probe in 1R12

SG	Row	Col	Ind	Elev	Volts	Cal	New?	ARC Out 1R13	ARC Out 1R12
SG 1-3	6	83	DOS	1H	0.95	CL-62	New		Yes
	8	12	DOS	6C	0.87	CL-54	New	Yes	Yes
	8	79	DOS	1H	0.8	CL-62	New		Yes
	8	12	DOS	3H	0.74	CL-54	New	Yes	Yes
	14	61	DOS	1H	0.72	CL-43	New		Yes
	31	70	DOS	2H	0.71	CL-41	New		Yes
	6	57	DOS	3H	0.7	CL-59	New		Yes
	7	76	DOS	2H	0.62	CL-60	New		Yes
	4	75	DOS	3H	0.61	HL-4	New		Yes
	29	84	DOS	1H	0.58	CL-49	New		Yes
	7	85	DOS	1H	0.57	CL-61	New		Yes
	21	64	DOS	5H	0.56	CL-43	New		Yes
	32	25	DOS	2H	0.5	CL-15	New		Yes
	31	20	DOS	2H	0.5	CL-15	New		Yes
SG 1-4	18	81	DOS	2H	0.98	HL-20	New		Yes
	42	29	DOS	1H	0.74	CL-19	New	Yes	Yes
	2	2	DOS	5H	0.72	HL-5	New		Yes
	11	20	DOS	1H	0.68	CL-62	New		Yes
	17	42	DOS	2H	0.65	CL-40	New	Yes	Yes
	22	81	DOS	1H	0.59	HL-20	New		Yes
	14	33	DOS	1H	0.52	CL-35	New		Yes

Table 3-20: Summary of New DOS Indications for Probe Wear Comparison

SG	1R13 DOSs in Active Tubes (Total)	New 1R13 DOS (Not Detected in 1R12)	New 1R13 DOS in Tubes Insp. w/ Worn Probe in 1R12	New 1R13 DOS in Tubes Insp. w/ Good Probe in 1R12	New 1R13 DOS ≥0.5 Volts	New 1R13 DOS ≥0.5 Volts in Tubes Insp. w/ Worn Probe in 1R12
1-1	751	168	71	97	57	23
1-2	508	144	74	70	57	23
1-3	257	77	27	50	34	14
1-4	177	52	15	37	24	7
Total	**1693**	**441**	**187**	**254**	**172**	**67**

Table 3-21: Summary of ARC In and Out Tube Inspections in 1R12

SG	No. ARC Out Tubes	No. ARC In Tubes	Total
1-1	1799	1529	3328
1-2	1499	1918	3417
1-3	1376	2203	3579
1-4	1089	2410	3499
Total	5763	8060	13823

Table 3-22: NDE Uncertainty Distributions

Analyst Uncertainty

Percent Variation	Cumulative Probability
-40.0%	0.00005
-38.0%	0.00011
-36.0%	0.00024
-34.0%	0.00048
-32.0%	0.00095
-30.0%	0.00179
-28.0%	0.00328
-26.0%	0.00580
-24.0%	0.00990
-22.0%	0.01634
-20.0%	0.02608
-18.0%	0.04027
-16.0%	0.06016
-14.0%	0.08704
-12.0%	0.12200
-10.0%	0.16581
-8.0%	0.21867
-6.0%	0.28011
-4.0%	0.34888
-2.0%	0.42302
0.0%	0.50000
2.0%	0.57698
4.0%	0.65112
6.0%	0.71989
8.0%	0.78133
10.0%	0.83419
12.0%	0.87800
14.0%	0.91296
16.0%	0.93984
18.0%	0.95973
20.0%	0.97392
22.0%	0.98366
24.0%	0.99010
26.0%	0.99420
28.0%	0.99672
30.0%	0.99821
32.0%	0.99905
34.0%	0.99952
36.0%	0.99976
38.0%	0.99989
40.0%	0.99995

Std Deviation = 10.3%
Mean = 0.0%
No Cutoff

Acquisition Uncertainty

Percent Variation	Cumulative Probability
<-15.0%	0.00000
-15.0%	0.01606
-14.0%	0.02275
-13.0%	0.03165
-12.0%	0.04324
-11.0%	0.05804
-10.0%	0.07656
-9.0%	0.09927
-8.0%	0.12655
-7.0%	0.15866
-6.0%	0.19568
-5.0%	0.23753
-4.0%	0.28385
-3.0%	0.33412
-2.0%	0.38755
-1.0%	0.44320
0.0%	0.50000
1.0%	0.55680
2.0%	0.61245
3.0%	0.66588
4.0%	0.71615
5.0%	0.76247
6.0%	0.80432
7.0%	0.84134
8.0%	0.87345
9.0%	0.90073
10.0%	0.92344
11.0%	0.94196
12.0%	0.95676
13.0%	0.96835
14.0%	0.97725
15.0%	0.98394
>15.0%	1.00000

Std Deviation = 7.0%
Mean = 0.0%
Cutoff = +/- 15.0%

Table 3-23: 1R12 AONDB Reported as DOS in 1R13

SG	Row	Col	TSP	1R13 Bobbin		1R13 +Point			1R12 +Point			Change from R12 to R13 (v/EFPY)		Cycle 13 Avg Voltage Change (v/EFPY)	1R12 Postulated AONDB Voltage	Delta Voltage
				Ind	Volts	Ind	+Pt Volts	Inferred Volts	Ind	+Pt Volts	Inferred Volts	Inferred to DOS	Inferred to Inferred			
11	3	62	1H	DOS	0.17	SAI	0.23	0.53	SAI	0.14	0.44	-0.20	0.07	0.07	0.08	0.36
11	4	20	1H	DOS	0.2	SAI	0.22	0.52	SAI	0.17	0.47	-0.20	0.04	0.07	0.11	0.36
11	5	34	1H	DOS	0.32	MAI	0.23/0.10	0.67	SAI	0.19	0.49	-0.13	0.13	0.07	0.23	0.26
11	8	32	3H	DOS	0.5	SAI	0.13	0.43	SAI	0.15	0.45	0.03	-0.02	0.07	0.41	0.04
11	13	41	2H	DOS	0.21	SAI	0.19	0.49	SAI	0.15	0.45	-0.18	0.03	0.07	0.12	0.33
11	17	27	3H	DOS	0.8	SAI	0.31	0.62	SAI	0.28	0.58	0.16	0.02	0.07	0.71	-0.13
11	21	49	1H	DOS	0.61	SAI	0.21	0.51	SAI	0.18	0.48	0.09	0.02	0.07	0.52	-0.04
11	26	33	1H	DOS	0.35	SAI	0.16	0.46	SAI	0.14	0.44	-0.07	0.01	0.07	0.26	0.18
11	26	46	1H	DOS	1.78	SAI	0.66	0.98	SAI	0.67	0.71	0.80	0.20	0.07	1.69	-0.98
11	36	48	2H	DOS	0.82	MAI	0.16/0.17/0.21	0.84	MAI	0.17/0.14/0.17	0.81	0.01	0.02	0.07	0.73	0.08
11	42	51	1H	DOS	0.43	MAI	0.18/0.25	0.74	SAI	0.19	0.49	-0.05	0.18	0.07	0.34	0.15
12	4	85	3H	DOS	0.31	SAI	0.18	0.48	SAI	0.15	0.45	-0.11	0.02	0.04	0.26	0.19
12	14	84	2H	DOS	0.62	SAI	0.23	0.53	SAI	0.21	0.51	0.08	0.01	0.04	0.57	-0.06
12	15	42	2H	DOS	0.43	SAI	0.26	0.56	SAI	0.27	0.57	-0.11	-0.01	0.04	0.38	0.19
12	27	83	2H	DOS	0.84	SAI	0.22	0.52	SAI	0.19	0.49	0.26	0.02	0.04	0.79	-0.30
12	30	72	2H	DOS	0.29	SAI	0.21	0.51	SAI	0.18	0.48	-0.14	0.02	0.04	0.24	0.24
12	31	62	1H	DOS	0.95	SAI	0.35	0.66	SAI	0.26	0.56	0.29	0.07	0.04	0.90	-0.34
13	13	10	1H	DOS	0.5	SAI	0.22	0.52	SAI	0.14	0.44	0.04	0.06	0.06	0.42	0.02
14	5	79	1H	DOS	0.79	SAI	0.17	0.47	SAI	0.19	0.49	0.22	-0.02	0.08	0.68	-0.19
14	9	37	1H	DOS	1.46	MAI	0.12/0.16/0.42	0.96	MAI	0.11/0.14/0.31	0.86	0.44	0.07	0.08	1.35	-0.49
14	11	46	1H	DOS	2.01	MAI	0.35/0.39	0.96	MAI	0.34/0.41	0.96	0.78	0.00	0.08	1.90	-0.94

Figure 3-1: 1R13 As-Found Voltage Distributions SGs 1-1 and 1-2

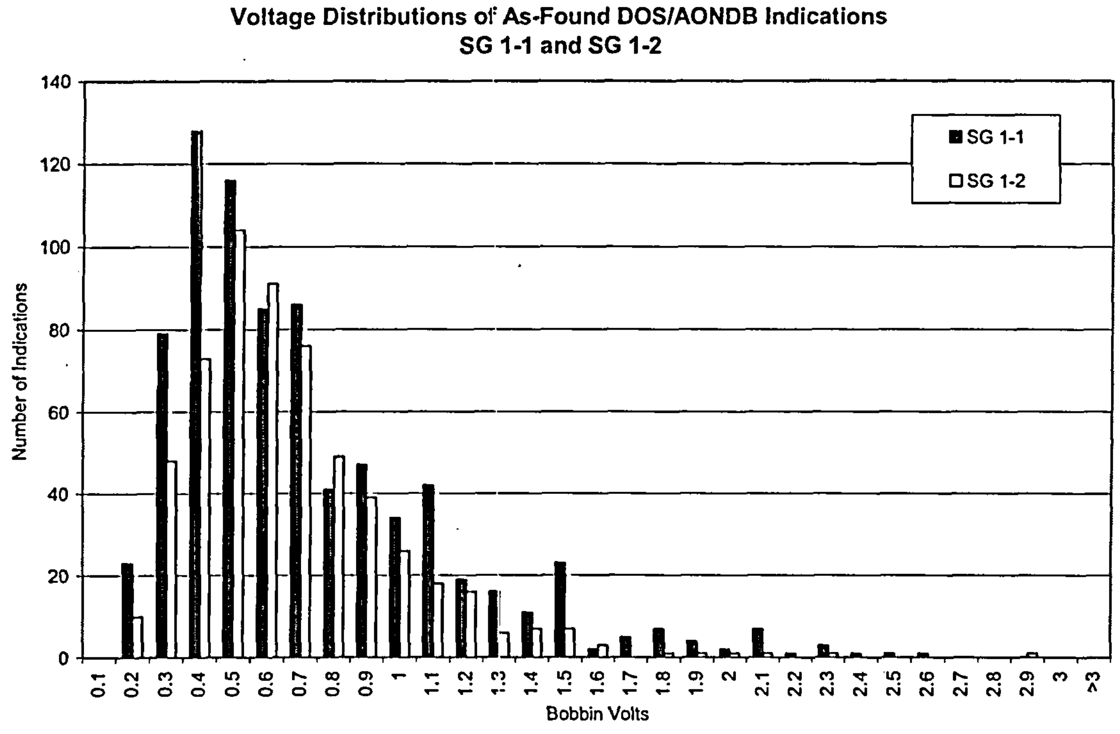


Figure 3-2: 1R13 As-Found Voltage Distributions SGs 1-3 and 1-4

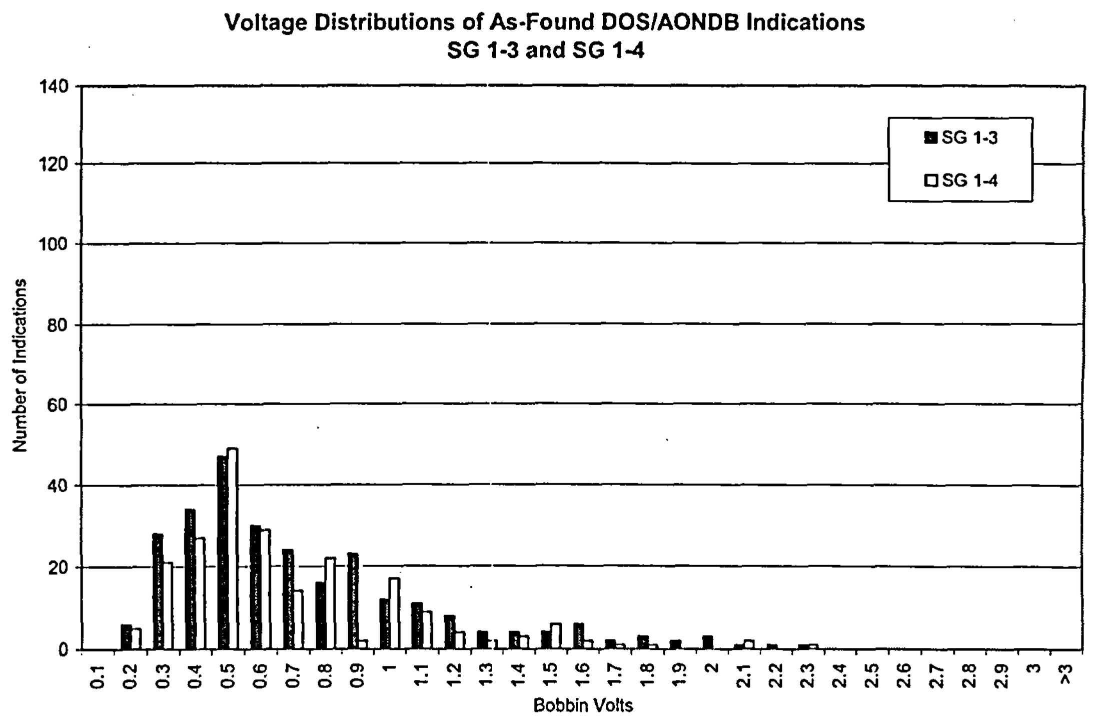


Figure 3-3: 1R13 Repaired Voltage Distributions SGs 1-1 and 1-2

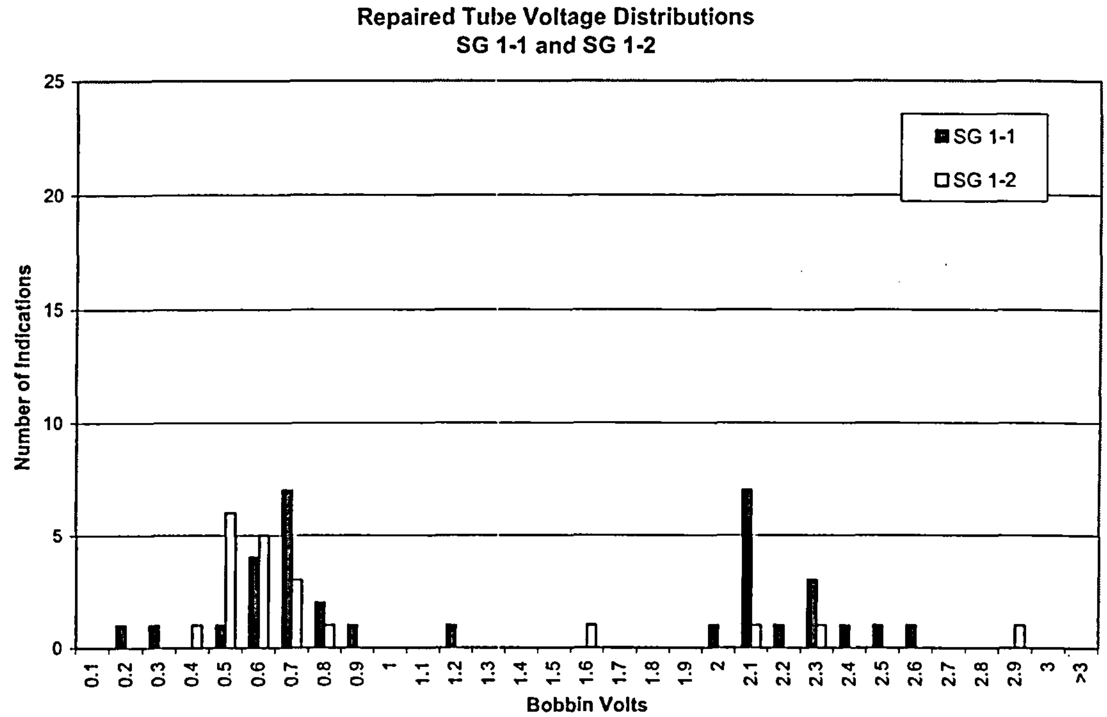


Figure 3-4: 1R13 Repaired Voltage Distributions SGs 1-3 and 1-4

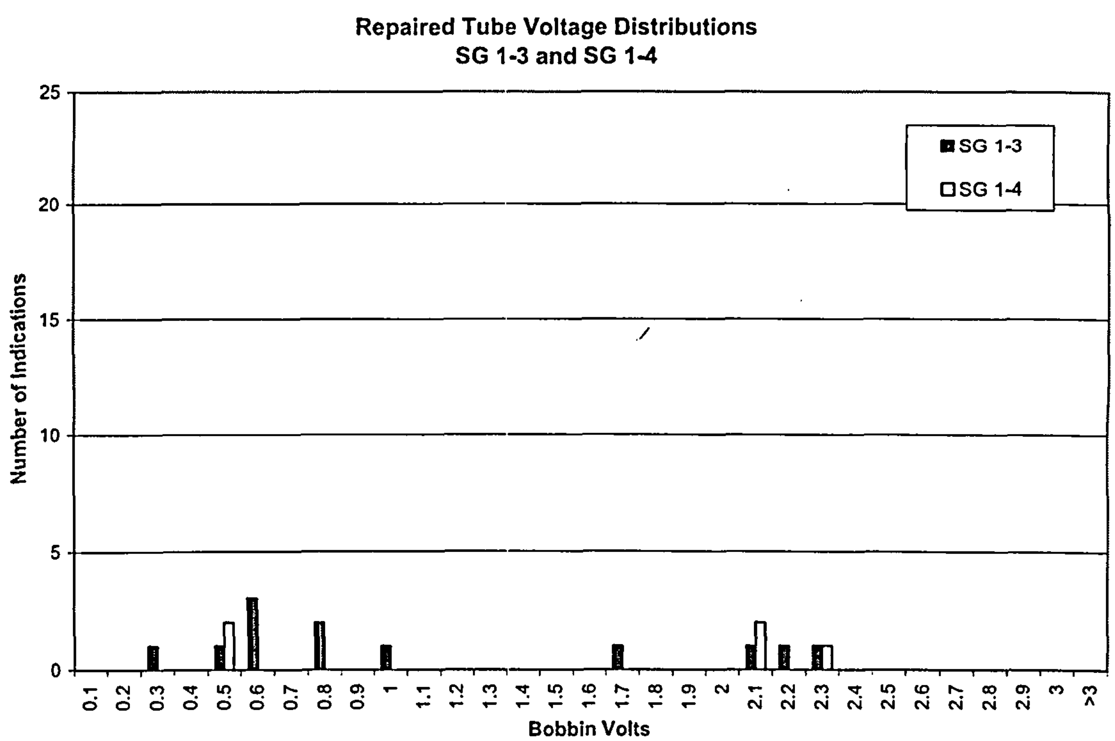


Figure 3-5: 1R13 RTS Voltage Distributions for RPC Confirmed or Not Inspected SGs 1-1 and 1-2

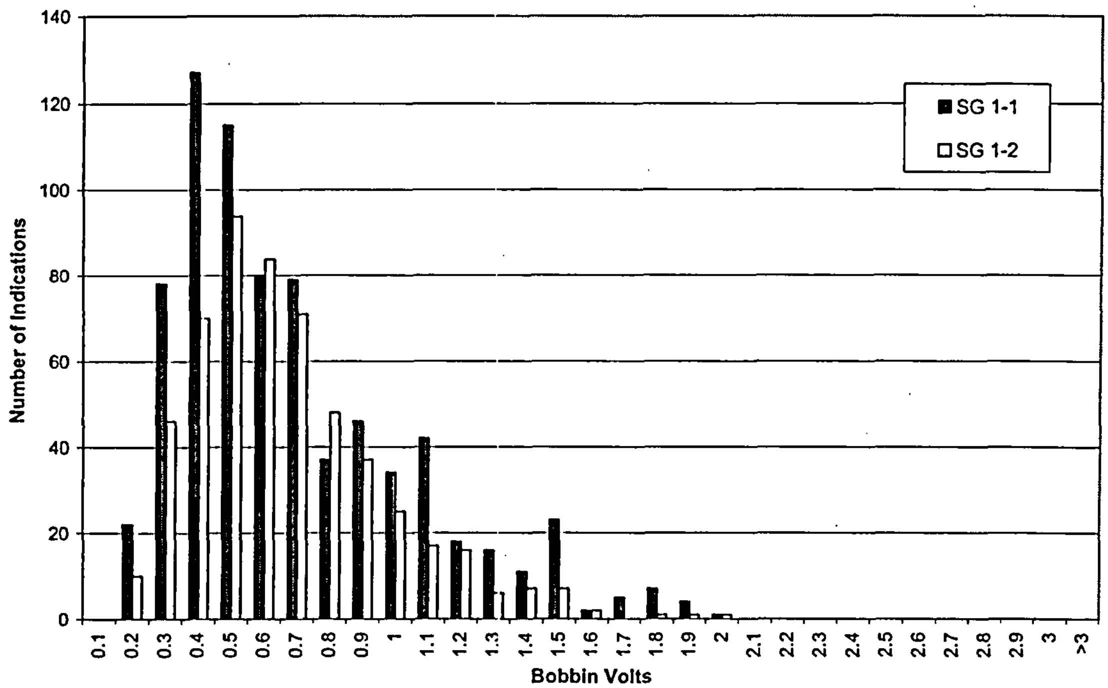


Figure 3-6: 1R13 RTS Voltage Distributions for RPC Confirmed or Not Inspected SGs 1-3 and 1-4

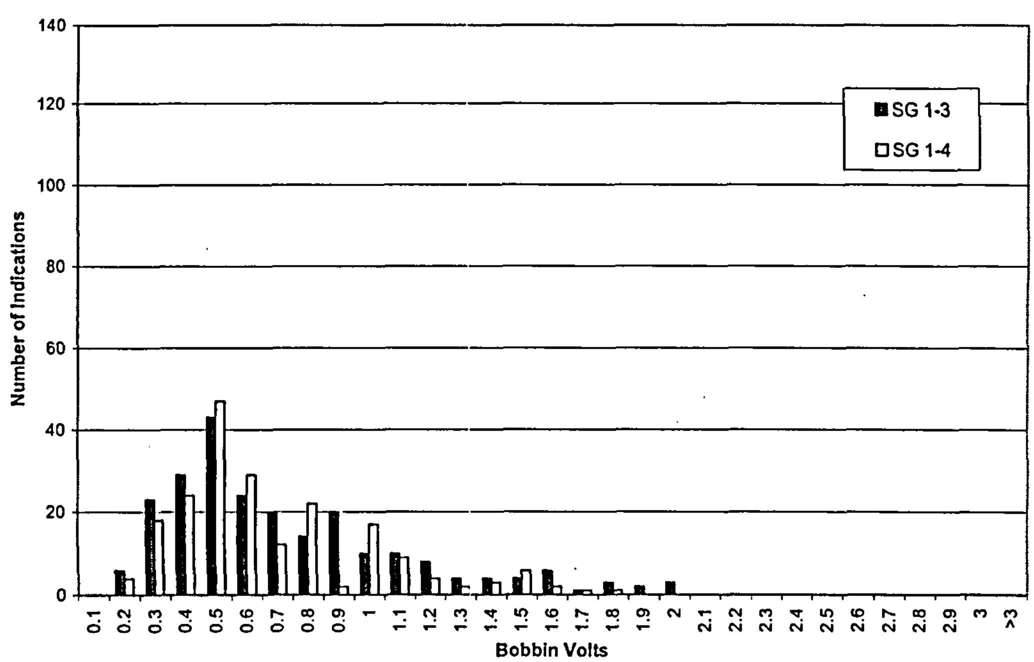


Figure 3-7: 1R13 Indications RTS Voltage Distributions SGs 1-1 and 1-2

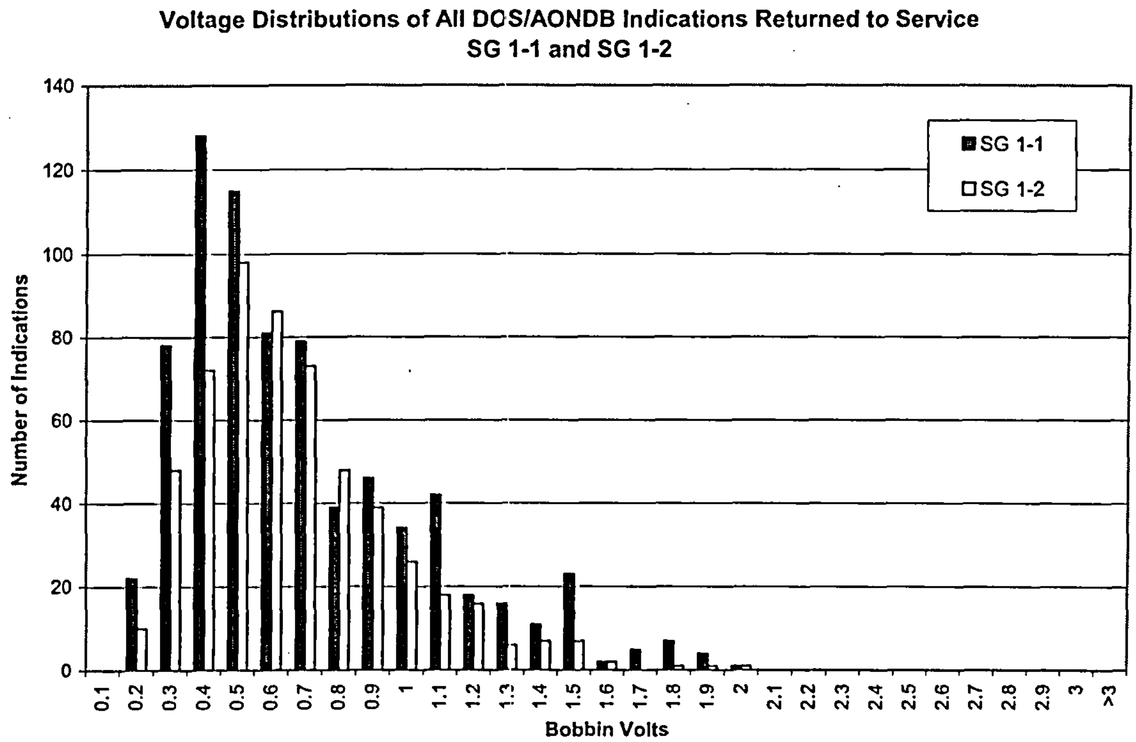


Figure 3-8: 1R13 Indications RTS Voltage Distributions SGs 1-3 and 1-4

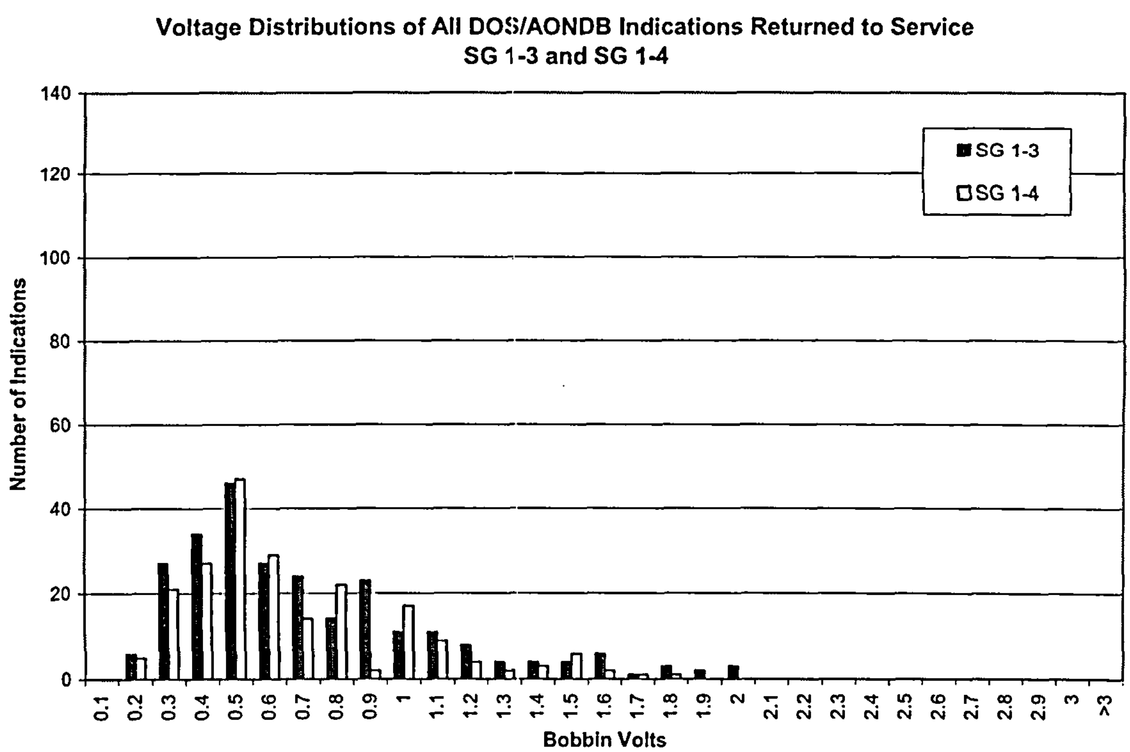
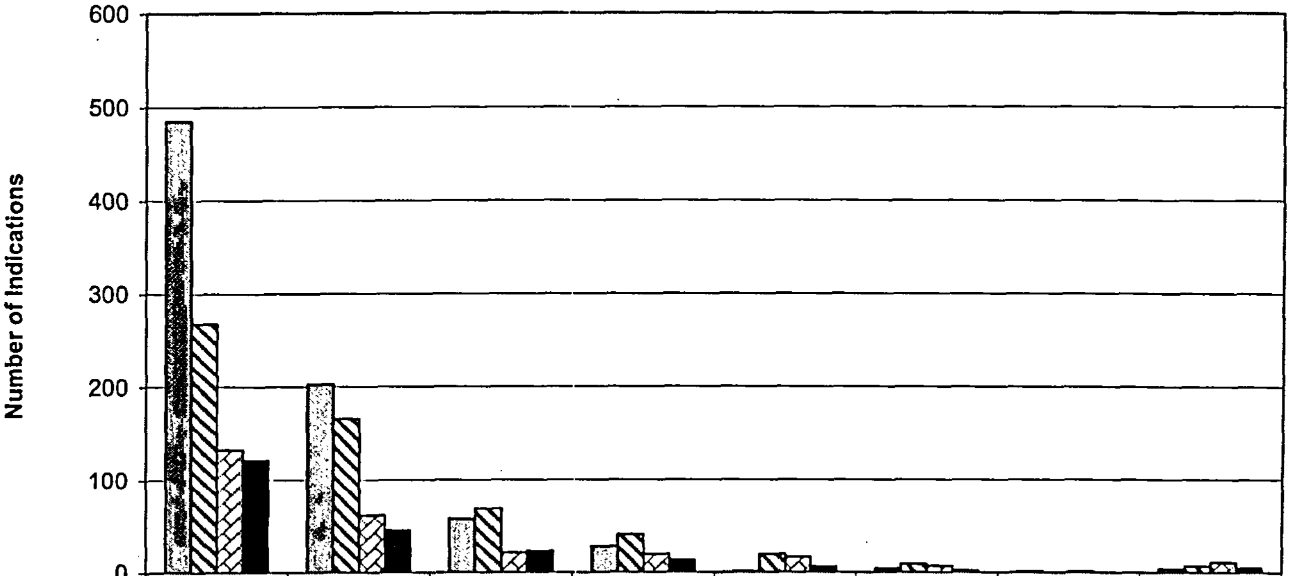


Figure 3-9: 1R13 DOS vs. TSP Elevation

Distribution of Indications by TSP Location



	1H	2H	3H	4H	5H	6H	7H	CL
SG 1-1	485	203	58	28	1	4	1	4
SG 1-2	268	166	69	41	19	9	0	7
SG 1-3	133	62	21	19	16	7	1	11
SG 1-4	122	46	23	13	6	2	0	5

Tube Support Plate

Figure 3-10: Cycle 13 Growth Distributions SGs 1-1 and 1-2

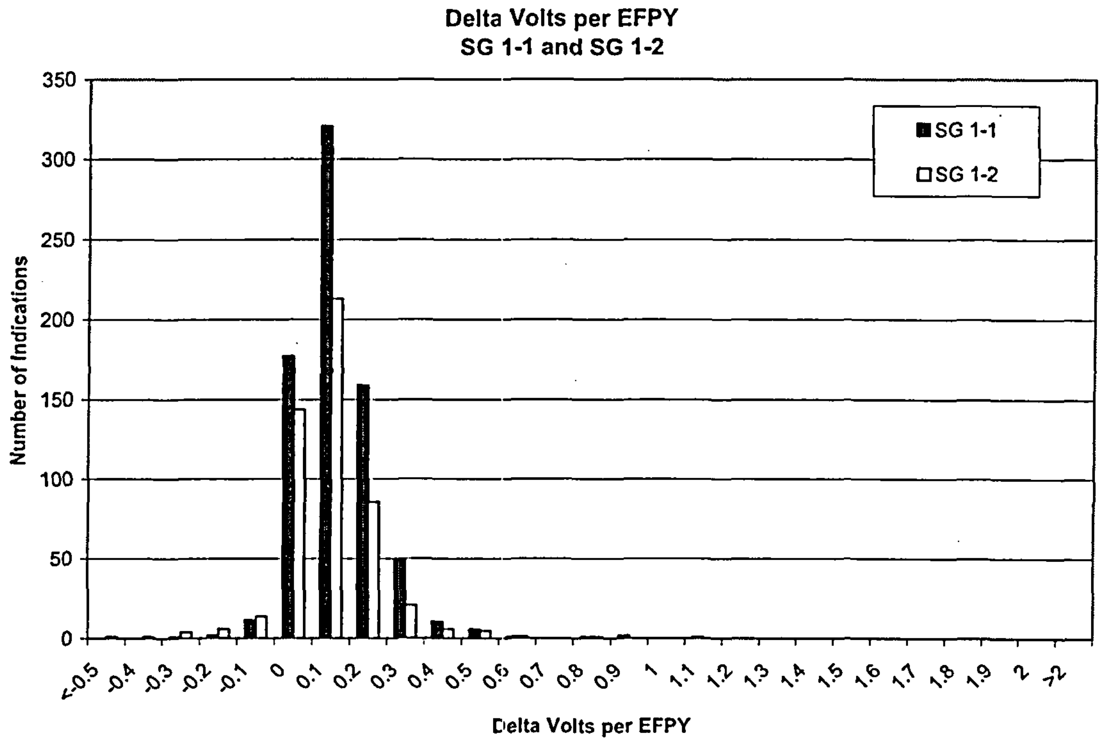


Figure 3-11: Cycle 13 Growth Distributions SGs 1-3 and 1-4

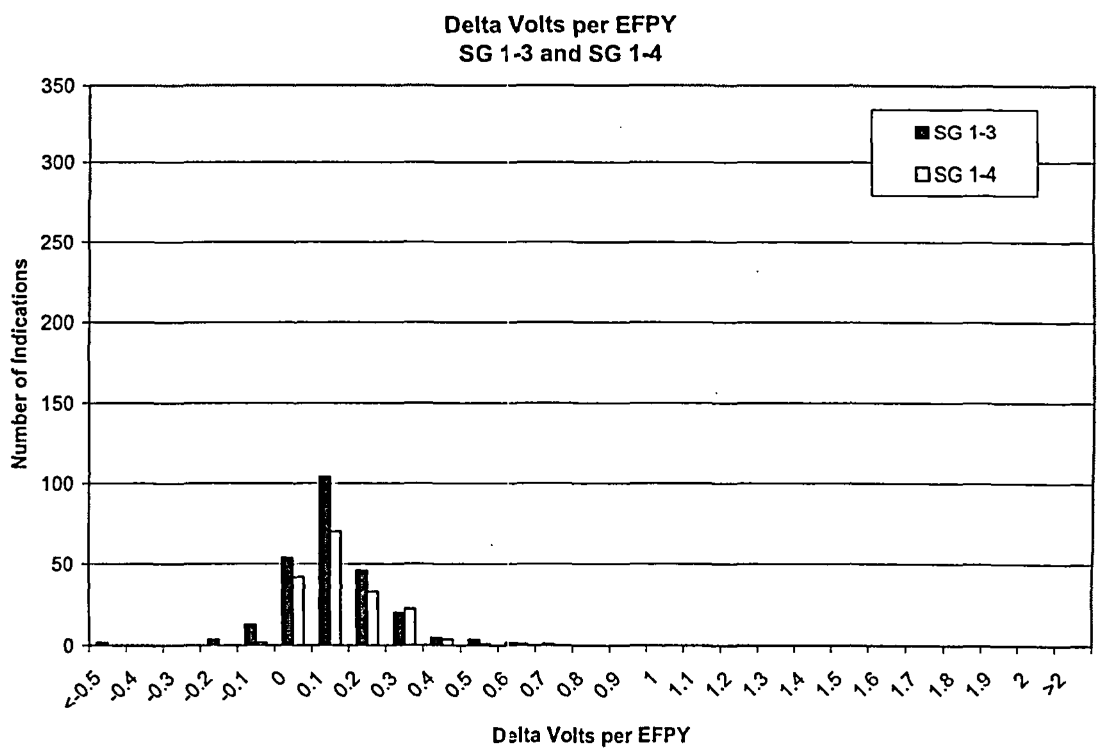


Figure 3-12: Cycle 13 Independent Growth Curves – All SGs

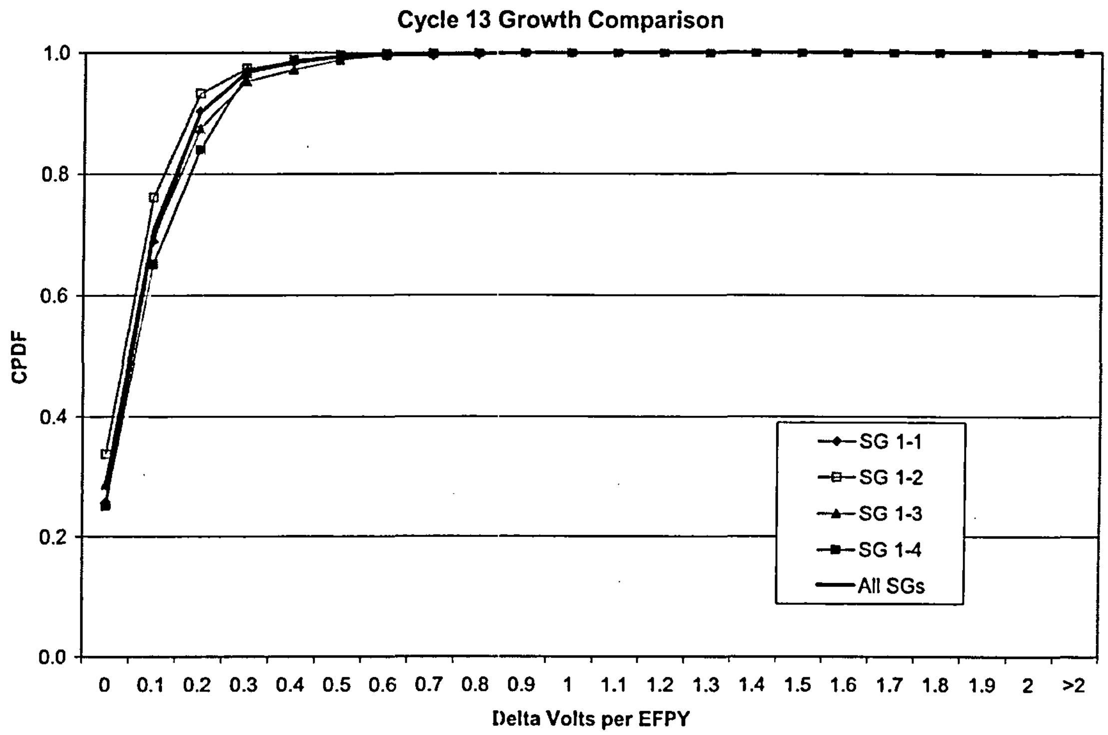


Figure 3-13: Historical Change in Growth and BOC Voltage - All SGs

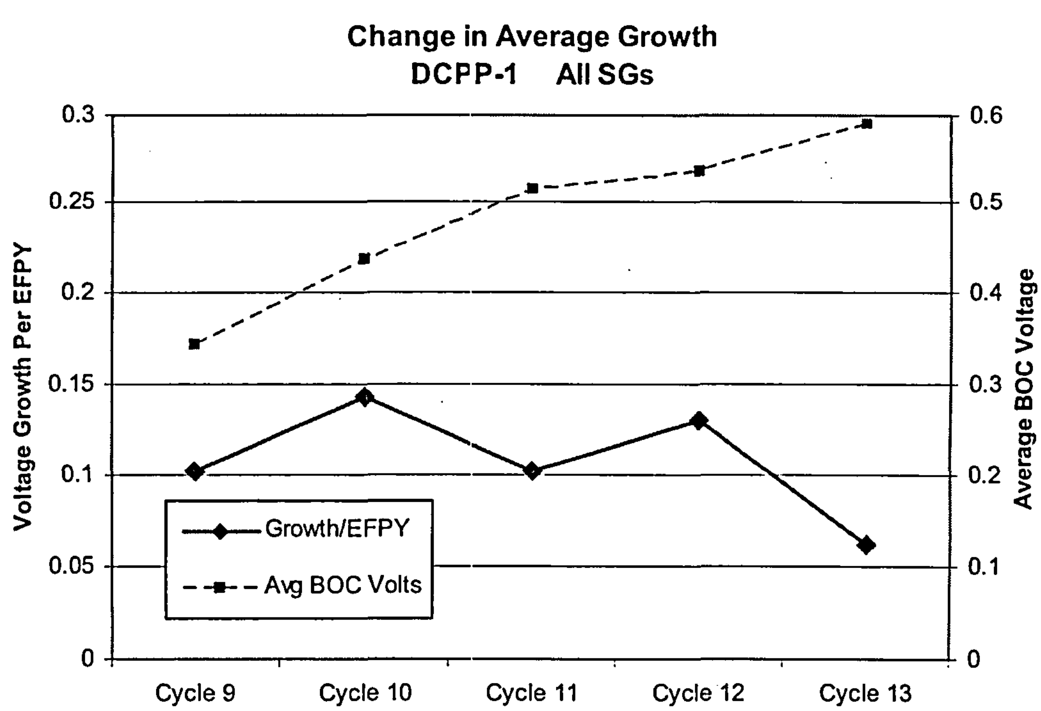


Figure 3-14: SG 1-1 Cycle 13 Growth vs. BOC Voltage

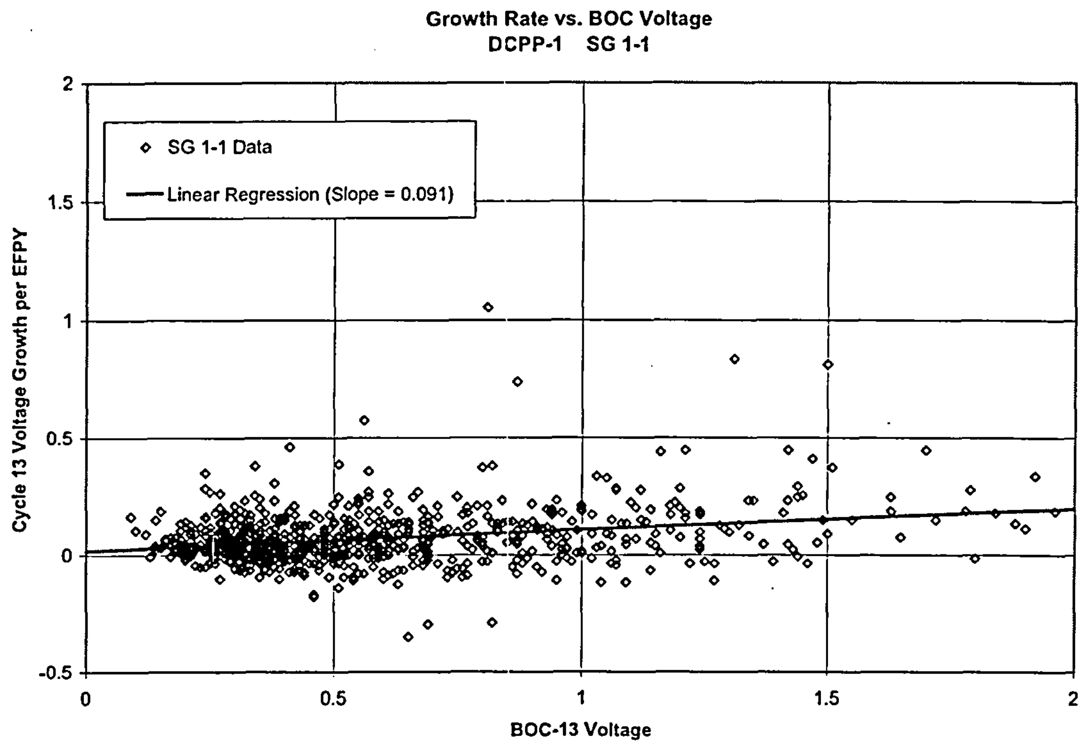


Figure 3-15: SG 1-2 Cycle 13 Growth vs. BOC Voltage

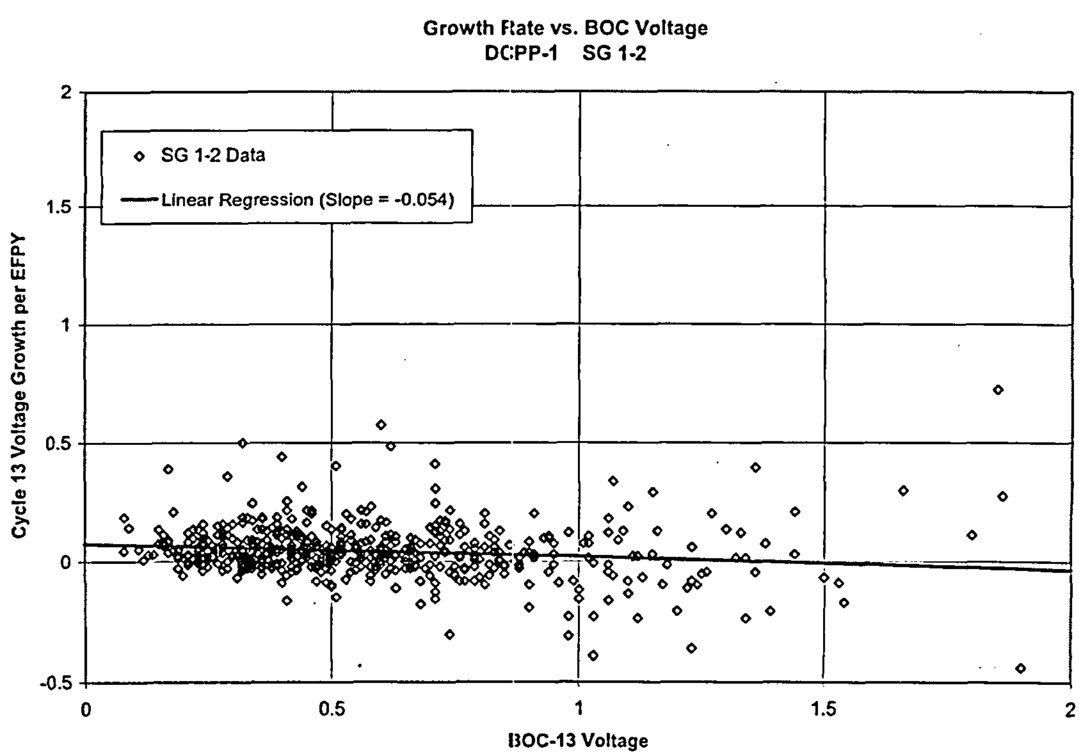


Figure 3-16: SG 1-3 Cycle 13 Growth vs. BOC Voltage

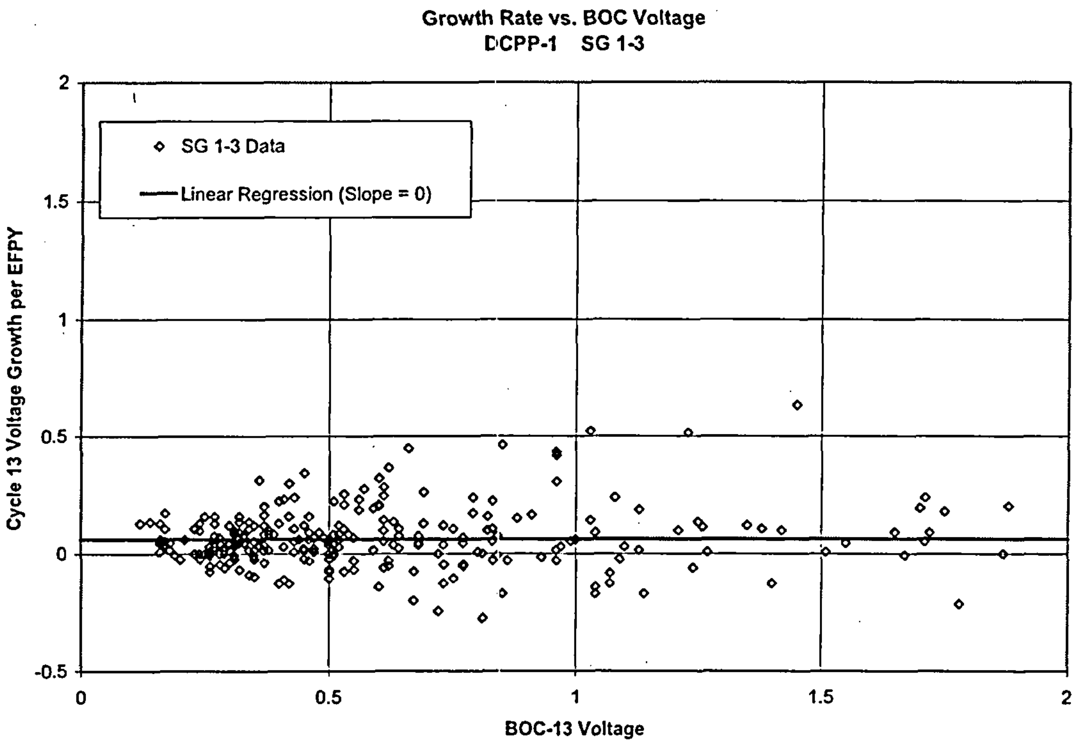


Figure 3-17: SG 1-4 Cycle 13 Growth vs. BOC Voltage

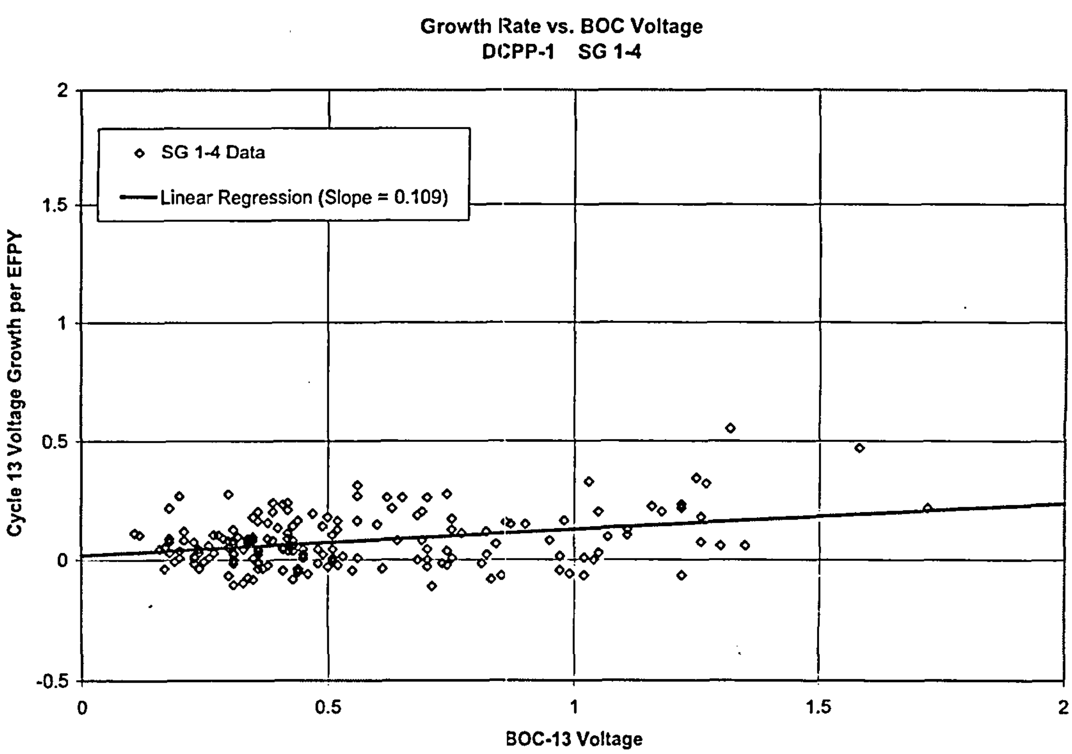


Figure 3-18: Cycle 13 Growth vs. BOC Voltage for All Steam Generators

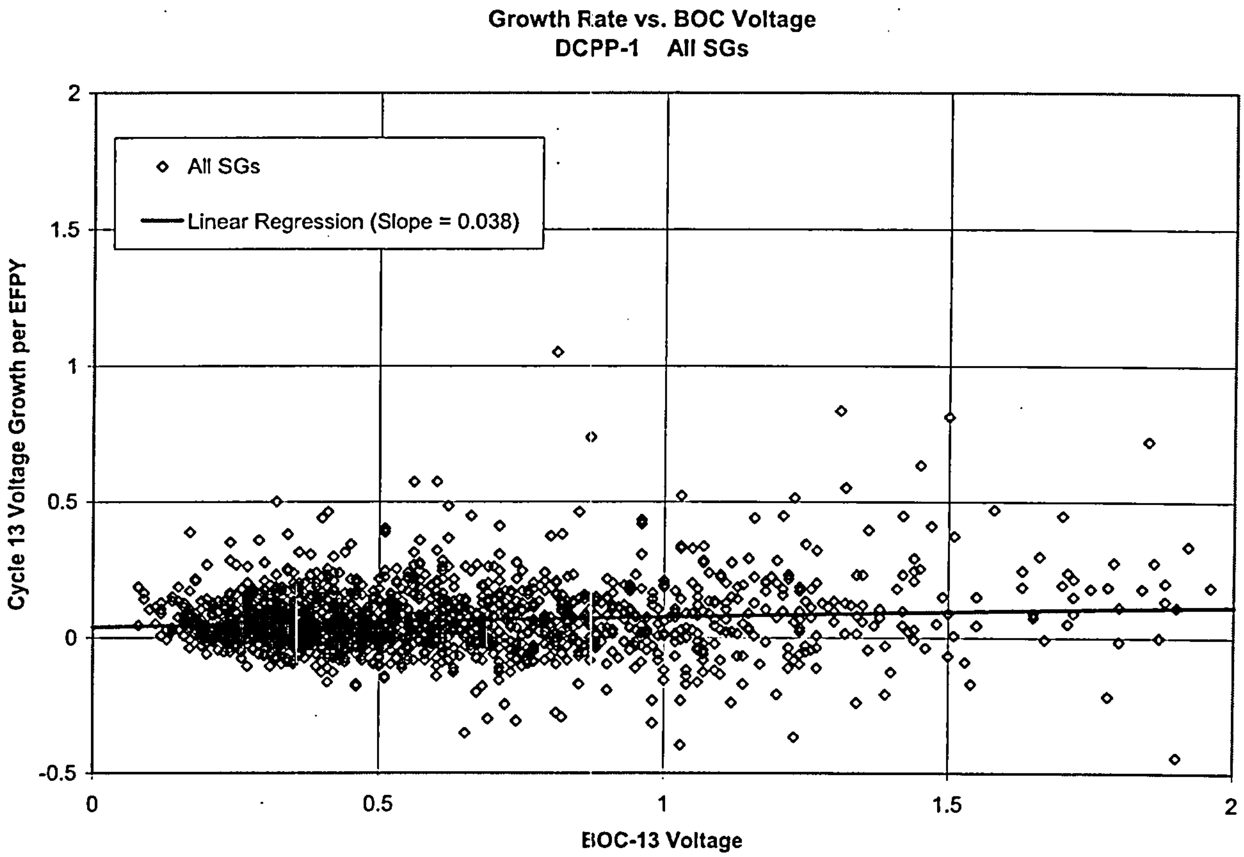


Figure 3-19: Cycle 12 vs. Cycle 13 Growth Comparison for SG 1-1

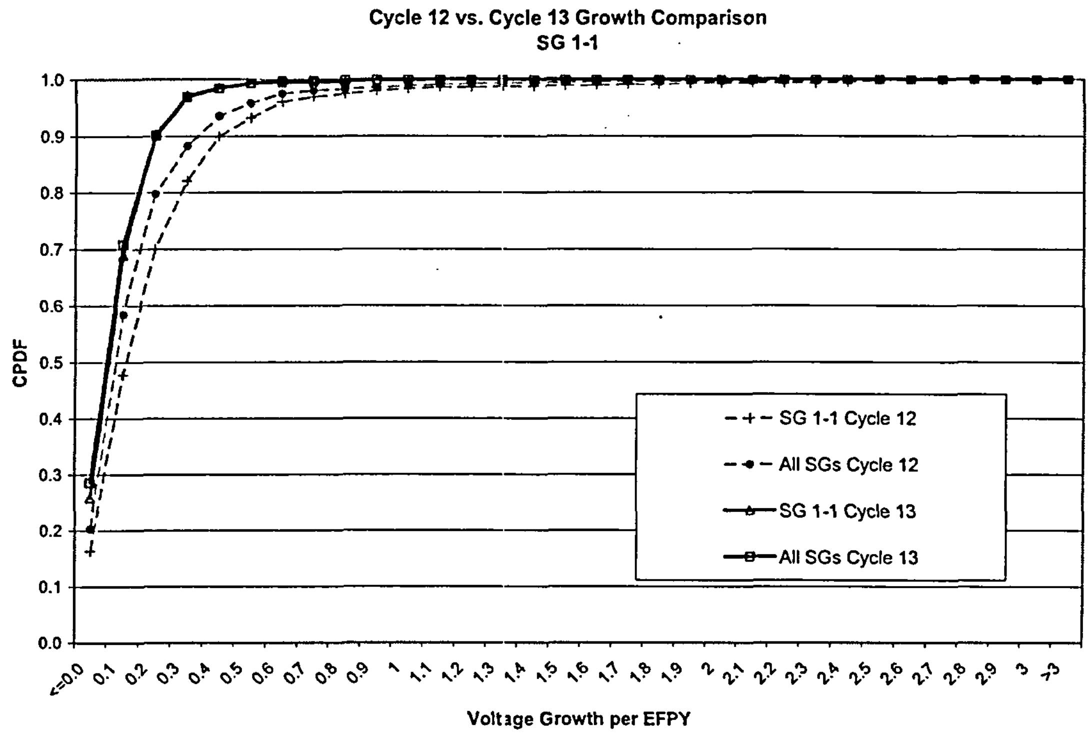


Figure 3-20: Cycle 12 vs. Cycle 13 Growth Comparison for SG 1-2

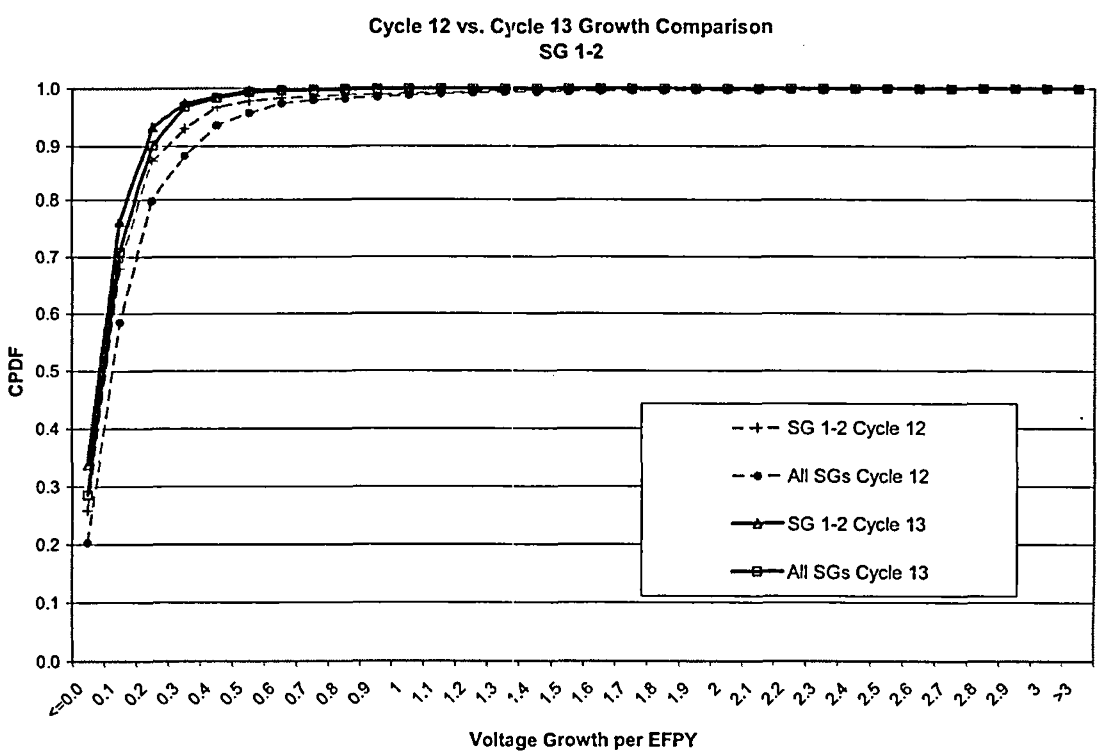


Figure 3-21: Cycle 12 vs. Cycle 13 Growth Comparison for SG 1-3

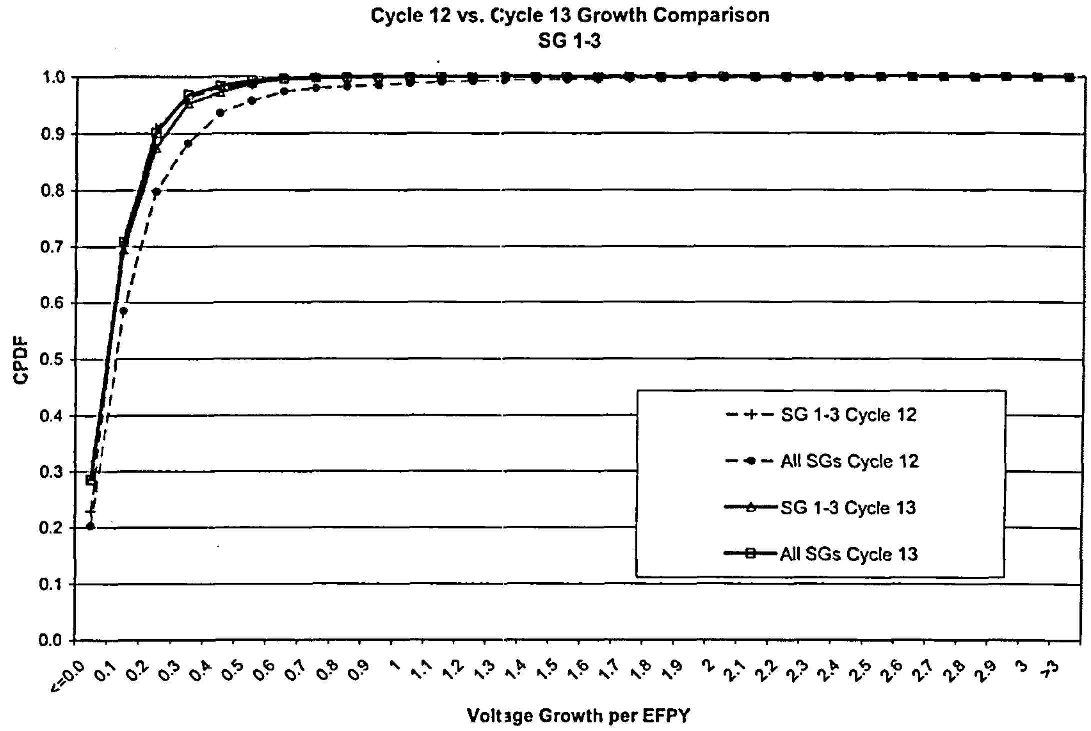


Figure 3-22: Cycle 12 vs. Cycle 13 Growth Comparison for SG 1-4

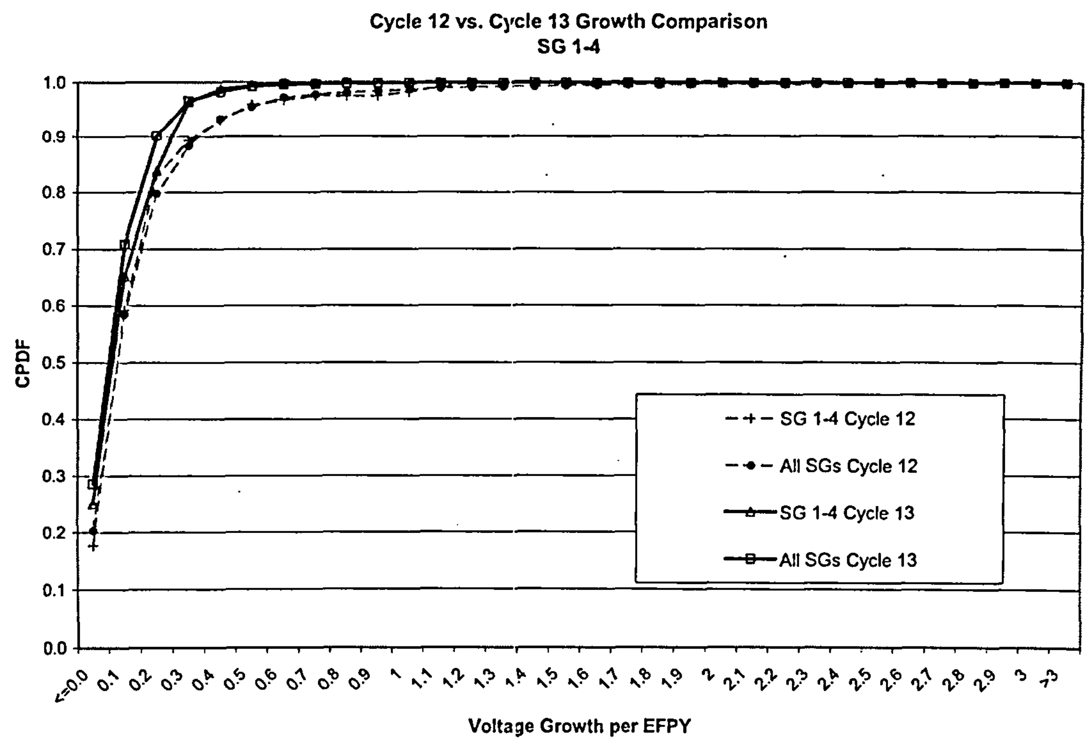


Figure 3-23: SG 1-1 Cycle 13 VDG Breakpoint Analysis Results

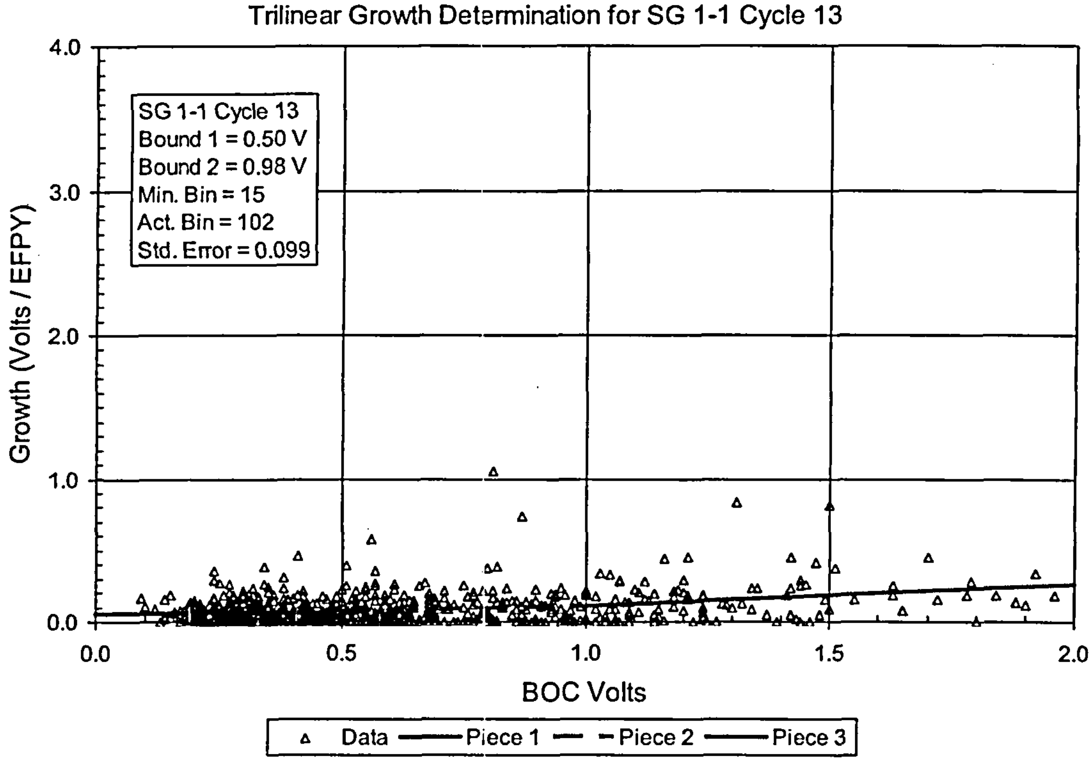


Figure 3-24: SG 1-2 Cycle 13 VDG Breakpoint Analysis Results

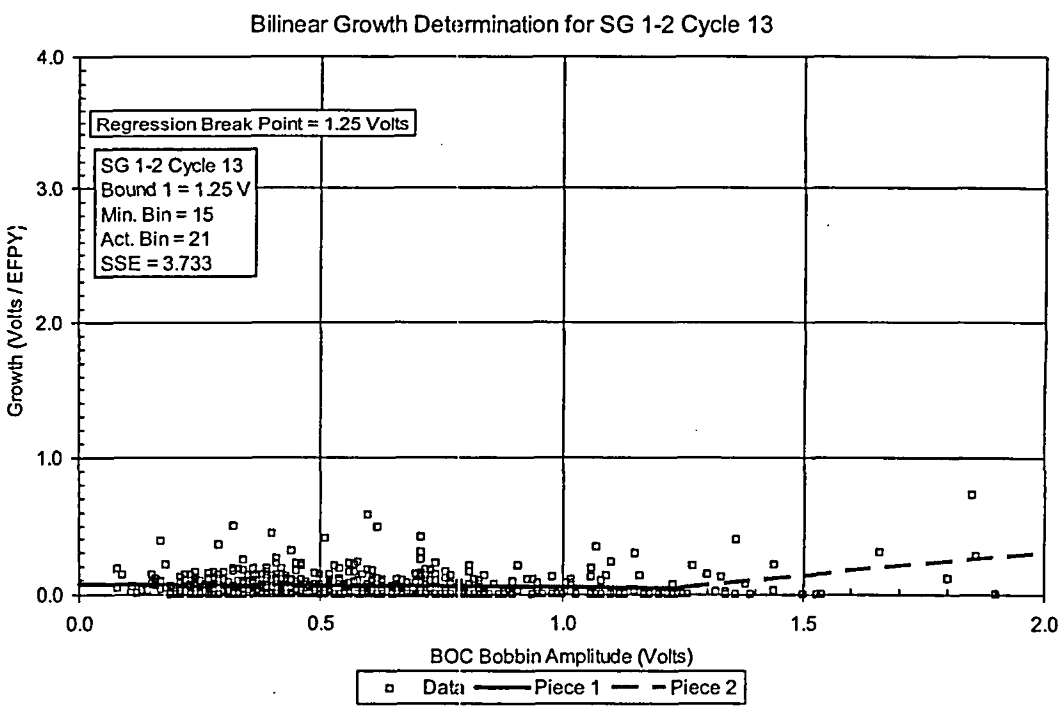


Figure 3-25: SG 1-3 Cycle 13 VDG Breakpoint Analysis Results

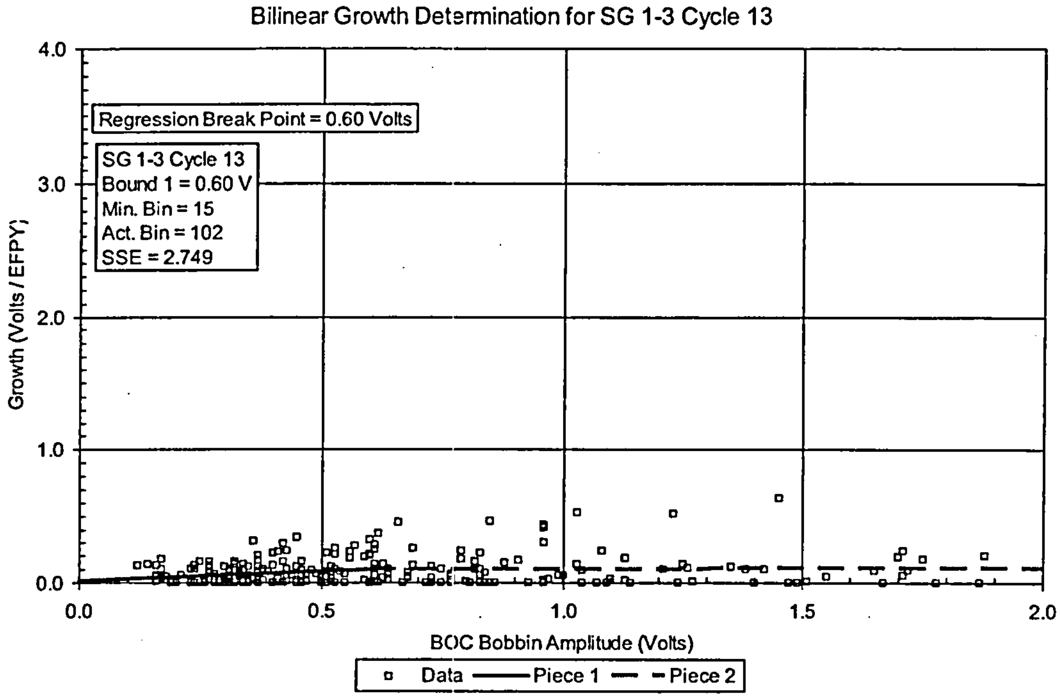


Figure 3-26: SG 1-4 Cycle 13 VDG Breakpoint Analysis Results

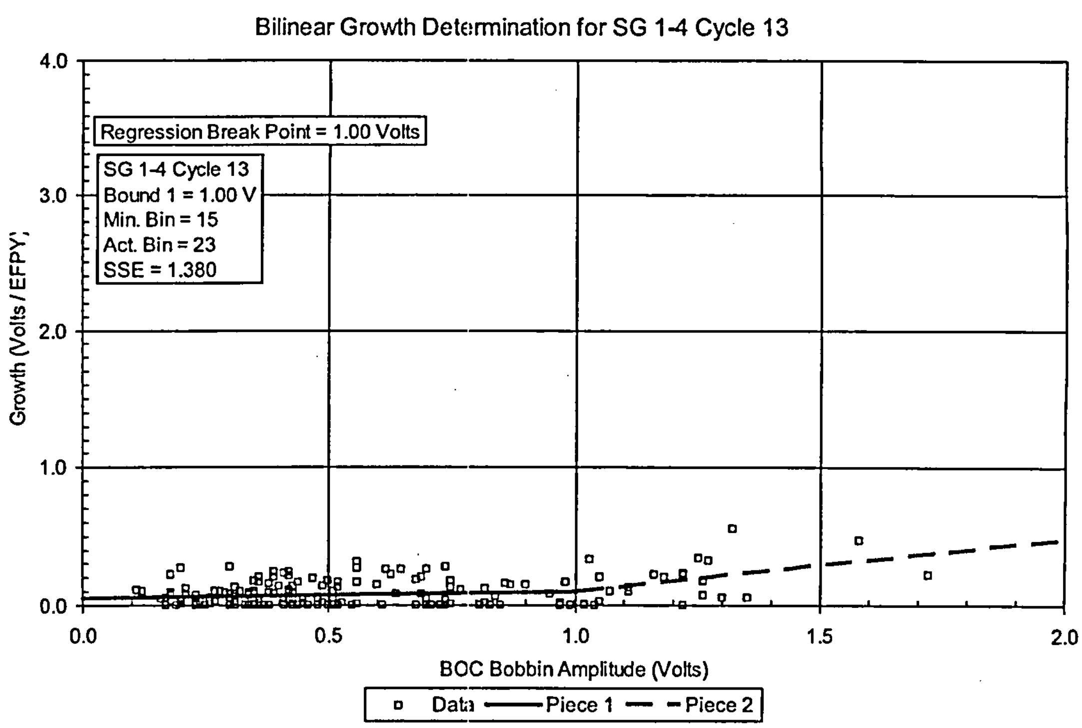


Figure 3-27: Composite Cycle 13 VDG Breakpoint Analysis Results

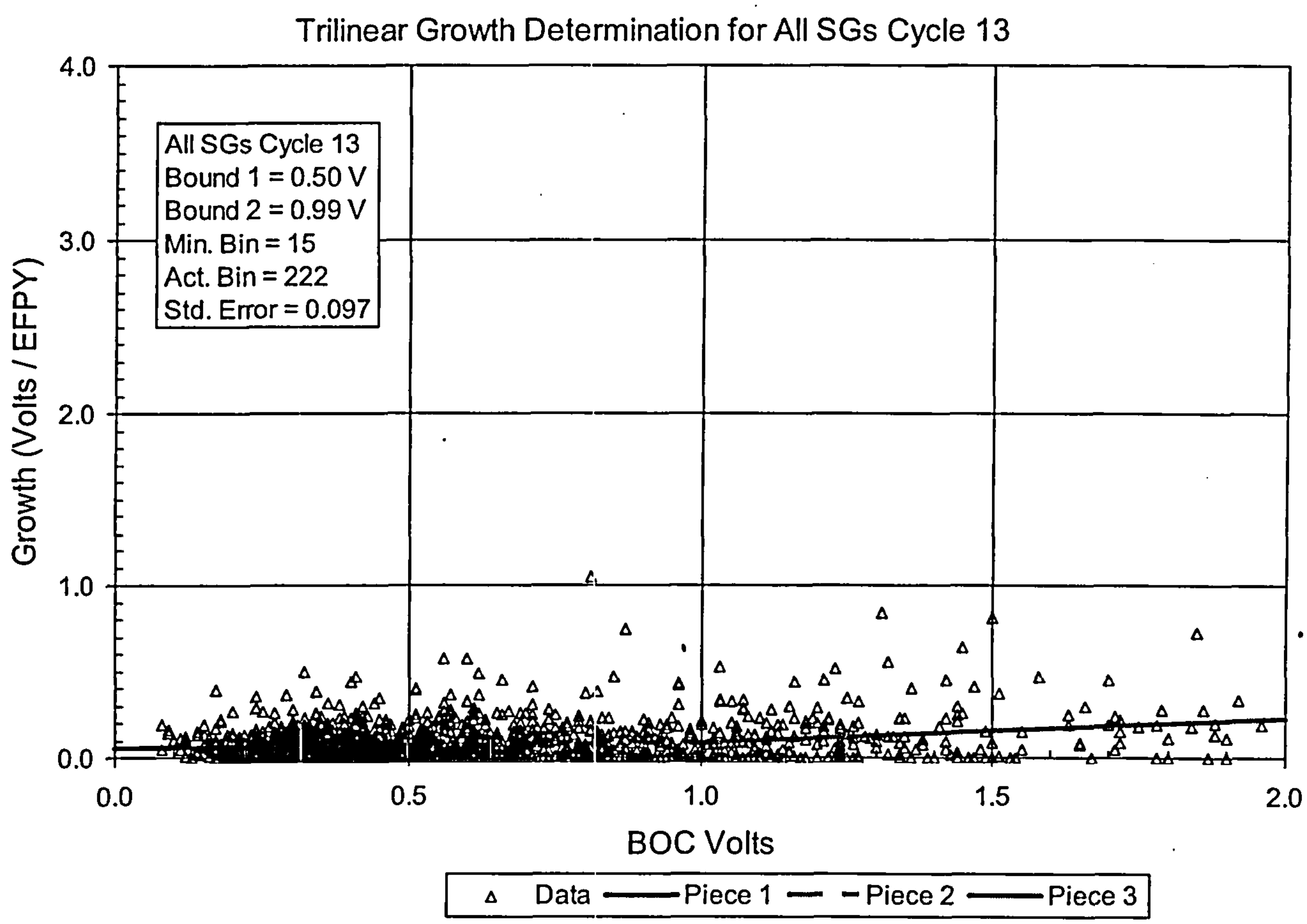


Figure 3-28: SG 1-1 Cycle 12 VDG Breakpoint Analysis Results

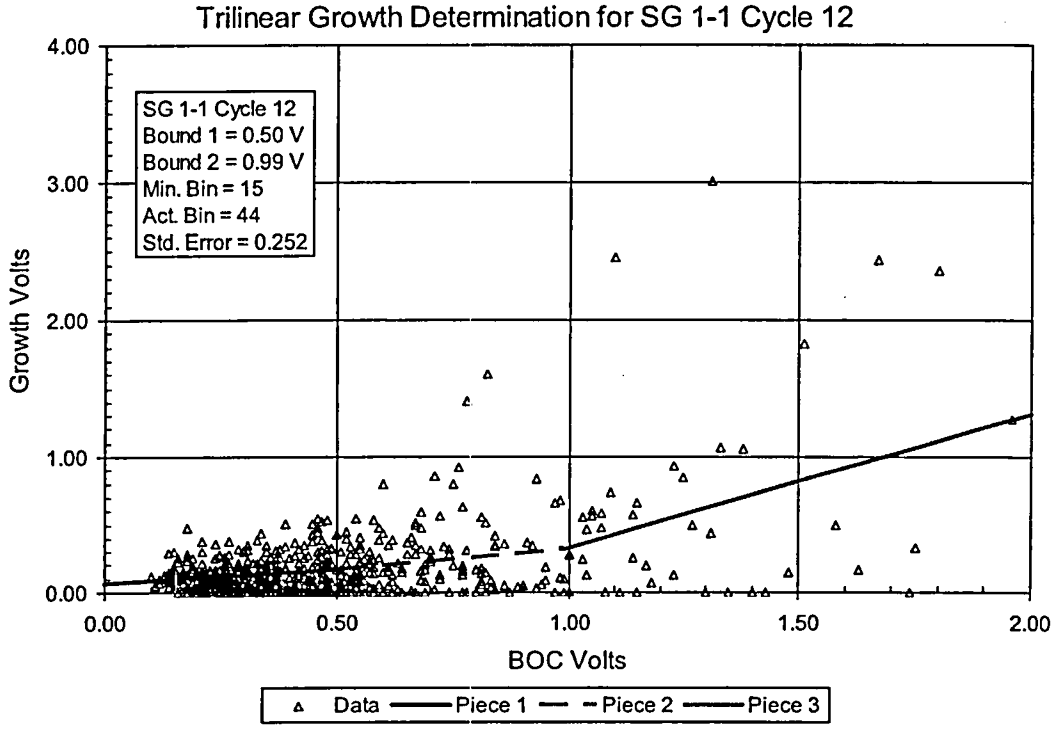


Figure 3-29: Composite Cycle 12 VDG Breakpoint Analysis Results

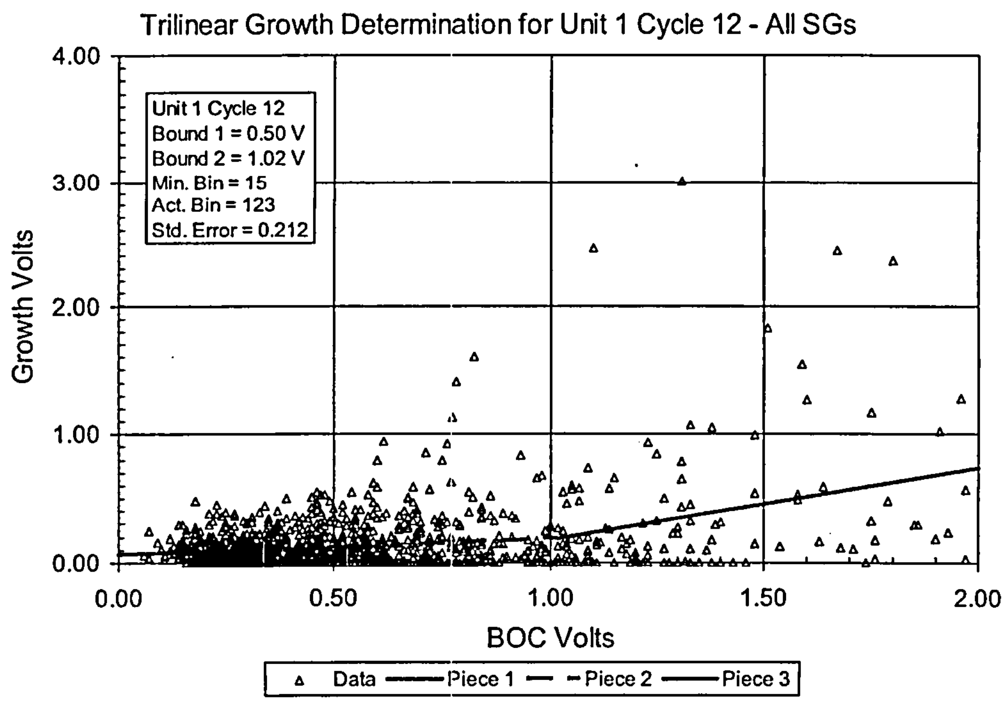


Figure 3-30: Cycle 13 VDG for SG 1-1

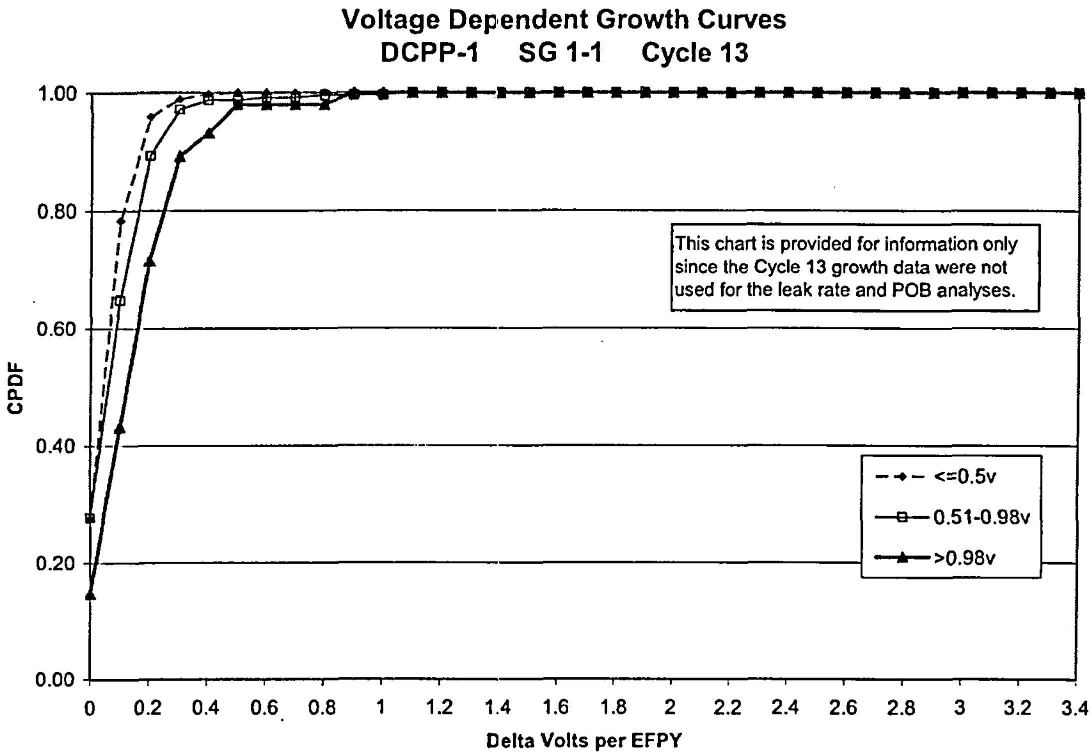


Figure 3-31: Cycle 13 VDG for SG 1-2

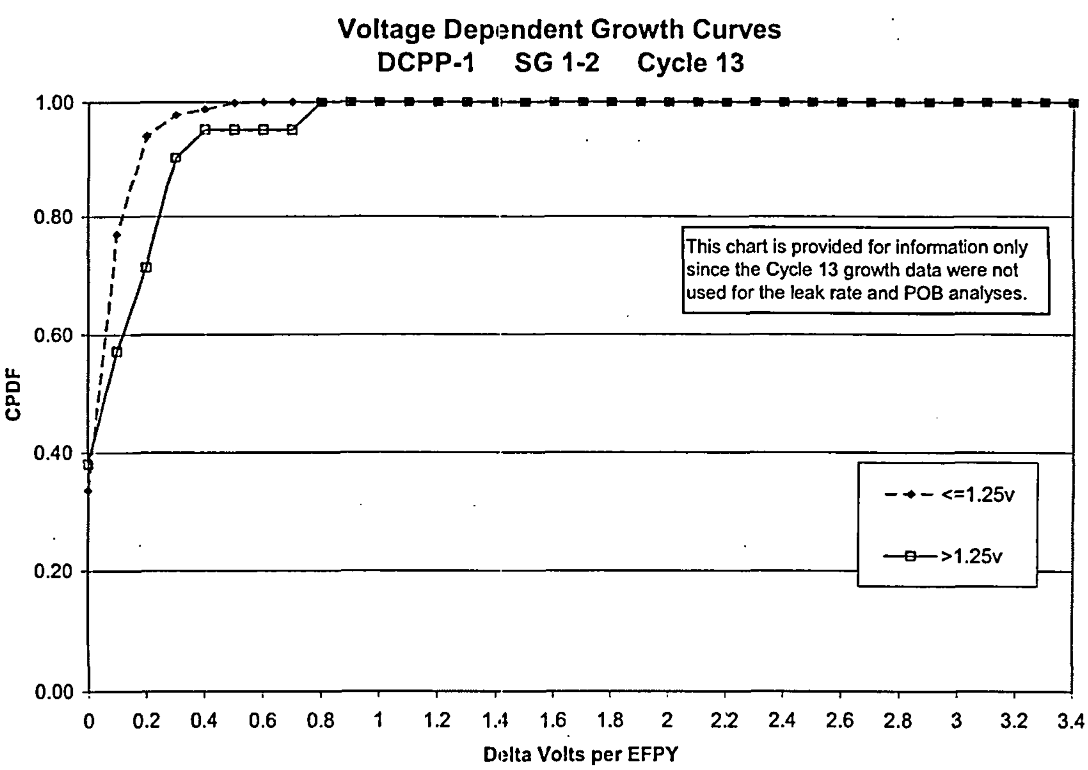


Figure 3-32: Cycle 13 VDG for SG 1-3

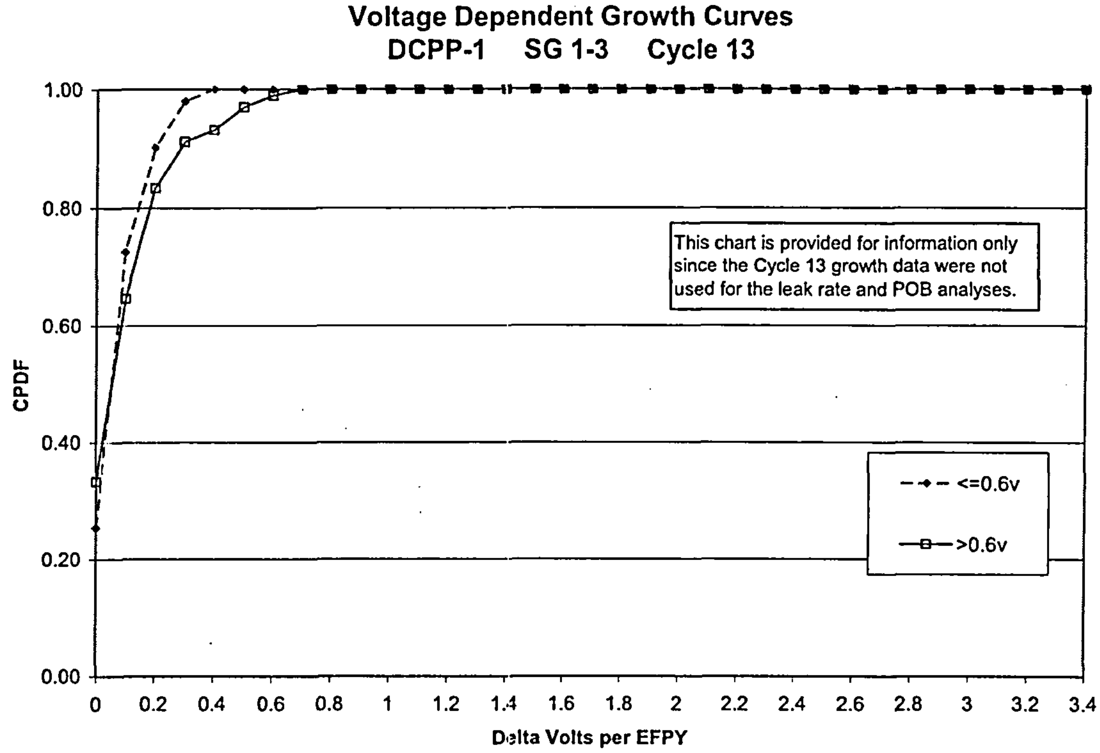


Figure 3-33: Cycle 13 VDG for SG 1-4

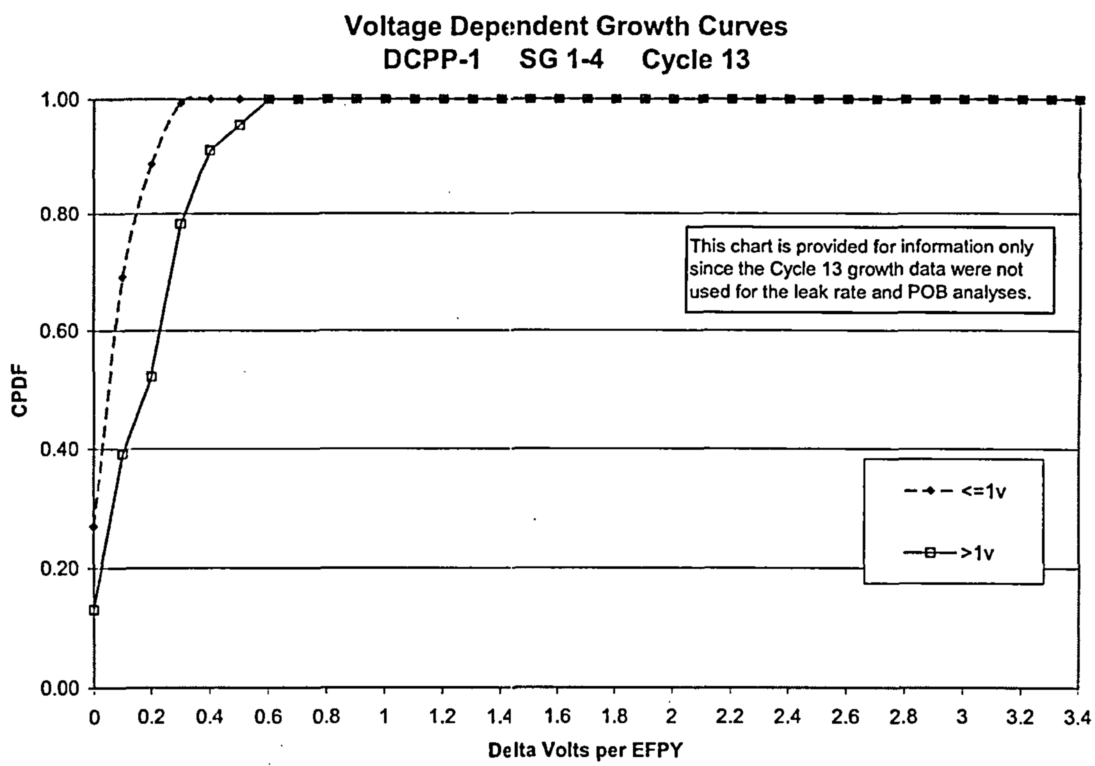


Figure 3-34: Cycle 13 VDG for All SGs

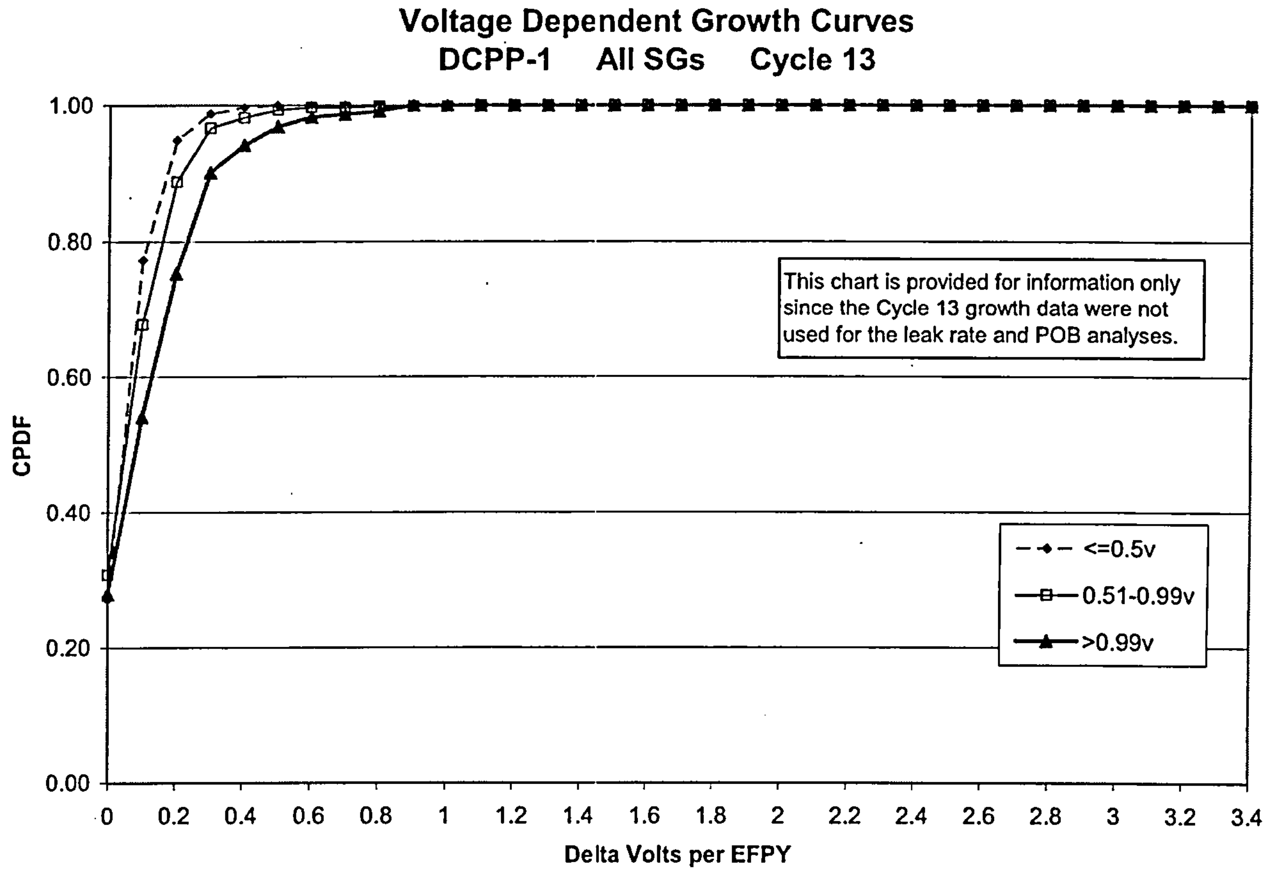


Figure 3-35: Cycle 12 VDG for SG 1-1

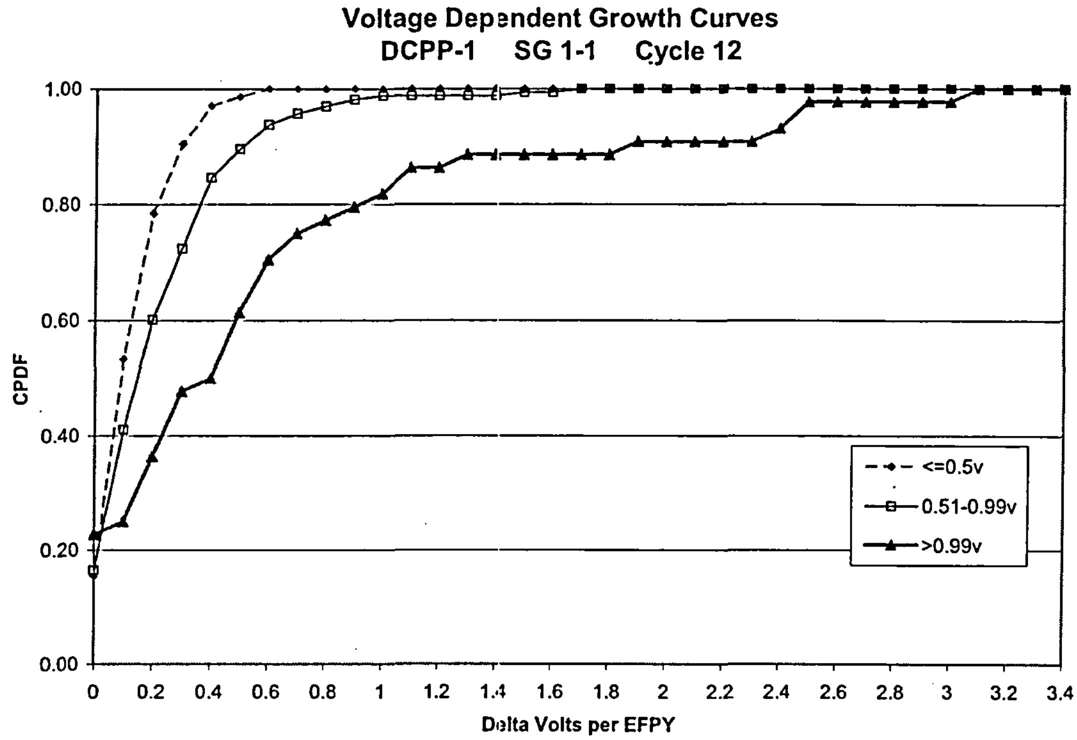


Figure 3-36: Cycle 12 VDG for All SGs

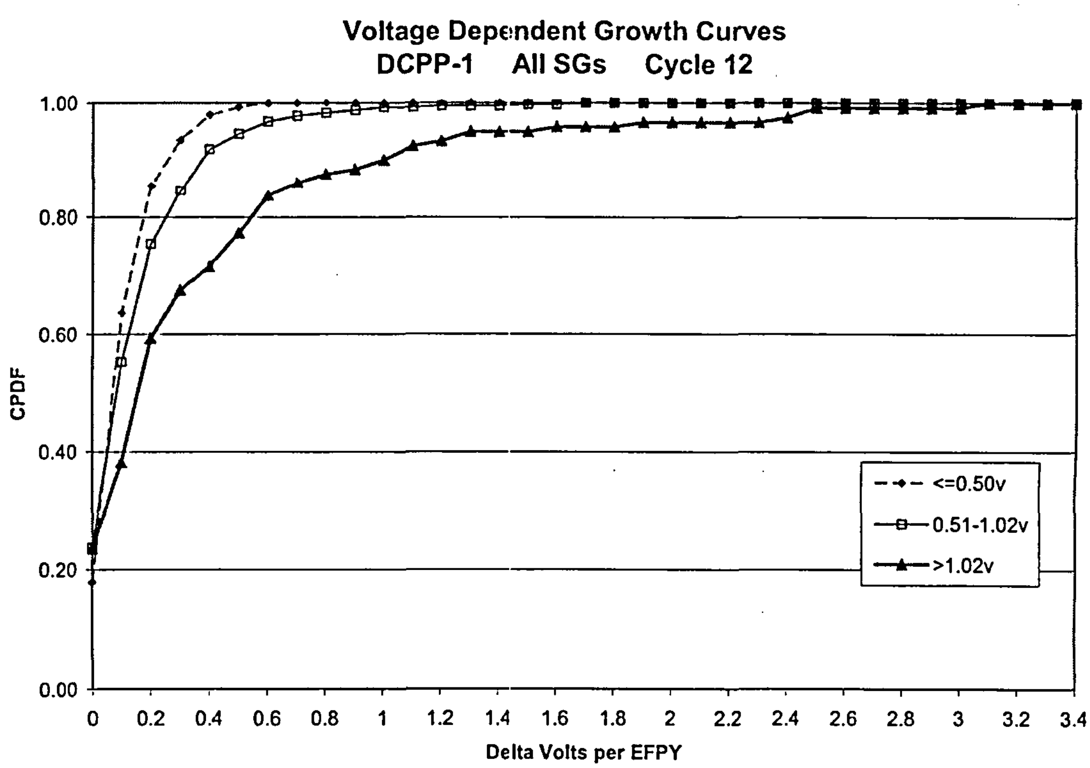


Figure 3-37: 1R13 Probe Wear Voltage Comparison

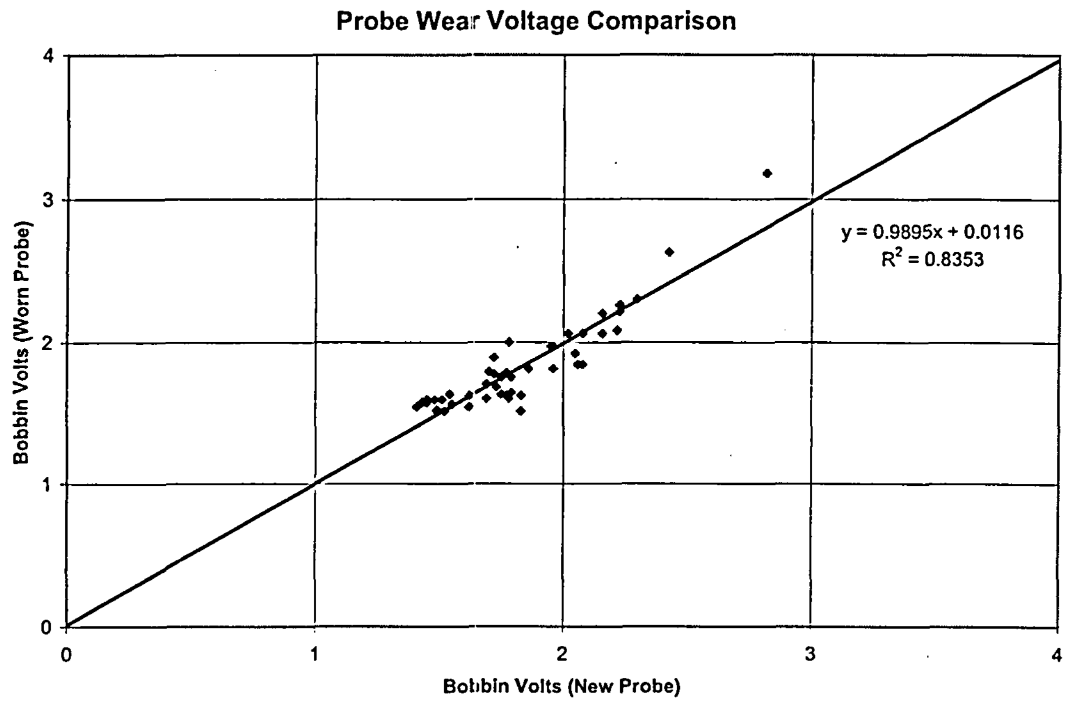


Figure 3-38: Bobbin Voltage Uncertainty Distributions

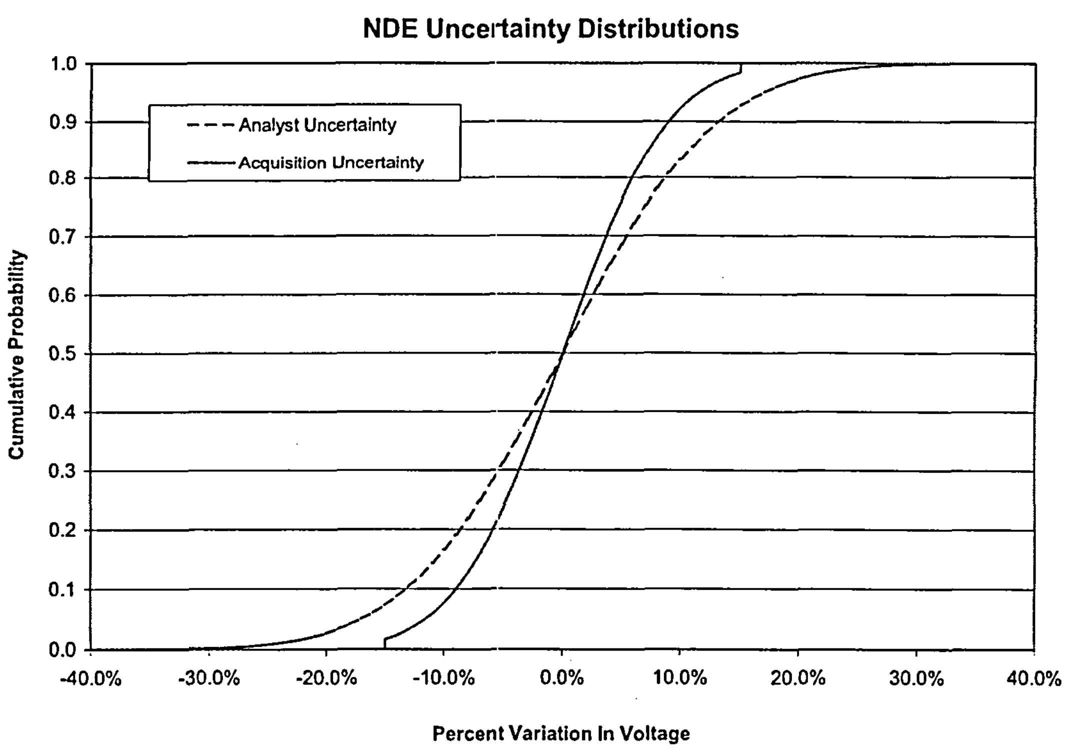


Figure 3-39: Inferred Voltage / Measured Voltage Comparison

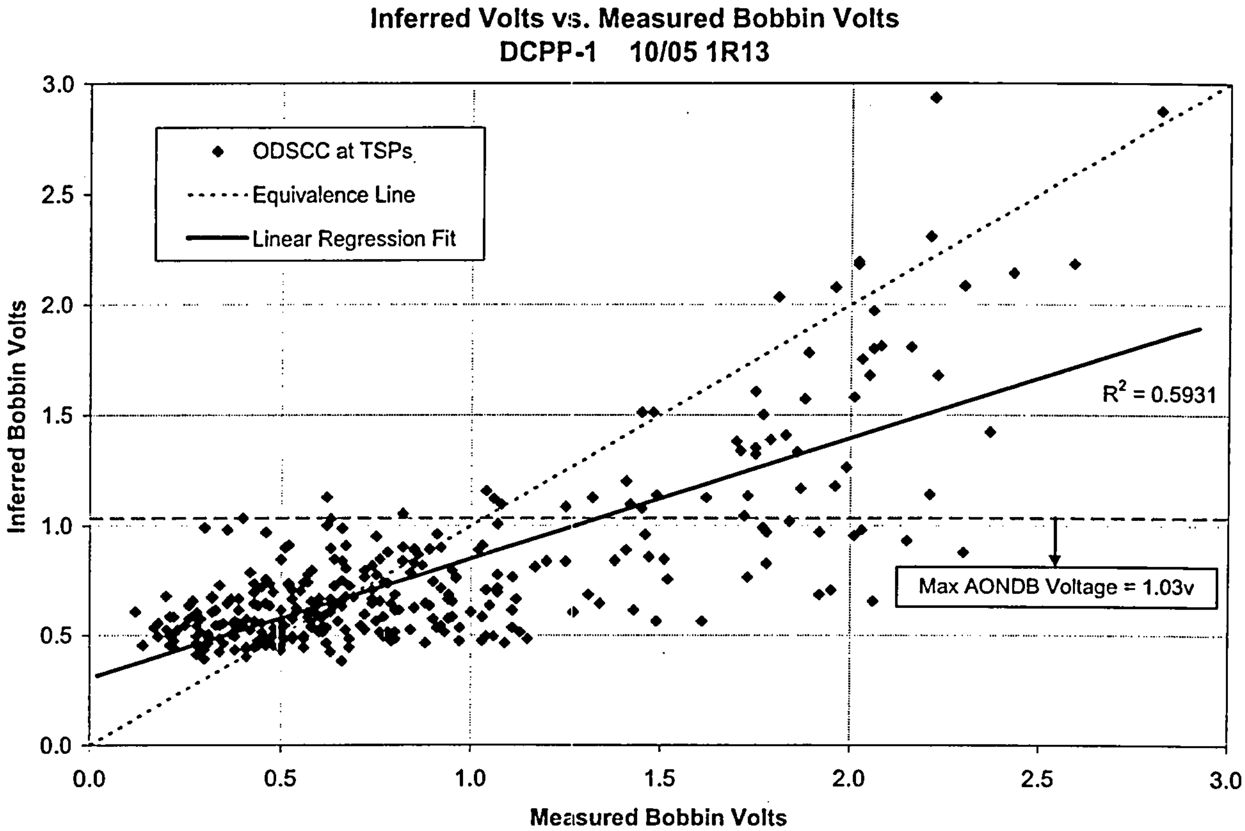


Figure 3-40: +Point™ Indication to Bobbin Voltage Comparison for SG 1-1

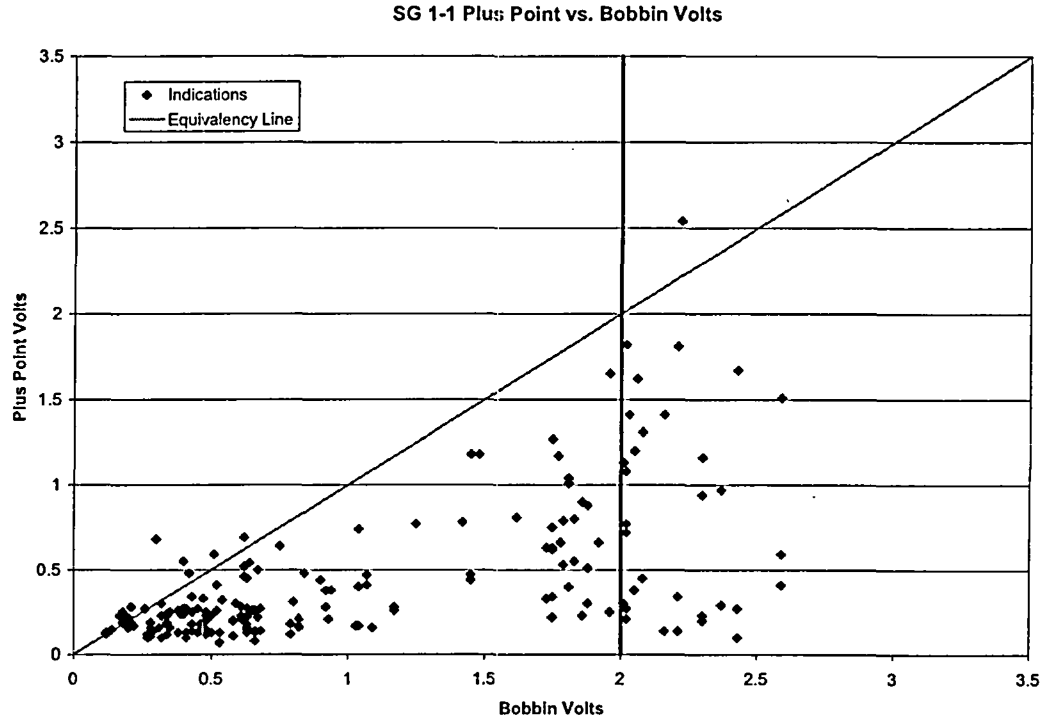


Figure 3-41: +Point™ Indication to Bobbin Voltage Comparison for SG 1-2

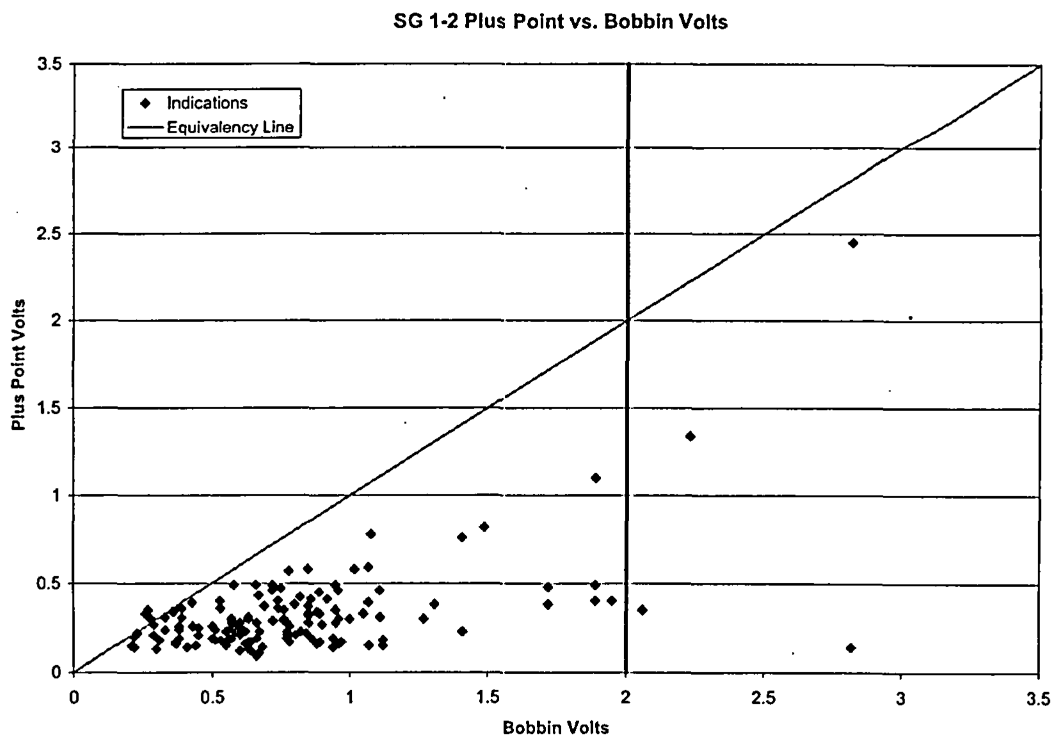


Figure 3-42: +Point™ Indication to Bobbin Voltage Comparison for SG 1-3

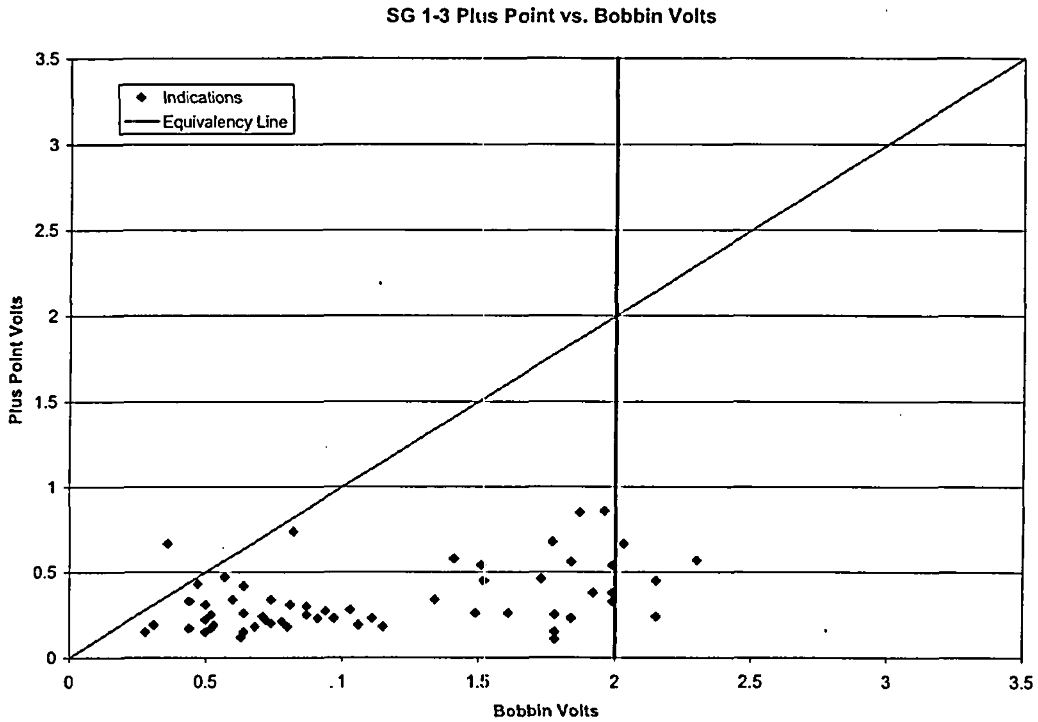
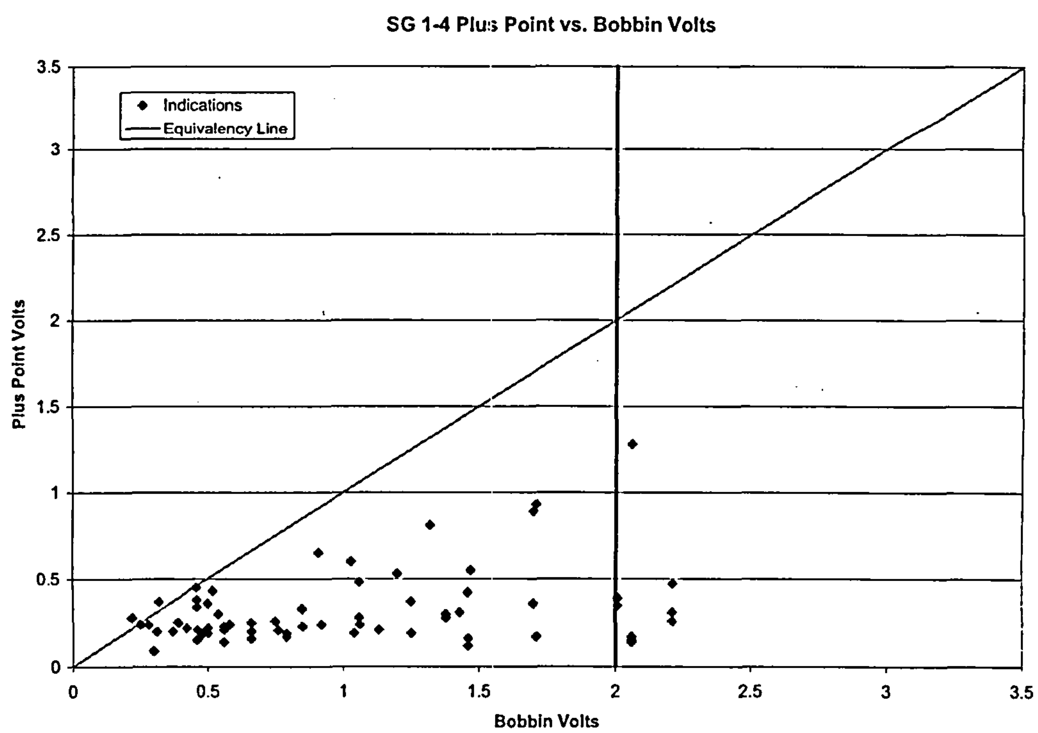


Figure 3-43: +Point™ Indication to Bobbin Voltage Comparison for SG 1-4



4.0 Database Applied for Leak and Burst Correlations

Per GL 95-05, the databases used to perform the tube integrity evaluations should be the latest NRC approved industry database. The updated leak and burst correlations for the ODSCC database include the 2R11 and 1R12 tube pull results from Diablo Canyon, as well as other recent industry tube pulls.

4.1 Conditional Probability of Burst

For the case of the burst pressure versus voltage correlation, the Addendum 6 database contained in Reference 8, meets all GL 95-05 requirements and was used in the as-found EOC-13 calculations and the EOC-14 projections, as well as the benchmarking of the prior cycle operational assessment. The correlation parameters were taken from Reference 8 and are shown in Table 4-1.

Table 4-1: Burst Pressure vs. Bobbin Amplitude Correlation

$$P_B = a_0 + a_1 \log(Volts)$$

Parameter	Addendum 6
Intercept, a_0	7.4801
Slope, a_1	-2.4002
r^2	79.67%
Std. Dev., σ_{Error}	0.8802
Mean Log(*V*)	0.3111
SS of Log(*V*)	51.6595
N (data pairs)	100
Structural Limit (2560 psi) (1)	7.51V
Structural Limit (2405 psi) (1)	9.40V
p Value for a_1 (2)	$5.60 \cdot 10^{-36}$
Reference σ_f	68.78 ksi (3)

Notes: The number of significant figures reported simply corresponds to the output from the calculation code and does not represent true engineering significance.

(1) Values reported correspond applying a safety factor of 1.4 on the differential pressure associated with a postulated SLB event.

(2) Numerical values are reported only to compare the calculated result to a criterion value of 0.05. For such small values the relative change is statistically meaningless.

(3) This is the flow stress value to which all data was normalized prior to performing the regression analysis.

4.2 Probability of Leak and Conditional Leak Rate

Reference 8 presents the results of the regression analysis for the voltage-dependent leak rate correlation using the Addendum 6 leak rate database for 7/8" tubes. It should be noted that, for the 2405 psi delta pressure, the one-sided p-value for the slope parameter in the voltage dependent leak rate correlation is 0.5%, which meets the 5% threshold for an acceptable correlation specified in Generic Letter 95-05. FANP computer simulations include the slope sampling method for the leak rate correlation that is presented in Reference 8.

The methodology used in the calculation of these parameters is consistent with NRC criteria in Reference 2. The probability of leak and leak rate correlation parameters used in the CM and OA were taken from Reference 8 and are shown in Tables 4-2 and 4-3.

Table 4-2: Probability of Leak Correlation

$$\Pr(Leak) = \frac{1}{1 + e^{-[b_1 + b_2 \log(Volts)]}}$$

Parameter	Addendum 6
Intercept, b_1	-5.0407
Slope, b_2	7.5434
V_{11} (1)	1.3311
V_{12}	-1.7606
V_{22}	2.7744
DoF (2)	118
Deviance	32.37
Pearson SD	0.611
MSE	0.279

Notes:

1) Parameters V_{ij} are elements of the covariance matrix of the coefficients, b_i of the regression equation.

2) Degrees of freedom.

Table 4-3: Leak Rate vs. Bobbin Amplitude Correlation (2405 psi)

$$Q = 10^{[b_3 + b_4 \log(Volts)]}$$

Parameter	Addendum 6
Intercept, b_3	-0.8039
Slope, b_4	1.2077
Index of Deter., r^2	20.0%
Std. Error	0.7774
Mean of Log(*Q*)	0.5090
Std. Dev. of Log(Q)	22.6667
p Value for b_4	0.5%
Data Pairs, *N*	32
Mean of Log(*V*)	1.0871
SS of Log(*V*)	3.1116
Note: The number of significant figures reported simply corresponds to the output from the calculation code and does not represent true engineering significance.	

5.0 EOC 13 Condition Monitoring, Benchmarking of EOC-13 Conditions and Assessment of Potential Underpredictions

This section provides the EOC-13 condition monitoring, the results of a benchmarking study that compares the projected EOC-13 conditions to the as-found conditions, and an assessment of potential underpredictions as committed to the NRC.

5.1 EOC-13 Condition Monitoring Results

EOC-13 as found conditions were evaluated to ensure that CM burst and leakage requirements were not exceeded. Failures at SLB pressure were predicted in 500,000 trials for each of the steam generators. The failures were distributed as follows: 67 failures were predicted in SG 1-1, 23 in 1-2, 12 in 1-3, and 8 in 1-4. The resulting burst probabilities are shown in Table 5-2 and at the bottom of Table 5-7. In the same manner, the leak rate was also calculated for each SG at EOC-13 and is also in Tables 5-2 and 5-7. The requirements for burst probabilities are met for all of the SGs, and for the leak rate, the plant-specific value of 10.5 gpm for the faulted steam generator was not exceeded in any steam generator.

5.2 EOC-13 Benchmark Calculations

EOC-13 projections using POPCD through 1R12 have been previously provided to the NRC in Reference 27 using the extreme growth model and in Reference 31 without the extreme growth model. The projections provided used an estimated Cycle 13 operating interval of 1.36 EFPY and also used Addendum 5 plus DCPP pulled tube data from 2R11. Since the database has been updated to Addendum 6 and the actual Cycle 13 operating interval was 1.34 EFPY, the EOC-13 projections have been recalculated. In addition, POPCD through 2R12 was used in the recalculations.

The determination of the growth distributions to use in these benchmark calculations followed the guidelines provided in References 25 and 28. Table 5-1 provides a summary of the inputs required and the corresponding section(s) or table(s) that provide these data.

Table 5-1: Inputs for EOC-13 Benchmark Projections

Input Description	Section or Table Reference	Comments
BOC Voltage Distribution	Tables 5-3 and 5-4	
Repaired Voltage Distribution	Tables 5-3 and 5-4	
NDE Uncertainties	Section 3.6 and Table 3-22	
POD	DCPP POPCD Table 6-8	Includes 2R12 Dataset (7 outages)
Growth	Table 5-5 and 5-6	
Cycle Length	Section 5.2	1.34 EFPY
Tube Integrity Correlations	Tables 4-1 to 4-3	Addendum 6
Material Properties	Section 7.1	Ref. 8

Per Reference 25, the growth analyses for these projections showed that Cycle 12 SG-specific growth should be used for SG 1-1. All other SGs should use the composite Cycle 12 growth data. For SG 1-1, the VDG breakpoint analysis for the Cycle 12 growth data revealed two breakpoints at 0.5 and 0.99v. The composite Cycle 12 revealed two breakpoints at 0.50v and 1.02v. Tables 5-5 and 5-6 provide the growth distributions used for the EOC-13 projections. Additionally, these growth rates were the adjusted growth rates based on the adjustment requirements discussed in the 1R12 90 day report.

Table 5-7 provides a comparison of the projected EOC-13 conditions to the as-found EOC-13 conditions. This table shows the voltage distributions as well as the POB and leak rate results. In all cases, the leak rate, POB, and the number of indications were over-predicted by wide margins. In conclusion, the EOC-13 projections using DCPP POPCD correlation and the growth guidelines provided conservative results relative to the as-found conditions. Therefore, no adjustments to either of the methodologies are warranted at this time.

5.3 Assessment of Potential Underpredictions

DCPP Tech Specs require that, upon implementation of POPCD, if the EOC conditional MSLB burst probability, the projected MSLB leak rate, or the number of indications are underpredicted by the previous cycle operational assessment, the following guidelines must be applied to assess the need for methods adjustments:

- The assessment of the probable causes for the under predictions, proposed corrective actions, and any recommended changes to probability of detection or growth methodology indicated by potential methods assessments.

- An assessment of the potential need to revise the ARC analysis methods if: the burst probability is underpredicted by more than 0.001 (i.e., 10% of the reporting threshold) or an order of magnitude; or the leak rate is underpredicted by more than 0.5 gpm or an order of magnitude.

- An assessment of the potential need to increase the number of predicted low voltage indications at the BOC if the total number of as found indications in any SG are underestimated by greater than 15 percent or by greater than 150 indications. If future inspection results provide additional information that could alter these guidelines, PG&E would provide recommended changes to the guidelines and basis for the changes in the subsequent 90 day report.

As discussed above, new EOC-13 projections using the actual Cycle 13 operating interval, DCPP POPCD through 7 inspections, and Addendum 6, were performed in order to benchmark the POPCD and growth methods. As shown in Table 5-7, the POBs, leak rates, and numbers of indications were overestimated in all cases for EOC-13. Therefore, there is no requirement to perform a method adjustment assessment.

Table 5-2: Summary of 95-05 ARC Calculations As-found vs. Projected EOC-13

		SG 1-1	SG 1-2	SG 1-3	SG 1-4
Number of DOS Plus AONDB	As-Found	784	579	270	217
	Projected	1242	706	340	289
Leak Rate (gpm)	As-Found	0.31	0.14	0.11	0.06
	Projected	1.62	0.60	0.41	0.20
POB	As-Found	1.64×10^{-4}	6.52×10^{-5}	3.89×10^{-5}	2.89×10^{-5}
	Projected	2.06×10^{-3}	5.89×10^{-4}	4.62×10^{-4}	1.88×10^{-4}
Acceptance Criteria		1.0×10^{-2} for POB		10.5 gpm	

Notes:
(1) Does include AONDB assigned bobbin voltages.
(2) The 95% Upper Confidence Limit (UCL) is based on the number of trials with one or more failures.
(3) Equivalent volumetric rate at room temperature.
(4) The calculated total leak rate reflects the upper 95% quantile value at an upper 95% confidence bound.
(5) The reference leak limits (10.5 gpm) consider contributions from other ARCs. Therefore other ARC Leak rates should be added to the results in this table to assess total leakage.

Table 5-3: BOC-13 Voltage Distribution Used for EOC-13 Benchmark Projections for SG 1-1

Voltage Bin	SG 1-1	
	As-Found EOC-12	Repaired
0.1	2	0
0.2	16	0
0.3	73	2
0.4	115	4
0.5	78	2
0.6	74	1
0.7	64	4
0.8	35	2
0.9	36	1
0.99	33	0
1	6	1
1.1	23	0
1.2	18	0
1.3	16	0
1.4	7	0
1.5	16	1
1.6	2	0
1.7	4	0
1.8	3	0
1.9	3	0
2	2	0
2.1	9	9
2.2	0	0
2.3	5	5
2.4	1	1
2.5	0	0
2.6	0	0
2.7	1	1
2.8	1	1
2.9	0	0
3	0	0
3.1	3	3
3.4	1	1
4	0	0
4.1	1	1
4.5	1	1
5.1	1	1
5.6	2	2
6.2	1	1
Total	**653**	**45**

Table 5-4: BOC-13 Voltage Distributions Used for EOC-13 Benchmark Projections for SGs 1-2, 1-3, and 1-4

Voltage Bin	SG 1-2		SG 1-3		SG 1-4	
	As-Found EOC-12	Repaired	As-Found EOC-12	Repaired	As-Found EOC-12	Repaired
0.1	0	0	0	0	0	0
0.2	10	0	3	0	5	0
0.3	30	3	23	3	15	0
0.4	54	3	30	4	23	1
0.5	71	3	36	6	43	5
0.6	73	6	24	4	19	2
0.7	45	1	24	0	15	3
0.8	48	1	12	1	9	0
0.9	26	0	10	1	11	0
1	12	0	12	3	6	0
1.02	4	0	0	0	1	0
1.1	17	0	11	0	5	0
1.2	12	1	4	1	3	0
1.3	8	0	6	0	8	0
1.4	9	0	4	1	2	0
1.5	3	0	4	0	0	0
1.6	2	0	3	1	1	0
1.7	1	0	3	0	0	0
1.8	2	1	6	1	0	0
1.9	3	0	2	0	0	0
2	0	0	0	0	0	0
2.1	1	1	1	1	1	1
2.2	0	0	1	1	1	1
2.3	0	0	0	0	0	0
2.4	2	2	3	3	0	0
2.5	1	1	0	0	0	0
2.6	2	2	0	0	2	2
2.7	0	0	0	0	0	0
2.8	0	0	0	0	0	0
2.9	0	0	1	1	0	0
3	0	0	0	0	0	0
3.1	1	1	0	0	0	0
3.2	0	0	0	0	0	0
3.3	0	0	0	0	0	0
3.4	0	0	0	0	0	0
3.5	0	0	0	0	0	0
3.6	0	0	0	0	1	1
3.7	1	1	0	0	1	1
3.8	0	0	0	0	0	0
3.9	0	0	0	0	0	0
4	0	0	0	0	0	0

Table 5-4: BOC-13 Voltage Distributions Used for EOC-13 Benchmark Projections for SGs 1-2, 1-3, and 1-4

Voltage Bin	SG 1-2		SG 1-3		SG 1-4	
	As-Found EOC-12	Repaired	As-Found EOC-12	Repaired	As-Found EOC-12	Repaired
4.1	1	1	0	0	0	0
4.2	0	0	0	0	0	0
4.3	0	0	0	0	0	0
4.4	0	0	0	0	0	0
4.5	0	0	0	0	0	0
>4.5	0	0	0	0	0	0
Total	**439**	**28**	**223**	**32**	**172**	**17**

Table 5-5: Cycle 12 Growth Distributions for SG 1-1

(Used for EOC-13 Benchmark Projections for SG 1-1)

Growth (Volts/EFPY)	Bin1 (<=0.50v)	Bin2 (0.51v-0.99v)	Bin3 (>0.99v)
<=0	29	20	1
0.1	132	32	3
0.2	110	39	5
0.3	54	21	2
0.4	29	23	4
0.5	8	8	5
0.6	5	9	2
0.7	0	3	3
0.8	0	1	5
0.9	0	4	3
1	0	1	1
1.1	0	0	1
1.2	0	0	1
1.3	0	0	2
1.4	0	0	0
1.5	0	1	1
1.6	0	0	0
1.7	0	1	0
1.8	0	0	0
1.9	0	0	0
2	0	0	0
2.1	0	0	1
2.2	0	0	0
2.3	0	0	0
2.4	0	0	0
2.5	0	0	0
2.6	0	0	1
2.7	0	0	2
2.8	0	0	0
2.9	0	0	0
3	0	0	0
3.1	0	0	0
3.2	0	0	0
3.3	0	0	1
3.4	0	0	0
3.5	0	0	0
>3.5	0	0	0
Total	**367**	**163**	**44**

Table 5-6: Cycle 12 Growth Distributions for All SGs

(Used for EOC-13 Benchmark Projections for SGs 1-2, 1-3, and 1-4)

Growth (Volts/EFPY)	Bin1 (<=0.50v)	Bin2 (0.51v-1.02v)	Bin3 (>1.02v)
<=0	93	65	5
0.1	329	127	8
0.2	207	112	22
0.3	64	40	20
0.4	35	36	20
0.5	10	15	13
0.6	5	8	0
0.7	0	6	7
0.8	0	0	9
0.9	0	4	2
1	0	2	2
1.1	0	0	2
1.2	0	1	2
1.3	0	0	2
1.4	0	0	1
1.5	0	1	2
1.6	0	0	0
1.7	0	1	0
1.8	0	0	1
1.9	0	0	0
2	0	0	1
2.1	0	0	0
2.2	0	0	0
2.3	0	0	0
2.4	0	0	0
2.5	0	0	0
2.6	0	0	1
2.7	0	0	2
2.8	0	0	0
2.9	0	0	0
3	0	0	0
3.1	0	0	0
3.2	0	0	1
3.3	0	0	0
3.4	0	0	0
3.5	0	0	0
>3.6	0	0	0
Total	**743**	**418**	**123**

Table 5-7: As-found EOC-13 vs. Projected EOC-13 Conditions

Voltage Bin	SG 1-1		SG 1-2		SG 1-3		SG 1-4	
	As-Found	Projected	As-Found	Projected	As-Found	Projected	As-Found	Projected
0.1	0	10.27	0	0.45	0	0.13	0	0.22
0.2	23	41.19	10	8.97	6	3.2	5	4.5
0.3	79	73.84	48	33.07	28	14.46	21	16.54
0.4	128	123.26	73	58.02	34	32.8	27	28.91
0.5	116	158.27	104	82.05	47	44.25	49	39.23
0.6	85	161.75	91	93.51	30	48	29	44.22
0.7	86	138.24	76	86.14	24	40.15	14	37.51
0.8	41	107.08	49	72.55	16	31.35	22	28.08
0.9	47	82.29	39	58.75	23	24.05	2	20.07
1	34	61.38	26	45.95	12	18.21	17	14.98
1.1	42	48.8	18	35.14	11	13.74	9	11.33
1.2	19	38.65	16	25.86	8	10.36	4	8.38
1.3	16	29.51	6	18.95	4	7.83	2	6.19
1.4	11	23.43	7	14.35	4	6.18	3	4.75
1.5	23	18.5	7	11.65	4	5.33	6	3.99
1.6	2	14.44	3	9.67	6	4.76	2	3.44
1.7	5	12.04	0	8.04	2	4.26	1	2.93
1.8	7	11.06	1	6.79	3	3.84	1	2.48
1.9	4	9.74	1	5.55	2	3.47	0	1.96
2	2	8.52	1	4.56	3	3.17	0	1.5
2.1	7	7.85	1	3.87	1	2.91	2	1.21
2.2	1	7.27	0	3.35	1	2.64	0	1.04
2.3	3	6.45	1	2.75	1	2.25	1	0.86
2.4	1	5.47	0	2.18	0	1.84	0	0.67
2.5	1	4.71	0	1.75	0	1.5	0	0.52
2.6	1	4.32	0	1.52	0	1.27	0	0.44
2.7	0	3.89	0	1.3	0	1.08	0	0.37
2.8	0	3.61	0	1.17	0	0.93	0	0.34
2.9	0	3.36	1	1.09	0	0.82	0	0.32
3	0	2.84	0	0.93	0	0.7	0	0.28
3.5	0	6.81	0	2.43	0	1.96	0	0.75
4	0	2.15	0	0.96	0	0.82	0	0.29
4.5	0	1.76	0	0.33	0	0.31	0	0.09
5	0	4.95	0	1.05	0	0.62	0	0.40
5.5	0	2.37	0	0.54	0	0.47	0	0.17
6	0	1.70	0	0.25	0	0.22	0	0.08
6.5	0	0.37	0	0.04	0	0.06	0	0.00
7	0	0.05	0	0.00	0	0.00	0	0.00
>7	0	0.01	0	0.00	0	0.00	0	0.00
Total	784	1242.19	579	705.54	270	339.94	217	289.03
<=1	639	957.57	516	539.46	220	256.60	186	234.26
>1	145	284.63	63	166.08	50	83.34	31	54.79
>2	14	69.94	3	25.52	3	20.40	3	7.84
>5	0	4.50	0	0.84	0	0.75	0	0.25
POB	1.64E-04	2.06E-03	6.52E-05	5.89E-04	3.89E-05	4.62E-04	2.89E-05	1.88E-04
Leak Rate	0.31	1.62	0.14	0.60	0.11	0.41	0.06	0.20

Figure 5-1: As-found SG 1-1 vs Projected Voltage Distributions (DCPP POPCD)

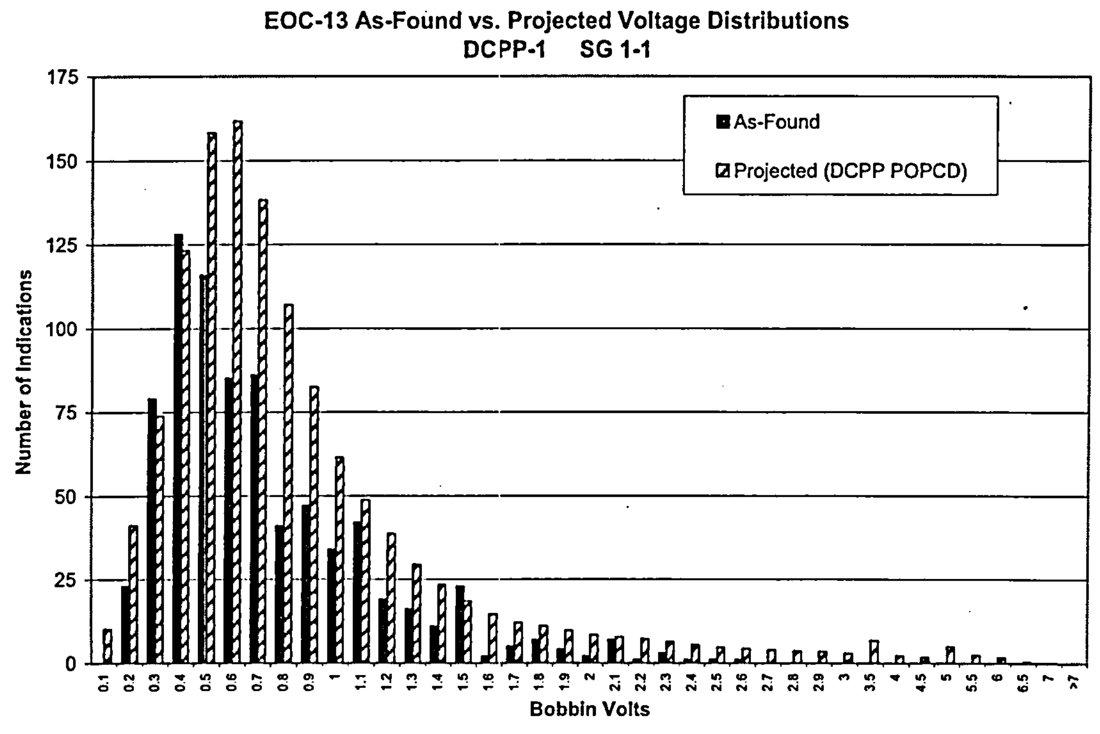


Figure 5-2: As-found SG 1-2 vs Projected Voltage Distributions (DCPP POPCD)

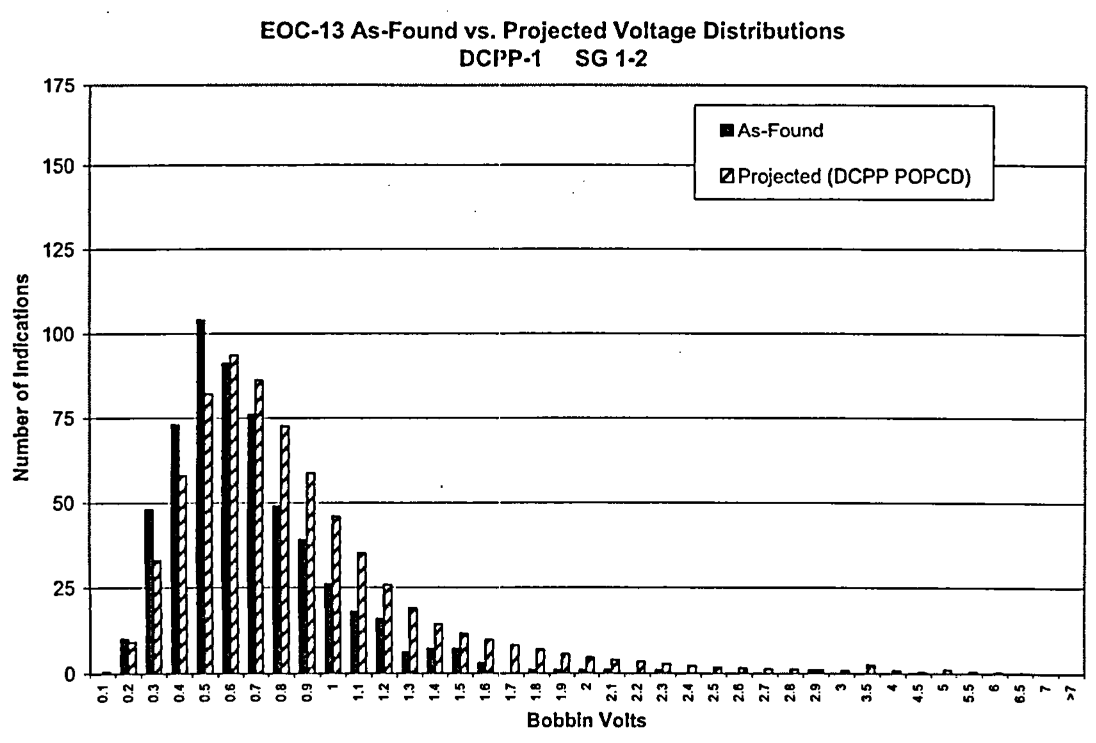


Figure 5-3: As-found SG 1-3 vs Projected Voltage Distributions (DCPP POPCD)

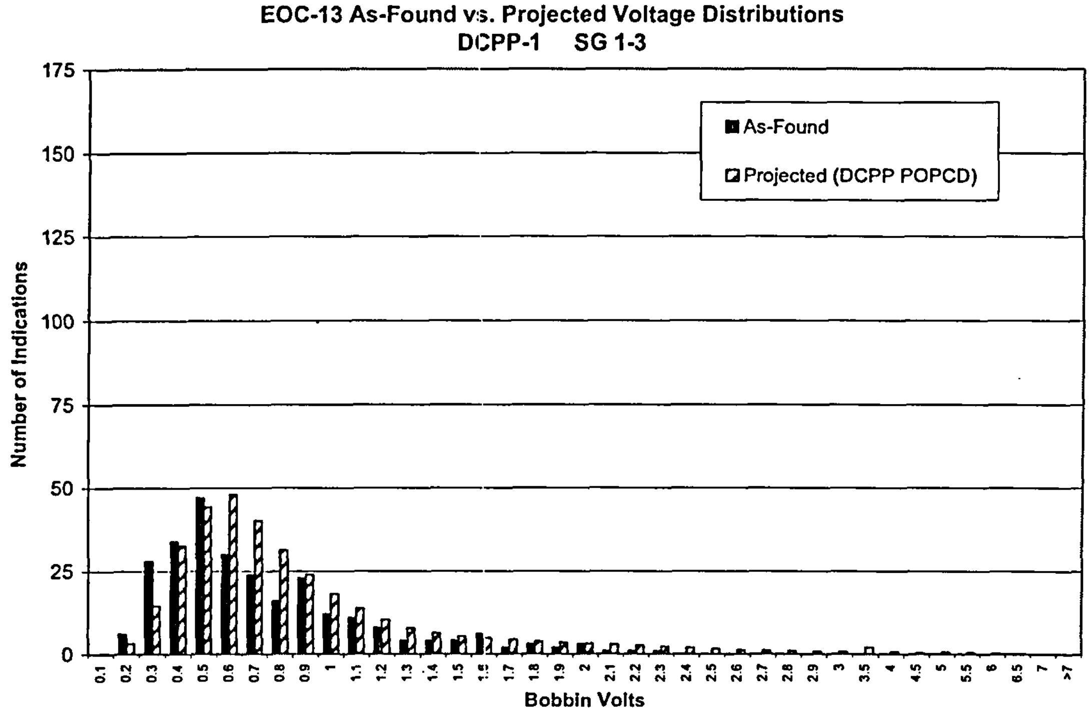
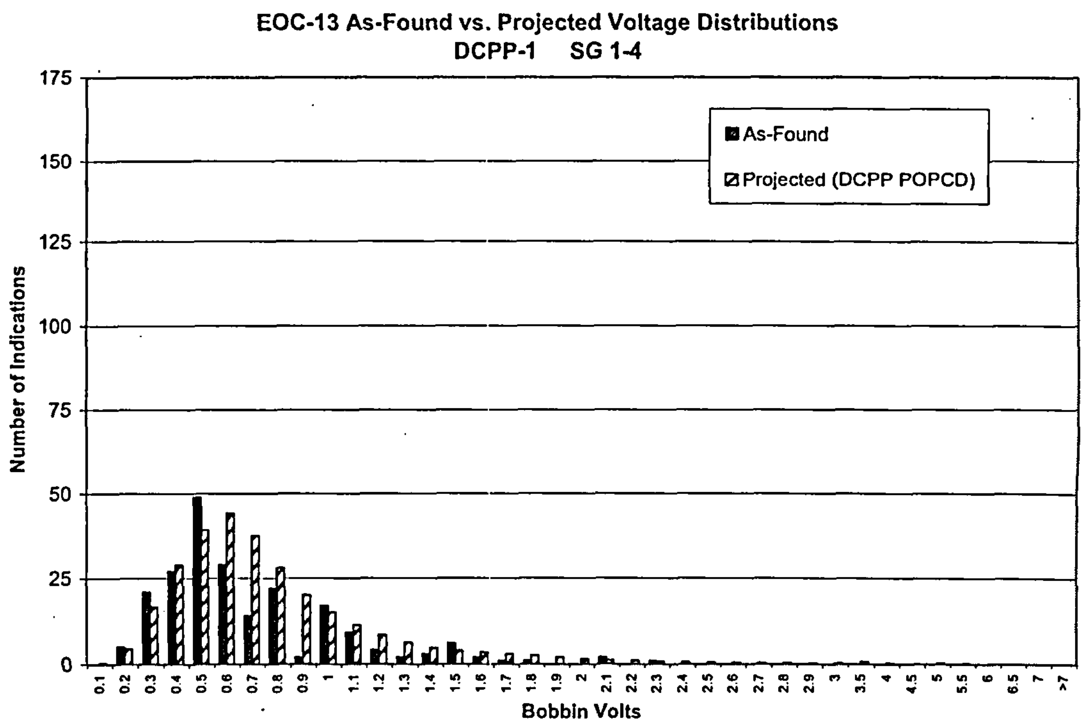


Figure 5-4: As-found SG 1-4 vs Projected Voltage Distributions (DCPP POPCD)



6.0 Probability of Prior Cycle Detection and EOC-14 Projections Using DCPP POPCD

The NRC approved use of the voltage-dependent POPCD at DCPP in Reference 29. This section provides the 1R12 POPCD results, which is based on the results of the 1R12 and 1R13 inspections. This section also provides the updated POPCD correlation that was used in the EOC-14 projections provided in Section 7, as well as NRC reporting requirements for continued application of POPCD.

6.1 Updated DCPP POPCD Correlation

The POPCD method, which is based on results from actual field inspections, reflects the DCPP detection results that approach 1.0 at bobbin voltages above 1.6 volts. The resulting larger POD above about two volts realistically lowers the detection uncertainty, thereby lowering the number of the larger undetected indications in the BOC voltage distribution. Reference 7 provided the DCPP-specific correlation through 2R12 (seven inspections). The data from Reference 7 has since been updated to include the 1R13 results, also referred to as the 1R12 POPCD data. Tables 6-1 and 6-2 provide the 1R12 and composite DCPP POPCD data, respectively. The composite POPCD includes results from eight inspections (2R8, 2R9, 2R10, 2R11, 1R9, 1R10, 1R11, and 1R12). Table 6-3 provides the POPCD tracking matrix with column letters that correspond to the columns in Tables 6-1 and 6-2. Table 6-4 provides the POPCD matrix table including data from only the just completed cycle segregated into voltage bins of <=1.00v, 1.01-2.00v, and >2.00v based on the beginning-of-cycle voltage. Table 6-5 provides the POPCD matrix table for the just completed cycle regardless of the beginning-of-cycle voltage. Table 6-6 provides the composite multi-cycle POPCD matrix table segregated into the three voltage bins. Table 6-7 provides the composite multi-cycle POPCD matrix table regardless of the beginning-of-cycle voltage. Table 6-8 provides the correlation parameters for the composite data set.

The largest "undetected" POPCD indication in 1R12 was 1.90v. SG 1-2 R20C63 2H had a 1.9 volt DOS reported in 1R12 and was inspected, but not confirmed, with +Point™ in 1R12 (BDD/RND in Table 6-1 Column G) and had a 1.31v DOS in 1R13, but not re-inspected with +Point™ (BDD w/o RPC). At the NRC's request, bobbin indications that were +Point™ inspected but not confirmed at the prior outage (EOC_n) should be considered as "No Detection" at EOC_n.

6.1.1 Assessment of POPCD Changes

NRC requires an assessment of the POPCD method for potential changes over time, that is, the multi-cycle POPCD distribution applied for the last operational assessment must be compared with the POPCD distribution obtained for only the last operating cycle. Differences in the two POPCD distributions must be assessed relative to the potential for significant changes in detection capability. Figure 6-1 shows the POPCD curves for the just completed cycle as well as three composite POPCD curves (composite data through 1R12, 1R13, and 2R12). The curve labeled "through 2R12 (seven inspections)" was used for the benchmarking calculations provided in Section 5 of this document. The composite POPCD through 1R13 was used for the EOC-14 projections provided in Section 8 of this document. The 1R12 POPCD distribution for

the just completed cycle (based on the 1R13 inspection results) is improved for voltages less than about 0.7 volts compared to the previous composite POPCD distribution used in the Section 5 benchmarking calculations. Therefore, the updated composite POPCD curve is also improved for voltages less than about 0.7 volts. For indications above 0.7 volts, the updated composite POPCD is essentially unchanged from the previous composite POPCD curve. Table 6-9 provides a direct comparison of the best estimates of the previous and current composite cycle POPCD values up through 10 volts. The improvement in the POPCD based on the just completed Cycle 13 may not represent a significant change in actual detection capability and may be more reflective of reduced rates of new crack initiation at detectable levels. The increased POPCD below about 0.7 volt moves the DCPP POPCD closer to that found across the industry as reflected in the industry POPCD distribution of the EPRI Addendum 6 Database (Ref. 8). The growth rates decreased in Cycle 13 compared to Cycle 12. This growth rate decrease may have contributed to the improvement in the POPCD distribution, assuming that slower growth implies reduced rates of new crack initiation at detectable levels and therefore fewer new indications, which translates into fewer misses for POPCD. From Table 6-1 which is the POPCD for the just completed cycle based on 1R13 inspections, the number of non-detected POPCD indications was only 574, compared to 1345 detected POPCD indications. This is a greater than 2-to-1 ratio. This ratio of detections has been steadily increasing over time at DCPP, and is consistent between the last two POPCD determinations at 2.35 and reflects the improvement in the POD curve. Additionally, there were a large number of new small voltage indications detected in 1R12. These new indications were then re-identified in 1R13 and counted as detections at EOCn, which also improved DCPP POPCD based on larger numbers of detected indications.

6.1.2 Assessment of Disappearing Flaws

NRC also requires an assessment of disappearing flaws. For RPC confirmed indications at EOC_n that are RPC NDD at EOC_{n+1}, an assessment is required for the cause of the "disappearing flaws" if the +Point™ voltage is greater than 0.5 volt. If there are a significant number of occurrences of these "disappearing flaws", the cause must be evaluated independent of the +Point™ voltage. (Note: In support of this evaluation, an RPC inspection is required at EOC_{n+1} for RPC confirmed indications at EOC_n (either bobbin detected or bobbin NDD) that are bobbin NDD at EOC_{n+1}. This inspection is necessary to ensure that all known ODSCC indications are included in the condition monitoring and operational assessments as well as properly categorized for the POPCD method evaluation.)

During the 1R13 inspection, there was only one case where a +Point™ confirmed indication from 1R12 was not also detected in 1R13. This tube (R8C32 in SG 1-4) contained a 0.15 volt +Point™ indication in 1R12 (and 1R11) that was not reported in 1R13. The bobbin voltage was essentially unchanged between the 1R12 and 1R13 inspections (0.36 volts in 1R12 and 0.35 volts in 1R13). Two independent techniques reflect no relative change, indicating that real degradation is not likely present. An assessment is not required because the +Point™ voltage is less than 0.5 volts.

6.2 Input to Industry POPCD Database

Tables 6-10 and 6-11 provide the 1R12 and the composite POPCD results in the format of EPRI ODSCC Database Report Addendum 6, Table 7-2, for eventual inclusion in the next addendum of the database report. The EPRI format differs slightly from the DCPP format in that DCPP treats EOC_n RPC NDD indications as no detection as requested by the NRC (listed in Column G of Table 6-1 and Table 6-2), whereas the EPRI table treats these as detection.

Table 6-1: 1R12 POPCD Results

Column	A	B	C	D	E	F	G	H	I	J	K
1R12 POPCD Data Table											
	Detection at EOC$_n$			No Detection at EOCn (New Indications)							
	EOC$_n$ Bobbin Ind. RPC Confirmed at EOC$_{n+1}$	EOC$_n$ Bobbin Ind. Not RPC Inspected at EOC$_{n+1}$	EOC$_n$ Bobbin Ind. Repaired at EOC$_n$	New EOC$_{n+1}$ Bobbin RPC Confirmed	New EOC$_{n+1}$ Bobbin Not RPC Inspected	Ind. Found Only by RPC at EOC$_{n+1}$ or at EOC$_n$ & Plugged at EOC$_n$ (3)	EOC$_n$ RPC NDD Bobbin Indications (2)	Excluded from POPCD	Totals for POPCD Evaluation		
Voltage Bin	BDD / RDD → BDD / RDD BDD / RDD → BND / RDD BDD w/o RPC → BDD / RDD BDD w/o RPC → BND / RDD	BDD w/o RPC → BDD w/o RPC BDD / RDD → BDD w/o RPC	BDD / RDD → Plugged at EOCn BDD w/o RPC → Plugged at EOCn	BND w/o RPC → BDD / RDD BND / RDD → BDD / RDD BND / RND → BDD / RDD	BND w/o RPC → BDD w/o RPC BND / RDD → BDD w/o RPC BND / RND → BDD w/o RPC	BND w/o RPC → BND / RDD BND / RDD → BND / RDD BND / RND → BND / RDD BND / RDD → Plugged at EOCn	BDD / RND → BDD w/o RPC BDD / RND → BDD / RDD BDD / RND → BND / RDD	All RND AT EOC$_{n+1}$ All BND w/o RPC at EOCn+1 BDD/RND/Plugged at EOCn	Detection at EOCn	No Detection at EOCn	POPCD for Voltage Bin Note (1)
0.01-0.10	1	1	0	2	4	0	0	0	2	6	0.250
0.11-0.20	7	25	0	5	42	0	0	5	32	47	0.405
0.21-0.30	12	112	8	9	91	0	1	10	132	101	0.567
0.31-0.40	27	174	12	14	91	52	3	15	213	160	0.571
0.41-0.50	39	124	18	10	54	58	0	12	181	122	0.597
0.51-0.60	33	108	14	7	27	26	1	7	155	61	0.718
0.61-0.70	25	98	8	3	13	7	1	6	131	24	0.845
0.71-0.80	17	75	3	3	15	3	0	4	95	21	0.819
0.81-0.90	18	58	2	3	7	2	1	3	78	13	0.857
0.91-1.00	10	52	4	4	6	1	1	1	66	12	0.846
1.01-1.10	13	45	0	0	1	0	0	2	58	1	0.983
1.11-1.20	6	28	2	0	2	0	0	0	36	2	0.947
1.21-1.30	13	25	0	1	0	0	0	0	38	1	0.974
1.31-1.40	8	12	1	0	0	0	0	0	21	0	1.000
1.41-1.50	11	11	1	0	0	0	0	0	23	0	1.000
1.51-1.60	4	3	1	0	0	0	0	0	8	0	1.000
1.61-1.70	7	1	0	0	0	0	0	0	8	0	1.000
1.71-1.80	9	0	2	2	0	0	0	0	11	2	0.846
1.81-1.90	7	0	0	0	0	0	1	0	7	1	0.875
1.91-2.00	2	0	0	0	0	0	0	0	2	0	1.000
2.01-2.10	0	0	12	0	0	0	0	0	12	0	1.000
2.11-2.20	0	0	2	0	0	0	0	0	2	0	1.000
2.21-2.30	0	0	5	0	0	0	0	0	5	0	1.000
2.31-2.40	0	0	6	0	0	0	0	0	6	0	1.000
2.41-2.50	0	0	1	0	0	0	0	0	1	0	1.000
2.51-2.60	0	0	4	0	0	0	0	0	4	0	1.000
2.61-2.70	0	0	1	0	0	0	0	0	1	0	1.000
2.71-2.80	0	0	1	0	0	0	0	0	1	0	1.000
2.81-2.90	0	0	1	0	0	0	0	0	1	0	1.000
2.91-3.00	0	0	0	0	0	0	0	0	0	0	
3.01-3.10	0	0	4	0	0	0	0	0	4	0	1.000
3.11-3.20	0	0	0	0	0	0	0	0	0	0	
3.21-3.30	0	0	0	0	0	0	0	0	0	0	
3.31-3.40	0	0	1	0	0	0	0	0	1	0	1.000
3.41-3.50	0	0	0	0	0	0	0	0	0	0	
3.51-3.60	0	0	1	0	0	0	0	0	1	0	1.000
3.61-3.70	0	0	2	0	0	0	0	0	2	0	1.000
3.71-3.80	0	0	0	0	0	0	0	0	0	0	
3.81-3.90	0	0	0	0	0	0	0	0	0	0	
3.91-4.00	0	0	0	0	0	0	0	0	0	0	
4.01-4.10	0	0	2	0	0	0	0	0	2	0	1.000
4.11-4.20	0	0	0	0	0	0	0	0	0	0	
4.21-4.30	0	0	0	0	0	0	0	0	0	0	
4.31-4.40	0	0	0	0	0	0	0	0	0	0	
4.41-4.50	0	0	1	0	0	0	0	0	1	0	1.000
5.01-5.10	0	0	1	0	0	0	0	0	1	0	1.000
5.11-5.20	0	0	0	0	0	0	0	0	0	0	
5.21-5.30	0	0	0	0	0	0	0	0	0	0	
5.31-5.40	0	0	0	0	0	0	0	0	0	0	
5.41-5.50	0	0	0	0	0	0	0	0	0	0	
5.51-5.60	0	0	2	0	0	0	0	0	2	0	1.000
6.11-6.20	0	0	1	0	0	0	0	0	1	0	1.000
Total	269	952	124	63	353	149	9	65	1345	574	

Notes:
1) POPCD for each voltage bin calculated as (Detection at EOCn)/(Detection at EOCn + No Detection at EOCn). By column, POPCD = (A+B+C)/(A+B+C+D+E+F+G).
2) EOCn RPC NDD bobbin indications are treated as new indications per NRC request
3) Includes indications at EOCn plugged at EOCn and new indications at EOCn+1, not reported in the bobbin inspection, and found only by RPC inspection of dents, mixed residuals or other reasons for the RPC inspection.
4) BDD = Bobbin detected indication; BND = Bobbin NDD intersection; RDD = RPC detected indication; RND = RPC NDD intersection

Table 6-2: DCPP Composite POPCD Results

Column	A	B	C	D	E	F	G	H	I	J	K
DCPP Specific POPCD Data Table											
	Detection at EOC_n			No Detection at EOCn (New Indications)							
	EOC_n Bobbin Ind. RPC Confirmed at EOC_{n+1}	EOC_n Bobbin Ind. Not RPC Inspected at EOC_{n+1}	EOC_n Bobbin Ind. Repaired at EOC_n	New EOC_{n+1} Bobbin RPC Confirmed	New EOC_{n+1} Bobbin Not RPC Inspected	Ind. Found Only by RPC at EOC_{n+1} or at EOC_n & Plugged at EOC_n [3]	EOC_n RPC NDD Bobbin Indications [2]	Excluded from POPCD	Totals for POPCD Evaluation		
Voltage Bin	BDD / RDD → BDD / RDD BDD / RDD → BND / RDD BDD w/o RPC → BDD / RDD BDD w/o RPC → BND / RDD	BDD w/o RPC → BDD w/o RPC BDD / RDD → BDD w/o RPC	BDD / RDD → Plugged at EOCn BDD w/o RPC → Plugged at EOCn	BND w/o RPC → BDD / RDD BND / RDD → BDD / RDD BND / RND → BDD / RDD	BND w/o RPC → BDD w/o RPC BND / RDD → BDD w/o RPC BND / RND → BDD w/o RPC	BND w/o RPC → BND / RDD BND / RDD → BND / RDD BND / RND → BND / RDD BND / RDD → Plugged at EOCn	BDD / RND → BDD w/o RPC BDD / RND → BDD / RDD BDD / RND → BND / RDD	All RND AT EOC_{n+1} All BND w/o RPC at EOCn+1 BDD/RND/Plugged at EOCn	Detection at EOCn	No Detection at EOCn	POPCD for Voltage Bin Note [1]
0.01-0.10	6	2	1	31	132	0	1	10	9	164	0.052
0.11-0.20	28	127	4	122	703	9	37	56	159	871	0.154
0.21-0.30	90	558	32	157	908	125	45	102	680	1235	0 355
0.31-0.40	146	755	49	142	642	171	49	94	950	1004	0.486
0.41-0.50	172	678	46	84	337	104	28	72	896	553	0.618
0.51-0.60	164	551	38	51	175	70	16	46	753	312	0.707
0.61-0.70	144	413	33	33	87	18	18	38	590	156	0.791
0.71-0.80	114	295	22	23	60	8	8	20	431	99	0.813
0.81-0.90	109	212	12	22	29	2	8	14	333	61	0.845
0.91-1.00	70	148	14	8	14	1	1	4	232	24	0.906
1.01-1.10	80	103	9	7	10	0	1	7	192	18	0.914
1.11-1.20	45	84	7	4	5	0	4	5	136	13	0.913
1.21-1.30	45	50	43	4	4	0	0	2	138	8	0.945
1.31-1.40	47	26	25	2	1	0	0	2	98	3	0.970
1.41-1.50	29	19	22	1	0	0	0	0	70	1	0.986
1.51-1.60	17	7	21	1	0	0	0	0	45	1	0.978
1.61-1.70	21	2	20	0	0	0	0	0	43	0	1.000
1.71-1.80	26	1	17	2	0	0	0	0	44	2	0.957
1.81-1.90	17	0	15	0	0	0	1	0	32	1	0.970
1.91-2.00	17	1	12	0	0	0	0	0	30	0	1.000
2.01-2.10	0	0	14	0	0	0	0	0	14	0	1.000
2.11-2.20	0	0	11	0	0	0	0	0	11	0	1.000
2.21-2.30	0	0	18	0	0	0	0	0	18	0	1.000
2.31-2.40	0	0	21	0	0	0	0	0	21	0	1.000
2.41-2.50	0	0	5	0	0	0	0	0	5	0	1.000
2.51-2.60	0	0	9	0	0	0	0	0	9	0	1.000
2.61-2.70	0	0	5	0	0	0	0	0	5	0	1.000
2.71-2.80	0	0	8	0	0	0	0	0	8	0	1.000
2.81-2.90	0	0	11	0	0	0	0	0	11	0	1.000
2.91-3.00	0	0	3	0	0	0	0	0	3	0	1.000
3.01-3.10	0	0	8	0	0	0	0	0	8	0	1.000
3.11-3.20	0	0	2	0	0	0	0	0	2	0	1.000
3.21-3.30	0	0	4	0	0	0	0	0	4	0	1.000
3.31-3.40	0	0	6	0	0	0	0	0	6	0	1.000
3.41-3.50	0	0	4	0	0	0	0	0	4	0	1.000
3.51-3.60	0	0	2	0	0	0	0	0	2	0	1.000
3.61-3.70	0	0	2	0	0	0	0	0	2	0	1.000
3.71-3.80	0	0	2	0	0	0	0	0	2	0	1.000
3.81-3.90	0	0	2	0	0	0	0	0	2	0	1.000
4.01-4.10	0	0	5	0	0	0	0	0	5	0	1.000
4.11-4.20	0	0	3	0	0	0	0	0	3	0	1.000
4.21-4.30	0	0	1	0	0	0	0	0	1	0	1.000
4.31-4.40	0	0	4	0	0	0	0	0	4	0	1.000
4.41-4.50	0	0	2	0	0	0	0	0	2	0	1.000
4.51-4.60	0	0	2	0	0	0	0	0	2	0	1.000
4.61-4.70	0	0	1	0	0	0	0	0	1	0	1.000
4.81-4.90	0	0	1	0	0	0	0	0	1	0	1.000
4.91-5.00	0	0	3	0	0	0	0	0	3	0	1.000
5.01-5.10	0	0	5	0	0	0	0	0	5	0	1.000
5.21-5.30	0	0	2	0	0	0	0	0	2	0	1.000
5.41-5.50	0	0	3	0	0	0	0	0	3	0	1.000
5.51-5.60	0	0	2	0	0	0	0	0	2	0	1.000
5.61-5.70	0	0	1	0	0	0	0	0	1	0	1.000
6.11-6.20	0	0	3	0	0	0	0	0	3	0	1.000
6.31-6.40	0	0	1	0	0	0	0	0	1	0	1.000
6.51-6.60	0	0	1	0	0	0	0	0	1	0	1.000
6.61-6.70	0	0	1	0	0	0	0	0	1	0	1.000
21.41-21.50	0	0	1	0	0	0	0	0	1	0	1.000
>21.50	0	0	0	0	0	0	0	0	0	0	
Total	1387	4032	621	694	3107	508	217	472	6040	4526	

Notes:

1) POPCD for each voltage bin calculated as (Detection at EOCn)/(Detection at EOCn + No Detection at EOCn). By column, POPCD = (A+B+C)/(A+B+C+D+E+F+G).

2) EOCn RPC NDD bobbin indications are treated as new indications per NRC request

3) Includes indications at EOCn plugged at EOCn and new indications at EOCn+1, not reported in the bobbin inspection, and found only by RPC inspection of dents, mixed residuals or other reasons for the RPC inspection.

4) BDD = Bobbin detected indication; BND = Bobbin NDD intersection; RDD = RPC detected indication; RND = RPC NDD intersection

Table 6-3: POPCD Matrix Table for Tracking Indications Between EOC_n and EOC_{n+1}

EOC_n				BDD at EOC_{n+1}						BND at EOC_{n+1}					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOC_n	BDD w/o RPC	Plugged	C												
		Not Plugged		B	B	A	A	H	H	H	H	A	A	H	H
	BDD w/ RDD	Plugged	C												
		Not Plugged		B	B	A	A	H (2)	H (2)	H (1)	H (1)	A	A	H (2)	H (2)
	BDD w/ RND	Plugged	H												
		Not Plugged		G (3)	G (3)	G (3)	G (3)	H	H	H	H	G (3)	G (3)	H	H
BND at EOC_n	BND w/o RPC	Plugged													
		Not Plugged		E	E	D	D	H	H	No Count	No Count	F	F	No Count	No Count
	BND w/ RDD	Plugged	F												
		Not Plugged		E	E	D	D	H (2)	H (2)	H (1)	H (1)	F	F	H (2)	H (2)
	BND w/ RND	Plugged													
		Not Plugged		E	E	D	D	H	H	No Count	No Count	F	F	No Count	No Count

General Notes:
The column letters correspond to the column letters in POPCD Tables 6-1 and 6-2.
BDD = Bobbin detected indication
BND = Bobbin no detectable degradation (NDD) intersection
RDD = RPC detected indication
RND = RPC no detectable degradation intersection
No Count = Intersections having no bobbin or RPC indication at either EOC_n or EOC_{n+1}. These are not needed for POPCD.

Specific Notes:
1) For EOC_n bobbin indications that are confirmed by RPC or detected only by RPC, EOC_{n+1} RPC will be performed when bobbin is NDD and the number in this category will be "0" for future inspections.
2) If indications are RPC confirmed at EOC_n but RPC NDD at EOC_{n+1}, and the +Point™ voltage is greater than 0.5 volts the causative factors for this change in RPC detection will be discussed in the ARC 90-day report. If there are a significant number of these occurrences of this category, independent of the +Point™ voltage, the cause will be evaluated in the 90-day report.
3) EOC_n bobbin indications that were RPC NDD at EOC_n, and at EOC_{n+1} are either RPC detected or bobbin detected without RPC inspection, are treated as undetected at EOC_n in accordance with NRC request.

Table 6-4: 1R12 POPCD Voltage-Specific Summary from 1R13 Inspection Results

1R12 POPCD Results

POPCD Matrix for Indications <=1.00v at EOCn

EOCn				BDD at EOCn+1*						BND at EOCn+1*					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	24												
		Not Plugged		19	800	1	24	2	12	1	7	0	4	0	0
	BDD w/ RDD	Plugged	45												
		Not Plugged		0	8	1	155	0	1	0	0	0	4	0	0
	BDD w/ RND	Plugged	0												
		Not Plugged		1	2	0	5	0	13	0	2	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		4	346	3	41	0	25	No Count	No Count	8	58	No Count	No Count
	BND w/ RDD	Plugged	0												
		Not Plugged		0	0	0	16	0	0	No Count	No Count	2	75	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	0	0	0	0	0	No Count	No Count	3	3	No Count	No Count

POPCD Matrix for Indications >1.00v and <=2.00v at EOCn

EOCn				BDD at EOCn+1*						BND at EOCn+1*					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	3												
		Not Plugged		3	111	2	9	0	1	0	0	0	0	0	0
	BDD w/ RDD	Plugged	4												
		Not Plugged		0	11	20	49	0	0	0	0	0	0	0	0
	BDD w/ RND	Plugged	0												
		Not Plugged		0	1	0	0	0	1	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		0	3	0	1	0	0	No Count	No Count	0	0	No Count	No Count
	BND w/ RDD	Plugged	0												
		Not Plugged		0	0	1	1	0	0	No Count	No Count	0	0	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	0	0	0	0	0	No Count	No Count	0	0	No Count	No Count

POPCD Matrix for Indications >2.00v at EOCn

EOCn				BDD at EOCn+1*						BND at EOCn+1*					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	0												
		Not Plugged		0	0	0	0	0	0	0	0	0	0	0	0
	BDD w/ RDD	Plugged	48												
		Not Plugged		0	0	0	0	0	0	0	0	0	0	0	0
	BDD w/ RND	Plugged	0												
		Not Plugged		0	0	0	0	0	0	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		0	0	0	0	0	0	No Count	No Count	0	0	No Count	No Count
	BND w/ RDD	Plugged	0												
		Not Plugged		0	0	0	0	0	0	No Count	No Count	0	0	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	0	0	0	0	0	No Count	No Count	0	0	No Count	No Count

Table 6-5: 1R12 POPCD Summary from 1R13 Inspection Results Regardless of Voltage

POPCD Matrix for All Indications Regardless of Voltage															
EOCn				BDD at EOCn+1*						BND at EOCn+1*					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	27												
		Not Plugged		22	911	3	33	2	13	1	7		4		
	BDD w/ RDD	Plugged	97												
		Not Plugged			19	21	204		1				4		
	BDD w/ RND	Plugged													
		Not Plugged		1	3		5		14		2				
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		4	349	3	42		25	No Count	No Count	8	58	No Count	No Count
	BND w/ RDD	Plugged													
		Not Plugged				1	17			No Count	No Count	2	75	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged								No Count	No Count	3	3	No Count	No Count

Table 6-6: DCPP Composite Voltage-Specific POPCD Summary

Composite of 1R9, 1R10, 1R11, 1R12, 2R8, 2R9, 2R10, & 2R11 POPCD Evaluations

POPCD Matrix for Indications <=1.00v at EOCn

EOCn				BDD at EOCn+1*						BND at EOCn+1*					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	102												
		Not Plugged		82	3163	146	219	2	73	1	62	0	8	0	0
	BDD w/ RDD	Plugged	149												
		Not Plugged		1	493	31	614	0	2	0	0	0	25	0	2
	BDD w/ RND	Plugged	4												
		Not Plugged		5	137	10	56	0	114	0	38	0	3	0	3
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		56	3027	112	519	4	145	No Count	No Count	45	206	No Count	No Count
	BND w/ RDD	Plugged	45												
		Not Plugged		0	3	1	33	0	0	No Count	No Count	10	161	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	1	3	5	0	6	No Count	No Count	19	22	No Count	No Count

POPCD Matrix for Indications >1.00v and <=2.00v at EOCn

EOCn				BDD at EOCn+1*						BND at EOCn+1*					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	13												
		Not Plugged		5	198	169	37	0	4	0	0	0	0	0	0
	BDD w/ RDD	Plugged	178												
		Not Plugged		2	88	49	88	0	0	0	0	0	1	0	0
	BDD w/ RND	Plugged	2												
		Not Plugged		0	4	0	2	0	5	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		0	20	4	15	1	4	No Count	No Count	0	0	No Count	No Count
	BND w/ RDD	Plugged	0												
		Not Plugged		0	0	1	1	0	0	No Count	No Count	0	0	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	0	0	0	0	0	No Count	No Count	0	0	No Count	No Count

POPCD Matrix for Indications >2.00v at EOCn

EOCn				BDD at EOCn+1*						BND at EOCn+1*					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	0												
		Not Plugged		0	0	0	0	0	0	0	0	0	0	0	0
	BDD w/ RDD	Plugged	179												
		Not Plugged		0	0	0	0	0	0	0	0	0	0	0	0
	BDD w/ RND	Plugged	0												
		Not Plugged		0	0	0	0	0	0	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		0	0	0	0	0	0	No Count	No Count	0	0	No Count	No Count
	BND w/ RDD	Plugged	0												
		Not Plugged		0	0	0	0	0	0	No Count	No Count	0	0	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	0	0	0	0	0	No Count	No Count	0	0	No Count	No Count

Table 6-7: DCPP Composite POPCD Summary Regardless of Voltage

				POPCD Matrix for All Indications Regardless of Voltage											
EOCn				BDD at EOCn+1*						BND at EOCn+1*					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	115												
		Not Plugged		87	3361	315	256	2	77	1	62		8		
	BDD w/ RDD	Plugged	506												
		Not Plugged		3	581	80	702		2				26		2
	BDD w/ RND	Plugged	6												
		Not Plugged		5	141	10	58		119		38		3		3
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		56	3047	116	534	5	149	No Count	No Count	45	206	No Count	No Count
	BND w/ RDD	Plugged	45												
		Not Plugged			3	2	34			No Count	No Count	10	161	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged			1	3	5		6	No Count	No Count	19	22	No Count	No Count

Table 6-8: DCPP POPCD Log Logistic Parameters

Parameter	POPCD Through 1R11 (6 Inspections)	POPCD Through 2R11 (7 Inspections)	Updated POPCD Through 1R12 (8 Inspections)
Number of Data Points	6219	8647	10566
a.0 (intercept)	1.844	2.147	2.125
a.1 (slope)	4.781	4.846	4.634
V_{11}	0.00407	0.00317	0.00245
V_{12}	0.00806	0.00607	0.00471
V_{22}	0.02022	0.01454	0.01146

Table 6-9: New DCPP POPCD Correlation Comparison to Previous POPCD Correlations (Best Estimates)

Volts	POPCD Through 1R11 (Six Inspections)	POPCD Through 2R11 (Seven Inspections)	New POPCD Through 1R12 (Eight Inspections)
0.1	0.050	0.063	0.075
0.12	0.072	0.090	0.105
0.14	0.096	0.120	0.138
0.16	0.123	0.153	0.173
0.18	0.152	0.188	0.210
0.2	0.183	0.224	0.247
0.22	0.214	0.261	0.285
0.25	0.262	0.316	0.340
0.3	0.342	0.404	0.426
0.35	0.417	0.484	0.503
0.4	0.485	0.554	0.570
0.45	0.546	0.615	0.627
0.5	0.600	0.666	0.675
0.6	0.686	0.745	0.750
0.7	0.751	0.802	0.803
0.8	0.799	0.843	0.842
0.9	0.836	0.873	0.871
1	0.863	0.895	0.893
1.1	0.885	0.913	0.910
1.2	0.902	0.926	0.924
1.4	0.927	0.946	0.943
1.6	0.944	0.958	0.956
1.8	0.955	0.967	0.965
2	0.964	0.974	0.971
2.2	0.970	0.978	0.976
2.4	0.975	0.982	0.980
2.6	0.979	0.985	0.983
2.8	0.982	0.987	0.985
3	0.984	0.989	0.987
3.5	0.988	0.992	0.990
4	0.991	0.994	0.993
4.5	0.993	0.995	0.994
5	0.9944	0.9961	0.9953
6	0.9962	0.9973	0.9968
7	0.9972	0.9981	0.9976
8	0.9979	0.9985	0.9982
9	0.9984	0.9989	0.9986
10	0.9987	0.9991	0.9988

Table 6-10: 1R12 POPCD Results In Industry Format

Column	A	B	C	D	E	F	G	H	I	J
DCPP 1R12 Input to Generic POPCD Data Table										
	Detection at EOC_n			No Detection at EOCn (New Indications)						
	EOC_n Bobbin Ind. RPC Confirmed at EOC_{n+1}	EOC_n Bobbin Ind. Not RPC Inspected at EOC_{n+1}	EOC_n Bobbin Ind. Repaired at EOC_n	New EOC_{n+1} Bobbin RPC Confirmed	New EOC_{n+1} Bobbin Not RPC Inspected	Ind. Found Only by RPC at EOC_{n+1} or at EOC_n & Plugged at EOC_n [3]	Excluded from POPCD	Totals for POPCD Evaluation		
Voltage Bin	BDD / RDD → BDD / RDD BDD / RDD → BND / RDD BDD / RND → BDD / RDD BDD / RND → BND / RDD BDD w/o RPC → BDD / RDD BDD w/o RPC → BND / RDD	BDD w/o RPC → BDD w/o RPC BDD / RDD → BDD w/o RPC BDD / RND → BDD w/o RPC	BDD / RDD → Plugged at EOCn BDD w/o RPC → Plugged at EOCn	BND w/o RPC → BDD / RDD BND / RDD → BDD / RDD BND / RND → BDD / RDD	BND w/o RPC → BDD w/o RPC BND / RDD → BDD w/o RPC BND / RND → BDD w/o RPC	BND w/o RPC → BND / RDD BND / RDD → BND / RDD BND / RND → BND / RDD BND / RDD → Plugged at EOCn	All RND AT EOC_{n+1} All BND w/o RPC at EOC_{n+1} BDD/RND/Plugged at EOCn	Detection at EOCn	No Detection at EOCn	POPCD for Voltage Bin (Note 1)
0.01-0.10	1	1	0	2	4	0	0	2	6	0.250
0.11-0.20	7	25	0	5	42	0	5	32	47	0.405
0.21-0.30	13	112	8	9	91	0	10	133	100	0.571
0.31-0.40	29	175	12	14	91	52	15	216	157	0.579
0.41-0.50	39	124	18	10	54	58	12	181	122	0.597
0.51-0.60	33	109	14	7	27	26	7	156	60	0.722
0.61-0.70	26	98	8	3	13	7	6	132	23	0.852
0.71-0.80	17	75	3	3	15	3	4	95	21	0.819
0.81-0.90	19	58	2	3	7	2	3	79	12	0.868
0.91-1.00	10	53	4	4	6	1	1	67	11	0.859
1.01-1.10	13	45	0	0	1	0	2	58	1	0.983
1.11-1.20	6	28	2	0	2	0	0	36	2	0.947
1.21-1.30	13	25	0	1	0	0	0	38	1	0.974
1.31-1.40	8	12	1	0	0	0	0	21	0	1.000
1.41-1.50	11	11	1	0	0	0	0	23	0	1.000
1.51-1.60	4	3	1	0	0	0	0	8	0	1.000
1.61-1.70	7	1	0	0	0	0	0	8	0	1.000
1.71-1.80	9	0	2	2	0	0	0	11	2	0.846
1.81-1.90	7	1	0	0	0	0	0	8	0	1.000
1.91-2.00	2	0	0	0	0	0	0	2	0	1.000
2.01-2.10	0	0	12	0	0	0	0	12	0	1.000
2.11-2.20	0	0	2	0	0	0	0	2	0	1.000
2.21-2.30	0	0	5	0	0	0	0	5	0	1.000
2.31-2.40	0	0	6	0	0	0	0	6	0	1.000
2.41-2.50	0	0	1	0	0	0	0	1	0	1.000
2.51-2.60	0	0	4	0	0	0	0	4	0	1.000
2.61-2.70	0	0	1	0	0	0	0	1	0	1.000
2.71-2.80	0	0	1	0	0	0	0	1	0	1.000
2.81-2.90	0	0	1	0	0	0	0	1	0	1.000
2.91-3.00	0	0	0	0	0	0	0	0	0	
3.01-3.10	0	0	4	0	0	0	0	4	0	1.000
3.11-3.20	0	0	0	0	0	0	0	0	0	
3.21-3.30	0	0	0	0	0	0	0	0	0	
3.31-3.40	0	0	1	0	0	0	0	1	0	1.000
3.41-3.50	0	0	0	0	0	0	0	0	0	
3.51-3.60	0	0	1	0	0	0	0	1	0	1.000
3.61-3.70	0	0	2	0	0	0	0	2	0	1.000
3.71-3.80	0	0	0	0	0	0	0	0	0	
3.81-3.90	0	0	0	0	0	0	0	0	0	
3.91-4.00	0	0	0	0	0	0	0	0	0	
4.01-4.10	0	0	2	0	0	0	0	2	0	1.000
4.11-4.20	0	0	0	0	0	0	0	0	0	
4.21-4.30	0	0	0	0	0	0	0	0	0	
4.31-4.40	0	0	0	0	0	0	0	0	0	
4.41-4.50	0	0	1	0	0	0	0	1	0	1.000
4.51-4.60	0	0	0	0	0	0	0	0	0	
4.61-4.70	0	0	0	0	0	0	0	0	0	
4.71-4.80	0	0	0	0	0	0	0	0	0	
4.81-4.90	0	0	0	0	0	0	0	0	0	
4.91-5.00	0	0	0	0	0	0	0	0	0	
5.01-5.10	0	0	1	0	0	0	0	1	0	1.000
5.11-5.20	0	0	0	0	0	0	0	0	0	
5.21-5.30	0	0	0	0	0	0	0	0	0	
5.31-5.40	0	0	0	0	0	0	0	0	0	
5.41-5.50	0	0	0	0	0	0	0	0	0	
5.51-5.60	0	0	2	0	0	0	0	2	0	1.000
5.61-5.70	0	0	0	0	0	0	0	0	0	
5.71-5.80	0	0	0	0	0	0	0	0	0	
5.81-5.90	0	0	0	0	0	0	0	0	0	
5.91-6.00	0	0	0	0	0	0	0	0	0	
>6.00	0	0	1	0	0	0	0	1	0	1.000
Total	274	956	124	63	353	149	65	1354	565	

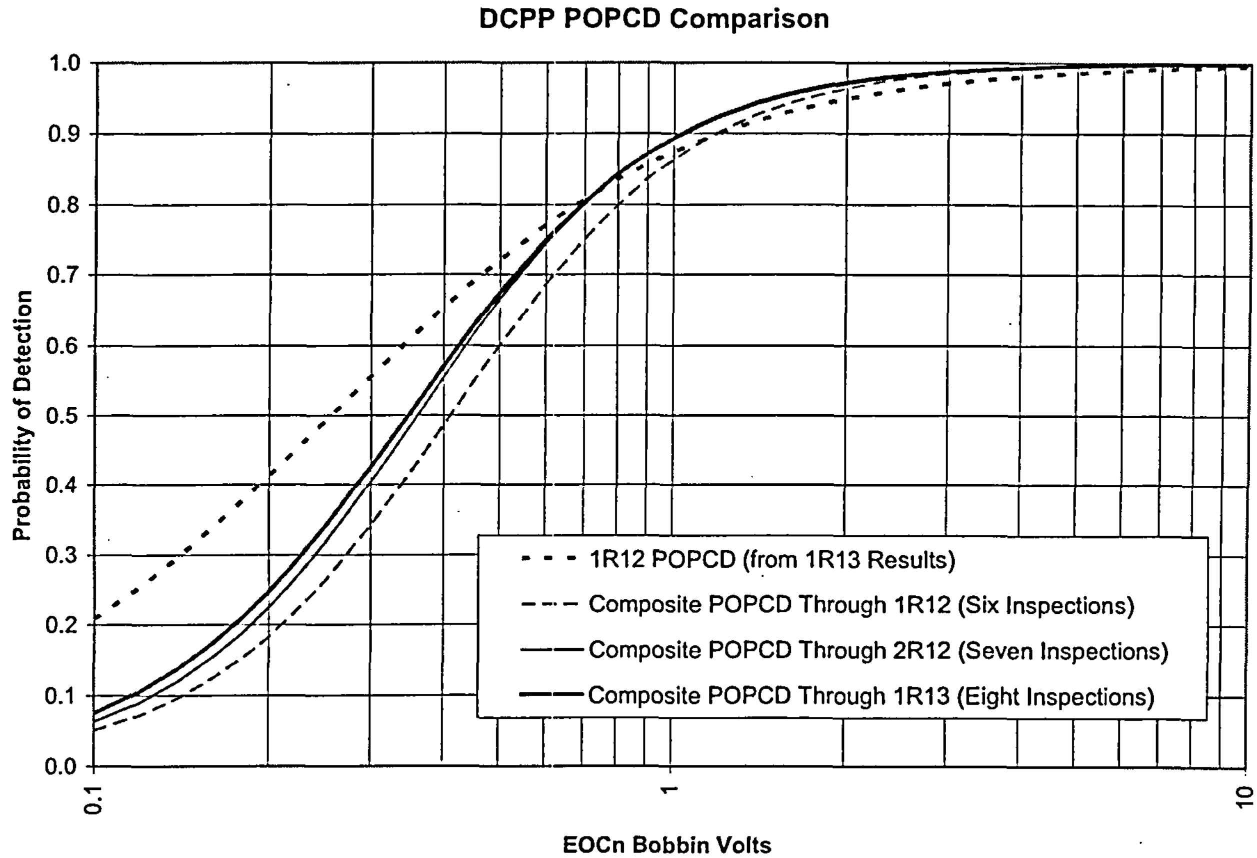
Notes:
1) POPCD for each voltage bin calculated as (Detection at EOCn)/(Detection at EOCn + No Detection at EOCn). By column, POPCD = (A+B+C)/(A+B+C+D+E+F).
2) Plant specific POPCD to be based upon voltage bins of 0.10 volt. Industry POPCD database may use 0.20 volt bins due to difficulty of adjusting existing database to smaller bins.
3) Includes indications at EOCn plugged at EOCn and new indications at EOCn+1, not reported in the bobbin inspection, and found only by RPC inspection of dents, mixed residuals or other reasons for the RPC inspection.
4) BDD = Bobbin detected indication; BND = Bobbin NDD intersection; RDD = RPC detected indication; RND = RPC NDD intersection

Table 6-11: DCPP Composite POPCD Results In Industry Format

Column	A	B	C	D	E	F	G	H	I	J
	DCPP Total Input to Generic POPCD Data Table									
	Detection at EOC_n			No Detection at EOCn (New Indications)						
	EOC_n Bobbin Ind. RPC Confirmed at EOC_{n+1}	EOC_n Bobbin Ind. Not RPC Inspected at EOC_{n+1}	EOC_n Bobbin Ind. Repaired at EOC_n	New EOC_{n+1} Bobbin RPC Confirmed	New EOC_{n+1} Bobbin Not RPC Inspected	Ind. Found Only by RPC at EOC_{n+1} or at EOC_n & Plugged at EOC_n (3)	Excluded from POPCD	Totals for POPCD Evaluation		
Voltage Bin	BDD / RDD → BDD / RDD BDD / RDD → BND / RDD BDD / RND → BDD / RDD BDD / RND → BND / RDD BDD w/o RPC → BDD / RDD BDD w/o RPC → BND / RDD	BDD w/o RPC → BDD w/o RPC BDD / RDD → BDD w/o RPC BDD / RND → BDD w/o RPC	BDD / RDD → Plugged at EOCn BDD w/o RPC → Plugged at EOCn	BND w/o RPC → BDD / RDD BND / RDD → BDD / RDD BND / RND → BDD / RDD	BND w/o RPC → BDD w/o RPC BND / RDD → BDD w/o RPC BND / RND → BDD w/o RPC	BND w/o RPC → BND / RDD BND / RDD → BND / RDD BND / RND → BND / RDD BND / RDD → Plugged at EOCn	All RND AT EOC_{n+1} All BND w/o RPC at EOC_{n+1} BDD/RND/Plugged at EOCn	Detection at EOCn	No Detection at EOCn	POPCD for Voltage Bin (Note 1)
0.01-0.10	6	3	1	31	132	0	10	10	163	0.058
0.11-0.20	49	143	4	122	703	9	56	196	834	0.190
0.21-0.30	112	581	32	157	908	125	102	725	1190	0.379
0.31-0.40	161	789	49	142	642	171	94	999	955	0.511
0.41-0.50	175	703	46	84	337	104	72	924	525	0.638
0.51-0.60	166	565	38	51	175	70	46	769	296	0.722
0.61-0.70	147	428	33	33	87	18	38	608	138	0.815
0.71-0.80	115	302	22	23	60	8	20	439	91	0.828
0.81-0.90	111	218	12	22	29	2	14	341	53	0.865
0.91-1.00	70	149	14	8	14	1	4	233	23	0.910
1.01-1.10	81	103	9	7	10	0	7	193	17	0.919
1.11-1.20	46	87	7	4	5	0	5	140	9	0.940
1.21-1.30	45	50	43	4	4	0	2	138	8	0.945
1.31-1.40	47	26	25	2	1	0	2	98	3	0.970
1.41-1.50	29	19	22	1	0	0	0	70	1	0.986
1.51-1.60	17	7	21	1	0	0	0	45	1	0.978
1.61-1.70	21	2	20	0	0	0	0	43	0	1.000
1.71-1.80	26	1	17	2	0	0	0	44	2	0.957
1.81-1.90	17	1	15	0	0	0	0	33	0	1.000
1.91-2.00	17	1	12	0	0	0	0	30	0	1.000
2.01-2.10	0	0	14	0	0	0	0	14	0	1.000
2.11-2.20	0	0	11	0	0	0	0	11	0	1.000
2.21-2.30	0	0	18	0	0	0	0	18	0	1.000
2.31-2.40	0	0	21	0	0	0	0	21	0	1.000
2.41-2.50	0	0	5	0	0	0	0	5	0	1.000
2.51-2.60	0	0	9	0	0	0	0	9	0	1.000
2.61-2.70	0	0	5	0	0	0	0	5	0	1.000
2.71-2.80	0	0	8	0	0	0	0	8	0	1.000
2.81-2.90	0	0	11	0	0	0	0	11	0	1.000
2.91-3.00	0	0	3	0	0	0	0	3	0	1.000
3.01-3.10	0	0	8	0	0	0	0	8	0	1.000
3.11-3.20	0	0	2	0	0	0	0	2	0	1.000
3.21-3.30	0	0	4	0	0	0	0	4	0	1.000
3.31-3.40	0	0	6	0	0	0	0	6	0	1.000
3.41-3.50	0	0	4	0	0	0	0	4	0	1.000
3.51-3.60	0	0	2	0	0	0	0	2	0	1.000
3.61-3.70	0	0	2	0	0	0	0	2	0	1.000
3.71-3.80	0	0	2	0	0	0	0	2	0	1.000
3.81-3.90	0	0	2	0	0	0	0	2	0	1.000
3.91-4.00	0	0	0	0	0	0	0	0	0	
4.01-4.10	0	0	5	0	0	0	0	5	0	1.000
4.11-4.20	0	0	3	0	0	0	0	3	0	1.000
4.21-4.30	0	0	1	0	0	0	0	1	0	1.000
4.31-4.40	0	0	4	0	0	0	0	4	0	1.000
4.41-4.50	0	0	2	0	0	0	0	2	0	1.000
4.51-4.60	0	0	2	0	0	0	0	2	0	1.000
4.61-4.70	0	0	1	0	0	0	0	1	0	1.000
4.71-4.80	0	0	0	0	0	0	0	0	0	
4.81-4.90	0	0	1	0	0	0	0	1	0	1.000
4.91-5.00	0	0	3	0	0	0	0	3	0	1.000
5.01-5.10	0	0	5	0	0	0	0	5	0	1.000
5.11-5.20	0	0	0	0	0	0	0	0	0	
5.21-5.30	0	0	2	0	0	0	0	2	0	1.000
5.31-5.40	0	0	0	0	0	0	0	0	0	
5.41-5.50	0	0	3	0	0	0	0	3	0	1.000
5.51-5.60	0	0	2	0	0	0	0	2	0	1.000
5.61-5.70	0	0	1	0	0	0	0	1	0	1.000
5.71-5.80	0	0	0	0	0	0	0	0	0	
5.81-5.90	0	0	0	0	0	0	0	0	0	
5.91-6.00	0	0	0	0	0	0	0	0	0	
>6.00	0	0	7	0	0	0	0	7	0	1.000
Total	1458	4178	621	694	3107	508	472	6257	4309	

Notes:
1) POPCD for each voltage bin calculated as (Detection at EOCn)/(Detection at EOCn + No Detection at EOCn). By column, POPCD = (A+B+C)/(A+B+C+D+E+F).
2) Plant specific POPCD to be based upon voltage bins of 0.10 volt. Industry POPCD database may use 0.20 volt bins due to difficulty of adjusting existing database to smaller bins.
3) Includes indications at EOCn plugged at EOCn and new indications at EOCn+1, not reported in the bobbin inspection, and found only by RPC inspection of dents, mixed residuals or other reasons for the RPC inspection.
4) BDD = Bobbin detected indication; BND = Bobbin NDD intersection; RDD = RPC detected indication; RND = RPC NDD intersection

Figure 6-1: 1R12 POPCD Comparison to Composite POPCDs



7.0 EOC-14 Projections for Probability of Burst and Leak Rate

This section provides the results of the EOC-14 POB and leak rate projections. FANP uses Monte Carlo codes, as described in References 4 and 5, to provide the burst and leak rate analysis simulations. These evaluations are based on the methods in Reference 6 (for burst) and the slope sampling method for calculating the leak rate as defined in Section 9 of Reference 8. In addition, these evaluations use the POPCD and growth methodologies as described in Reference 16, as updated in References 25 and 28.

7.1 Inputs for Calculations

Most of the inputs required for the POB and leak rate calculations have been described in other sections of this document. Table 7-1 provides a summary of the inputs required and the corresponding section(s) or table(s) that provide these data. The inputs that have not been previously discussed are provided in this section.

Table 7-1: Inputs for EOC-14 POB and Leak Rate Projections

Input Description	Section or Table Reference	Comments
BOC Voltage Distribution	Table 3-17	
Repaired Voltage Distribution	Table 3-17	
NDE Uncertainties	Section 3.6; Table 3-22	
POD	Table 6-8	Composite POPCD through 1R12 (8 inspections)
Growth	Section 3.2; Tables 3-15 and 3-16	Cycle 12 growth used for EOC-14 projections
Cycle Length	Section 7.1	1.39 EFPY
Tube Integrity Correlations	Tables 4-1 through 4-3	Addendum 6
Material Properties	Section 7.1	

<u>Material Properties</u>

Since the burst pressure for a given flaw varies with the material properties of the tube, the material properties of the tubes must be included as an input into the POB program. This data is obtained from Reference 6. The values used for the EOC-14 projections were taken directly from Reference 6 and were a mean flow stress of 68.78 ksi and a standard deviation of the flow stress of 3.1725 ksi.

Cycle Length

The estimated cycle length for Unit 1 Cycle 14 is 1.39 EFPY (Ref. 12). This value was used in all projections for EOC-14 conditions.

7.2 Projected EOC-14 Voltage Distributions

The EOC-14 voltage distributions are obtained by applying a Monte Carlo sampling process to the BOC-14 voltages. The process starts by selecting a random POPCD correlation based on the POPCD parameters through 1R12 shown in Table 6-8. Based on the POPCD correlation, the BOC-14 population of indications is determined (detected plus assumed undetected). The process then randomly assigns NDE uncertainty values and a growth value to each of the BOC-14 indications. The EOC-14 voltage distributions are then used to calculate a leak rate and probability of tube burst. As discussed in Section 3.2, the Cycle 12 growth rates were determined to bound the Cycle 13 growth rates. Therefore, the Cycle 12 growth rates were used for projecting the EOC-14 voltages. SG 1-1 used SG-specific Cycle 12 growth rates divided into three growth bins with breakpoints at 0.5 and 0.99v. SGs 1-2, 1-3 and 1-4 used composite Cycle 12 growth rates divided into three bins with breakpoints at 0.5v and 1.02v. No "delta volts adjustment" was required. Table 7-2 and Figures 7-1 through 7-4 provide the projected EOC-14 voltage distributions.

Table 7-2: Projected EOC-14 Voltage Distributions (DCPP POPCD + Cycle 12 Growth)

Voltage Bin	EOC-14 Projected Distributions			
	SG 1-1	SG 1-2	SG 1-3	SG 1-4
<=0.1	1.10	0.56	0.33	0.28
0.2	23.01	12.30	7.33	6.00
0.3	69.31	42.11	24.32	19.38
0.4	120.54	80.44	44.09	35.10
0.5	162.02	112.08	56.38	47.02
0.6	171.22	129.37	59.85	53.07
0.7	148.10	116.53	49.57	45.08
0.8	117.95	95.53	38.31	34.25
0.9	91.83	76.72	30.22	25.85
1	72.69	60.51	24.37	20.02
1.1	58.80	47.33	19.72	15.84
1.2	47.15	35.93	15.40	12.18
1.3	36.90	26.45	11.78	9.29
1.4	29.37	19.65	9.23	7.19
1.5	23.53	14.63	7.34	5.59
1.6	18.70	10.79	5.89	4.42
1.7	15.64	7.97	4.86	3.52
1.8	13.97	6.15	4.18	2.89
1.9	12.53	5.01	3.69	2.40
2	10.82	4.14	3.22	1.96
2.1	8.90	3.21	2.70	1.52
2.2	7.18	2.51	2.23	1.21
2.3	5.81	1.98	1.84	0.96
2.4	4.83	1.50	1.47	0.76
2.5	4.25	1.19	1.21	0.62
2.6	3.98	1.10	1.05	0.54
2.7	3.75	1.08	0.93	0.50
2.8	3.27	0.96	0.80	0.43
2.9	2.99	0.92	0.71	0.41
3	2.67	0.85	0.62	0.37
3.1	2.03	0.65	0.50	0.29
3.2	1.44	0.47	0.41	0.23
3.3	1.01	0.36	0.34	0.18
3.4	0.67	0.26	0.27	0.14
3.5	0.47	0.19	0.21	0.10
3.6	0.51	0.15	0.17	0.08
3.7	0.62	0.15	0.15	0.08
3.8	0.62	0.14	0.13	0.07
3.9	0.53	0.12	0.11	0.06
4	0.42	0.09	0.09	0.04
4.1	0.34	0.06	0.07	0.04
4.2	0.32	0.05	0.06	0.03
4.3	0.50	0.06	0.06	0.04
4.4	0.94	0.12	0.09	0.06
4.5	1.42	0.20	0.13	0.10
4.6	1.56	0.25	0.16	0.11
4.7	1.40	0.24	0.15	0.11
4.8	1.16	0.20	0.13	0.09
4.9	0.93	0.15	0.12	0.08
5	0.73	0.10	0.10	0.07
5.1	0.56	0.07	0.08	0.05
5.2	0.50	0.05	0.07	0.04
5.3	0.61	0.07	0.08	0.04
5.4	0.69	0.09	0.08	0.05
5.5	0.63	0.10	0.08	0.04
5.6	0.52	0.09	0.07	0.04
5.7	0.41	0.07	0.05	0.03
5.8	0.32	0.05	0.04	0.03
5.9	0.24	0.03	0.04	0.02
6	0.18	0.02	0.03	0.01
7	0.36	0.04	0.08	0.02
>7	0.00	0.00	0.00	0.00
Totals	**1315.45**	**924.15**	**437.77**	**361.01**

Figure 7-1: SG 1-1 EOC-14 Projected Voltage Distribution

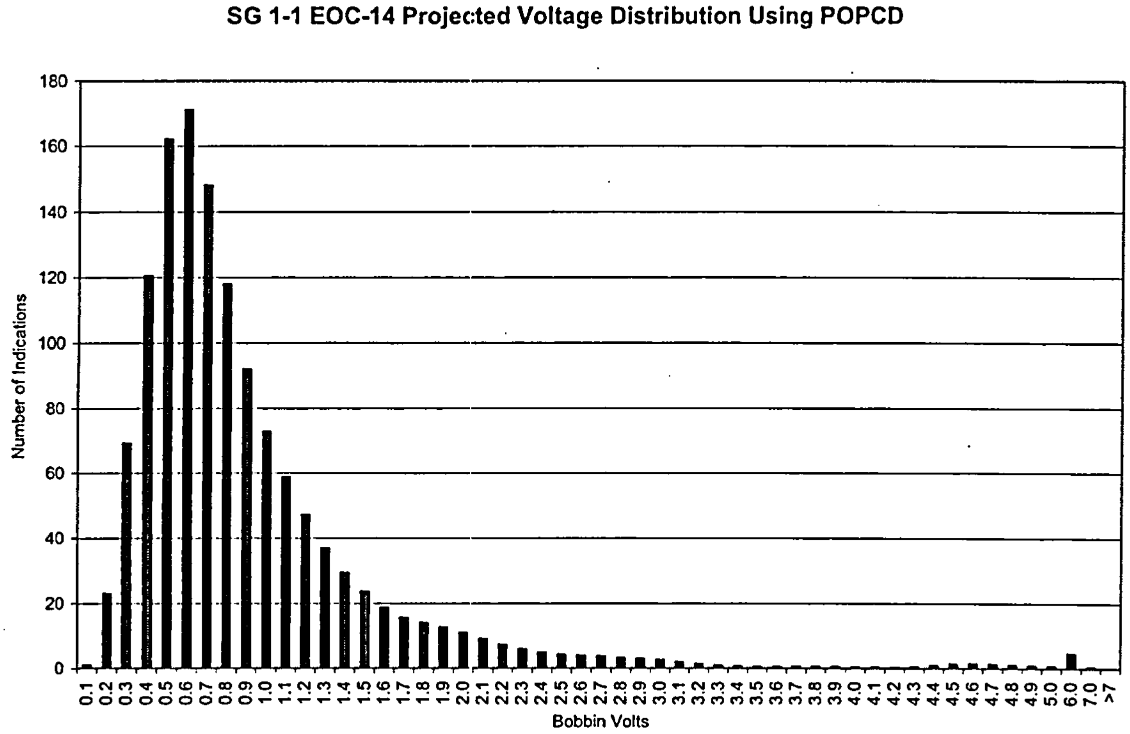


Figure 7-2: SG 1-2 EOC-14 Projected Voltage Distribution

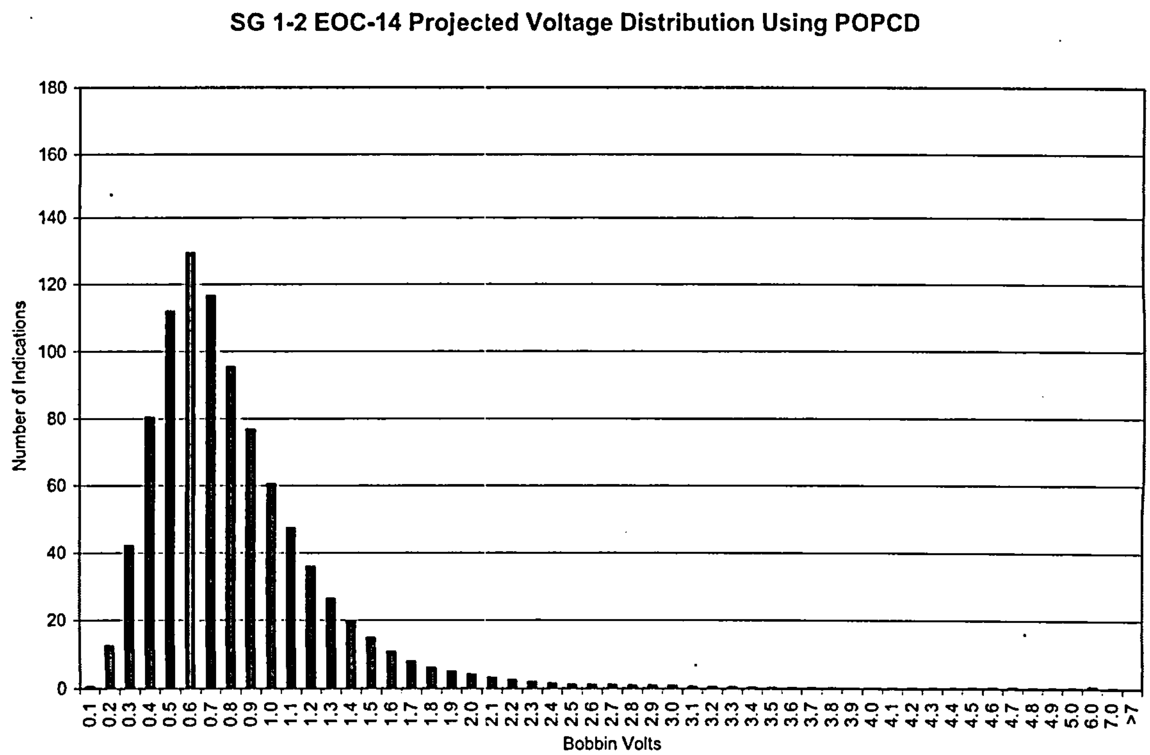


Figure 7-3: SG 1-3 EOC-14 Projected Voltage Distribution

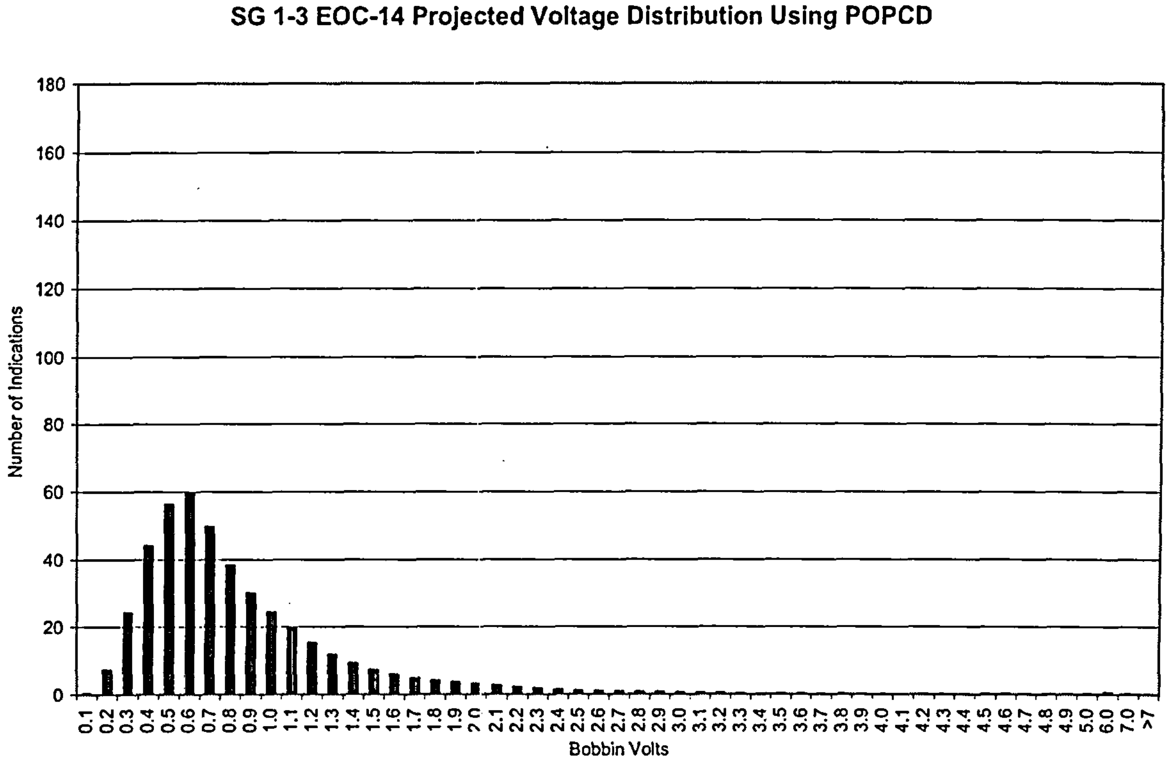
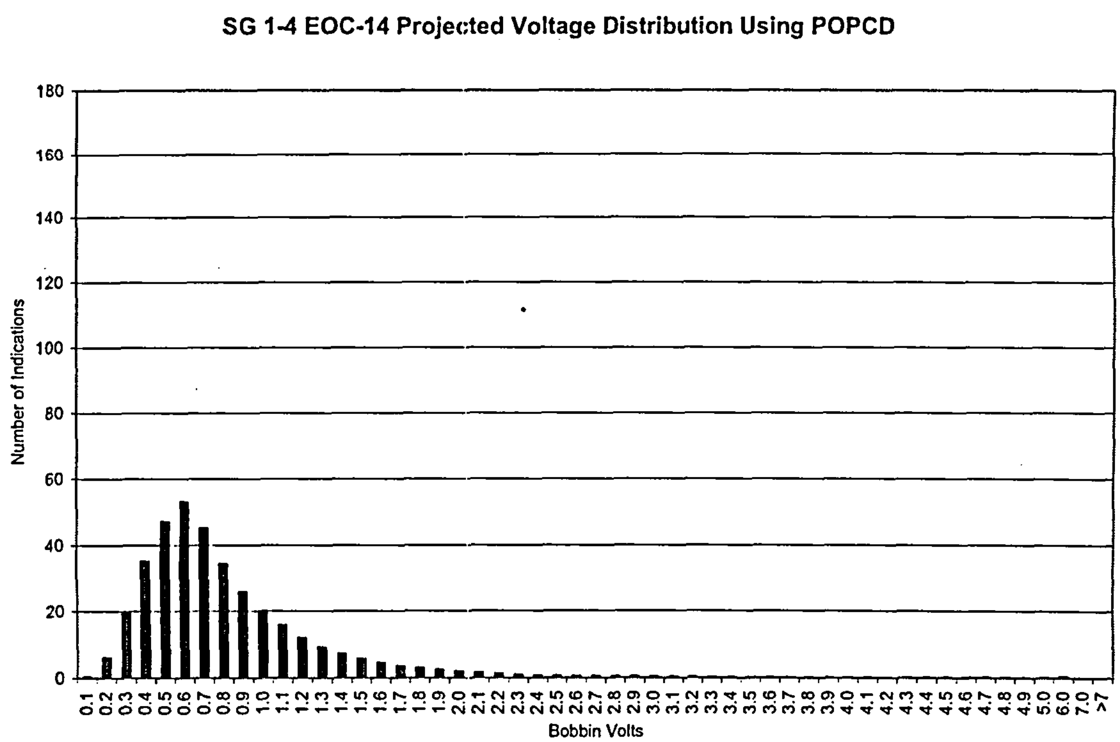


Figure 7-4: SG 1-4 EOC-14 Projected Voltage Distribution



7.3 Projected Tube Burst Probability and Leak Rate for EOC-14

Calculations to predict SLB leak rate and tube burst probability for each steam generator in DCPP Unit 1 at the projected EOC-14 conditions were performed using the burst pressure, leak rate, and probability of leakage correlations provided in Tables 4-1 through 4-3. The results of these calculations are shown in Table 7-3. As shown in Table 7-3, all of the results for projected EOC-14 conditions are below the acceptance criteria of 1.0 x 10^{-2} for POB and 10.5 gpm for leakage.

Table 7-3: Projected Leak Rate and Burst Probability at EOC-14 Using DCPP POPCD

Steam Generator	Projected Number of Indications at EOC-14	Probability of Burst		SLB Leak Rate
		Best Estimate	95% UCL (1 or More Failures)	(gpm)
SG 1-1	1315.45	2.21 x 10^{-3}	2.32 x 10^{-3}	1.83
SG 1-2	924.15	4.18 x 10^{-4}	4.69 x 10^{-4}	0.58
SG 1-3	437.77	3.62 x 10^{-4}	4.09 x 10^{-4}	0.41
SG 1-4	361.01	2.20 x 10^{-4}	2.58 x 10^{-4}	0.26
Reporting Threshold			**1.0 x 10^{-2}**	**10.5**

8.0 References

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5. FANP Document 51-5001151-02, "Steam Generator Leak Rate Simulation Code LKR97VB2_r30.F90", December 2003.

6. WCAP 14277, Revision 1, SLB Leak Rate and Tube Burst Probability Analysis Methods for ODSCC at TSP Intersections, December 1996.

7. FANP Document 86-5059194-00, "DCPP 2R12 Bobbin Voltage ARC 90-Day Summary Report", March 2005.

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10. "Noise Requirements for Voltage-Based ARC", transmitted in NEI letter to NRC dated April 13, 2004.

11. Diablo Canyon Power Plant Procedure, NDE ET-7, "Eddy Current Examination of Steam Generator Tubing", Revision 7, November 1, 2005.

12. Pacific Gas and Electric Company, Diablo Canyon Power Plant, Surveillance Test Procedure, STP M-SGTI, Revision 11, "Steam Generator Tube Inspection", November 1, 2005.

13. FANP Document 51-9005801-00, "Bobbin Coil Probe Wear Monitoring for DCPP 1R13", November 2005.

14. FANP Document 86-5029429-00, "DCPP 2R11 Bobbin Voltage ARC 90 Day Summary Report", June 2003.

15. NRC Letter to NEI, dated February 9, 1996, "Probe Wear Criteria."

16. PG&E Letter DCL-04-028, License Amendment Request 04-01, "Revised Steam Generator Voltage-based Repair Criteria Probability of Detection Method for DCPP Units 1 and 2", March 18, 2004.

17. FANP Document 51-5039454-00, "Bobbin/+Point™ Correlation for AONDB Indications at DCPP", February 2004.

18. Not Used.

19. Not Used.

20. Not Used.

21. Not Used.

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23. FANP Document 32-9011355-000, "DCPP Unit 1 R13 Voltage-Based ARC 90-Day Report Supporting Calculation File".

24. NEI Letter to NRC, "Generic Letter 95-05 Alternate Repair Criteria Methodology Updates", June 2, 2004.

25. PG&E Letter DCL-04-104, "Response to NRC Request for Additional Information Regarding License Amendment Request 04-01", August 18, 2004.

26. Not used.

27. FANP Document 86-5049264-00, "DCPP Unit 1 R12 Voltage-Based ARC 90-Day Report", September 2004.

28. PG&E Letter DCL-04-117, "Response to August 24, 2004, NRC Request for Additional Information Regarding License Amendment Request 04-01", September 17, 2004.

29. NRC Letter to PG&E, "Diablo Canyon Power Plant, Unit Nos. 1 and 2 – Issuance of Amendment Re: Permanently Revised Steam Generator Voltage-Based Repair Criteria Probability of Detection Method (TAC Nos. MC2313 and MC2314)", October 28, 2004.

30. PG&E Letter DCL-04-105, "Response to July 8, 2004, NRC Request for Additional Information Regarding License Amendment Request 04-01", August 20, 2004.

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