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PURPOSE AND SUMMARY OF RESULTS:

This report summarizes the Diablo Canyon Unit 2 – 2R12 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.

* Appended pages include Pages A-1 to A-2

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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 2 completed the twelfth cycle of operation and subsequent steam generator ISI in November 2004. 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 2R12 inspection, a total of 2102 DOS indications were detected with the bobbin coil. There were an additional 59 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 Plus Point results per the methodology provided in Reference 8. All of the inferred bobbin voltages were less than 1 volt.

There were 10 DOS indications greater than the lower repair limit of 2.0 volts. All of these indications were confirmed as axial ODSCC with Plus Point and were subsequently plugged. An additional 29 DOS and AONDB indications less than or equal to 2 volts were also plugged for other reasons, such as ODSCC in the wedge region and 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 2-4. SG 2-4 had the highest average growth rate and two of the three highest growth rates during Cycle 12. Voltage dependent growth was clearly evident in SGs 2-1 and 2-4. SGs 2-2 and 2-3 showed slight 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. 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 OA.

The POB and leak rate projections for EOC-13 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 7. Using the DCPP-specific POPCD and the conservative growth rate analyses discussed in Section 3.2, the projected POB at EOC-13 for the limiting steam generator (SG 2-4) was determined to be 2.75×10^{-3}. The projected leak rate for the limiting generator (SG 2-4) was 3.25 gpm. Both of these results are below the acceptance criteria of 1×10^{-2} and 10.5 gpm, respectively.

Section 6 provides the as-found EOC-12 condition monitoring results and results of a benchmarking study that compares the projected EOC-12 conditions to the as-found conditions. The as-found leak rate and POB at EOC-12 for the limiting steam generator (SG 2-4) were determined to be 0.47 gpm and 1.42×10^{-4}, respectively, and are both below the acceptance criteria of 10.5 gpm and 1×10^{-2}. EOC-12 projections have been previously provided to the NRC in Table 5 of Reference 25. The projections provided in Reference 25 used an estimated Cycle 12 operating interval of 1.54 EFPY and also used the Extreme Growth methodology as described in Reference 22. Since the NRC has not approved the Extreme Growth methodology and the actual Cycle 12 operating interval was 1.52 EFPY, the EOC-12 projections have been recalculated without the Extreme Growth methodology and with a cycle length of 1.52 EFPY, and with and without the SG 2-4 R44C45 11 volt/EFPY extreme growth rate in cycle 11. As shown in Section 6, the POB, leak rate, and number of indications were over predicted in all cases for EOC-12.

3.0 EOC-12 Inspection Results and Voltage Growth Rates

3.1 EOC-12 Inspection Results

The DCPP 2R12 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 Plus Point. 0.720" replaceable feet bobbin probes were used for the straight length examinations. All in-service TSP intersections were inspected with a 0.720" bobbin probe.

Special interest Plus-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 2102 DOS indications were identified. The results of the inspections are summarized as follows:

1) Voltage Dependent Growth was evident in SGs 2-1 and 2-4. Its effect was minimal in SGs 2-2 and 2-3.
2) 10 DOS indications were greater than the lower repair limit (LRL-2.0 volts). Each of the indications were confirmed as ODSCC, required repair by plugging, and were distributed as follows: 5 in SG 2-1, 1 in SG 2-2, 0 in SG 2-3 and 4 in SG 2-4. 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 5.51 volts.
4) No less than or equal to 2.0 volt bobbin indications exceeded the 1.9 volt Plus 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) 59 indications were identified as AONDB (axial ODSCC not detected by bobbin). Table 3-2 lists the indications that were identified as AONDB. These are Plus-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 Plus 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 Plus-Point voltage. Once the calculated voltages are obtained per Reference 17, the locations are subjected to exclusion criteria defined in Reference 12.

6) Overall, 39 DOS/AONDB indications were repaired during 2R12. The breakdown is: 8 in SG 2-1, 10 in SG 2-2, 1 in SG 2-3, and 20 in SG 2-4. This population was used in computing the BOC-13 distributions for the OA calculations.

The average voltage was 0.61 volts, including AONDB indications. The 2R11 average was 0.68 volts. The main reason for the decrease in the average volts is the preventative plugging (down to 1.2 volts) that was performed during 2R11. The average voltage for new DOS indications, excluding prior AONDB indications, was 0.40v. The majority of the largest voltages were detected in SGs 2-1 and 2-4. SG 2-4 had the highest overall average voltage of 0.68 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 Plus-point or not inspected with Plus-point, and the total indications returned to service. Ten confirmed DOS had to be repaired because they exceeded the 2-volt repair limit. The main reasons for repair of the other 29 DOS included DOS < 2.0v (preventively, as discussed below), the wedge exclusion criterion, combined ID/OD degradation at the same intersection, or other pluggable tube degradation.

NEI letter to NRC dated April 13, 2004, provided 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 Plus Point inspection of 100% of greater than 1.7 volt bobbin indications, and to repair any Plus Point confirmed ODSCC with a Plus 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. (Note: This NEI report guideline has been subsequently incorporated into Addendum 6 of the EPRI ODSCC Database, with a more conservative recommendation to Plus Point inspect 100% of greater than 1.7 volt bobbin indications, consistent with PG&E's commitment, instead of performing a 20% sample.) 20 greater than 1.7 volt bobbin indications were therefore Plus Point inspected in 2R12 (that would not have been inspected otherwise) to meet this commitment. All of the indications were confirmed as ODSCC, and all Plus Point amplitudes were less than 1.9 volts, so none required preventive plugging per the guideline. Nonetheless, as an additional precautionary measure, the Plus Point and bobbin voltages were reviewed for all confirmed ODSCC with less than or equal to 2 volt DOS, see Figures 3-42 to 3-45. Based on review of these figures, 10 less than 2 volt DOS indications with Plus Point amplitudes greater than about 1.4 volts (2 in SG 2-1, 2 in SG 2-2, and 6 in SG 2-4) were preventively plugged, thereby removing from service all tubes with ODSCC Plus Point amplitudes exceeding about 1.4 volts. A seventh indication in SG 2-4 in this category was already required to be plugged due to its location in the wedge exclusion region. Since some intersections contained more than one axial ODSCC indication, the figures noted above indicate that more than 10 Plus Point ODSCC indications were preventively plugged. The 10 indications with Plus Point amplitudes greater than about 1.4 volts were also depth profiled using phase angle analysis, and the profiles were adjusted using the Plus Point amplitude sizing correlation in Figure 8-23 of Addendum 6 of the EPRI ODSCC Database. The maximum depths of the adjusted profiles of these indications ranged from about 89% to 93% throughwall. Therefore, it is concluded that the preventive plugging program removed all confirmed ODSCC indications from service with a Plus Point amplitude greater than about 1.4 volts (and associated maximum depths in excess of about 89%), which is more conservative than PG&E's commitment to the NRC.

Based on preventive plugging of all greater than 1.2 volt DOS in 2R11, the largest Plus Point amplitude found in 2R12 was 2.37 volts and the largest bobbin voltage growth rate was 1.43 v/EFPY, therefore validating the basis that preventive plugging will significantly reduce the potential for large growth rates.

The Plus Point inspections required for DOS indications were accomplished as a part of the special interest exams. 330 Plus-point inspections were performed where DOS indications were called by bobbin, excluding the AONDB intersections. Of these inspections, 237 were confirmed yielding an overall confirmation rate of about 72%.

The 2R12 Plus 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 threshold 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 Plus 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 be inspected with Plus Point. A total of 10 hot leg SPRs ≥ 2.3 volts were identified. Since none of the steam generators contained five SPRs ≥ 2.3 volts, a minimum of the five largest SPRs were inspected in each steam generator. A total of 24 SPRs were inspected with Plus Point. No confirmed ODSCC indications were detected from these Plus Point inspections.

To augment the mixed residual inspection program, PG&E proactively implemented the recommendation in report "Noise Requirements for Voltage-Based ARC", transmitted in NEI letter to NRC dated April 13, 2004 (Ref. 10, but also later incorporated into EPRI ODSCC Database Addendum 6). Section 4 of the report provides a recommendation for performing a minimum of 100 (up to 200) hot leg TSP noise measurements per SG (prior or current outage data) and recommends rotating coil inspection of a minimum of 25 intersections exceeding the noise threshold value or the 25 TSP intersections with the highest noise levels. The noise threshold value is calculated using the DCPP POPCD curve that indicates a 0.86 POD assuming a 1.0 volt repair limit at noisy TSP intersections, which in turn correlates to a signal to noise (S/N) value of 1.6 by applying Figure 6 of the NEI report. Therefore 1.0/1.6 is 0.63 volts, or the DCPP specific noise threshold. To implement this recommendation, PG&E performed noise measurements (peak to peak) of the prior outage bobbin data for about 1000 non-dented, non-flawed hot leg intersections (250 per SG), biased to the lower TSP elevations. Only nineteen of the noise measurements exceeded 0.63 volts and were inspected along with an additional 6 TSPs for a total of 25. 24 of these inspections were NDD by Plus Point. One TSP had two AONDB indications detected in this inspection (SG 2-4 R14C7 2H), with an inferred bobbin voltage of 0.70 volts (see Table 3-2), and the intersection was determined to have a small 0.73 volt dent. The indication was returned to service under voltage based ARC, and no further sample inspections were performed based on the NEI report.

Figures 3-1 and 3-2 show the as-found voltage distribution (including AONDB) for all indications detected during the 2R12 inspection. Figures 3-3 and 3-4 show the indications removed from service at 2R12. 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 2R12 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 the intersections containing DOS/AONDB indications that were returned to service, 241 contained confirmed axial ODSCC at dented intersections. 224 of these intersections contained dents ≤2.0v, 16 of these intersections contained dents between 2 and 5 volts , and one intersection contained >5 volt dent and was therefore plugged. Of these indications, the largest bobbin voltage was 1.94v. This indication had six axial ODSCC indications with a maximum Plus Point voltage of 0.49v. The largest Plus Point voltage from this population was 1.36v with a corresponding bobbin voltage of 1.60v.

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 temperature dependence of ODSCC.

Table 3-5 also includes a small number of cold leg DOS indications that were NDD by Plus Point based on the 100% Plus Point inspection of cold leg DOS performed in 2R12. 100% of cold leg DOS were Plus Point inspected to validate the cold leg thinning region. [Note: If 100% Plus Point inspection of cold leg DOS inspections is not conducted, as is normally the practice, potential cold leg ODSCC indications are distinguished from cold leg thinning indications by requiring that bobbin indications in the region of occurrence for cold leg thinning be Plus Point inspected (and confirmed as volumetric indications by Plus-Point) at the first occurrence of the bobbin indication]. No cold leg ODSCC has been confirmed by Plus Point to date at DCPP-2. Non-confirmed bobbin DOS indications in the cold leg are retained in the ODSCC ARC calculations.

3.2 Voltage Growth Rates

For projection of leak rates and tube burst probabilities at the EOC-13 operation, voltage growth rates were developed from the 2R11 and 2R12 inspection data. Cycle 12 was 1.52 EFPY in length per Reference 12. For repeat indications reported as DOS in both 2R11 and 2R12, growth rates were determined based on comparison of the voltages called in 2R11 and 2R12. For indications not reported during the 2R11 inspection (i.e. new at 2R12), the indications were sized using the 2R11 ECT signals based on a lookup review. Lookups were also performed for all of the 2R12 DOS locations that were previously reported as DIS. In some of these cases, an OD component could not be found in the 2R11 bobbin lookup results, and these intersections were excluded from the growth distributions.

As discussed in Section 3.2.1 below, the Cycle 12 growth rates for each SG were less than Cycle 11 growth rates. As mentioned above, repeat indication growth rates are determined based on comparison of the voltages called in the current and prior cycle (without lookup of prior cycle data). To validate this process and to investigate if potential analyst variability/sensitivity in 2R11 could have contributed to a growth rate reduction, the 2R11 and 2R12 bobbin data for all repeat indications were re-reviewed by two analysts. Minor changes were noted in some of the voltages, but were within the expected tolerance of the bobbin voltage analyst uncertainty distribution. The resultant Cycle 12 growth distributions were unaffected when compared with the growth distributions using the as-found 2R11 voltages and no changes were discernible. Therefore, the repeat indications' voltages as reported in 2R11 were used in the analysis in the following sections that assess limiting growth distributions, and potential analyst variability was not a factor in the Cycle 12 growth rate reduction.

There were 615 newly reported DOS indications in 2R12. This value excludes those intersections which had DIS indications reported in 2R11. 509 of these new indications were detected during the 2R11 lookup and were assigned a 2R11 voltage and subsequently included in the growth distributions. There were 106 new DOS indications that were not detected during the 2R11 lookup and were, therefore, not included in the growth rate analyses. The largest of these indications was 1.04v in SG 2-1 R36C71 2H. The upper 95% growth rates of all new and repeat indications were 0.23 and 0.39 v/EFPY, respectively. The average growth rates for new and repeat indications excluding prior AONDB were 0.08 and 0.12 v/EFPY, respectively. 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 12. 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-2. 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 2-4. 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-13 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. In accordance with Reference 28, the large growth from Unit 2 Cycle 11 (11.89 v/EFPY) was excluded from the growth assessments since no growth rates greater than 8 v/EFPY were observed during Cycle 12. 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, four different growth curves must be compared (SG-specific for Cycle 11, SG-specific for Cycle 12, composite for Cycle 11, and composite for Cycle 12). In order to provide a fair comparison between Cycle 11 and Cycle 12, the Cycle 12 growth data was supplemented with Cycle 11 data for those indications which were >1.2v at BOC-11. This was done because all indications >1.2v were plugged during 2R11. Without this adjustment, the results would have been heavily skewed toward Cycle 11 being bounding due to the voltage-dependent growth effects.

Figures 3-19 through 3-22 provide these comparisons for each steam generator. Figures 3-20 and 3-21 show that the Cycle 11 composite curve is bounding for SGs 2-2 and 2-3. From Figure 3-19, it appears that the Cycle 11 composite curve is bounding for SG 2-1. However, the Cycle 11 SG-specific curve for SG 2-1 is bounding above 2 volts per EFPY. For this case, sensitivity calculations were performed as discussed in Section 3.2.5 to determine which growth curve is bounding. Figure 3-22 appears to show that the Cycle 11 SG-specific curve is bounding for SG 2-4. However, following the voltage-dependent growth analyses, it was unclear if the Cycle 11 specific or composite growth curve was bounding for SG 2-4. Therefore, sensitivity calculations were also performed for SG 2-4 to determine which growth curve was bounding. These sensitivity calculations are also discussed in Section 3.2.5.

3.2.2 Voltage-Dependent Growth Analyses for Cycle 12

Even though the Cycle 11 growth rates were determined to be bounding, the voltage-dependent growth analyses for the Cycle 12 data are documented in this report for future reference. For Cycle 12, growth rates were plotted against the BOC voltage for all steam generators. Their data are shown in Figures 3-14 through 3-18. As demonstrated by the figures, a positive slope exists in all SGs. The slope is minimal (near 0.1) in SGs 2-2 and 2-3. A slope of 0.1 was included 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 2-3 is slightly below this value. However, these curves include only indications that were ≤1.2v at BOC-12 since all indications >1.2v were plugged at 2R11. The fact that there are no data points >1.2v is likely lowering the slope because the indications with the highest likelihood of experiencing higher growth rates were removed from service during 2R11. In addition, a review of similar figures for Cycle 11 show slopes significantly greater than 0.1 for SGs 2-2 and 2-3. For these reasons, it is considered prudent to consider voltage-dependent growth to be active in all four steam generators.

Voltage-dependent growth is not a new concept, and has been documented by the European steam generators affected by ODSCC. Because of their higher repair limits, their data encompasses 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. These methods were used to determine breakpoints for the Cycle 12 growth data.

Cycle 12 VDG breakpoint analyses were performed for each steam generator and for a composite growth distribution (including all steam generators). Since all DOS indications greater than 1.2 volts were plugged in 2R11, there are no Cycle 12 indications in the 1.2v-2.0v range. Therefore, as discussed previously, the Cycle 12 growth data was supplemented with Cycle 11 data for those indications that were greater than 1.2 volts at BOC-11.

Figures 3-23 through 3-27 show the scatter charts and the resulting breakpoints for all of these analyses. The analyses for SGs 2-1, 2-2, and 2-3 each yielded one breakpoint at 1.12v, 1.00v, and 0.96v, respectively. The SG 2-4 analysis yielded two breakpoints at 0.47v and 1.038v. The composite analysis yielded two breakpoints at 1.10v and 1.71v.

3.2.3 Voltage-Dependent Growth Analyses for Cycle 11

As discussed in Section 3.2.1, the Cycle 11 growth rates were determined to bound the Cycle 12 growth rates, and the extreme 11 volt/EFPY Cycle 11 growth rate can be excluded from Cycle 13 projections. This section provides the VDG breakpoint analyses for the growth curves used in the Monte Carlo analyses. These Cycle 11 growth curves include SG-specific curves for SGs 2-1 and 2-4, and the composite curve which was used for SGs 2-2 and 2-3. Figures 3-28 through 3-30 provide the results of the breakpoint analyses for these three data sets. As shown in the figures, SG 2-1 yielded one breakpoint at 1.06v. Both SG 2-4 and the composite data set yielded two breakpoints of 0.59v and 1.66v. These breakpoint values are the same as those determined in the prior cycle 90 day report, and used in the Section 6 benchmark assessment.

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. The purpose of this adjustment is to account for the possibility that the growth rates may increase over the next operating cycle. The amount of this adjustment is determined by comparing the average growth from Cycle 12 to the average growth from Cycle 11 for each voltage bin. Tables 3-8 and 3-9 provide the required adjustments based on the Cycle 12 and Cycle 11 breakpoints, respectively. Per the Reference 25 guideline, if the Cycle 12 data has a higher average growth rate than the Cycle 11 data, then the difference between the average growth rates should be added to each growth rate value in the distribution being used prior to binning the data. If the Cycle 12 growth rates for SGs 2-1 and 2-2 were being used for the Monte Carlo analyses, which is not the case, small adjustments would have been required in Bins 1 and 2 based on Table 3-8. Table 3-9 shows the average growth rates and required adjustments for SG 2-1, SG 2-4, and the composite distributions because these are the bounding Cycle 11 growth curves that were used for these analyses. As shown in Table 3-9, only Bin 1 in SG 2-1 requires an adjustment.

3.2.5 Sensitivity Studies and Growth Summary

As discussed in Section 3.2.1, the Cycle 11 composite growth curves should be used for SGs 2-2 and 2-3. For SG 2-1, however, it is not readily apparent from examining Figure 3-19 if the Cycle 11 composite or the Cycle 11 SG-specific growth is bounding. Therefore, probability of burst and leak rate calculations were performed using each curve (after the VDG breakpoint analyses and the delta volts adjustment) to determine the more conservative growth rate. These calculations showed that the Cycle 11 SG 2-1 growth curve was more conservative.

For SG 2-4, it was not clear after the VDG analyses which growth curve was bounding. A comparison of Figures 3-37 and 3-38 shows that the Bin 2 curve is more

conservative for the SG-specific Cycle 11 data, but the Bin 3 curve is more conservative for the composite Cycle 11 data. In addition to the question over the Cycle 11 growth curves, the supplemented Cycle 12 growth curve for SG 2-4 yielded an upper breakpoint of 1.038v. This is much lower than the 1.66 volt breakpoint for either the SG 2-4 Cycle 11 or the composite Cycle 11 curves. A lower breakpoint means that more indications are having growth rates applied from the upper bin. Even though the average growth in the upper bin for the Composite Cycle 12 curve is lower, it was believed that this Cycle 12 curve could be more conservative since it would be applied to more indications. Therefore, leak rate and probability of burst calculations were performed using the SG 2-4 Cycle 11 growth curves, the composite Cycle 11 growth curves, and the supplemented SG 2-4 Cycle 12 growth curves. For both leak rate and probability of burst, the SG 2-4 Cycle 11 growth curves gave the most conservative results.

Tables 3-10 through 3-14 show the supplemented Cycle 12 growth distributions for each steam generator as well as the composite growth distributions. These growth distributions were not used in the EOC-13 projections and are provided for information only. Tables 3-10 and 3-11 for SGs 2-1 and 2-2 respectively, reflect the delta volts adjusted growth rates as discussed in Section 3.2.4. No delta volts adjustments were required for the other growth curves. These results are shown graphically in Figures 3-31 through 3-35.

Tables 3-15 through 3-17 show the Cycle 11 growth distributions that were used in the Monte Carlo analyses for SG 2-1, SG 2-4 and SGs 2-2/2-3, respectively. Table 3-15 for SG 2-1 reflects a +0.002v adjustment applied to Bin 1. The composite growth distributions shown in Table 3-17 were used for both the SG 2-2 and the SG 2-3 Monte Carlo analyses. These curves are shown graphically in Figures 3-36 through 3-38. 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. Tables 3-18 and 3-19 show the voltage distributions used for the Monte Carlo analyses. As shown in the tables, additional voltage bins are inserted at the value of the VDG breakpoints: an additional voltage bin at 1.06v was inserted into the SG 2-1 voltage distribution and additional voltage bins at 0.59v and 1.66v were inserted into the voltage distributions for SGs 2-2, 2-3, and 2-4. Adding these additional voltage bins forces the Monte Carlo simulation codes to apply each growth bin to the correct number of indications. As a result, these voltage distributions are slightly different than the distributions shown in Table 3-3.

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 2R12 eddy current inspection resulted in 25 bobbin indications in excess of 1.5 volts that were inspected with a worn probe. These indications are shown in Table 3-20. Figure 3-39 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. R25C47 in SG 2-4 had an RSS voltage of 2.19v with a DOS voltage of 1.46v. Since the voltage with the worn probe was overestimated relative to the voltage with the good probe, this discrepancy is not a concern. The average change between the DOS and RSS voltage was -1.1% with the maximum increase in voltage being +13.9%. 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 3-21 shows the new 2R12 DOS indications that were ≥0.5 volts and were inspected on cal groups that failed the probe wear check in 2R11. As shown in Table 3-21, there are no newly reported DOS indications greater than 1 volt in tubes that were inspected with worn probes in 2R11.

Overall, there were 2102 DOS indications detected in the 2R12 inspection. 615 (or ~29%) of the DOS indications were new indications. In order to assess the number of new indications against the probe wear requirements, Table 3-22 and 3-23 are presented. Of the 615 total new indications, 137 (~22%) were in tubes inspected with a worn probe in 2R11 and 478 were in tubes inspected with a good probe in 2R11. Additionally, the number of new indications ≥ 0.5 volts was determined to be 133. Out of these, about 18% were in tubes that were inspected with a worn probe in 2R11.

Table 3-23 shows the ratio of the number of 2R11 examinations performed with worn probes versus good probes. The total number of examinations shown in this table is greater than the number of tubes in service because several tubes have multiple examinations. This table shows that approximately 29% of the tubes were inspected with a worn probe in 2R11. This

percentage compares reasonably well with the percentages of new DOSs inspected with worn probes in 2R11 (about 22%) and new ≥ 0.5 volt DOSs inspected with worn probes in 2R11 (about 18%). This demonstrates that the number of new indications is not biased towards the tubes that were inspected with worn probes in 2R11.

In summary, the NRC analysis requirements regarding probe wear monitoring were met during the 2R12 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 11 was 38.7% (Ref. 7 and Table 3-6), the actual Cycle 11 average growth 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 5 database supplemented with the tube pull results from 2R11. Based on the following formula, the upper repair limit was calculated to be 5.51v.

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

where:
V_{URL} = upper voltage repair limit,
V_{NDE} = NDE voltage measurement uncertainty = 20%,
V_{CG} = voltage growth anticipated between inspections = 38.7%/EFPY x 1.33 EFPY = 51.5%,
V_{SL} = voltage structural limit from the burst pressure – Bobbin voltage correlation, where the limit of 9.45 volts was used based on Reference 7.

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 3-24 and Figure 3-40.

3.7 Plus 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 2R12, none of the three 2R11 returned to service AONDB indications were detected with bobbin and were reported as AONDB again. Therefore, an assessment is not required to be performed.

As a prudent measure, the bobbin to Plus 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 Plus Point indications of axial ODSCC. The 2R12 Plus 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 Plus 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 235 intersections with DOS indications that were confirmed as containing axial ODSCC with Plus Point. In 148 of these 235 cases (about 63%), 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 0.026v over-prediction.

In 2R12, the largest inferred voltage for an AONDB indication was 0.842v. Since the Plus Point to bobbin voltage correlation was only used for intersections with inferred voltages less than 0.842v, this is the voltage range of interest for this comparison. When only the inferred voltages less than 0.842v are considered, 89 of 138 (about 64%) 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 0.034v over-prediction.

Figure 7-41 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 (<0.842 inferred volts), the voltage is generally over predicted. Based on the facts that about 64% of the voltages are over predicted and the average difference in voltages is a 0.034v over-prediction in the range of interest, the Plus Point to bobbin voltage correlation is shown to provide generally conservative results.

Table 3-1: 2R12 DOS Indications > 2.0 Volts

SG	Row	Col	Ind	Elev	Volts
SG 2-1	38	46	DOS	2H	2.38
SG 2-1	3	47	DOS	1H	2.14
SG 2-1	6	85	DOS	2H	2.11
SG 2-1	25	42	DOS	1H	2.1
SG 2-1	17	45	DOS	1H	2.02
SG 2-2	29	70	DOS	2H	2.03
SG 2-4	2	65	DOS	2H	2.87
SG 2-4	33	50	DOS	2H	2.62
SG 2-4	27	43	DOS	2H	2.43
SG 2-4	14	41	DOS	2H	2.09

Table 3-2: 2R12 AONDB Indications

SG	Row	Col	Elev	Dent Voltage	Plus Pt Voltage	Inferred Bobbin Voltage	
						Indication	Intersection
SG 2-1	2	47	2H	0.81	0.21	0.514	0.514
SG 2-1	22	58	2H	1	0.40	0.706	0.706
SG 2-1	44	55	1H	0.91	0.09	0.395	0.395
SG 2-1	44	57	2H	0.55	0.11	0.414	0.414
SG 2-2	8	13	1H	2.91	0.22	0.524	0.524
SG 2-2	8	30	1H	2.47	0.24	0.544	0.544
SG 2-2	11	12	1H	7.7	0.21	0.514	0.514
SG 2-2	13	22	1H	3.92	0.16	0.464	0.464
SG 2-2	14	42	1H	3	0.23	0.534	0.534
SG 2-2	17	42	1H	3.69	0.29	0.595	0.595
SG 2-2	19	75	1H	0.87	0.19	0.494	0.494
SG 2-2	22	28	2H	2.71	0.21	0.514	0.514
SG 2-2	22	62	1H	0.93	0.14	0.444	0.444
SG 2-2	24	40	2H	1.11	0.16	0.464	0.464
SG 2-2	25	8	1H	4.16	0.24	0.544	0.544
SG 2-2	25	46	2H	1.19	0.26	0.564	0.564
SG 2-2	26	17	3H	0.47	0.18	0.484	0.484
SG 2-2	31	22	2H	1.49	0.30	0.605	0.605
SG 2-2	37	46	2H	1.18	0.30	0.605	0.605
SG 2-2	45	39	2H	1.14	0.44	0.746	0.746
SG 2-3	5	66	3H	1.53	0.19	0.494	0.494
SG 2-3	6	76	2H	0.68	0.08	0.385	0.385
SG 2-3	13	58	1H	0.58	0.20	0.504	0.504
SG 2-3	16	32	1H	0.62	0.09	0.395	0.395
SG 2-3	18	53	2H	1.11	0.21	0.514	0.514
SG 2-3	22	10	1H	0.52	0.14	0.444	0.444
SG 2-3	24	45	1H	0.56	0.09	0.395	0.395
SG 2-3	29	61	1H	1.14	0.29	0.595	0.842
SG 2-3	29	61	1H	1.14	0.16	0.464	
SG 2-3	29	61	1H	1.14	0.07	0.375	
SG 2-3	29	66	2H	0.81	0.13	0.434	0.434
SG 2-3	33	35	2H	0.96	0.09	0.395	0.395
SG 2-3	33	57	2H	0.73	0.17	0.474	0.636
SG 2-3	33	57	2H	0.73	0.12	0.424	
SG 2-3	37	19	1H	1.21	0.36	0.665	0.665
SG 2-3	37	61	1H	NA	0.14	0.444	0.444
SG 2-4	2	21	3H	2.77	0.20	0.504	0.504
SG 2-4	2	36	2H	0.86	0.18	0.484	0.484
SG 2-4	5	27	1H	1.01	0.14	0.444	0.444
SG 2-4	5	67	2H	0.91	0.15	0.454	0.454
SG 2-4	7	65	3H	0.47	0.28	0.584	0.584
SG 2-4	8	41	1H	0.76	0.22	0.524	0.524
SG 2-4	10	29	3H	2.2	0.12	0.424	0.424
SG 2-4	10	77	3H	0.66	0.14	0.444	0.601
SG 2-4	10	77	3H	0.66	0.10	0.404	

Table 3-2: 2R12 AONDB Indications

SG	Row	Col	Elev	Dent Voltage	Plus Pt Voltage	Inferred Bobbin Voltage	
						Indication	Intersection
SG 2-4	10	84	2H	1.23	0.22	0.524	0.687
SG 2-4	10	84	2H	1.23	0.14	0.444	
SG 2-4	13	77	4H	0.37	0.14	0.444	0.444
SG 2-4	14	7	2H	0.73	0.26	0.564	0.700
SG 2-4	14	7	2H	0.73	0.11	0.414	
SG 2-4	16	36	1H	0.8	0.25	0.554	0.704
SG 2-4	16	36	1H	0.8	0.13	0.434	
SG 2-4	19	82	2H	1.14	0.13	0.434	0.600
SG 2-4	19	82	2H	1.14	0.11	0.414	
SG 2-4	20	78	4H	0.35	0.21	0.514	0.514
SG 2-4	22	16	1H	0.74	0.27	0.574	0.574
SG 2-4	22	22	3H	0.88	0.14	0.444	0.444
SG 2-4	24	10	1H	0.78	0.18	0.484	0.484
SG 2-4	25	27	1H	0.84	0.12	0.424	0.424
SG 2-4	25	66	2H	0.46	0.38	0.685	0.685
SG 2-4	30	36	3H	4.08	0.22	0.524	0.524
SG 2-4	35	65	2H	1.1	0.18	0.484	0.777
SG 2-4	35	65	2H	1.1	0.14	0.444	
SG 2-4	35	65	2H	1.1	0.11	0.414	
SG 2-4	36	28	2H	1.08	0.13	0.434	0.594
SG 2-4	36	28	2H	1.08	0.10	0.404	
SG 2-4	36	29	1H	1.13	0.26	0.564	0.689
SG 2-4	36	29	1H	1.13	0.09	0.395	
SG 2-4	36	33	2H	0.94	0.09	0.395	0.395
SG 2-4	37	29	2H	0.6	0.22	0.524	0.650
SG 2-4	37	29	2H	0.6	0.08	0.385	
SG 2-4	41	61	4H	0.8	0.15	0.454	0.454

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

Voltage Bin	SG 2-1				SG 2-2				SG 2-3			
	As-Found EOC-12	Repaired Tubes	DOSs Returned to Service		As-Found EOC-12	Repaired Tubes	DOSs Returned to Service		As-Found EOC-12	Repaired Tubes	DOSs 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	1	0	1	1
0.2	29	0	28	29	28	1	24	27	17	0	17	17
0.3	74	0	72	74	54	0	46	54	42	0	35	42
0.4	97	0	84	97	70	1	59	69	65	0	61	65
0.5	55	1	52	54	72	2	64	70	35	0	33	35
0.6	54	0	48	54	47	2	43	45	38	1	34	37
0.7	43	0	42	43	31	0	28	31	20	0	20	20
0.8	33	0	32	33	24	1	20	23	18	0	18	18
0.9	25	0	23	25	23	0	21	23	11	0	11	11
1	14	0	13	14	15	0	15	15	5	0	5	5
1.1	11	0	11	11	5	0	5	5	2	0	2	2
1.2	10	0	10	10	5	0	5	5	5	0	5	5
1.3	2	0	2	2	7	0	7	7	5	0	5	5
1.4	4	0	4	4	4	0	4	4	1	0	1	1
1.5	8	0	8	8	6	0	6	6	5	0	5	5
1.6	1	0	1	1	1	0	1	1	2	0	2	2
1.7	3	0	3	3	2	0	2	2	0	0	0	0
1.8	2	1	1	1	1	1	0	0	0	0	0	0
1.9	2	1	1	1	0	0	0	0	0	0	0	0
2	0	0	0	0	1	1	0	0	0	0	0	0
2.1	2	2	0	0	1	1	0	0	0	0	0	0
2.2	2	2	0	0	0	0	0	0	0	0	0	0
2.3	0	0	0	0	0	0	0	0	0	0	0	0
2.4	1	1	0	0	0	0	0	0	0	0	0	0
2.5	0	0	0	0	0	0	0	0	0	0	0	0
2.6	0	0	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	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
>3	0	0	0	0	0	0	0	0	0	0	0	0
Total	472	8	435	464	397	10	350	387	272	1	255	271
>1V	48	7	41	41	33	3	30	30	20	0	20	20
>2V	5	5	0	0	1	1	0	0	0	0	0	0

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

	SG 2-4				Composite of All SGs			
Voltage Bin	As-Found EOC-12	Repaired Tubes	DOSs Returned to Service		As-Found EOC-12	Repaired Tubes	DOSs 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	1	0	1	1
0.2	31	0	31	31	105	1	100	104
0.3	104	0	99	104	274	0	252	274
0.4	134	0	128	134	366	1	332	365
0.5	141	3	137	138	303	6	286	297
0.6	127	1	126	126	266	4	251	262
0.7	100	0	100	100	194	0	190	194
0.8	77	2	73	75	152	3	143	149
0.9	66	2	64	64	125	2	119	123
1	56	0	56	56	90	0	89	90
1.1	45	0	45	45	63	0	63	63
1.2	38	0	38	38	58	0	58	58
1.3	26	0	26	26	40	0	40	40
1.4	20	0	20	20	29	0	29	29
1.5	18	0	18	18	37	0	37	37
1.6	5	0	5	5	9	0	9	9
1.7	11	1	10	10	16	1	15	15
1.8	7	2	5	5	10	4	6	6
1.9	6	3	3	3	8	4	4	4
2	4	2	2	2	5	3	2	2
2.1	1	1	0	0	4	4	0	0
2.2	0	0	0	0	2	2	0	0
2.3	0	0	0	0	0	0	0	0
2.4	0	0	0	0	1	1	0	0
2.5	1	1	0	0	1	1	0	0
2.6	0	0	0	0	0	0	0	0
2.7	1	1	0	0	1	1	0	0
2.8	0	0	0	0	0	0	0	0
2.9	1	1	0	0	1	1	0	0
3	0	0	0	0	0	0	0	0
>3	0	0	0	0	0	0	0	0
Total	1020	20	986	1000	2161	39	2026	2122
>1V	184	12	172	172	285	22	263	263
>2V	4	4	0	0	10	10	0	0

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

SG	Row	Col	Elev	Volts	Prev Volts (2R11)	Growth/ EFPY	Plus Pt Results	New?
SG24	2	65	2H	2.87	0.69	1.434	SAI	Repeat
SG21	6	85	2H	2.11	0.56	1.020	SAI	New
SG24	33	50	2H	2.62	1.11	0.993	SAI	Repeat
SG21	3	47	1H	2.14	0.70	0.947	SAI	Repeat
SG21	38	46	2H	2.38	1.01	0.901	SAI	Repeat
SG24	27	43	2H	2.43	1.080	0.888	SAI	Repeat
SG21	16	49	3H	1.84	0.58	0.829	SAI	Repeat
SG24	37	23	2H	1.88	0.65	0.809	SAI	Repeat
SG24	10	60	2H	1.80	0.62	0.776	SAI	Repeat
SG22	29	70	2H	2.03	0.85	0.776	SAI	Repeat
SG21	12	40	1H	1.78	0.64	0.750	SAI	Repeat
SG21	1	47	2H	1.79	0.710	0.711	SAI	Repeat
SG24	7	78	3H	1.72	0.66	0.697	SAI	Repeat
SG24	1	60	2H	1.41	0.36	0.691		New
SG24	32	66	2H	1.97	0.95	0.671	SAI	Repeat
SG21	25	42	1H	2.10	1.09	0.664	SAI	Repeat
SG24	20	43	2H	1.41	0.420	0.651		Repeat
SG21	17	45	1H	2.02	1.04	0.645	SAI	Repeat
SG24	18	25	1H	1.39	0.43	0.632		Repeat
SG22	2	88	3H	1.79	0.87	0.605	SAI	Repeat
SG24	13	88	2H	1.67	0.75	0.605		Repeat
SG22	4	67	1H	1.96	1.07	0.586	SAI	Repeat
SG24	14	41	2H	2.09	1.20	0.586	SAI	Repeat
SG24	9	61	1H	1.69	0.80	0.586		Repeat
SG24	25	34	1H	1.99	1.12	0.572	SAI	Repeat
SG23	22	52	2H	1.40	0.54	0.566		Repeat
SG21	40	56	1H	1.89	1.04	0.559	SAI	Repeat
SG24	7	10	2H	1.64	0.79	0.559		Repeat
SG24	16	84	2H	1.80	0.97	0.546	SAI	Repeat
SG24	36	34	3H	1.92	1.09	0.546	SAI	Repeat
SG24	33	55	2H	1.60	0.78	0.539		Repeat
SG24	19	43	2H	1.75	0.94	0.533	SAI	Repeat
SG24	8	76	2H	1.94	1.13	0.533	SAI	Repeat
SG24	30	16	2H	1.80	1.01	0.520	SAI	Repeat
SG24	17	43	1H	1.87	1.08	0.520	SAI	Repeat
SG22	29	44	2H	1.62	0.84	0.513		Repeat
SG24	9	79	2H	1.31	0.53	0.513		Repeat
SG24	40	47	2H	1.69	0.91	0.513		Repeat
SG24	4	60	1H	1.61	0.84	0.507		Repeat
SG24	27	31	2H	1.19	0.42	0.507		Repeat
SG24	20	46	1H	1.78	1.01	0.507	SAI	Repeat
SG21	25	52	1H	1.44	0.68	0.500		Repeat
SG24	11	63	2H	1.14	0.38	0.500		Repeat

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

Tube Support Plate	SG 2-1					Tube Support Plate	SG 2-2				
	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	294	2.14	0.59	0.89	0.11	1H	138	1.96	0.59	0.55	0.10
2H	102	2.38	0.53	0.96	0.10	2H	156	2.03	0.57	0.73	0.08
3H	31	1.84	0.53	0.78	0.09	3H	58	1.79	0.50	0.57	0.07
4H	5	0.89	0.50	0.34	0.14	4H	18	1.16	0.50	0.14	0.03
5H	18	0.93	0.51	0.16	0.01	5H	3	0.98	0.57	0.32	0.13
6H	3	0.9	0.65	0.37	0.12	6H	1	0.35	0.35	0.09	0.09
7H						7H	2	0.51	0.51	0.16	0.07
CL	19	0.91	0.47	0.06	0.01	CL	21	0.83	0.40	0.22	0.03
All Inds	472	2.38	0.57	0.96	0.10	All Inds	397	2.03	0.55	0.73	0.08

Tube Support Plate	SG 2-3					Tube Support Plate	SG 2-4				
	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	148	1.60	0.53	0.34	0.05	1H	371	1.99	0.66	0.60	0.12
2H	83	1.49	0.55	0.53	0.06	2H	436	2.87	0.76	1.35	0.15
3H	23	1.18	0.46	0.16	0.02	3H	148	1.92	0.57	0.66	0.10
4H	1	0.30	0.30	-0.01	-0.01	4H	47	1.19	0.51	0.34	0.10
5H	4	0.86	0.44	0.14	0.03	5H	7	0.71	0.39	0.12	0.05
6H	2	0.32	0.30	0.05	0.03	6H	1	0.20	0.20	-0.03	-0.03
7H	1	0.21	0.21	0.04	0.04	7H					
CL	10	0.42	0.30	0.09	0.00	CL	10	0.75	0.39	0.19	0.04
All Inds	272	1.60	0.52	0.53	0.05	All Inds	1020	2.87	0.68	1.35	0.13

Tube Support Plate	Composite of All Four SGs				
	No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY
1H	951	2.14	0.61	0.89	0.10
2H	777	2.87	0.67	1.35	0.12
3H	260	1.92	0.54	0.96	0.09
4H	71	1.19	0.51	0.34	0.08
5H	32	0.98	0.48	0.96	0.03
6H	7	0.90	0.44	0.37	0.07
7H	3	0.51	0.41	0.16	0.06
CL	60	0.91	0.40	0.22	0.02
All Inds	2161	2.87	0.61	1.35	0.10

Table 3-6: Voltage Growth for Cycles 8 through 12

		SG 2-1	SG 2-2	SG 2-3	SG 2-4	All
Cycle 8	Avg BOC Volts	0.338	0.358	0.403	0.415	0.385
	Average Growth Per EFPY	0.054	0.054	-0.008	0.059	0.051
	Average Percent Growth Per EFPY	16.0%	15.2%	-1.9%	14.3%	13.3%
Cycle 9	Avg BOC Volts	0.388	0.362	0.324	0.387	0.377
	Avg Growth Per EFPY	0.036	0.087	0.168	0.173	0.134
	Average Percent Growth Per EFPY	9.2%	24.2%	52.0%	44.7%	35.6%
Cycle 10	Avg BOC Volts	0.42	0.43	0.48	0.53	0.49
	Avg Growth Per EFPY	0.14	0.08	0.12	0.20	0.16
	Average Percent Growth Per EFPY	33.2%	19.0%	25.5%	37.5%	33.4%
Cycle 11	Avg BOC Volts	0.423	0.437	0.379	0.514	0.467
	Avg Growth Per EFPY	0.131	0.103	0.131	0.233	0.181
	Average Percent Growth Per EFPY	30.9%	23.5%	34.7%	45.3%	38.7%
Cycle 12	Avg BOC Volts	0.419	0.432	0.448	0.496	0.461
	Avg Growth Per EFPY	0.106	0.085	0.050	0.136	0.110
	Average Percent Growth Per EFPY	25.3%	19.8%	11.2%	27.4%	23.8%

Table 3-7: Summary of Independent Cycle 12 Voltage Growth per EFPY

Delta Volts Per EFPY	SG 2-1		SG 2-2		SG 2-3		SG 2-4		Total	
	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF
<=0.0	75	0.170	71	0.196	79	0.324	75	0.080	300	0.151
0.1	198	0.620	163	0.645	110	0.775	389	0.492	860	0.583
0.2	88	0.820	84	0.876	39	0.934	266	0.774	477	0.823
0.3	43	0.918	27	0.950	10	0.975	121	0.902	201	0.924
0.4	20	0.964	9	0.975	4	0.992	44	0.949	77	0.962
0.5	7	0.980	5	0.989	1	0.996	21	0.971	34	0.979
0.6	1	0.982	2	0.994	1	1.000	16	0.988	20	0.989
0.7	2	0.986	1	0.997	0	1.000	6	0.995	9	0.994
0.8	2	0.991	1	1.000	0	1.000	1	0.996	4	0.996
0.9	1	0.993	0	1.000	0	1.000	2	0.998	3	0.997
1	2	0.998	0	1.000	0	1.000	1	0.999	3	0.999
1.1	1	1.000	0	1.000	0	1.000	0	0.999	1	0.999
1.2	0	1.000	0	1.000	0	1.000	0	0.999	0	0.999
1.3	0	1.000	0	1.000	0	1.000	0	0.999	0	0.999
1.4	0	1.000	0	1.000	0	1.000	0	0.999	0	0.999
1.5	0	1.000	0	1.000	0	1.000	1	1.000	1	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	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
Total	440	NA	363	NA	244	NA	943	NA	1990	NA
Upper 95% Growth	0.362		0.296		0.235		0.401		0.355	

Table 3-8: Delta Volts Adjustments
Based on Cycle 12 Breakpoints (Information Only)

SG	Cycle	Breakpoint(s)	Average Growth (Volts per EFPY)		
			Bin1	Bin2*	Bin3
SG 2-1	Cycle 11	1.12	0.104	0.198	NA
	Cycle 12		0.105	0.204	
	Delta		+0.001	+0.006	
SG 2-2	Cycle 11	1.00	0.080	0.157	NA
	Cycle 12		0.083	0.160	
	Delta		+0.003	+0.003	
SG 2-3	Cycle 11	0.96	0.114	0.654	NA
	Cycle 12		0.046	0.130	
	Delta		<0	<0	
SG 2-4	Cycle 11	0.47 / 1.03	0.116	0.261	0.790*
	Cycle 12		0.095	0.178	0.284*
	Delta		<0	<0	<0
Composite	Cycle 11	1.10 / 1.71	0.140	0.384	NA**
	Cycle 12		0.108	0.205	
	Delta		<0	<0	

* Since no indications were returned to service >1.2 volts at BOC-12, the averages for both cycles in Bin2 (Bin3 for SG 2-4) only include indications up to and including 1.2v.

** Since all indications >1.2 volts were plugged at BOC-12, there are no Cycle 12 indications that fall into the Bin3 category for indications >1.71 volts at EOC-12. Therefore, no comparison is possible.

Table 3-9: Delta Volts Adjustments Based on Cycle 11 Breakpoints

SG	Cycle	Breakpoint(s)	Average Growth (Volts per EFPY)		
			Bin1	Bin2*	Bin3
SG 2-1	Cycle 11	1.06	0.103	0.286	NA
	Cycle 12		0.105	0.219	
	Delta		+0.002	<0	
SG 2-4	Cycle 11	0.59 / 1.66	0.127	0.347	NA**
	Cycle 12		0.103	0.212	
	Delta		<0	<0	
Composite	Cycle 11	0.59 / 1.66	0.105	0.289	NA**
	Cycle 12		0.085	0.182	
	Delta		<0	<0	

* Since no indications were returned to service >1.2 volts at BOC-12, the averages for both cycles in Bin2 only include indications up to and including 1.2v.

** Since all indications >1.2 volts were plugged at BOC-12, there are no Cycle 12 indications that fall into the Bin3 category for indications >1.66 volts at EOC-12. Therefore, no comparison is possible.

Table 3-10: Supplemented Cycle 12 Voltage Dependent Growth for SG 2-1 (Information Only)

Growth (volts/EFPY)	Cycle 12 Data		Cycle 11 Data		Combined	
	Bin1 (<=1.12v)	Bin2 (>1.12v)	Bin1 (<=1.12v)	Bin2 (>1.12v)	Bin1 (<=1.12v)	Bin2 (>1.12v)
<0	62	0	0	3	62	3
0.1	211	0	0	1	211	1
0.2	86	2	0	1	86	3
0.3	43	0	0	1	43	1
0.4	19	1	0	0	19	1
0.5	6	0	0	0	6	0
0.6	2	0	0	0	2	0
0.7	2	0	0	0	2	0
0.8	2	0	0	0	2	0
0.9	1	0	0	1	1	1
1	2	0	0	1	2	1
1.1	1	0	0	0	1	0
1.2	0	0	0	0	0	0
1.3	0	0	0	0	0	0
1.4	0	0	0	0	0	0
1.5	0	0	0	0	0	0
1.6	0	0	0	1	0	1
1.7	0	0	0	0	0	0
1.8	0	0	0	0	0	0
1.9	0	0	0	0	0	0
2	0	0	0	0	0	0
2.1	0	0	0	0	0	0
2.2	0	0	0	0	0	0
2.3	0	0	0	1	0	1
2.4	0	0	0	0	0	0
2.5	0	0	0	0	0	0
2.6	0	0	0	1	0	1
2.7	0	0	0	0	0	0
2.8	0	0	0	0	0	0
2.9	0	0	0	1	0	1
3	0	0	0	0	0	0
3.1	0	0	0	0	0	0
3.2	0	0	0	0	0	0
>3.2	0	0	0	0	0	0
Total	437	3	0	12	437	15

Table 3-11: Supplemented Cycle 12 Voltage Dependent Growth for SG 2-2 (Information Only)

Growth (volts/EFPY)	Cycle 12 Data		Cycle 11 Data		Combined	
	Bin1 (<=1v)	Bin2 (>1v)	Bin1 (<=1v)	Bin2 (>1v)	Bin1 (<=1v)	Bin2 (>1v)
<0	53	1	0	0	53	1
0.1	169	3	0	0	169	3
0.2	89	2	0	0	89	2
0.3	25	3	0	0	25	3
0.4	8	1	0	0	8	1
0.5	5	0	0	0	5	0
0.6	1	1	0	0	1	1
0.7	1	0	0	0	1	0
0.8	1	0	0	1	1	1
0.9	0	0	0	0	0	0
1	0	0	0	0	0	0
1.1	0	0	0	0	0	0
1.2	0	0	0	0	0	0
1.3	0	0	0	0	0	0
1.4	0	0	0	1	0	1
1.5	0	0	0	0	0	0
1.6	0	0	0	0	0	0
1.7	0	0	0	1	0	1
1.8	0	0	0	0	0	0
1.9	0	0	0	0	0	0
2	0	0	0	0	0	0
2.1	0	0	0	0	0	0
2.2	0	0	0	0	0	0
2.3	0	0	0	0	0	0
2.4	0	0	0	0	0	0
2.5	0	0	0	0	0	0
2.6	0	0	0	0	0	0
2.7	0	0	0	1	0	1
2.8	0	0	0	0	0	0
2.9	0	0	0	0	0	0
3	0	0	0	0	0	0
3.1	0	0	0	0	0	0
3.2	0	0	0	0	0	0
>3.2	0	0	0	0	0	0
Total	352	11	0	4	352	15

Table 3-12: Supplemented Cycle 12 Voltage Dependent Growth for SG 2-3 (Information Only)

Growth (volts/EFPY)	Cycle 12 Data		Cycle 11 Data		Combined	
	Bin1 (<=0.96v)	Bin2 (>0.96v)	Bin1 (<=0.96v)	Bin2 (>0.96v)	Bin1 (<=0.96v)	Bin2 (>0.96v)
<0	77	2	0	2	77	4
0.1	107	3	0	0	107	3
0.2	36	3	0	0	36	3
0.3	5	5	0	0	5	5
0.4	4	0	0	0	4	0
0.5	1	0	0	0	1	0
0.6	1	0	0	0	1	0
0.7	0	0	0	0	0	0
0.8	0	0	0	0	0	0
0.9	0	0	0	0	0	0
1	0	0	0	0	0	0
1.1	0	0	0	1	0	1
1.2	0	0	0	0	0	0
1.3	0	0	0	0	0	0
1.4	0	0	0	0	0	0
1.5	0	0	0	0	0	0
1.6	0	0	0	0	0	0
1.7	0	0	0	0	0	0
1.8	0	0	0	0	0	0
1.9	0	0	0	0	0	0
2	0	0	0	0	0	0
2.1	0	0	0	0	0	0
2.2	0	0	0	0	0	0
2.3	0	0	0	0	0	0
2.4	0	0	0	0	0	0
2.5	0	0	0	0	0	0
2.6	0	0	0	0	0	0
2.7	0	0	0	0	0	0
2.8	0	0	0	0	0	0
2.9	0	0	0	0	0	0
3	0	0	0	0	0	0
3.1	0	0	0	0	0	0
3.2	0	0	0	0	0	0
>3.2	0	0	0	0	0	0
Total	231	13	0	3	231	16

Table 3-13: Supplemented Cycle 12 Voltage Dependent Growth for SG 2-4 (Information Only)

Growth (volts/EFPY)	Cycle 12 Data			Cycle 11 Data			Combined		
	Bin1 (<=0.47v)	Bin2 (0.48v-1.03v)	Bin3 (>1.03v)	Bin1 (<=0.47v)	Bin2 (0.48v-1.03v)	Bin3 (>1.03v)	Bin1 (<=0.47v)	Bin2 (0.48v-1.03v)	Bin3 (>1.03v)
<0	47	25	3	0	0	6	47	25	9
0.1	286	98	5	0	0	8	286	98	13
0.2	134	122	10	0	0	4	134	122	14
0.3	47	68	6	0	0	7	47	68	13
0.4	3	38	3	0	0	1	3	38	4
0.5	4	11	6	0	0	1	4	11	7
0.6	1	10	5	0	0	3	1	10	8
0.7	3	3	0	0	0	2	3	3	2
0.8	0	1	0	0	0	2	0	1	2
0.9	0	1	1	0	0	2	0	1	3
1	0	0	1	0	0	1	0	0	2
1.1	0	0	0	0	0	0	0	0	0
1.2	0	0	0	0	0	2	0	0	2
1.3	0	0	0	0	0	2	0	0	2
1.4	0	0	0	0	0	1	0	0	1
1.5	0	1	0	0	0	3	0	1	3
1.6	0	0	0	0	0	2	0	0	2
1.7	0	0	0	0	0	0	0	0	0
1.8	0	0	0	0	0	1	0	0	1
1.9	0	0	0	0	0	2	0	0	2
2	0	0	0	0	0	1	0	0	1
2.1	0	0	0	0	0	0	0	0	0
2.2	0	0	0	0	0	4	0	0	4
2.3	0	0	0	0	0	1	0	0	1
2.4	0	0	0	0	0	0	0	0	0
2.5	0	0	0	0	0	1	0	0	1
2.6	0	0	0	0	0	1	0	0	1
2.7	0	0	0	0	0	1	0	0	1
2.8	0	0	0	0	0	0	0	0	0
2.9	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	1	0	0	1
3.1	0	0	0	0	0	0	0	0	0
3.2	0	0	0	0	0	0	0	0	0
>3.2	0	0	0	0	0	0	0	0	0
Total	525	378	40	0	0	60	525	378	100

Table 3-14: Supplemented Cycle 12 Voltage Dependent Growth for All Steam Generators (Information Only)

Growth (volts/EFPY)	Cycle 12 Data			Cycle 11 Data			Combined		
	Bin1 (<=1.1v)	Bin2 (1.11v-1.71v)	Bin3 (>1.71v)	Bin1 (<=1.1v)	Bin2 (1.11v-1.71v)	Bin3 (>1.71v)	Bin1 (<=1.1v)	Bin2 (1.11v-1.71v)	Bin3 (>1.71v)
<0	293	7	0	0	11	0	293	18	0
0.1	856	4	0	0	7	2	856	11	2
0.2	468	9	0	0	5	0	468	14	0
0.3	192	9	0	0	6	2	192	15	2
0.4	75	2	0	0	1	0	75	3	0
0.5	29	4	0	0	1	0	29	5	0
0.6	18	3	0	0	2	1	18	5	1
0.7	9	0	0	0	3	0	9	3	0
0.8	4	0	0	0	2	0	4	2	0
0.9	3	0	0	0	4	0	3	4	0
1	2	1	0	0	1	0	2	2	0
1.1	1	0	0	0	1	0	1	1	0
1.2	0	0	0	0	2	0	0	2	0
1.3	0	0	0	0	2	0	0	2	0
1.4	0	0	0	0	1	1	0	1	1
1.5	1	0	0	0	1	2	1	1	2
1.6	0	0	0	0	2	1	0	2	1
1.7	0	0	0	0	0	1	0	0	1
1.8	0	0	0	0	1	0	0	1	0
1.9	0	0	0	0	1	1	0	1	1
2	0	0	0	0	1	0	0	1	0
2.1	0	0	0	0	0	0	0	0	0
2.2	0	0	0	0	3	1	0	3	1
2.3	0	0	0	0	2	0	0	2	0
2.4	0	0	0	0	0	0	0	0	0
2.5	0	0	0	0	1	0	0	1	0
2.6	0	0	0	0	1	1	0	1	1
2.7	0	0	0	0	0	2	0	0	2
2.8	0	0	0	0	0	0	0	0	0
2.9	0	0	0	0	0	1	0	0	1
3	0	0	0	0	0	1	0	0	1
3.1	0	0	0	0	0	0	0	0	0
3.2	0	0	0	0	0	0	0	0	0
>3.2	0	0	0	0	0	0	0	0	0
Total	1951	39	0	0	62	17	1951	101	17

Table 3-15: Cycle 11 Voltage-Dependent Growth for SG 2-1 (Used for SG 2-1)

Growth (Volts/EFPY)	Bin1 (<=1.06v)	Bin2 (>1.06v)
<=0	38	3
0.1	179	2
0.2	73	1
0.3	19	1
0.4	9	1
0.5	9	1
0.6	0	0
0.7	1	0
0.8	0	0
0.9	0	2
1	0	0
1.1	0	0
1.2	1	0
1.3	1	0
1.4	1	0
1.5	0	0
1.6	0	1
1.7	1	0
1.8	0	0
1.9	0	0
2	0	0
2.1	0	0
2.2	0	0
2.3	0	1
2.4	0	0
2.5	0	0
2.6	0	1
2.7	0	0
2.8	0	0
2.9	0	1
3	0	0
3.1	0	0
3.2	0	0
>3.2	0	0
Total	332	15

Table 3-16: Cycle 11 Voltage-Dependent Growth for SG 2-4 (Used for SG 2-4)

Growth (Volts/EFPY)	Bin1 (<=0.59v)	Bin2 (0.59v to 1.66v)	Bin3 (>1.66v)
<=0	48	28	0
0.1	307	50	2
0.2	220	37	1
0.3	79	29	3
0.4	24	24	0
0.5	5	21	0
0.6	8	13	1
0.7	5	6	0
0.8	3	4	0
0.9	0	7	0
1	1	6	0
1.1	0	6	0
1.2	0	3	0
1.3	1	5	0
1.4	0	1	1
1.5	0	3	2
1.6	0	3	1
1.7	1	0	0
1.8	0	2	0
1.9	0	1	1
2	0	1	0
2.1	0	0	0
2.2	0	3	1
2.3	0	1	0
2.4	0	1	0
2.5	0	1	1
2.6	0	1	0
2.7	0	0	1
2.8	0	0	0
2.9	0	0	0
3	0	0	1
3.1	0	0	0
3.2	0	0	0
>3.2	0	0	0
Total	702	257	16

Table 3-17: Cycle 11 Voltage-Dependent Growth for All SGs (Used for SGs 2-2 and 2-3)

Growth (Volts/EFPY)	Bin1 (<=0.59v)	Bin2 (0.59v to 1.66v)	Bin3 (>1.66v)
<=0	152	68	0
0.1	690	84	2
0.2	374	59	1
0.3	124	53	3
0.4	32	37	0
0.5	17	28	0
0.6	10	19	1
0.7	5	10	0
0.8	3	6	0
0.9	0	10	0
1	1	6	0
1.1	0	7	0
1.2	1	3	0
1.3	1	7	0
1.4	0	3	1
1.5	0	3	2
1.6	0	3	2
1.7	1	1	1
1.8	0	2	0
1.9	0	2	1
2	0	1	0
2.1	0	0	0
2.2	0	3	1
2.3	0	2	0
2.4	0	1	0
2.5	0	1	1
2.6	0	1	1
2.7	0	0	2
2.8	0	0	0
2.9	0	0	1
3	0	0	1
3.1	0	0	0
3.2	0	0	0
>3.2	0	0	0
Total	1411	420	21

Table 3-18: BOC-13 Voltage Distribution Used for Monte Carlo Analyses for SG 2-1

Voltage Bin	SG 2-1	
	As-Found EOC-12	Repaired
0.1	0	0
0.2	29	0
0.3	74	0
0.4	97	0
0.5	55	1
0.6	54	0
0.7	43	0
0.8	33	0
0.9	25	0
1	14	0
1.06	9	0
1.1	2	0
1.2	10	0
1.3	2	0
1.4	4	0
1.5	8	0
1.6	1	0
1.7	3	0
1.8	2	1
1.9	2	1
2	0	0
2.1	2	2
2.2	2	2
2.3	0	0
2.4	1	1
2.5	0	0
2.6	0	0
2.7	0	0
2.8	0	0
2.9	0	0
3	0	0
>3	0	0
Total	472	8

Table 3-19: BOC-13 Voltage Distributions Used for Monte Carlo Analyses for SGs 2-2, 2-3, and 2-4

Voltage Bin	SG 2-2		SG 2-3		SG 2-4	
	As-Found EOC-12	Repaired	As-Found EOC-12	Repaired	As-Found EOC-12	Repaired
0.1	0	0	1	0	0	0
0.2	28	1	17	0	31	0
0.3	54	0	42	0	104	0
0.4	70	1	65	0	134	0
0.5	72	2	35	0	141	3
0.59	42	2	35	1	108	1
0.6	5	0	3	0	19	0
0.7	31	0	20	0	100	0
0.8	24	1	18	0	77	2
0.9	23	0	11	0	66	2
1	15	0	5	0	56	0
1.1	5	0	2	0	45	0
1.2	5	0	5	0	38	0
1.3	7	0	5	0	26	0
1.4	4	0	1	0	20	0
1.5	6	0	5	0	18	0
1.6	1	0	2	0	5	0
1.66	2	0	0	0	7	1
1.7	0	0	0	0	4	0
1.8	1	1	0	0	7	2
1.9	0	0	0	0	6	3
2	1	1	0	0	4	2
2.1	1	1	0	0	1	1
2.2	0	0	0	0	0	0
2.3	0	0	0	0	0	0
2.4	0	0	0	0	0	0
2.5	0	0	0	0	1	1
2.6	0	0	0	0	0	0
2.7	0	0	0	0	1	1
2.8	0	0	0	0	0	0
2.9	0	0	0	0	1	1
3	0	0	0	0	0	0
>3	0	0	0	0	0	0
Total	397	10	272	1	1020	20

Table 3-20: Re-tested DOSs ≥ 1.5 Volts that Failed the Probe Wear Check

SG	Row	Col	Ind	Elev	Volts	Probe	Cal No.	ARC Out 2R12	% Diff
SG 2-1	16	49	RSS	3H	1.64	720RF	HL-6	Yes	
	16	49	DOS	3H	1.84	720RF	CL-17		12.2%
	17	45	RSS	1H	1.89	720RF	HL-6	Yes	
	17	45	DOS	1H	2.02	720RF	CL-17		6.9%
	25	42	RSS	1H	2.09	720RF	HL-6	Yes	
	25	42	DOS	1H	2.1	720RF	CL-15		0.5%
	38	46	RSS	2H	2.46	720RF	HL-7	Yes	
	38	46	DOS	2H	2.38	720RF	CL-28		-3.3%
	40	56	RSS	1H	1.66	720RF	HL-5	Yes	
	40	56	DOS	1H	1.89	720RF	CL-17		13.9%
SG 2-3	12	8	RSS	2H	1.61	720RF	HL-16	Yes	
	12	8	DOS	2H	1.43	720RF	CL-35		-11.2%
	20	32	RSS	1H	1.61	720RF	HL-8	Yes	
	20	32	DOS	1H	1.6	720RF	CL-35		-0.6%
SG 2-4	7	10	RSS	2H	1.89	720RF	CL-33	Yes	
	7	10	DOS	2H	1.64	720RF	CL-39		-13.2%
	14	36	RSS	2H	1.89	720RF	CL-10	Yes	
	14	36	DOS	2H	1.87	720RF	CL-31		-1.1%
	14	41	RSS	1H	1.75	720RF	CL-9	Yes	
	14	41	DOS	1H	1.63	720RF	CL-31		-6.9%
	14	41	RSS	2H	1.99	720RF	CL-9	Yes	
	14	41	DOS	2H	2.09	720RF	CL-31		5.0%
	15	47	RSS	1H	1.6	720RF	CL-9	Yes	
	15	47	DOS	1H	1.6	720RF	CL-39		0.0%
	17	43	RSS	1H	1.68	720RF	CL-9	Yes	
	17	43	DOS	1H	1.87	720RF	CL-31		11.3%
	18	71	RSS	2H	1.56	720RF	HL-10	Yes	
	18	71	DOS	2H	1.63	720RF	CL-39		4.5%
	19	40	RSS	1H	1.51	720RF	CL-9	Yes	
	19	40	DOS	1H	1.4	720RF	CL-30		-7.3%
	19	43	RSS	2H	1.6	720RF	CL-9	Yes	
	19	43	DOS	2H	1.75	720RF	CL-31		9.4%
	20	46	RSS	1H	1.84	720RF	CL-9	Yes	
	20	46	DOS	1H	1.78	720RF	CL-39		-3.3%
	21	42	RSS	1H	1.71	720RF	CL-9	Yes	
	21	42	DOS	1H	1.76	720RF	CL-30		2.9%
	24	75	RSS	2H	1.53	720RF	HL-10	Yes	
	24	75	DOS	2H	1.6	720RF	CL-39		4.6%
	25	34	RSS	1H	1.81	720RF	CL-9	Yes	
	25	34	DOS	1H	1.99	720RF	CL-30		9.9%
	25	47	RSS	1H	1.55	720RF	CL-10	Yes	
	25	47	RSS	1H	2.19	720RF	CL-29	Yes	
	25	47	DOS	1H	1.46	720RF	CL-39		-33.3% / -5.8%
	28	78	RSS	2H	1.97	720RF	CL-26	Yes	
	28	78	RSS	2H	1.98	720RF	CL-33	Yes	
	28	78	DOS	2H	1.88	720RF	CL-39		-5.1% / -4.6%
	30	16	RSS	2H	1.66	720RF	CL-14	Yes	
	30	16	DOS	2H	1.8	720RF	CL-31		8.4%
	33	50	RSS	2H	2.58	720RF	HL-10	Yes	
	33	50	RSS	2H	3.03	720RF	CL-33	Yes	
	33	50	DOS	2H	2.62	720RF	CL-39		-13.5% / -1.6%
	34	53	RSS	2H	1.69	720RF	HL-10	Yes	
	34	53	RSS	2H	1.74	720RF	CL-33	Yes	
	34	53	DOS	2H	1.59	720RF	CL-39		-8.6% / -5.9%

Table 3-21: New 2R12 DOSs >=0.5 Volts In Tubes Inspected With A Worn Probe In 2R11

SG	Row	Col	Ind	Elev	Volts	Cal	New?	ARC Out 2R12	ARC Out 2R11
SG 2-1	9	39	DOS	1H	0.76	HC-15	New		Yes
	12	37	DOS	2H	0.72	HC-16	New		Yes
	8	48	DOS	1H	0.69	HC-16	New		Yes
	34	50	DOS	1H	0.65	CC-5	New	Yes	Yes
	26	42	DOS	1H	0.61	CC-16	New		Yes
	25	54	DOS	1H	0.6	CC-9	New		Yes
	17	55	DOS	3H	0.58	CC-9	New		Yes
	1	23	DOS	1H	0.51	HC-2	New		Yes
SG 2-2	1	58	DOS	1H	0.93	HC-2	New		Yes
	23	51	DOS	1H	0.86	CC-12	New		Yes
	23	55	DOS	2H	0.83	CC-9	New		Yes
	3	56	DOS	1H	0.77	HC-1	New		Yes
	21	85	DOS	3H	0.68	CC-9	New		Yes
	12	45	DOS	1H	0.66	HC-17	New		Yes
	4	56	DOS	1H	0.58	HC-2	New		Yes
SG 2-3	14	36	DOS	1H	0.54	HC-7	New		Yes
	31	15	DOS	1H	0.5	HC-12	New		Yes
SG 2-4	14	57	DOS	1H	0.76	HC-16	New		Yes
	12	65	DOS	2H	0.75	HC-14	New		Yes
	2	10	DOS	5H	0.71	HC-1	New		Yes
	24	25	DOS	2H	0.59	CC-14	New	Yes	Yes
	5	4	DOS	1H	0.58	HC-1	New		Yes
	18	63	DOS	1H	0.55	HC-8	New		Yes
	27	76	DOS	2H	0.51	CC-25	New	Yes	Yes

Table 3-22: Summary of New DOS Indications for Probe Wear Comparison

SG	2R12 DOSs in Active Tubes (Total)	New 2R12 Not Detected in 2R11	New 2R12 Ind. In Tubes Insp. w/ Worn Probe in 2R11	New 2R12 Ind. In Tubes Insp. w/ Good Probe in 2R11	New 2R12 Ind. >=0.5 Volts	New 2R12 Ind. >=0.5 Volts in Tubes Insp. w/ Worn Probe in 2R11
SG 2-1	468	147	54	93	23	8
SG 2-2	381	125	50	75	19	7
SG 2-3	259	48	9	39	9	2
SG 2-4	994	295	24	271	82	7
Total	2102	615	137	478	133	24

Table 3-23: Summary of ARC Out Tube Inspections in 2R11

SG	# ARC Out Tubes (2R11)	# ARC In Tubes (2R11)	Total # of Inspections
SG 2-1	1322	2361	3683
SG 2-2	1120	2269	3389
SG 2-3	986	2671	3657
SG 2-4	669	2895	3564
Total	**4097**	**10196**	**14293**

Table 3-24: 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%

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

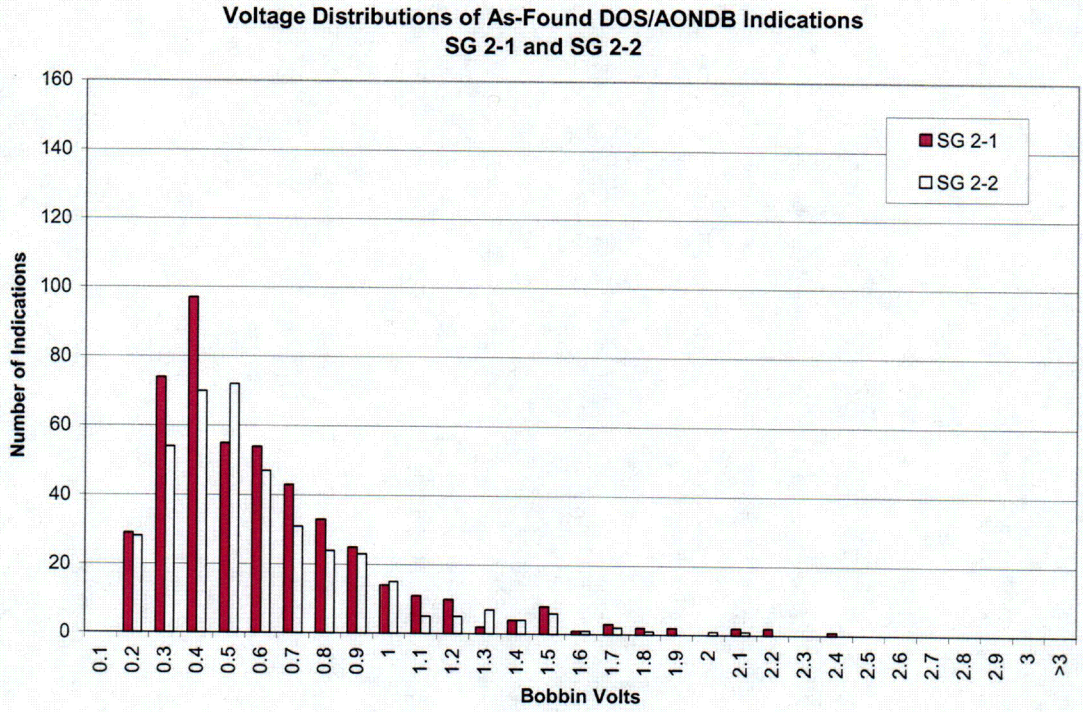
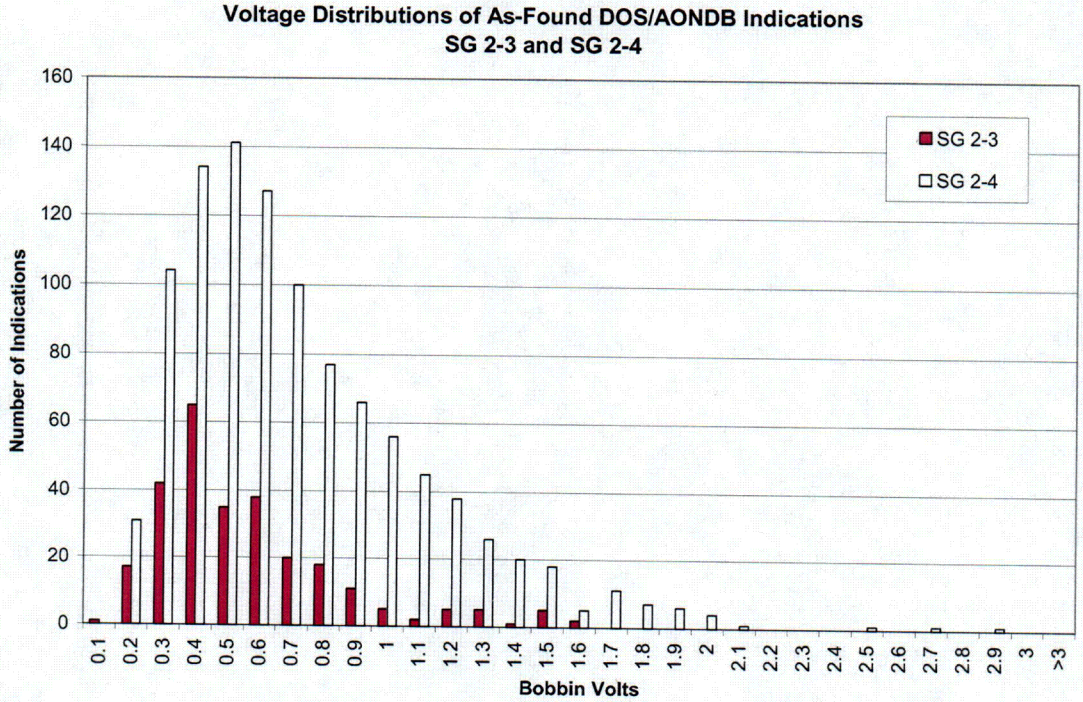


Figure 3-2: As-Found Voltage Distributions SGs 2-3 and 2-4



C01

Figure 3-3: 2R12 Repaired Voltage Distributions SGs 2-1 and 2-2

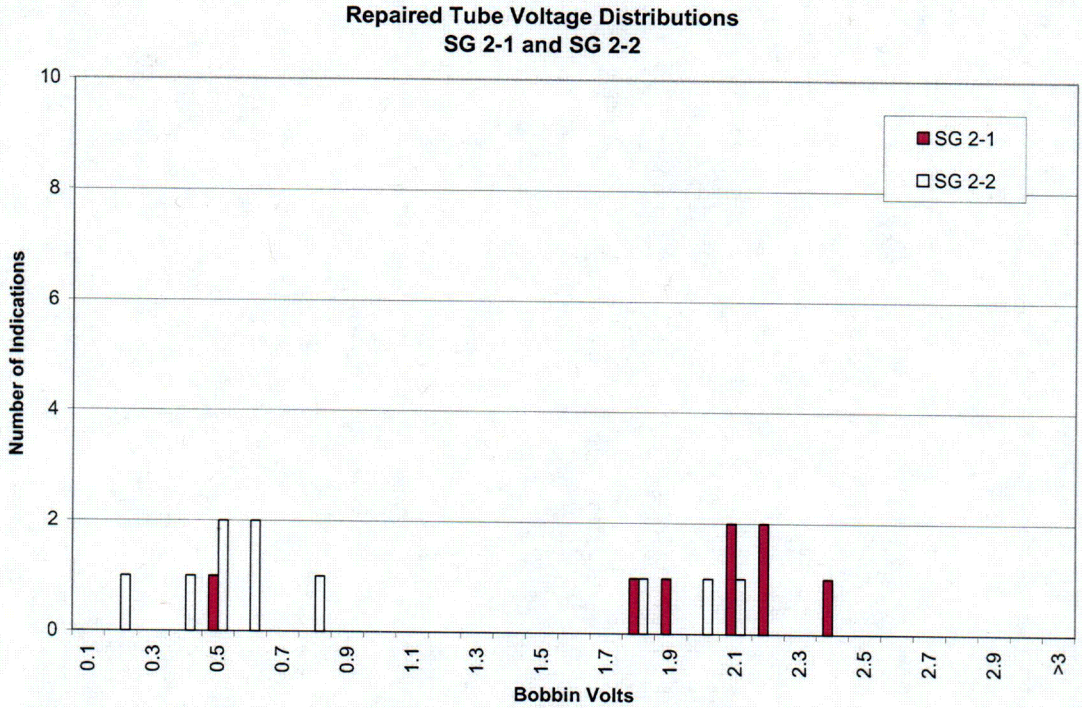
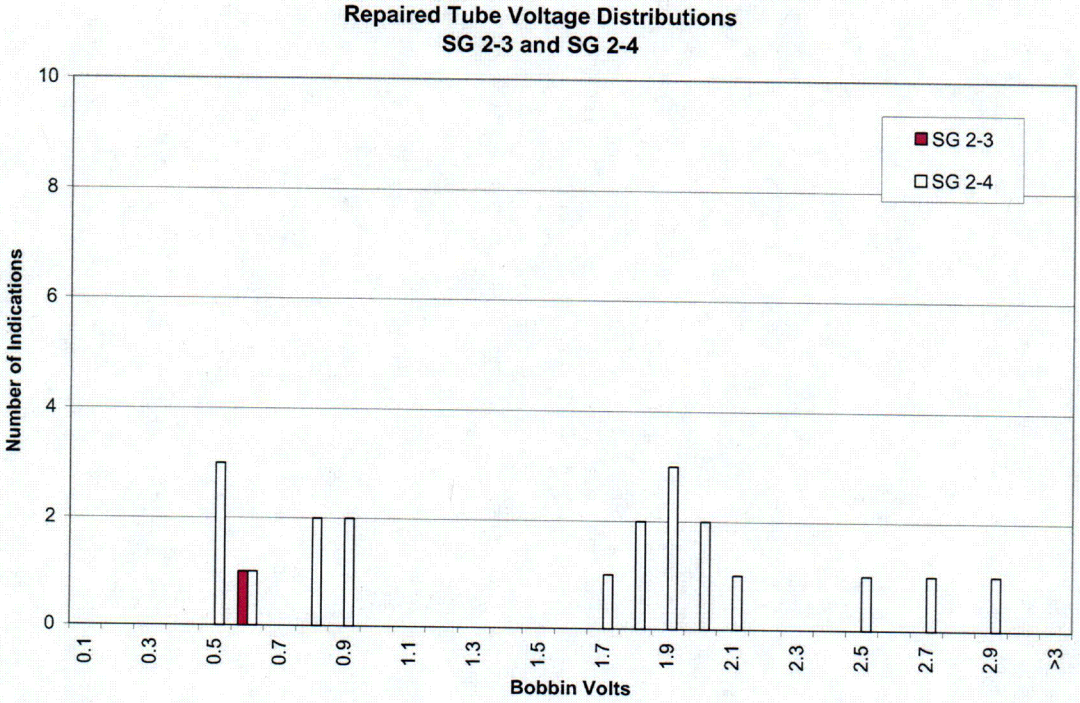
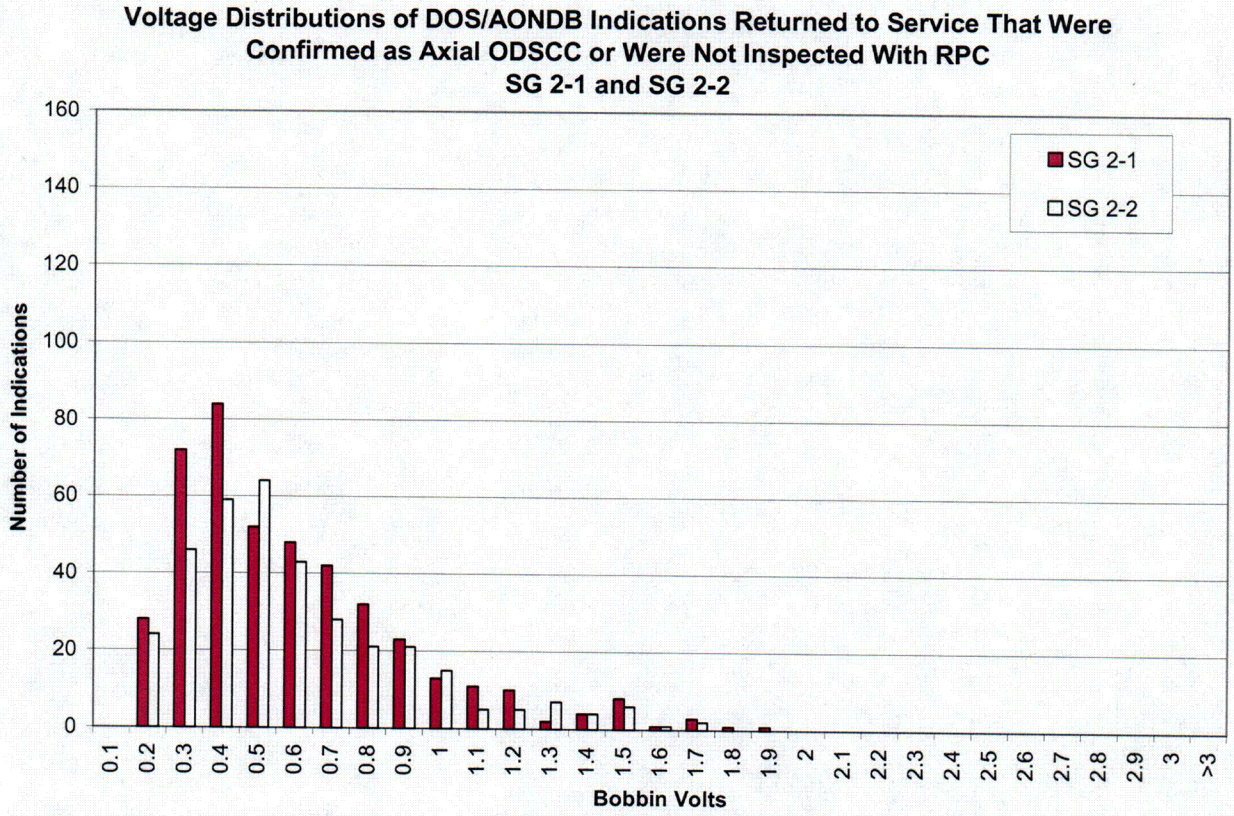


Figure 3-4: 2R12 Repaired Voltage Distributions SGs 2-3 and 2-4



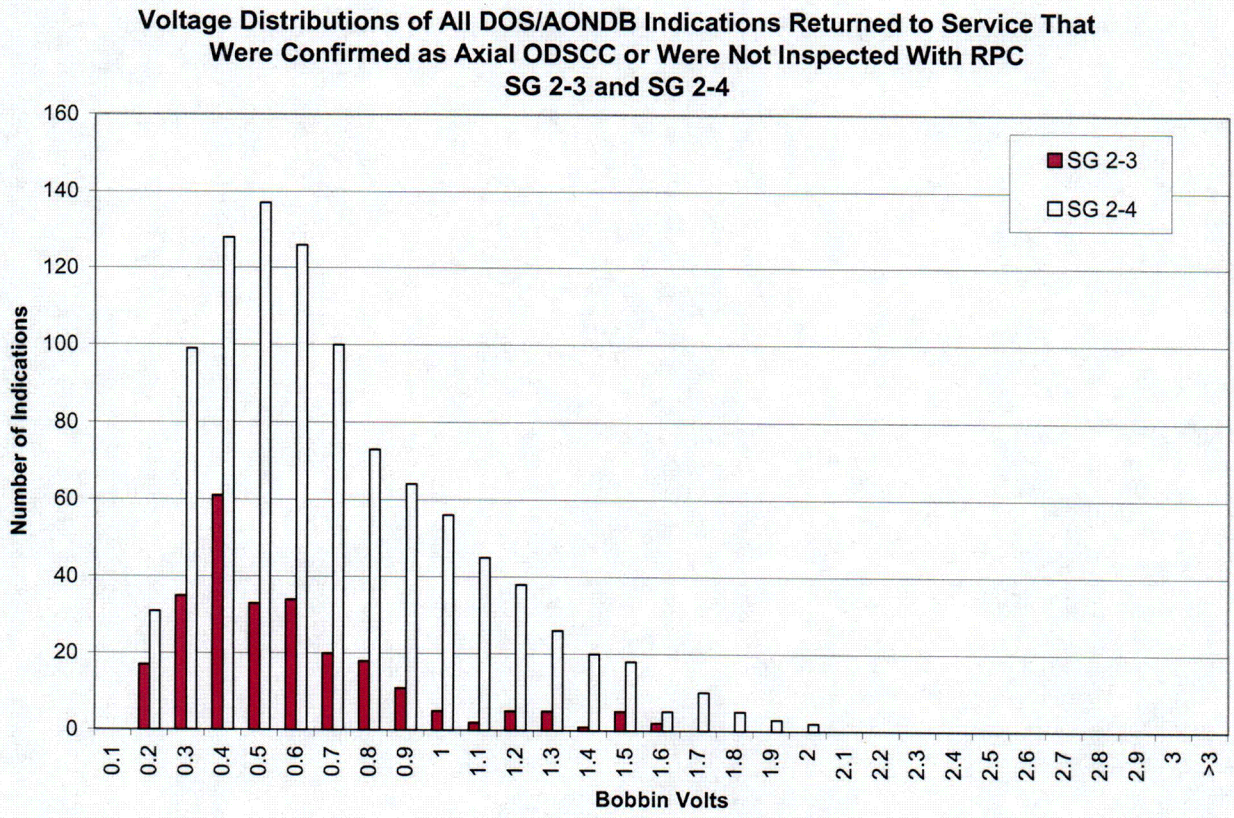
C02

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



C03

Figure 3-6: RTS Voltage Distributions for RPC Confirmed or Not Inspected SGs 2-3 and 2-4



COY

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

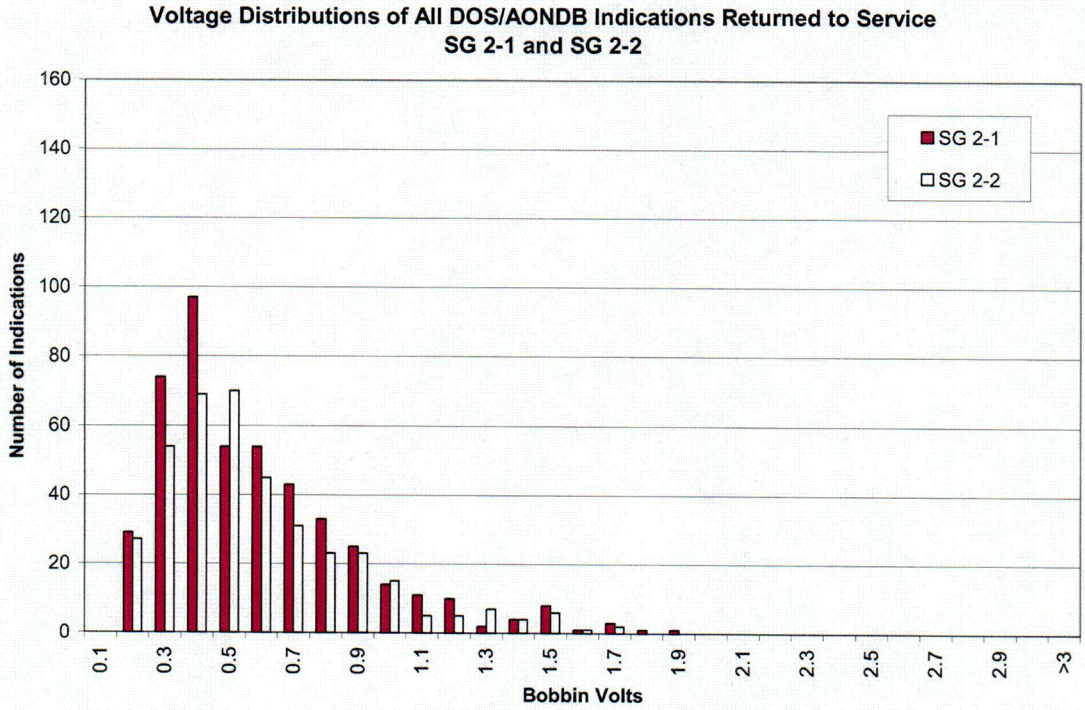


Figure 3-8: Indications RTS Voltage Distributions SGs 2-3 and 2-4

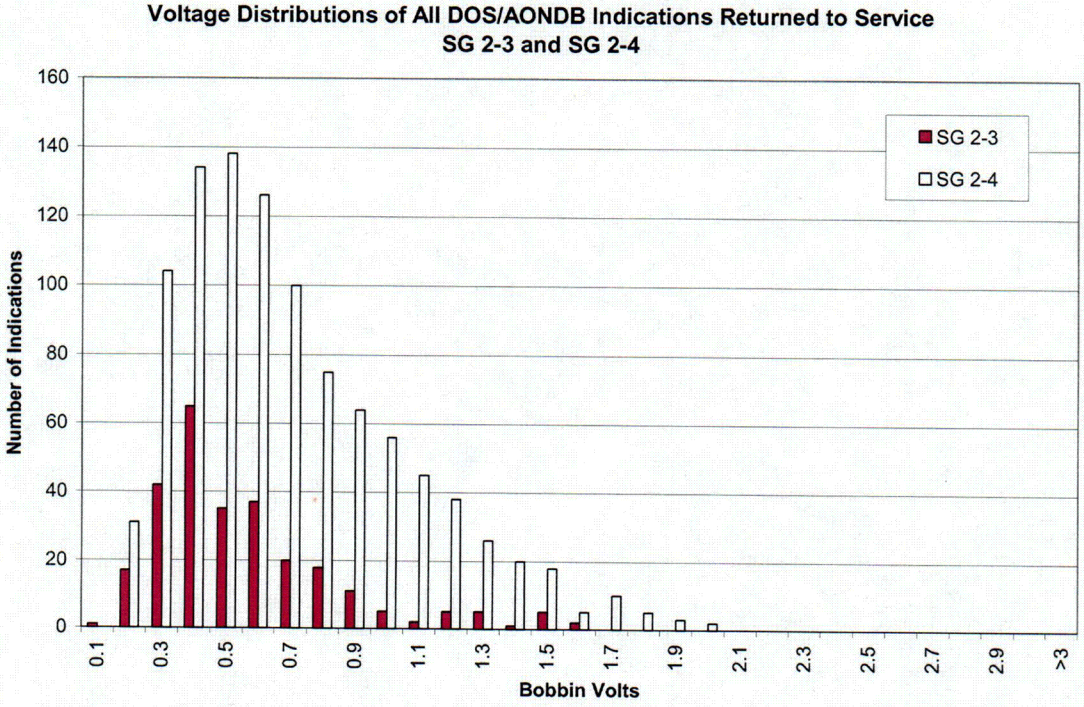
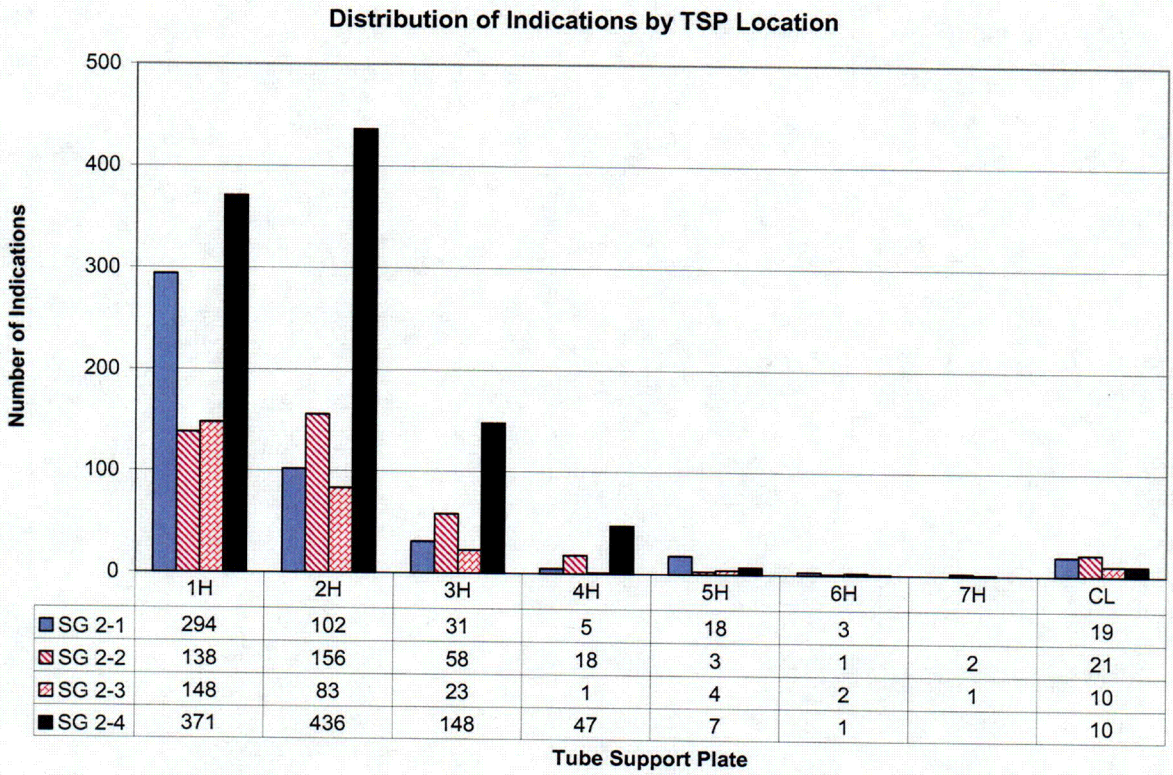


Figure 3-9: 2R12 DOS vs. TSP Elevation



	1H	2H	3H	4H	5H	6H	7H	CL
SG 2-1	294	102	31	5	18	3		19
SG 2-2	138	156	58	18	3	1	2	21
SG 2-3	148	83	23	1	4	2	1	10
SG 2-4	371	436	148	47	7	1		10

C06

Figure 3-10: Cycle 12 Growth Distributions SGs 2-1 and 2-2

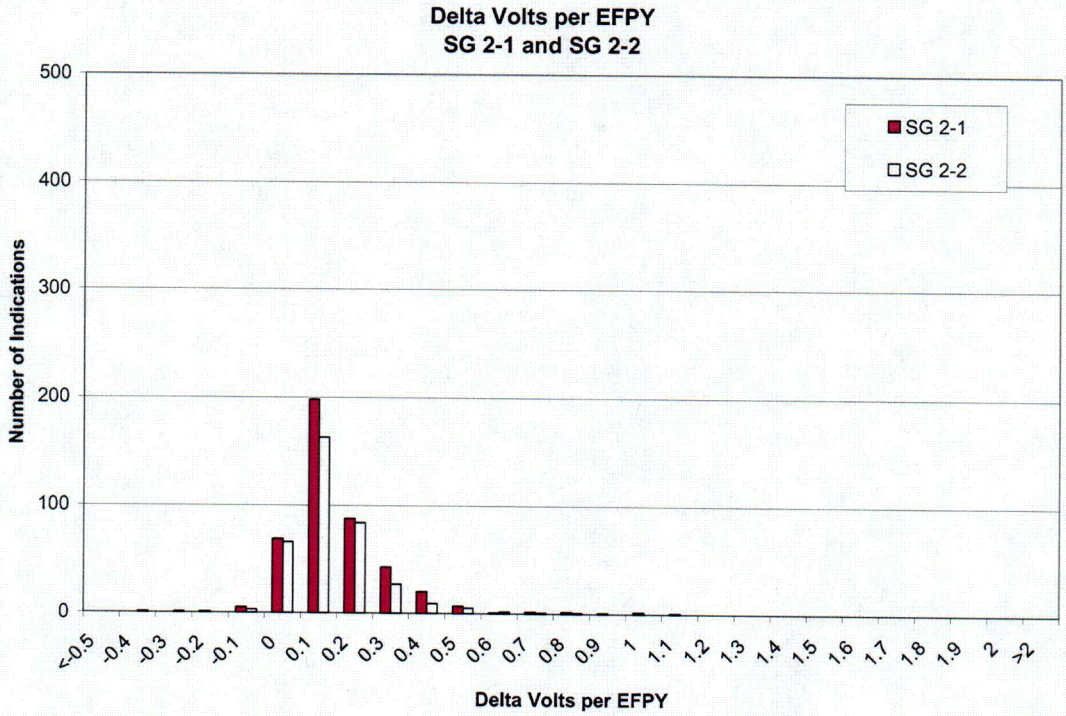
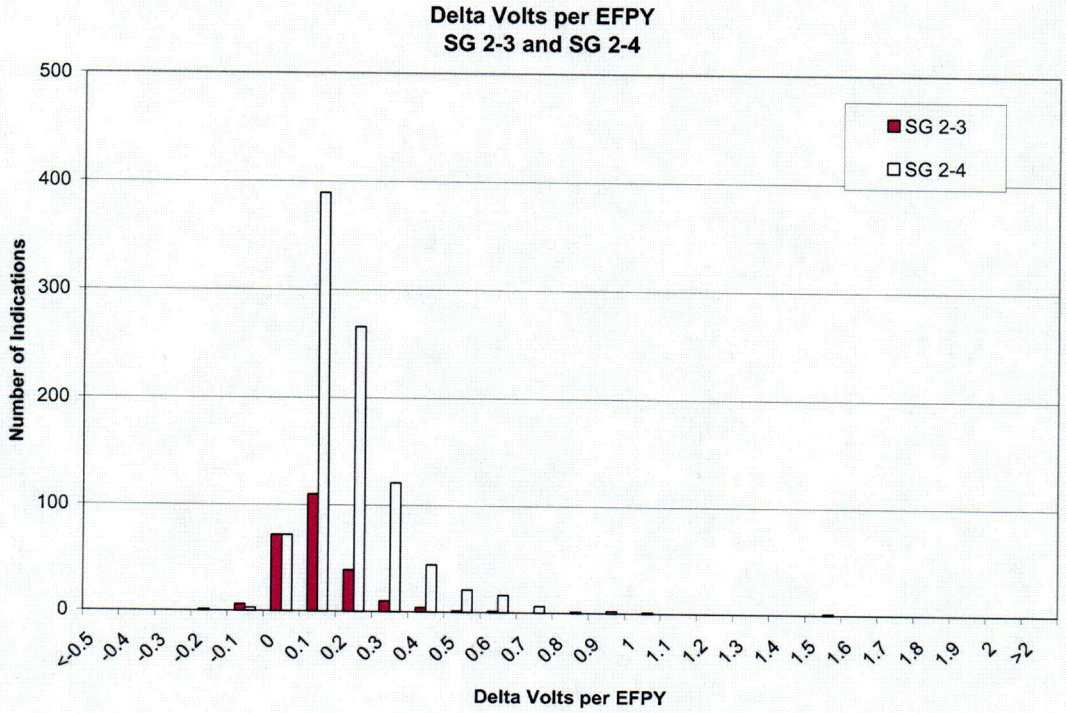


Figure 3-11: Cycle 12 Growth Distributions SGs 2-3 and 2-4



C07

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

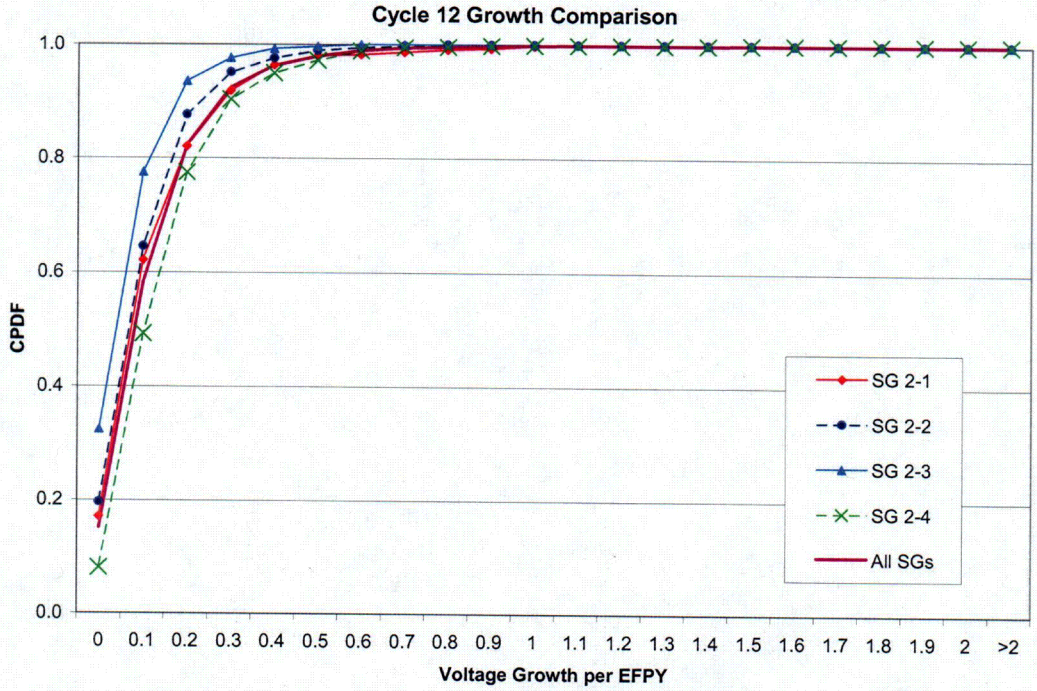
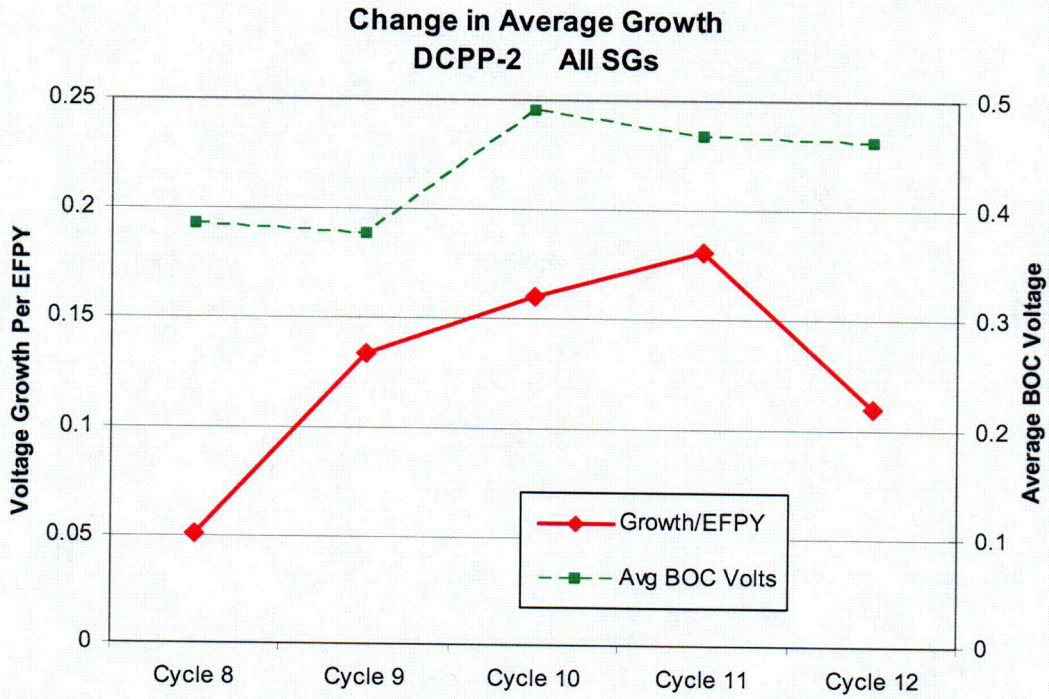


Figure 3-13: Historical Change in Growth and BOC Voltage - All SGs



C08

Figure 3-14: SG 2-1 Cycle 12 Growth vs. BOC Voltage

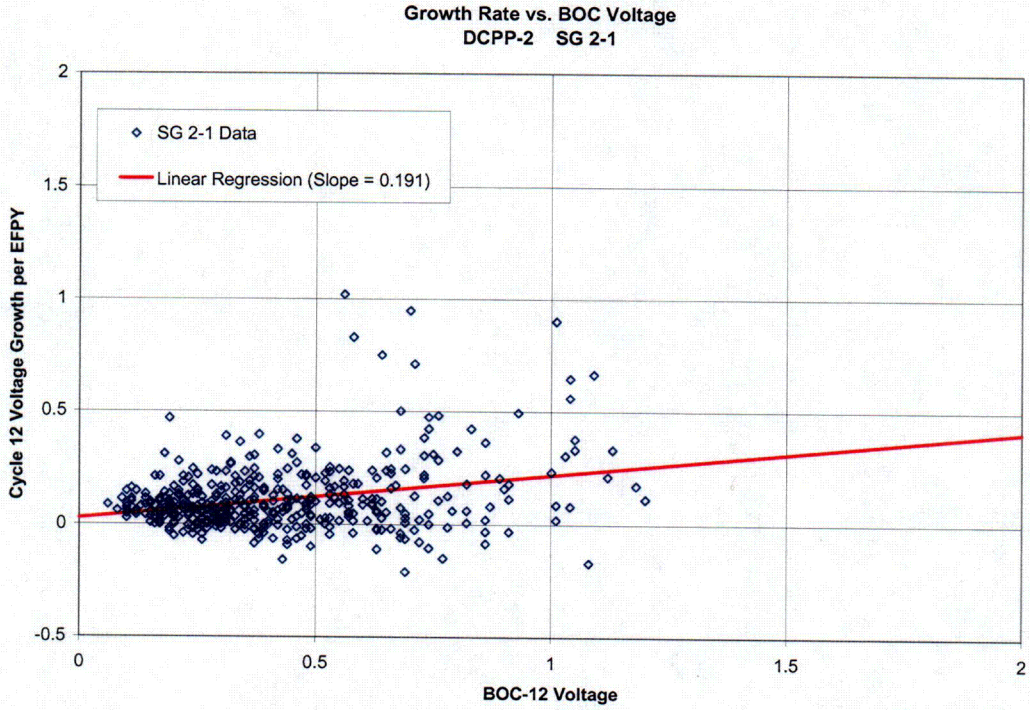
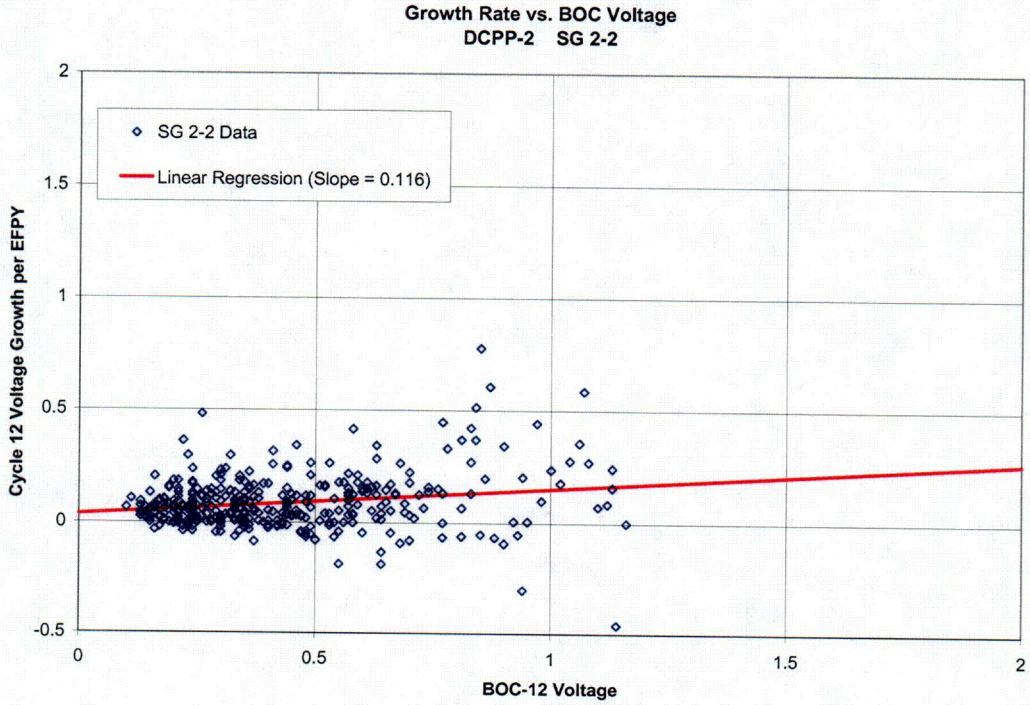


Figure 3-15: SG 2-2 Cycle 12 Growth vs. BOC Voltage



C09

Figure 3-16: SG 2-3 Cycle 12 Growth vs. BOC Voltage

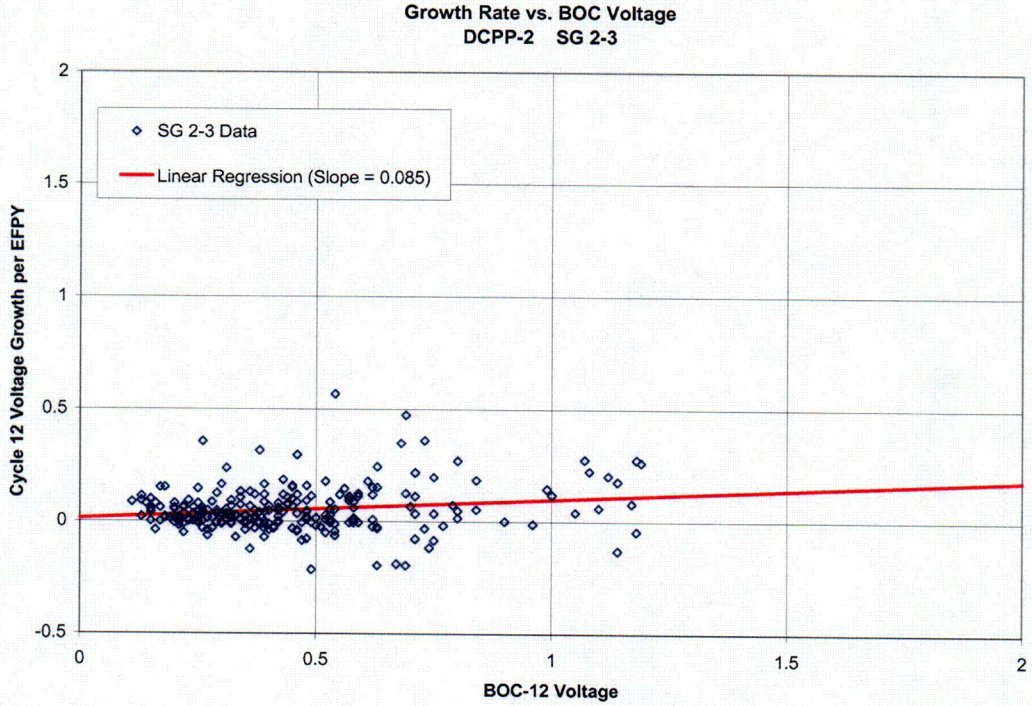
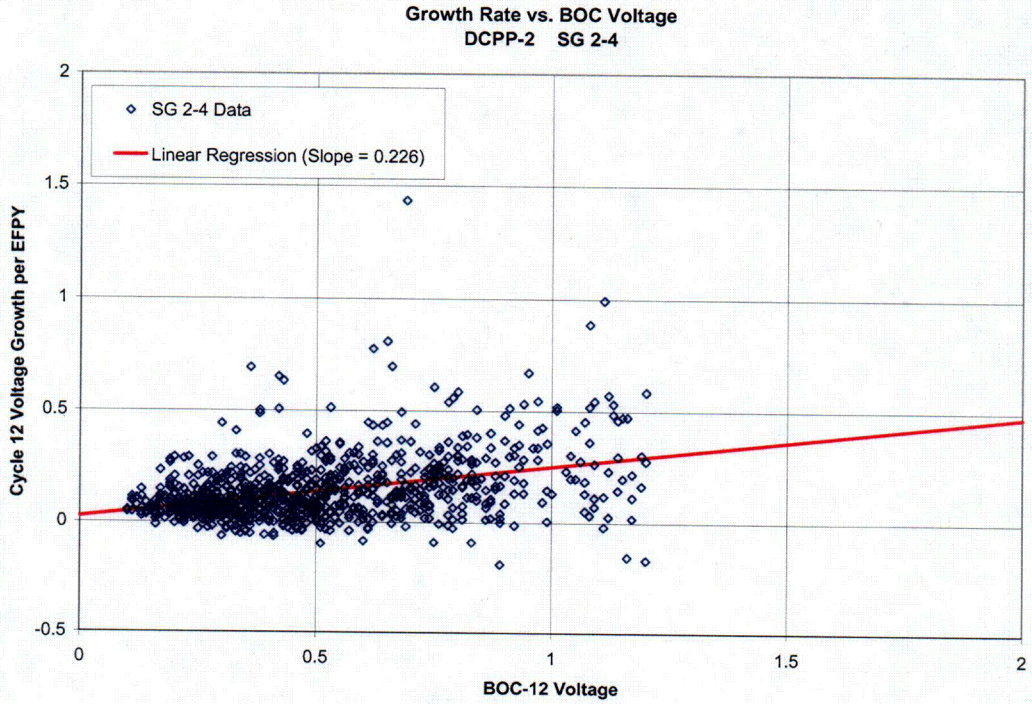


Figure 3-17: SG 2-4 Cycle 12 Growth vs. BOC Voltage



C10

Figure 3-18: Cycle 12 Growth vs. BOC Voltage for All Steam Generators

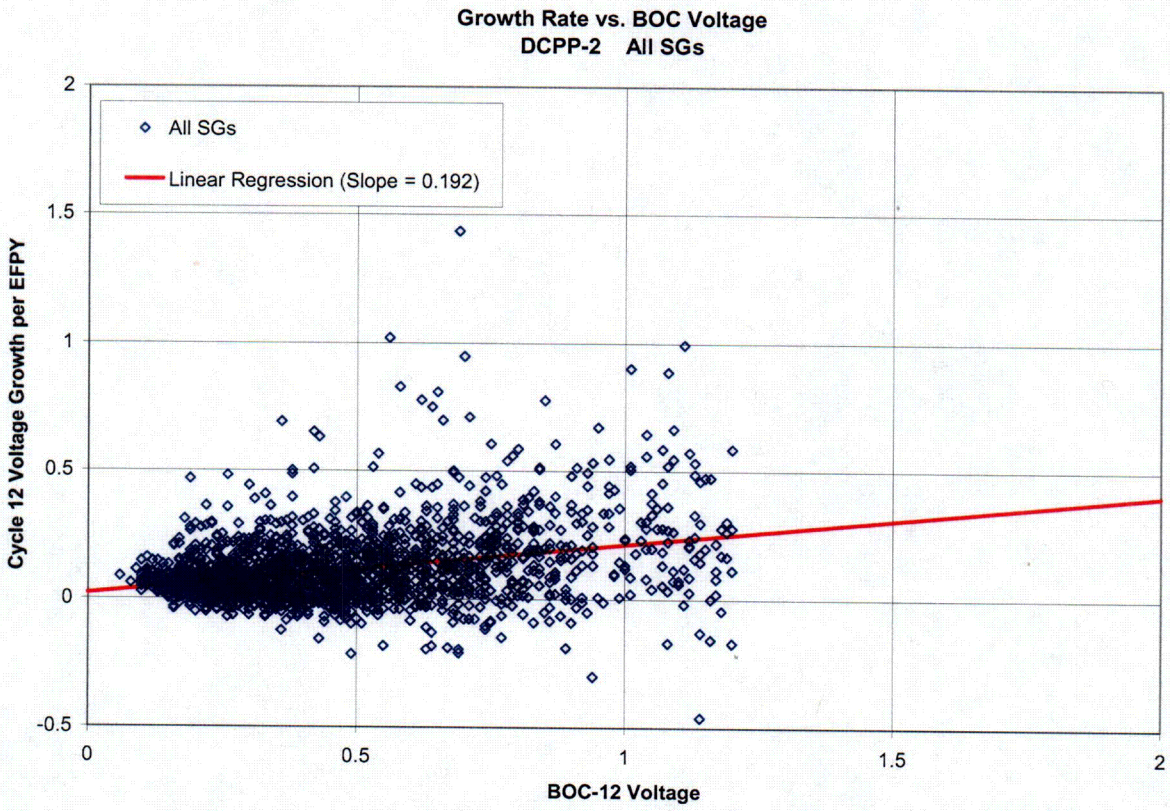


Figure 3-19: Cycle 11 vs. Cycle 12 Growth Comparison for SG 2-1

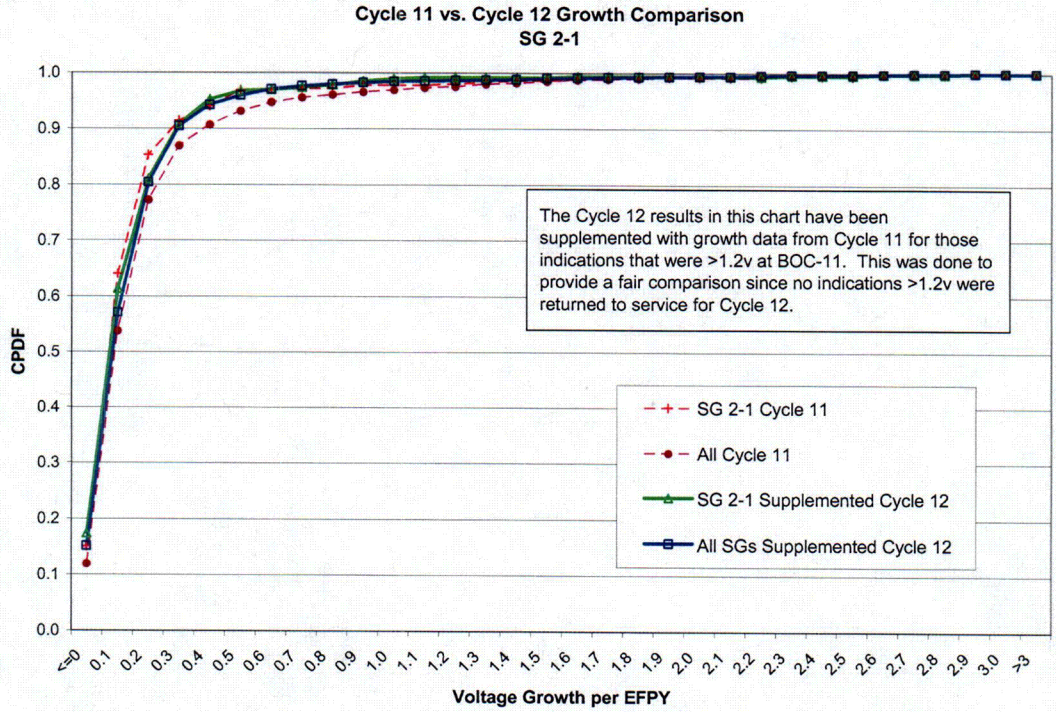
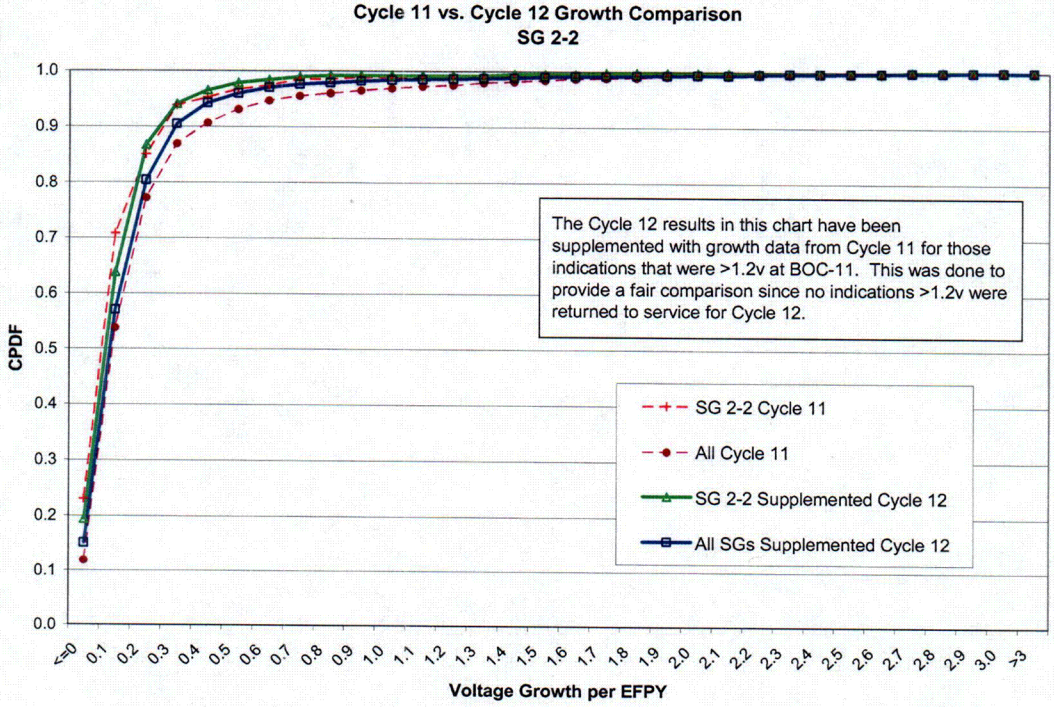


Figure 3-20: Cycle 11 vs. Cycle 12 Growth Comparison for SG 2-2



C12

Figure 3-21: Cycle 11 vs. Cycle 12 Growth Comparison for SG 2-3

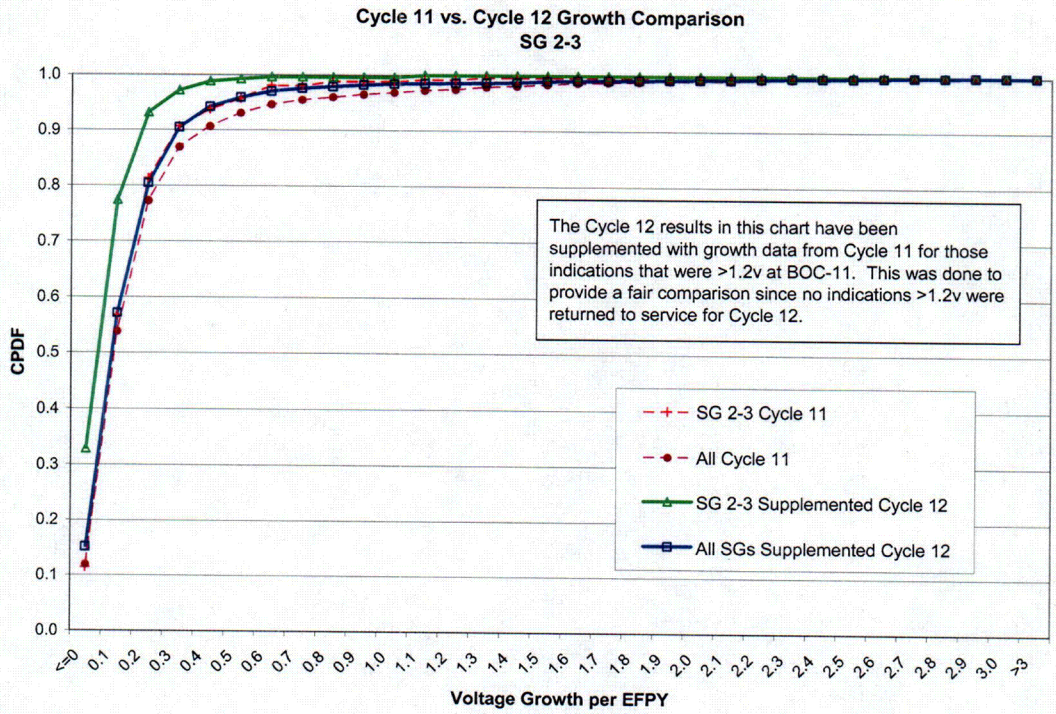


Figure 3-22: Cycle 11 vs. Cycle 12 Growth Comparison for SG 2-4

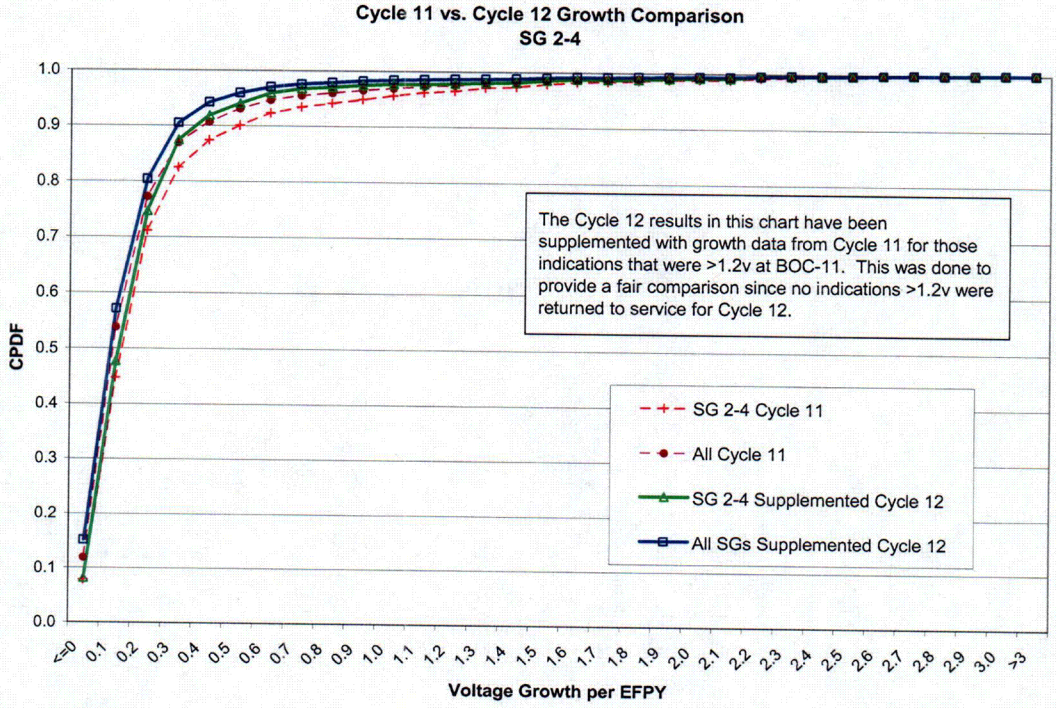


Figure 3-23: SG 2-1 Supplemented Cycle 12 VDG Breakpoint Analysis Results

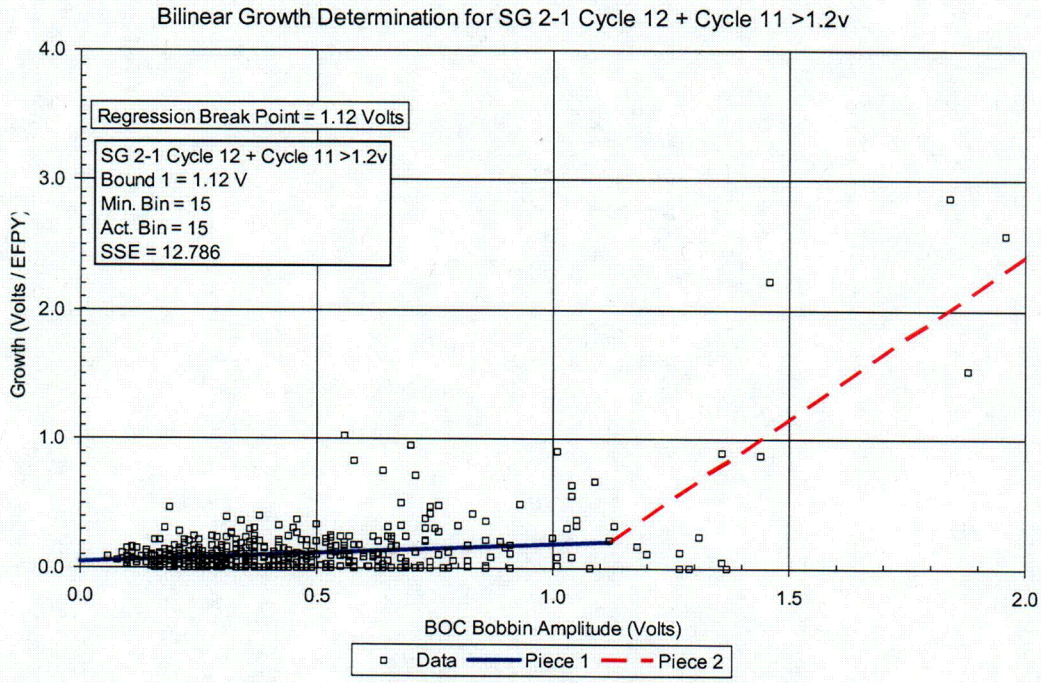
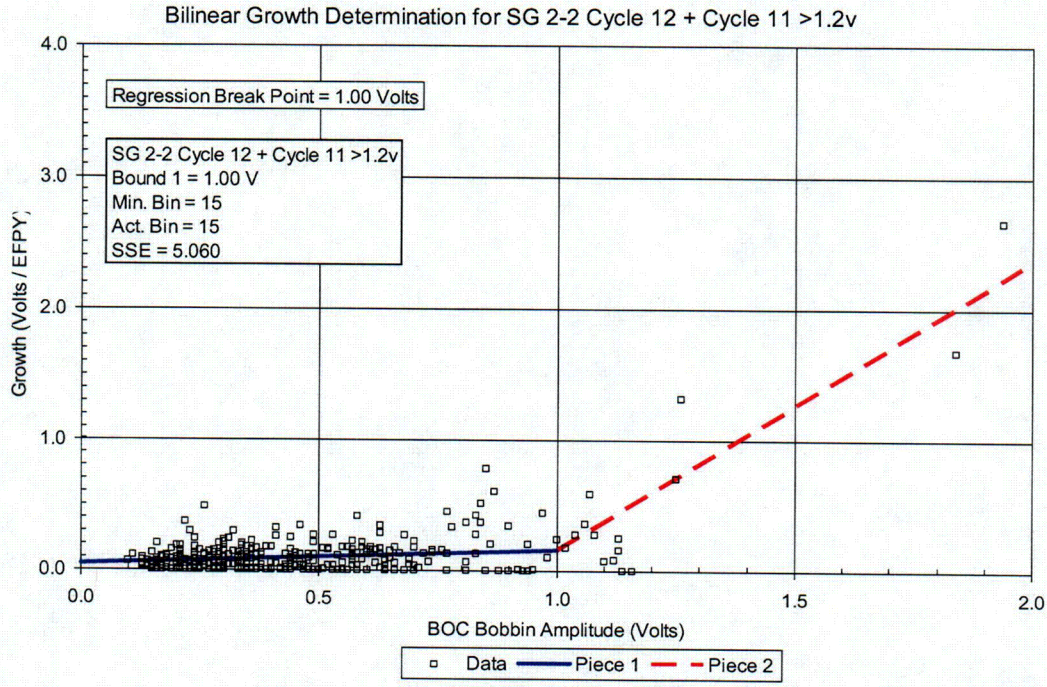


Figure 3-24: SG 2-2 Supplemented Cycle 12 VDG Breakpoint Analysis Results



C14

Figure 3-25: SG 2-3 Supplemented Cycle 12 VDG Breakpoint Analysis Results

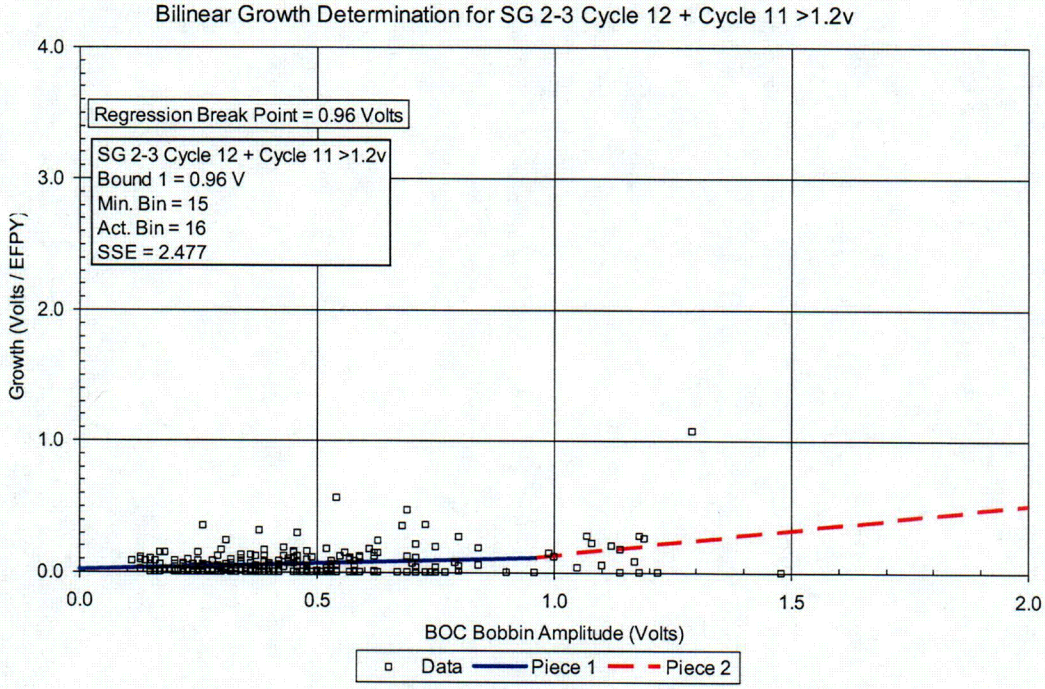
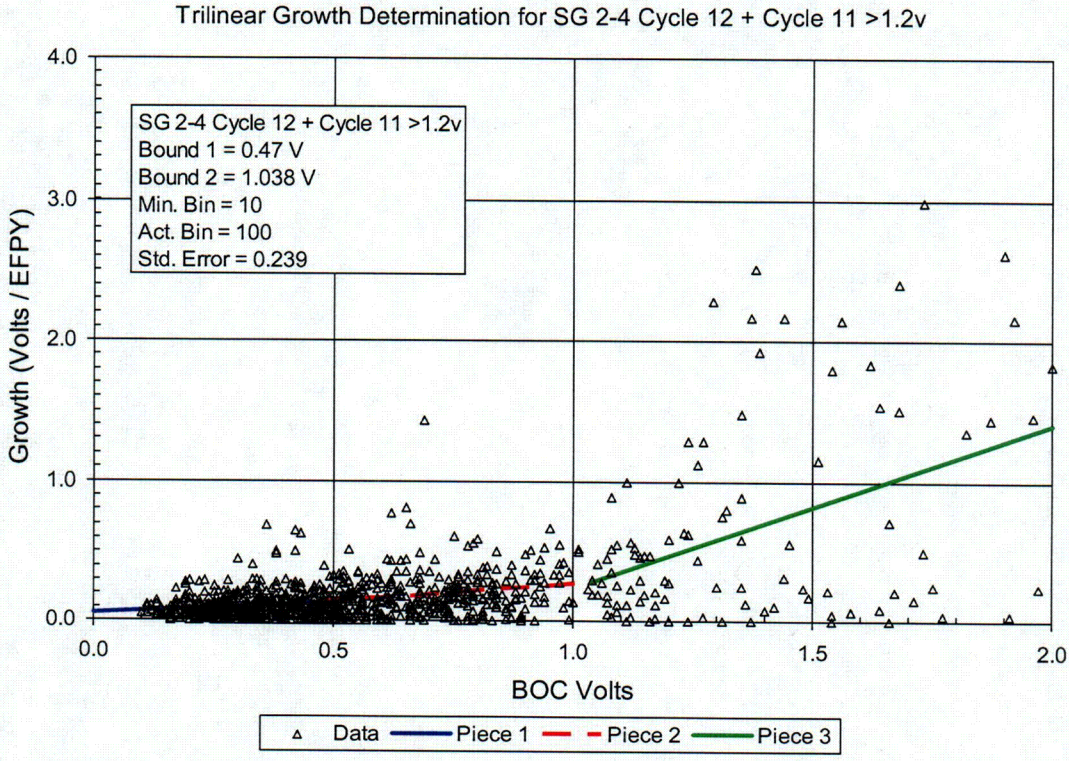


Figure 3-26: SG 2-4 Supplemented Cycle 12 VDG Breakpoint Analysis Results



C15

Figure 3-27: Composite Supplemented Cycle 12 VDG Breakpoint Analysis Results

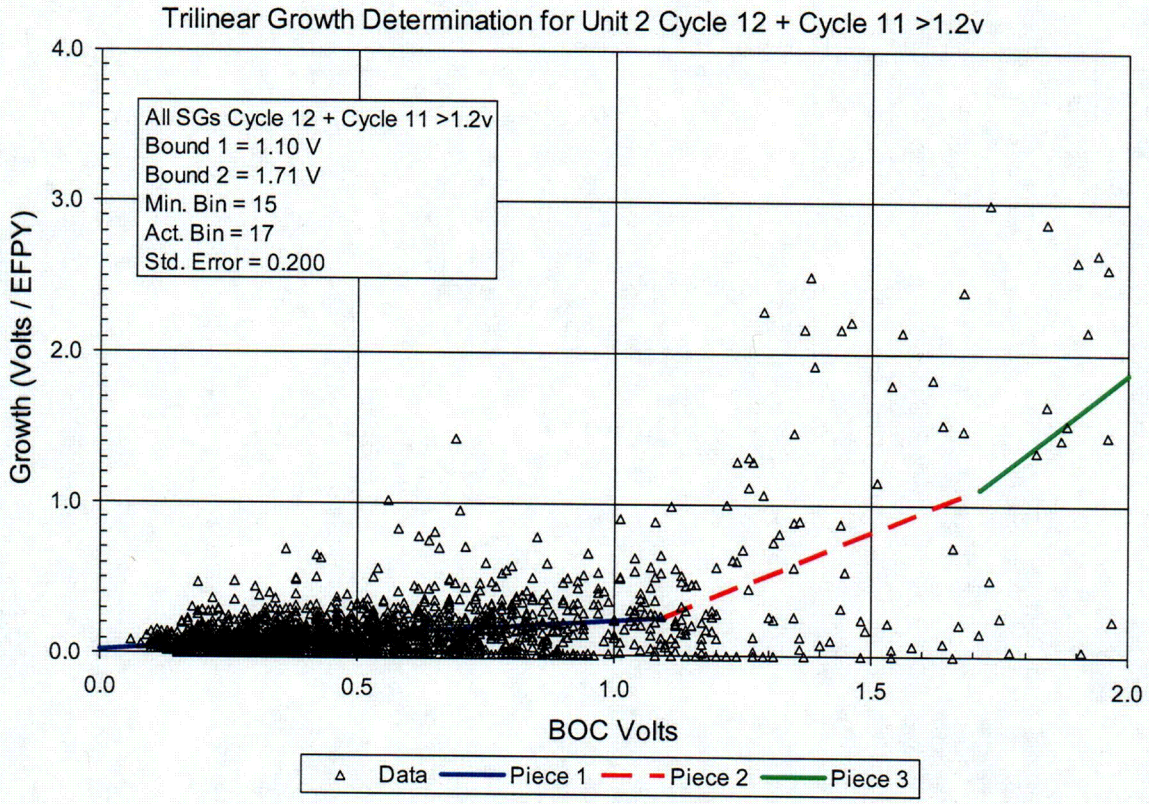


Figure 3-28: SG 2-1 Cycle 11 VDG Breakpoint Analysis Results

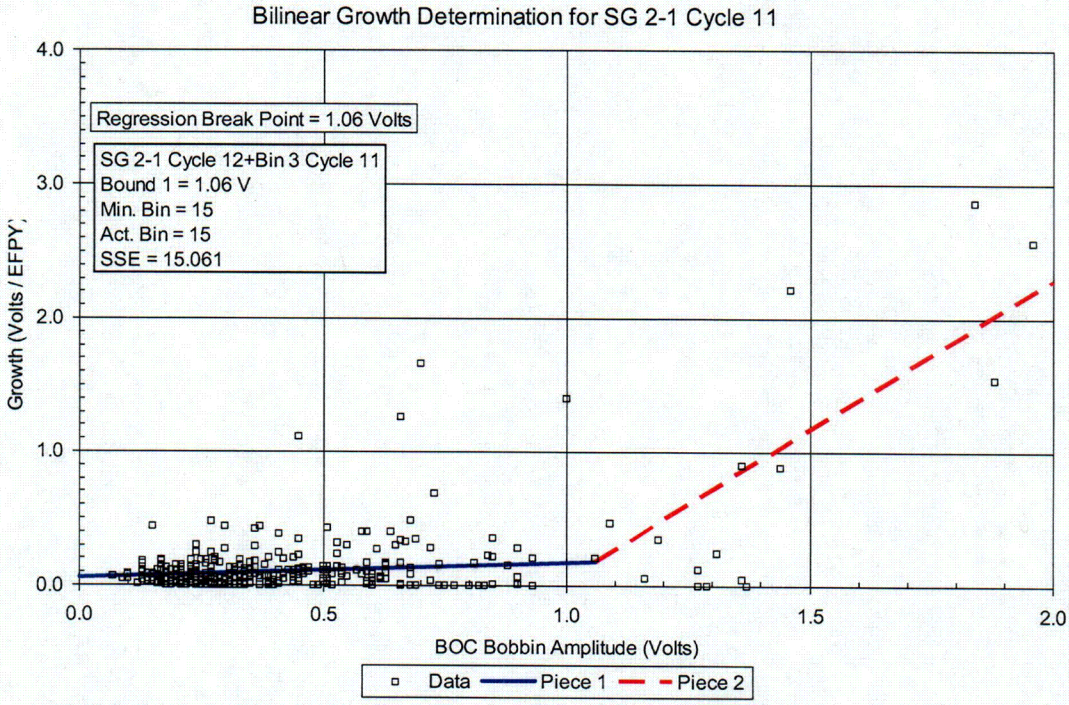
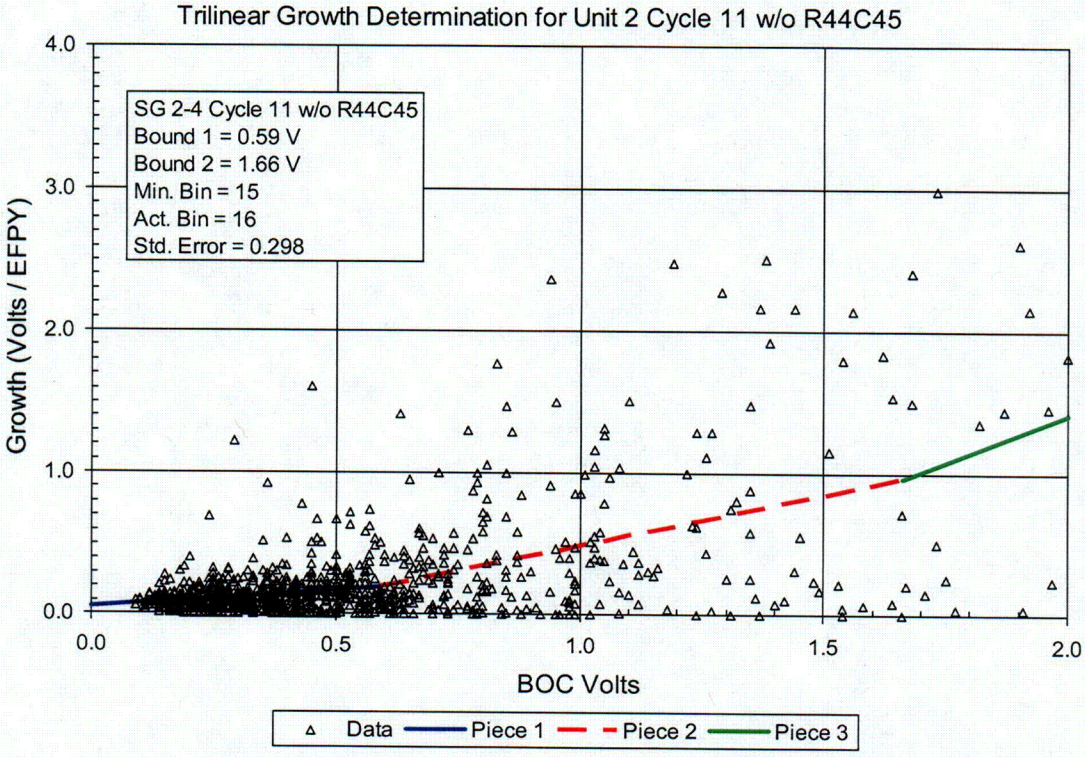
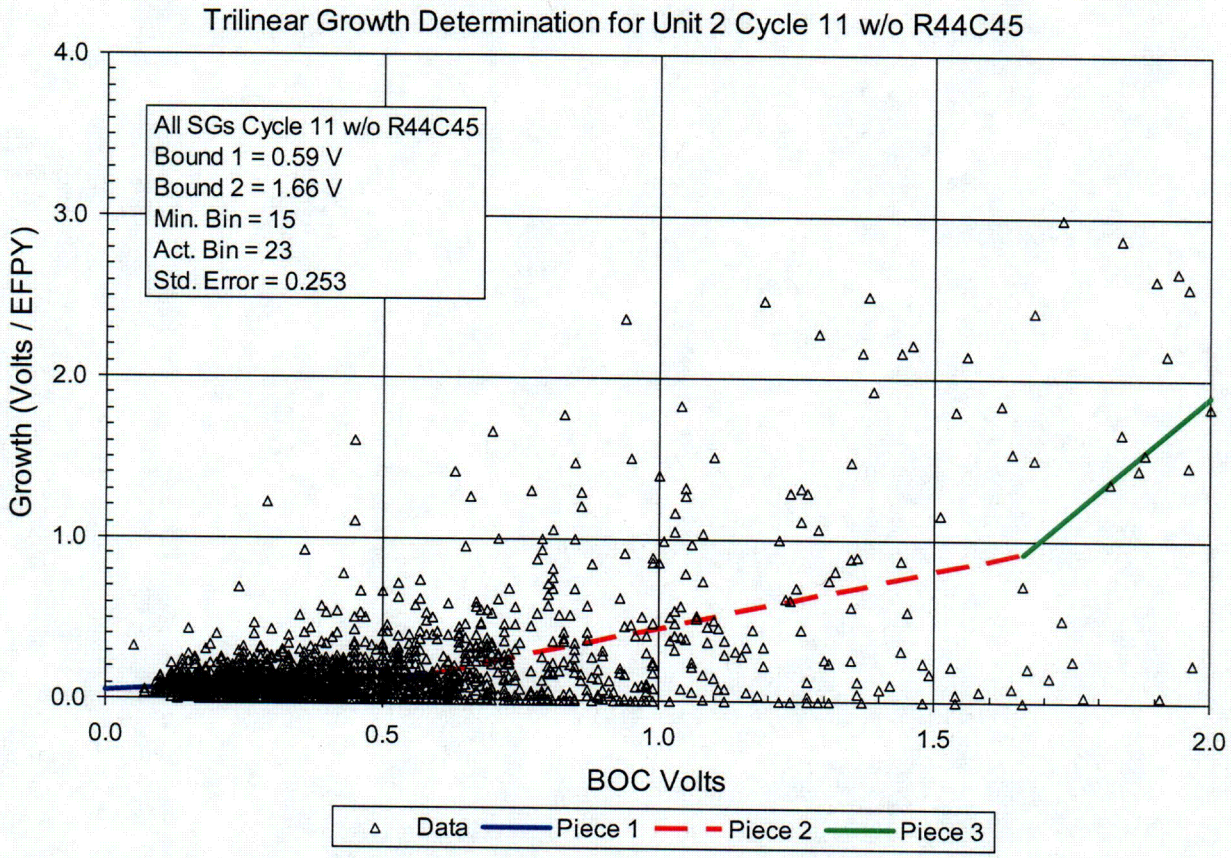


Figure 3-29: SG 2-4 Cycle 11 VDG Breakpoint Analysis Results



C17

Figure 3-30: Composite Cycle 11 VDG Breakpoint Analysis Results



C18

Figure 3-31: Supplemented Cycle 12 VDG for SG 2-1

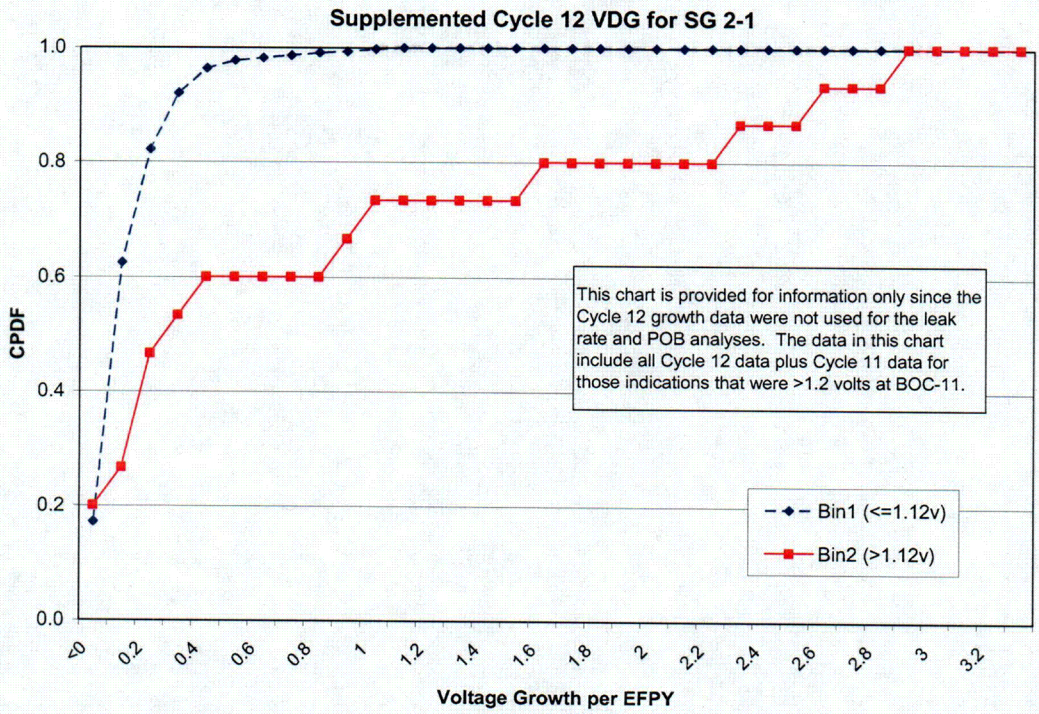


Figure 3-32: Supplemented Cycle 12 VDG for SG 2-2

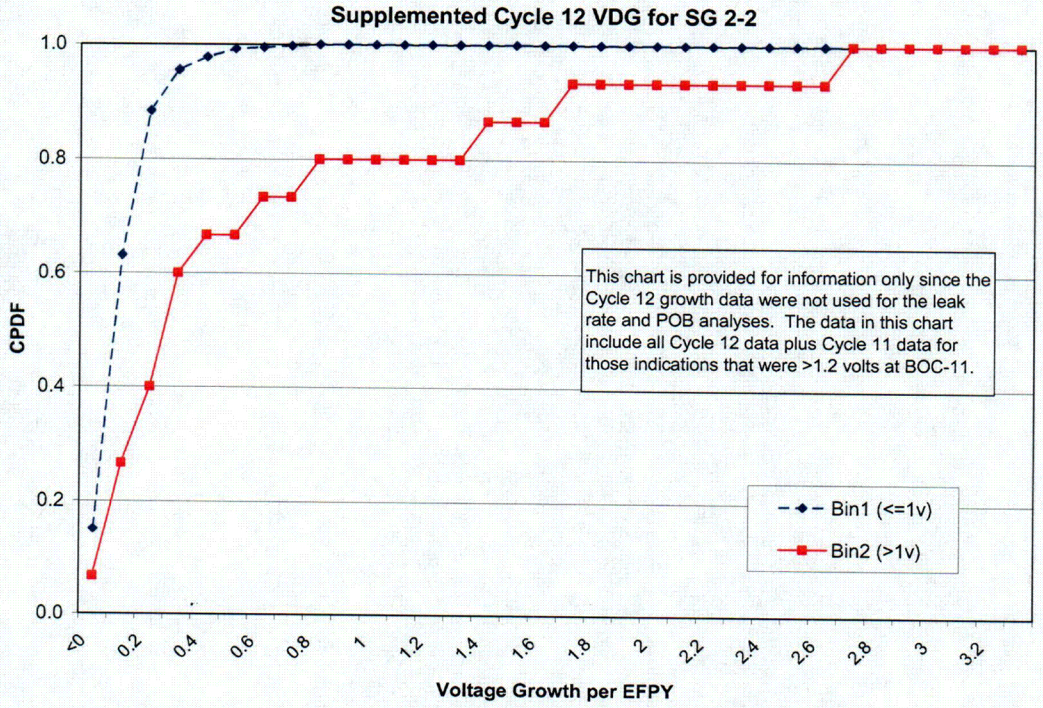


Figure 3-33: Supplemented Cycle 12 VDG for SG 2-3

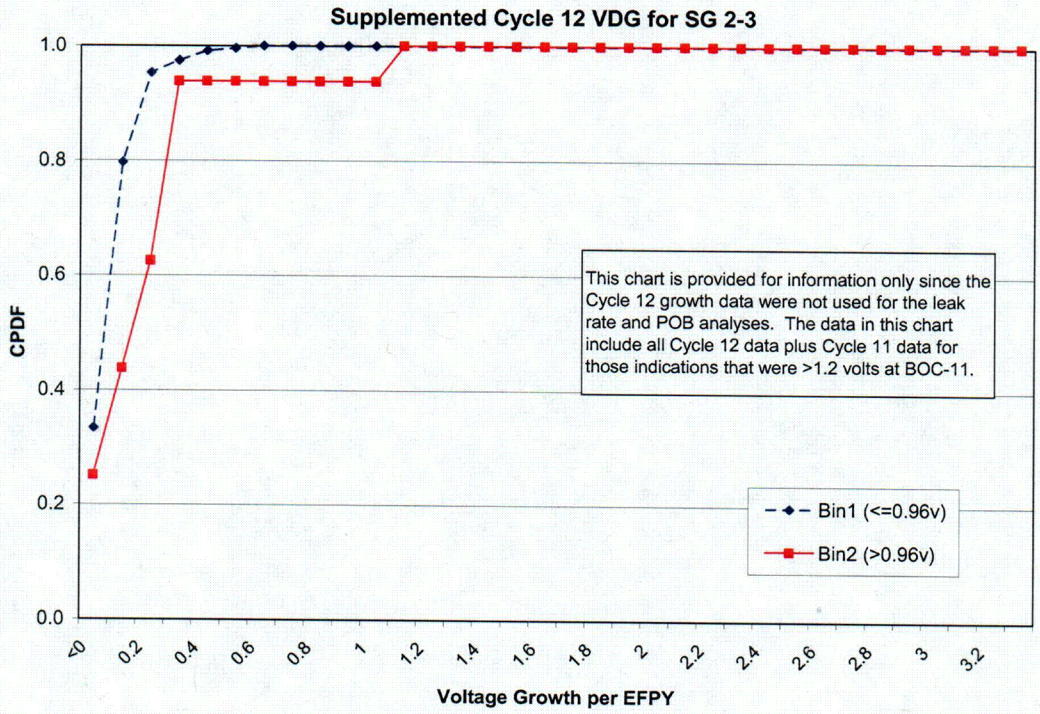
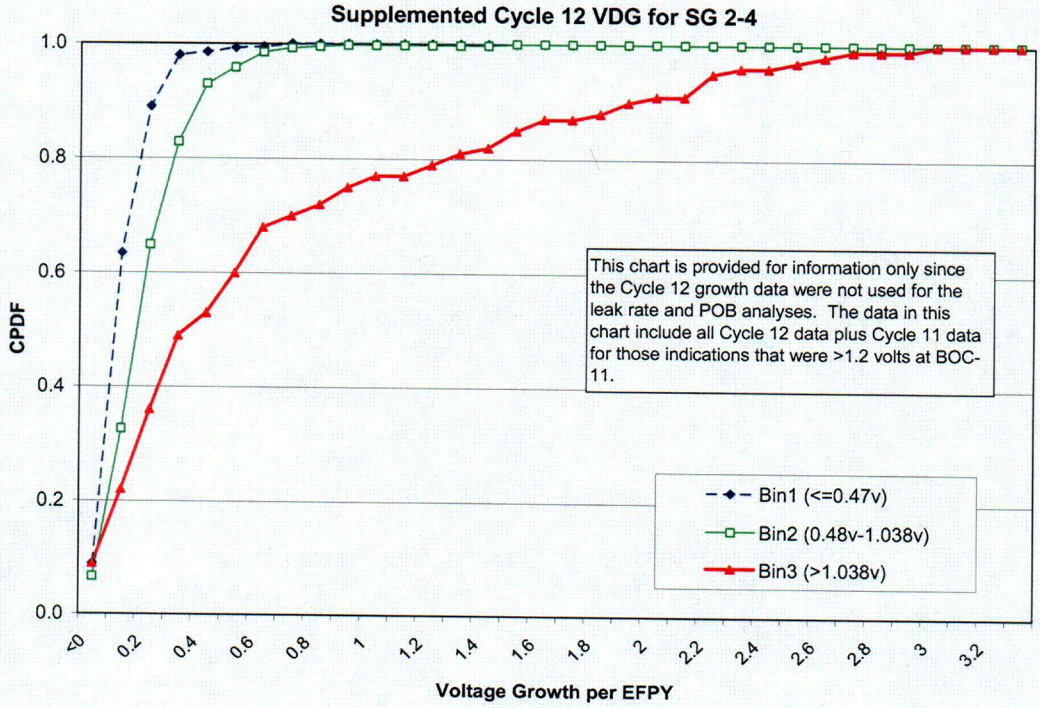
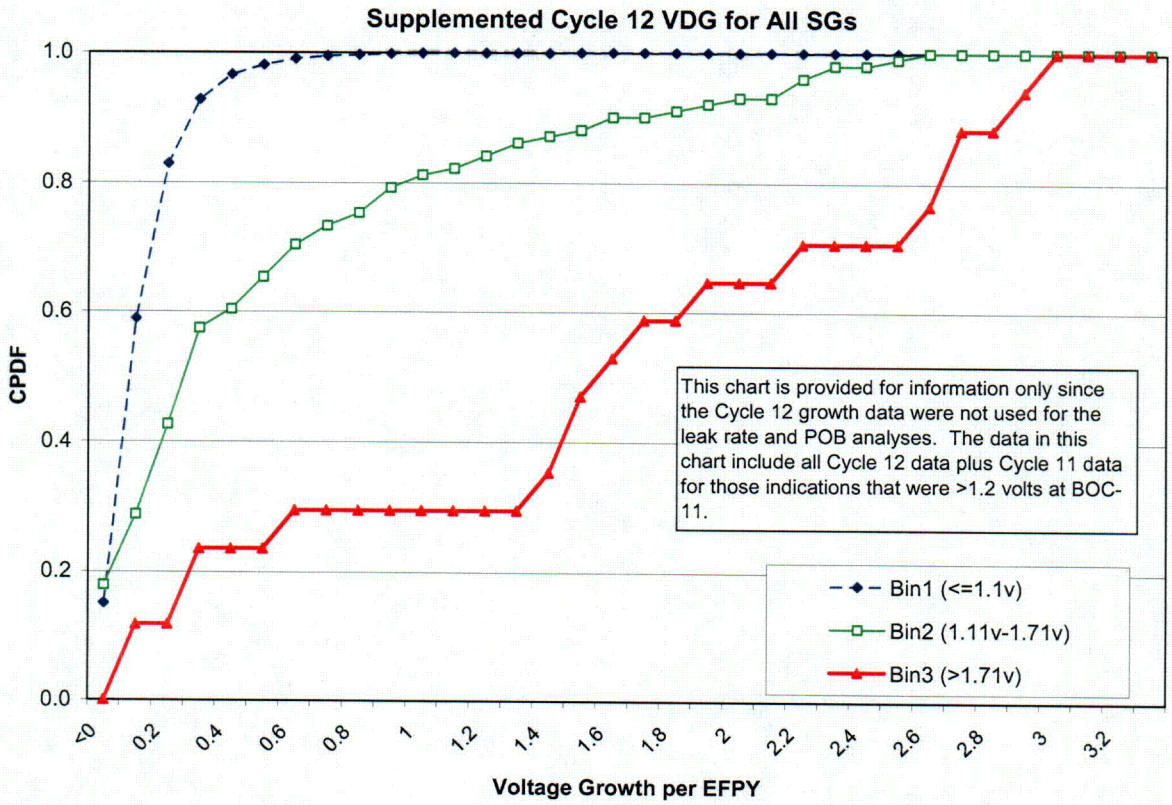


Figure 3-34: Supplemented Cycle 12 VDG for SG 2-4



C20

Figure 3-35: Supplemented Cycle 12 VDG for All SGs



C21

Figure 3-36: Cycle 11 VDG for SG 2-1

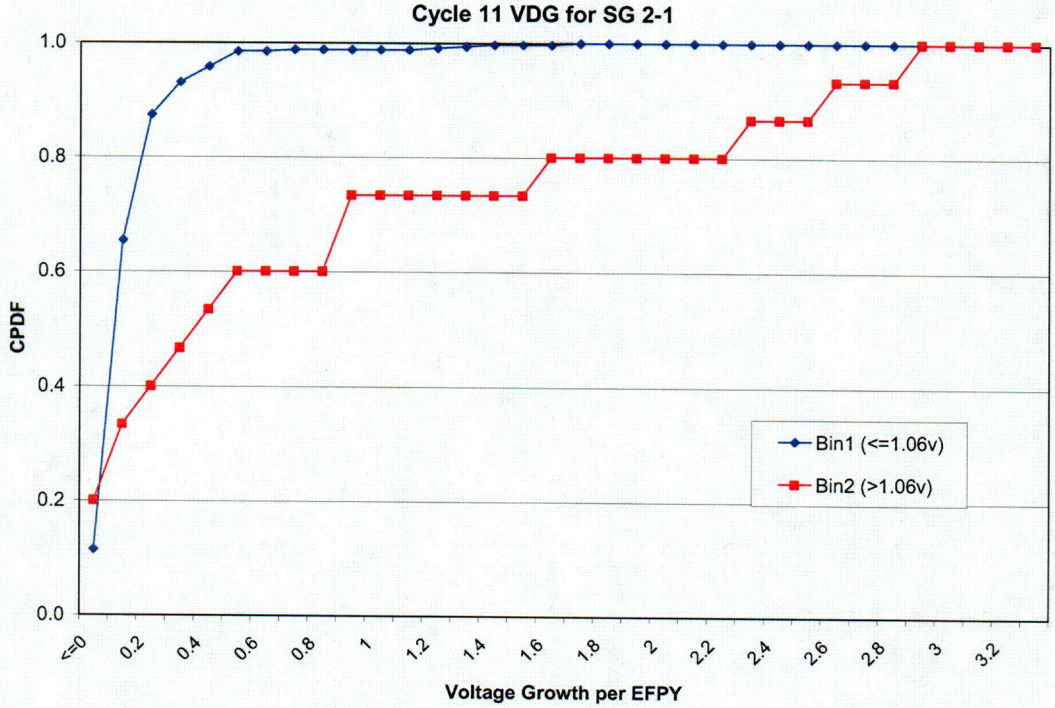
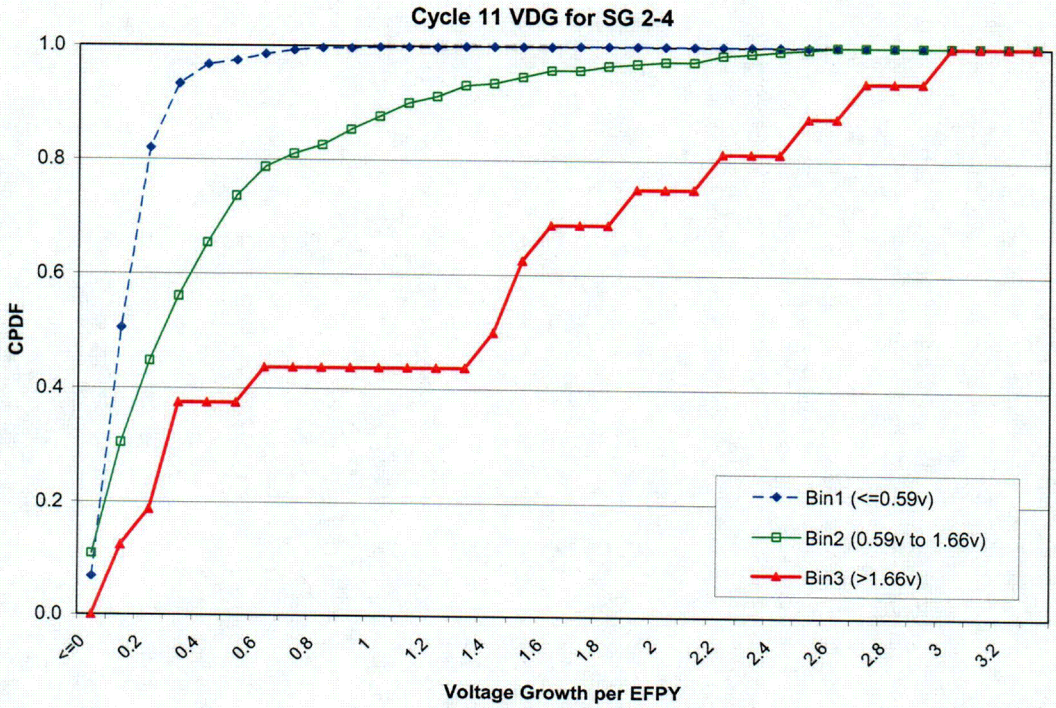
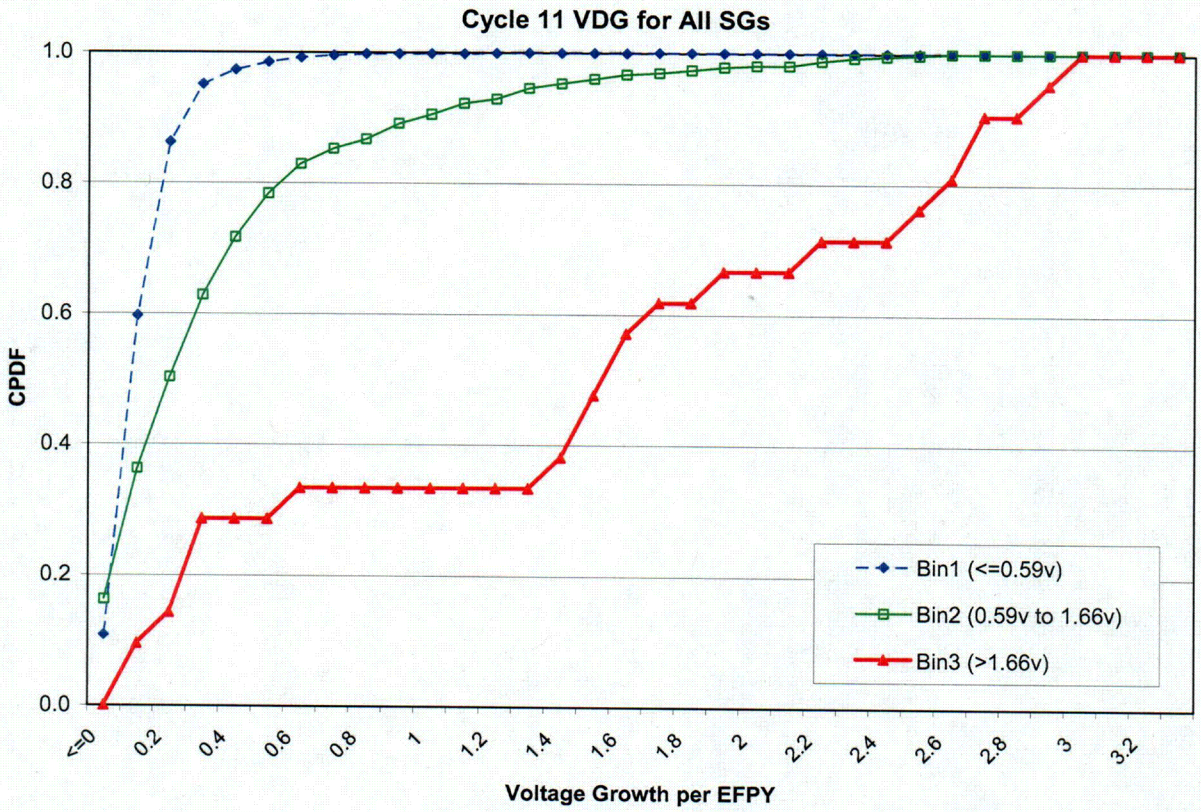


Figure 3-37: Cycle 11 VDG for SG 2-4



C22

Figure 3-38: Cycle 11 VDG for All SGs



C23

Figure 3-39: 2R12 Probe Wear Voltage Comparison

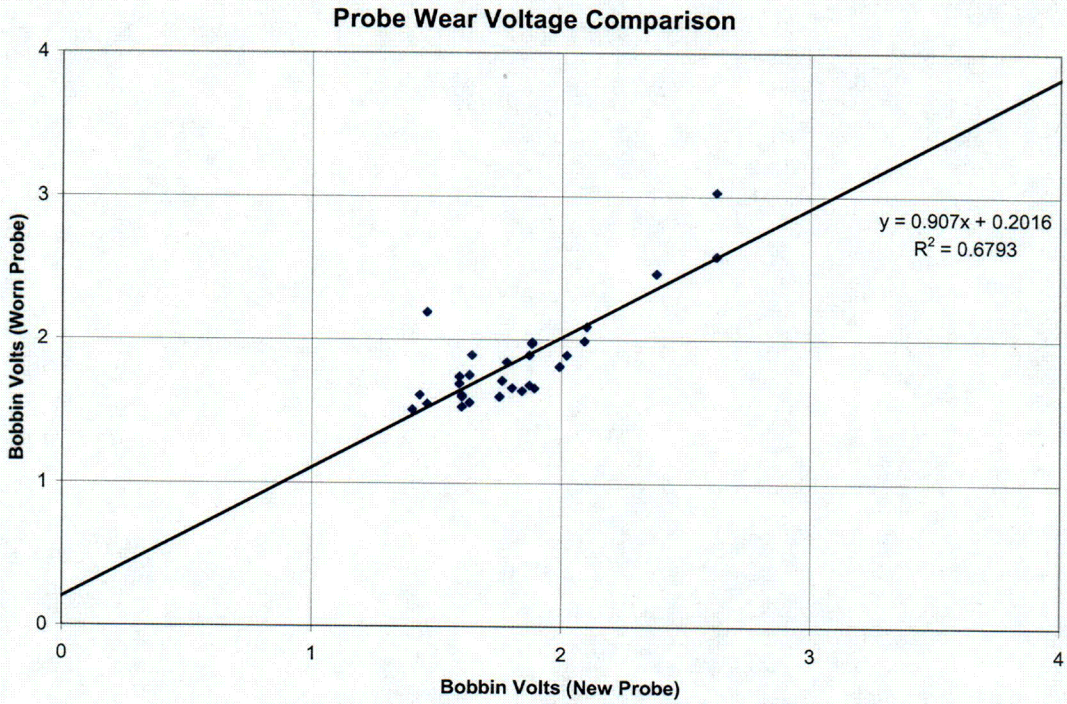
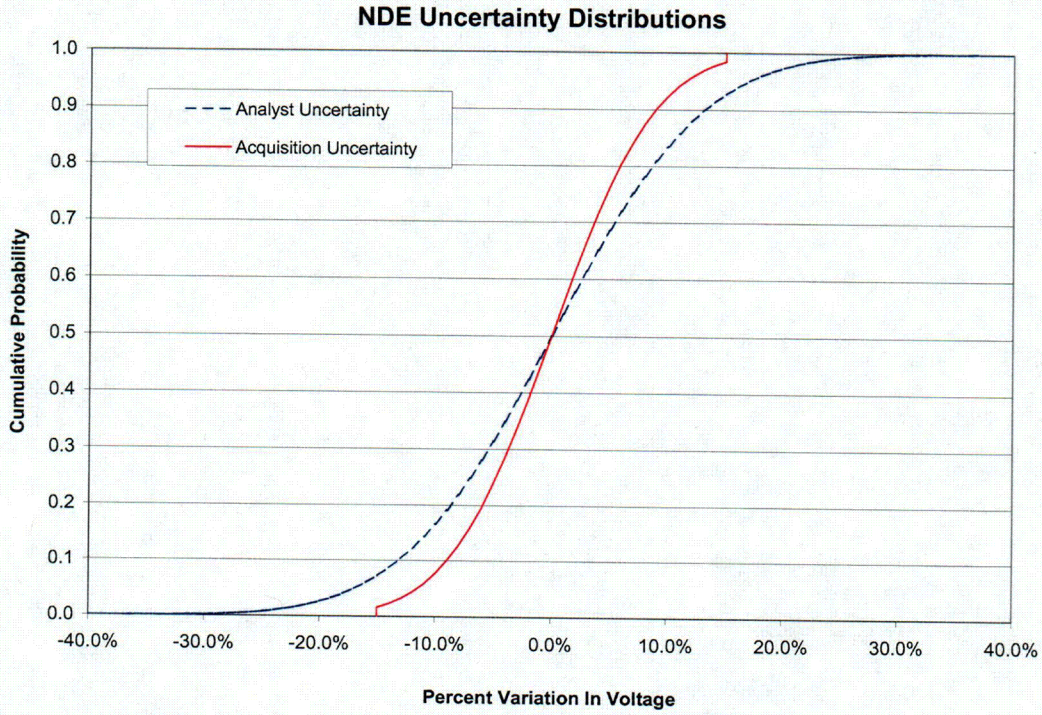
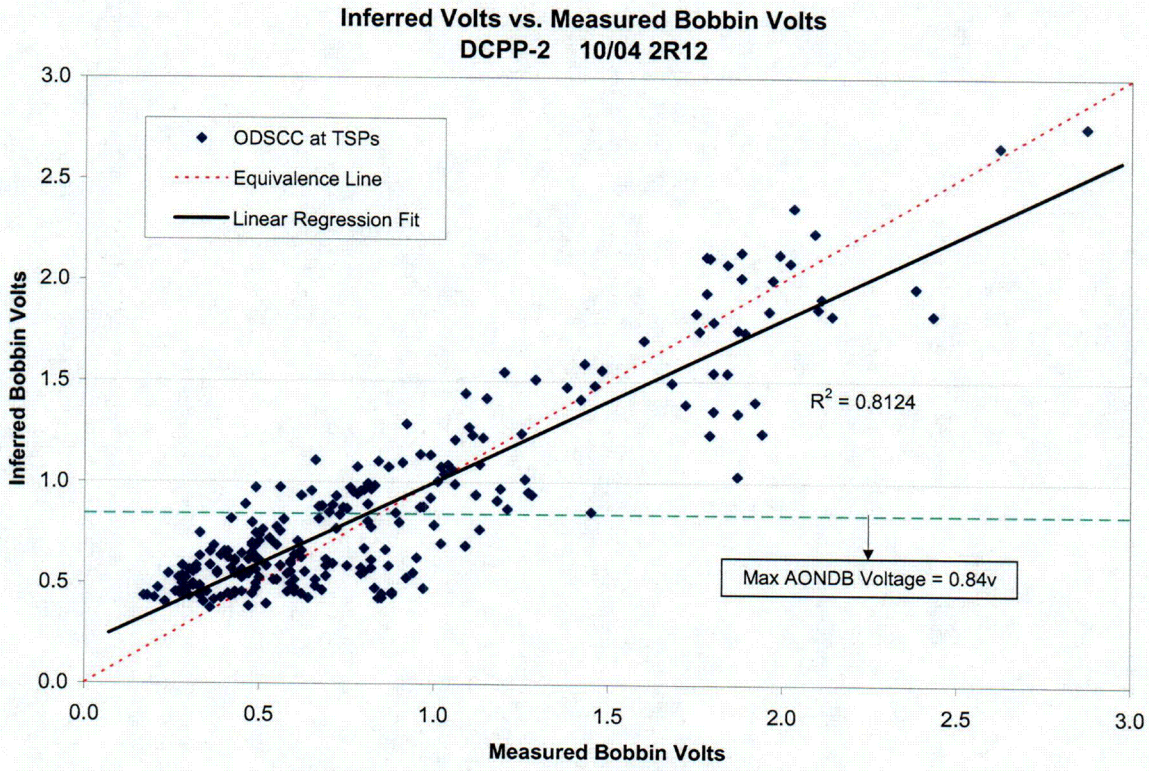


Figure 3-40: Bobbin Voltage Uncertainty Distributions



C24

Figure 3-41: Inferred Voltage / Measured Voltage Comparison



C25

Figure 3-42: Plus Point to Bobbin Voltage Comparison for SG 2-1

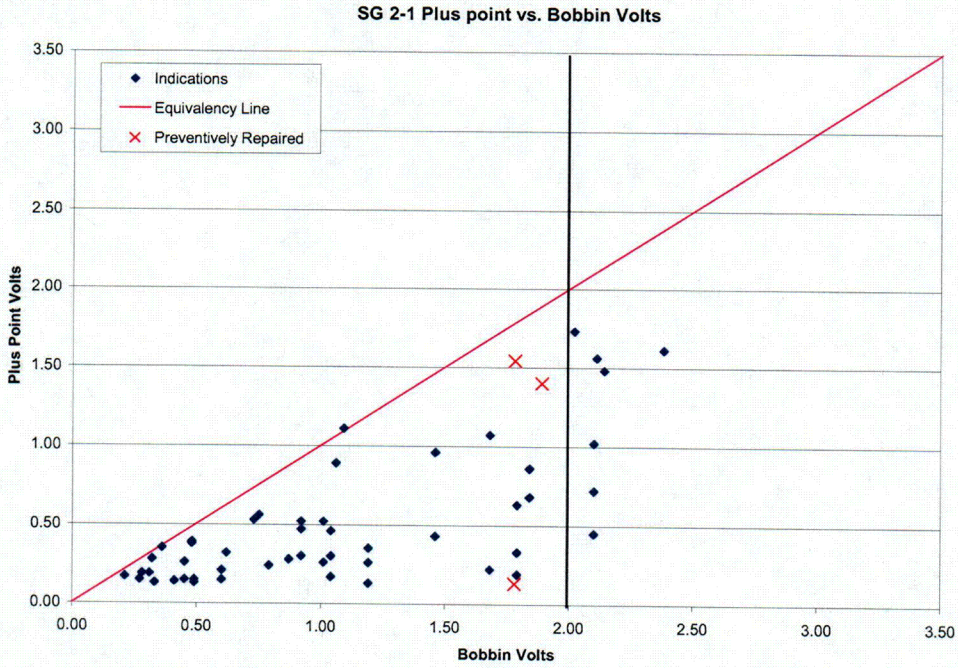


Figure 3-43: Plus Point to Bobbin Voltage Comparison for SG 2-2

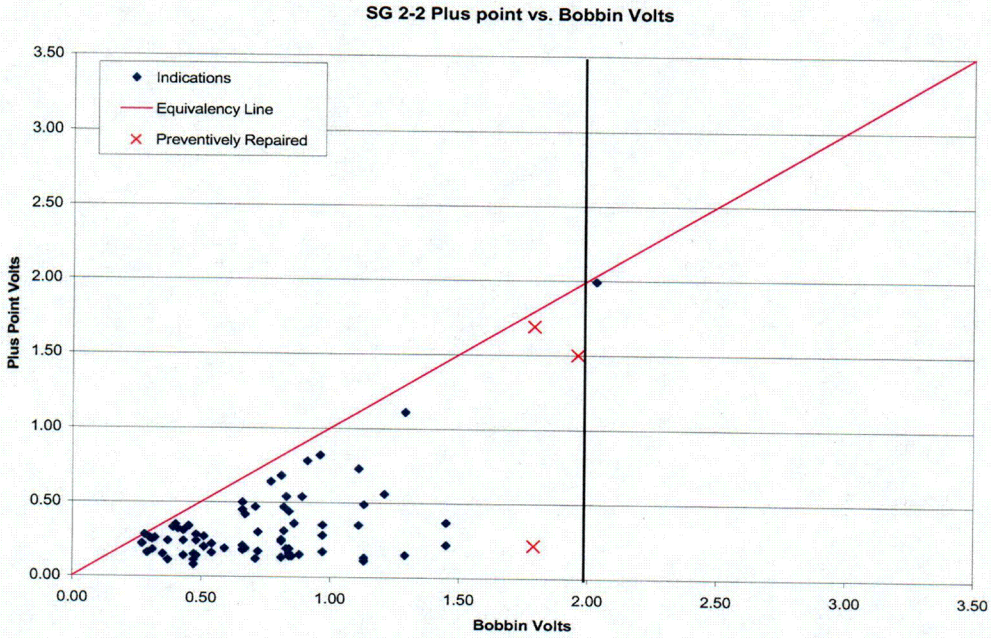


Figure 3-44: Plus Point to Bobbin Voltage Comparison for SG 2-3

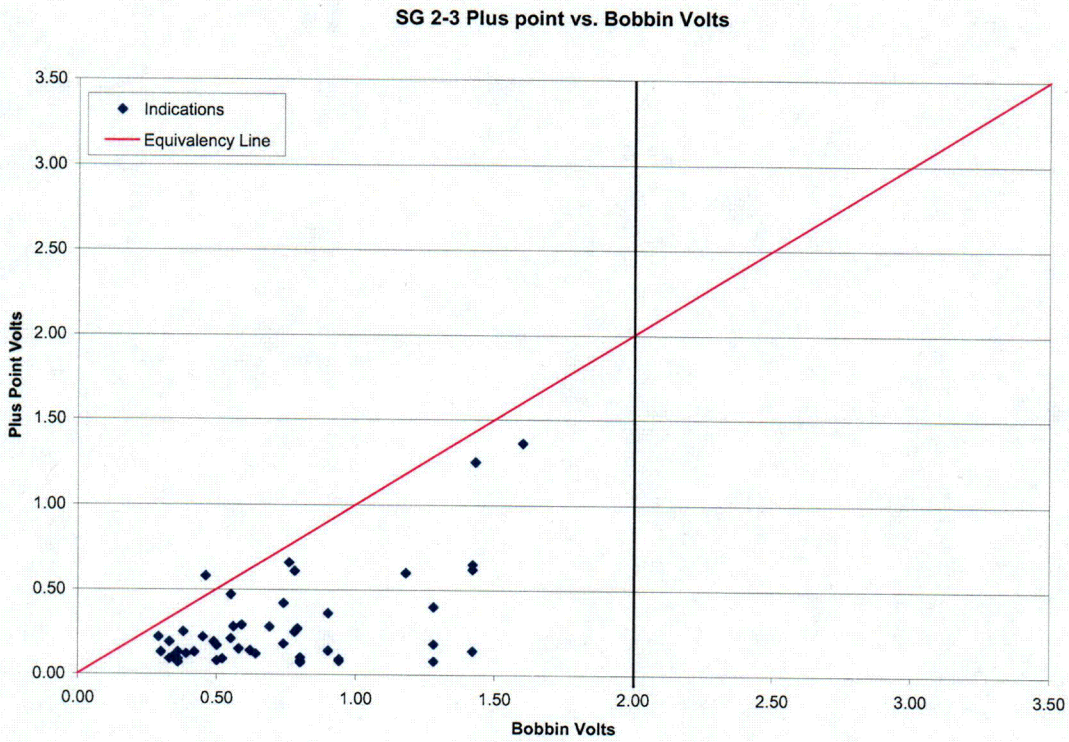
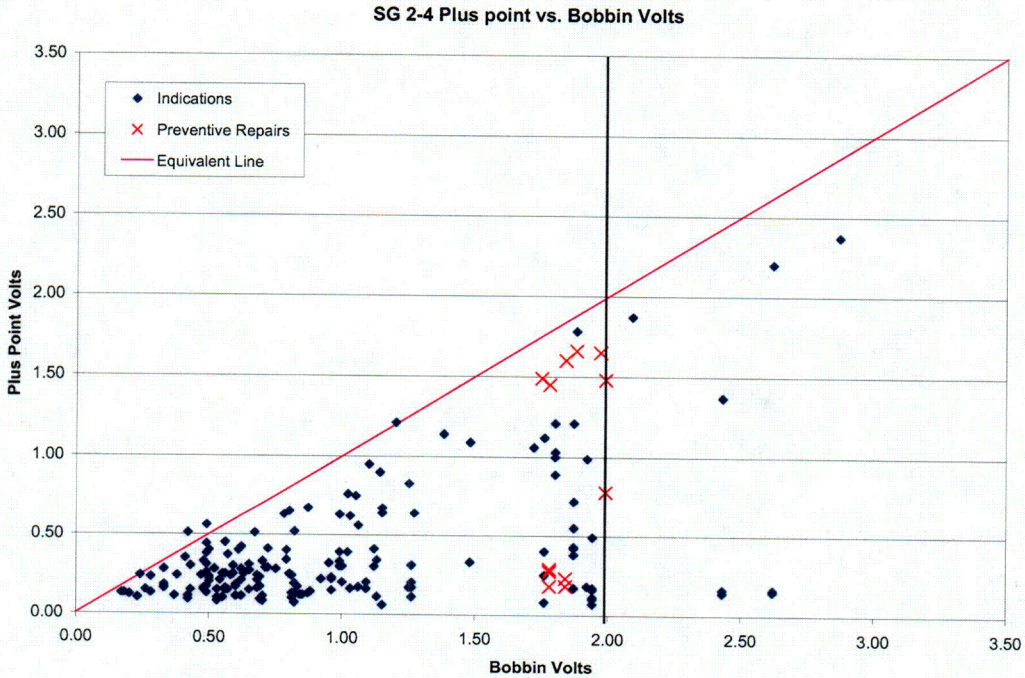


Figure 3-45: Plus Point to Bobbin Voltage Comparison for SG 2-4



4.0 Chemical Cleaning

During 2R12, chemical cleaning was performed on all four steam generators. GL 95-05 requires that, if the SGs are chemically cleaned, the impact of chemical cleaning on the BOC voltage distribution and on voltage growth rates shall be evaluated. The TSP crevice cleaning step was not performed in 2R12, which was the same practice in 1R12, so PG&E's judgment was that the TSP ODSCC signals would not be affected by chemical cleaning. This judgment was determined to be correct based on the assessment performed during the 1R12 chemical cleaning. Since the evaluation performed for the 1R12 chemical cleaning showed no significant changes in the bobbin voltages, this study was not repeated for the 2R12 chemical cleaning. The 1R12 assessment is documented in Reference 27.

5.0 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 databases used for the evaluations in this report use the data from Reference 8 plus the results from the tubes pulled during the 2R11 outage at Diablo Canyon. During 2R11, a 21.5 volt indication was detected at a 2H intersection in SG 2-4. Due to the potential impact of this large indication on the databases, new correlation parameters were calculated in 2003 using the latest EPRI database plus the 2R11 pulled tube results. The 2R11 pulled tube results plus the updated ARC correlation parameters were included in the 2R11 90-Day Report (Ref. 7). Since the updated correlation parameters have already been provided to the NRC, these parameters were used again for the tube integrity evaluations provided in this report.

The correlation parameters presented in this section do not include the results from the tube that was removed during the 1R12 outage. A summary of the results from the 1R12 pulled tube are presented in Reference 27. Updated leak and burst correlations for the ODSCC database including the 2R11 and 1R12 tube pull results are provided in Addendum 6 of the ODSCC Database Report, EPRI Report NP-7480-L Update 2004, issued January 2005. The Addendum 6 leak and burst correlations are very similar to the correlation used in this 2R12 90 day report (referred to as Addendum 5+ in Tables 5-1, 5-2, and 5-3) but were not available at the time of these calculations. In Tables 5-1, 5-2, and 5-3, the Addendum 6 values are listed next to the Addendum 5+ values to show that they are very similar. Therefore, the affect of not using the Addendum 6 values has no impact on the results for EOC-13.

5.1 Conditional Probability of Burst

For the case of the burst pressure versus voltage correlation, the Addendum 5 database contained in Reference 8, as modified by the addition of the DCPP 2R11 pulled tubes meets all GL 95-05 requirements and was used in both the as-found calculations and the EOC-13 projections. The correlation parameters were taken from Reference 20 and are shown in Table 5-1.

Table 5-1: Burst Pressure vs. Bobbin Amplitude Correlation

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

Parameter	Addendum 5 + DCPP 2R11 Database	Addendum 6
Intercept, a_0	7.48475	7.4801
Slope, a_1	-2.39502	-2.4002
r^2	79.6 %	79.67%
Std. Dev., σ_{Error}	0.88248	0.8802
Mean Log(V)	0.306657	0.3111
SS of Log(V)	51.4665	51.6595
N (data pairs)	99	100
Structural Limit (2560 psi) (1)	7.54 V	7.51V
Structural Limit (2405 psi) (1)	9.45 V	9.40V
p Value for a_1 (2)	$1.4 \cdot 10^{-35}$	$5.60 \cdot 10^{-36}$
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.

5.2 *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 5 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 Addendum 5 voltage dependent leak rate correlation is 2.3% which meets the 5% threshold for an acceptable correlation specified in Generic Letter 95-05. Additionally, when adding the DCPP 2R11 data to the database, the Addendum 5+ correlation is improved with the new p-value at 1.0%. FANP computer simulations included 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 20 and are shown in Tables 5-2 and 5-3.

Table 5-2: Probability of Leak Correlation

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

Parameter	Addendum 5 + DCPP 2R11 Database	Addendum 6
Intercept, b_1	-5.0503	-5.0407
Slope, b_2	7.4342	7.5434
V_{11} (1)	1.3299	1.3311
V_{12}	-1.7253	-1.7606
V_{22}	2.6861	2.7744
DoF (2)	115	118
Deviance	31.47	32.37
Pearson SD	0.594	0.611
MSE	0.274	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 5-3: Leak Rate vs. Bobbin Amplitude Correlation (2405 psi)

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

Parameter	Addendum 5 + DCPP 2R11 Database	Addendum 6
Intercept, b_3	-0.664317	-0.8039
Slope, b_4	1.106101	1.2077
Index of Deter., r^2	17.5%	20.0%
Std. Error	0.772757	0.7774
Mean of Log(Q)	0.55024	0.5090
Std. Dev. of Log(Q)	0.83625	22.6667
p Value for b_4	1.0%	0.5%
Data Pairs, *N*	31	32
Mean of Log(*V*)	1.09805	1.0871
SS of Log(*V*)	2.99300	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.

6.0 EOC 12 Condition Monitoring, Benchmarking of EOC-12 Conditions and Assessment of Potential Underpredictions

This section provides the EOC-12 condition monitoring, the results of a benchmarking study that compares the projected EOC-12 conditions to the as-found conditions, and an assessment of potential underpredictions as committed to the NRC.

6.1 EOC-12 Condition Monitoring Results

EOC-12 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: 27 failures were predicted in SG 2-1, 14 in 2-2, 5 in 2-3, and 57 in 2-4. The resulting burst probabilities are shown at the bottom of Table 6-7. In the same manner, the leak rate was also calculated for each SG at EOC-12 and is also in Table 6-7. 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.

6.2 EOC-12 Benchmark Calculations

EOC-12 projections have been previously provided to the NRC in Table 5 of Reference 25. The projections provided in Reference 25 used an estimated Cycle 12 operating interval of 1.54 EFPY and also used the Extreme Growth methodology as described in Reference 22. Since the NRC has not approved the Extreme Growth methodology and the actual Cycle 12 operating interval was 1.52 EFPY, the EOC-12 projections have been recalculated without the Extreme Growth methodology and with a cycle length of 1.52 EFPY.

The determination of the growth distributions to use in these benchmark calculations followed the guidelines provided in References 25 and 28, with special considerations for the application of the large (11.89 v/EFPY) growth from Unit 2 Cycle 11. One set of leak rate and POB calculations were performed for SG 2-4 (limiting) which included this large growth point in the upper growth bin. The results from these calculations over predicted the as-found EOC-12 results by a wide margin, as expected (projected POB and leak rate of 6.36E-03 and 3.10 gpm versus as-found values of 1.42E-04 and 0.47 gpm). The other steam generators would be expected to be over-predicted by a wide margin as well if the large Cycle 11 growth point were used in the composite growth distribution. Therefore, in order to obtain a more realistic benchmark comparison, calculations for all four steam generators were done without the large Cycle 11 growth value.

Table 6-1 provides a summary of the inputs required and the corresponding section(s) or table(s) that provide these data.

Table 6-1: Inputs for EOC-12 Benchmark Projections

Input Description	Section or Table Reference	Comments
BOC Voltage Distribution	Tables 6-2 and 6-3	Same as Reference 25
Repaired Voltage Distribution	Tables 6-2 and 6-3	Same as Reference 25
NDE Uncertainties	Section 3.6; Table 3-24	
POD	Table 7-7	Composite POPCD through 2R11 (5 inspections)
Growth	Tables 6-4 through 6-6	Same as Reference 25
Cycle Length	Section 6.0	1.52 EFPY (actual Cycle 12 operating interval)
Tube Integrity Correlations	Tables 5-1 through 5-3	Addendum 5 plus 2R11 tube pull
Material Properties	Section 8.1	

Per Reference 25, the growth analyses for these projections showed that Cycle 11 SG-specific growth should be used for SGs 2-1 and 2-4. SGs 2-2 and 2-3 should use the composite Cycle 11 growth data. For SG 2-1, the VDG breakpoint analysis for the Cycle 11 growth data revealed a single breakpoint at 1.06v. The composite Cycle 11 revealed two breakpoints at 0.59v and 1.66v. Tables 6-4 through 6-6 provide the growth distributions used for the EOC-12 projections.

Tables 6-2 and 6-3 provide the BOC-12 voltage distributions that were used for these analyses.

Table 6-7 provides a comparison of the projected EOC-12 conditions to the as-found EOC-12 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. Since these calculations didn't include the large Cycle 11 growth value, the projections would be even more conservative if the large growth value had been included. In conclusion, the EOC-12 projections using DCPP POPCD correlation and the new growth guidelines provided conservative results relative to the as-found conditions. Therefore, no adjustments to either of the methodologies are warranted at this time.

6.3 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-12 projections using the actual Cycle 12 operating interval were performed in order to benchmark the POPCD and growth methods. As shown in Table 6-1, the POBs, leak rates, and numbers of indications were overestimated in all cases for EOC-12. Therefore, there is no requirement to perform a method adjustment assessment.

Table 6-2: Voltage Distribution Used for EOC-12 Benchmark Projections for SG 2-1

Voltage Bin	SG 2-1	
	As-Found EOC-12	Repaired
0.1	0	0
0.2	21	0
0.3	66	3
0.4	59	2
0.5	51	1
0.6	36	1
0.7	34	0
0.8	21	0
0.9	11	0
1	5	0
1.06	9	0
1.1	2	0
1.2	4	0
1.3	11	11
1.4	2	2
1.5	4	4
1.6	0	0
1.7	1	1
1.8	1	1
1.9	2	2
2	0	0
2.1	0	0
2.2	0	0
2.3	1	1
2.4	0	0
2.5	0	0
2.6	0	0
2.7	0	0
2.8	1	1
2.9	2	2
3	0	0
3.1	0	0
3.2	0	0
3.3	1	1
3.4	0	0
3.5	1	1
3.6	0	0
3.7	0	0
3.8	0	0
3.9	0	0
4	0	0

Table 6-2: Voltage Distribution Used for EOC-12 Benchmark Projections for SG 2-1

Voltage Bin	SG 2-1	
	As-Found EOC-12	Repaired
4.1	0	0
4.2	0	0
4.3	0	0
4.4	1	1
4.5	0	0
4.6	0	0
4.7	0	0
4.8	0	0
4.9	0	0
5	0	0
5.1	0	0
5.2	1	1
5.3	0	0
5.4	0	0
5.5	0	0
5.6	0	0
5.7	0	0
5.8	0	0
5.9	0	0
6	0	0
6.1	0	0
6.2	1	1
6.3	0	0
6.4	0	0
6.5	0	0
6.6	1	1
6.7	0	0
>6.7	0	0
Total	**350**	**38**

Table 6-3: Voltage Distributions Used for EOC-12 Benchmark Projections for SGs 2-2, 2-3, and 2-4

Voltage Bin	SG 2-2		SG 2-3		SG 2-4	
	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	13	0	17	0	14	1
0.3	50	1	42	3	91	8
0.4	45	3	58	3	135	13
0.5	47	3	39	0	139	15
0.59	29	1	28	1	100	11
0.6	2	0	0	0	6	0
0.7	27	2	19	1	94	13
0.8	11	0	19	1	81	6
0.9	18	1	3	0	60	7
1	7	0	4	0	33	5
1.1	7	0	4	0	22	2
1.2	5	0	7	0	26	3
1.3	5	5	6	6	20	20
1.4	1	1	1	1	18	18
1.5	1	1	3	3	12	12
1.6	0	0	3	3	16	16
1.66	0	0	1	1	9	9
1.7	2	2	0	0	7	7
1.8	1	1	1	1	12	12
1.9	0	0	2	2	10	10
2	2	2	1	1	9	9
2.1	0	0	1	1	1	1
2.2	0	0	0	0	2	2
2.3	0	0	1	1	6	6
2.4	1	1	0	0	8	8
2.5	1	1	0	0	3	3
2.6	0	0	0	0	3	3
2.7	0	0	0	0	3	3
2.8	0	0	0	0	2	2
2.9	0	0	1	1	4	4
3	0	0	0	0	3	3
3.1	0	0	1	1	2	2
3.2	0	0	0	0	1	1
3.3	0	0	0	0	2	2
3.4	0	0	0	0	3	3
3.5	1	1	0	0	1	1
3.6	0	0	0	0	1	1
3.7	0	0	0	0	0	0
3.8	0	0	0	0	2	2

Table 6-3: Voltage Distributions Used for EOC-12 Benchmark Projections for SGs 2-2, 2-3, and 2-4

Voltage Bin	SG 2-2		SG 2-3		SG 2-4	
	As-Found EOC-12	Repaired	As-Found EOC-12	Repaired	As-Found EOC-12	Repaired
3.9	0	0	0	0	0	0
4	0	0	0	0	0	0
4.1	0	0	1	1	1	1
4.2	0	0	0	0	2	2
4.3	0	0	0	0	1	1
4.4	0	0	0	0	1	1
4.5	0	0	0	0	1	1
4.6	1	1	0	0	1	1
4.7	0	0	0	0	1	1
4.8	0	0	0	0	0	0
4.9	0	0	0	0	1	1
5	0	0	0	0	3	3
5.1	0	0	0	0	2	2
5.2	0	0	0	0	0	0
5.3	0	0	0	0	1	1
5.4	0	0	0	0	0	0
5.5	0	0	0	0	2	2
5.6	0	0	0	0	0	0
5.7	0	0	0	0	1	1
5.8	0	0	0	0	0	0
5.9	0	0	0	0	0	0
6	0	0	0	0	0	0
6.1	0	0	0	0	0	0
6.2	0	0	0	0	1	1
6.3	0	0	0	0	0	0
6.4	1	1	0	0	0	0
6.5	0	0	0	0	0	0
6.6	0	0	0	0	0	0
6.7	0	0	0	0	1	1
6.8	0	0	0	0	0	0
21.4	0	0	0	0	0	0
21.5	0	0	0	0	1	1
>21.5	0	0	0	0	0	0
Total	**278**	**28**	**263**	**32**	**982**	**265**

Table 6-4: Cycle 11 Growth Distributions for SG 2-1

(Used for EOC-12 Benchmark Projections for SG 2-1)

Growth (Volts/EFPY)	Bin1 (<=1.06v)	Bin2 (>1.06v)
<=0	49	0
0.1	168	1
0.2	73	1
0.3	20	0
0.4	8	0
0.5	9	0
0.6	0	0
0.7	1	2
0.8	0	2
0.9	0	1
1	0	1
1.1	0	0
1.2	1	1
1.3	1	0
1.4	1	0
1.5	0	0
1.6	0	2
1.7	1	0
1.8	0	0
1.9	0	0
2	0	0
2.1	0	0
2.2	0	1
2.3	0	0
2.4	0	0
2.5	0	0
2.6	0	0
2.7	0	0
2.8	0	0
2.9	0	1
3	0	0
3.1	0	0
3.2	0	0
3.3	0	1
3.4	0	0
3.5	0	0
3.6	0	1
>3.6	0	0
Total	**332**	**15**

Table 6-5: Cycle 11 Growth Distributions for SG 2-4

(Used for EOC-12 Benchmark Projections for SG 2-4)

Growth (Volts/EFPY)	Bin1 (<=0.59v)	Bin2 (0.60v-1.66v)	Bin3 (>1.66v)
<=0	48	6	0
0.1	307	31	2
0.2	220	54	1
0.3	79	40	3
0.4	24	30	0
0.5	5	28	0
0.6	8	17	1
0.7	5	15	0
0.8	3	7	1
0.9	0	5	0
1	1	6	0
1.1	0	9	0
1.2	0	5	0
1.3	1	2	0
1.4	0	7	1
1.5	0	2	2
1.6	0	4	1
1.7	1	1	1
1.8	0	0	1
1.9	0	2	1
2	0	2	0
2.1	0	1	0
2.2	0	0	1
2.3	0	3	0
2.4	0	1	0
2.5	0	1	1
2.6	0	2	0
2.7	0	2	1
2.8	0	0	0
2.9	0	0	0
3	0	1	1
3.1	0	0	0
3.2	0	0	0
3.3	0	0	0
3.4	0	0	0
3.5	0	0	0
3.6	0	0	0
>3.6	0	0	0
Total	**702**	**284**	**19**

Table 6-6: Cycle 11 Growth Distributions for All SGs

(Used for EOC-12 Benchmark Projections for SGs 2-2 and 2-3)

Growth (Volts/EFPY)	Bin1 (<=0.59v)	Bin2 (0.60v-1.66v)	Bin3 (>1.66v)
<=0	152	24	0
0.1	690	75	0
0.2	374	76	2
0.3	124	62	2
0.4	32	38	2
0.5	17	38	0
0.6	10	22	1
0.7	5	18	0
0.8	3	7	0
0.9	0	6	0
1	1	10	0
1.1	0	7	0
1.2	1	5	0
1.3	1	3	0
1.4	0	8	0
1.5	0	2	1
1.6	0	5	3
1.7	1	0	1
1.8	0	1	1
1.9	0	4	0
2	0	1	1
2.1	0	0	0
2.2	0	0	0
2.3	0	4	1
2.4	0	1	0
2.5	0	1	1
2.6	0	2	0
2.7	0	0	2
2.8	0	0	1
2.9	0	0	0
3	0	0	1
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
3.6	0	0	0
>3.6	0	0	0
Total	**1411**	**420**	**21**

Table 6-7: As-found EOC-12 vs. Projected EOC-12 Conditions Without the 11.89 v/EFPY Growth

Voltage Bin	SG 2-1		SG 2-2		SG 2-3		SG 2-4	
	As-Found	Projected	As-Found	Projected	As-Found	Projected	As-Found	Projected
0.1	0	1.5	0	0.68	1	0.89	0	0.46
0.2	29	30.42	28	14.15	17	17.46	31	10.6
0.3	74	87.95	54	50.73	42	58.15	104	52.85
0.4	97	146.52	70	96.28	65	100.07	134	134.35
0.5	55	165.92	72	121.52	35	128.87	141	218.11
0.6	54	134.33	47	110.24	38	110.86	127	253.43
0.7	43	97.56	31	83.38	20	85.06	100	224.65
0.8	33	71.93	24	57.26	18	55.42	77	169.63
0.9	25	52	23	35.42	11	33.49	66	115.46
1	14	38.44	15	23.05	5	20.67	56	77.54
1.1	11	26.07	5	17.15	2	14.48	45	57.52
1.2	10	16.23	5	13.61	5	10.9	38	47.53
1.3	2	10.44	7	11.19	5	8.75	26	41.44
1.4	4	6.42	4	9.61	1	7.4	20	37.9
1.5	8	3.65	6	7.95	5	6.16	18	33.54
1.6	1	1.96	1	6.3	2	4.88	5	27.83
1.7	3	1.04	2	5.09	0	3.9	11	22.87
1.8	2	0.55	1	4.03	0	3.09	7	18.68
1.9	2	0.28	0	2.99	0	2.32	6	14.6
2	0	0.66	1	2.32	0	1.81	4	11.24
2.1	2	1.17	1	1.95	0	1.54	1	8.89
2.2	2	1.65	0	1.8	0	1.49	0	7.75
2.3	0	2.05	0	1.61	0	1.33	0	7.67
2.4	1	1.98	0	1.37	0	1.1	0	7.47
2.5	0	1.52	0	1.17	0	0.89	1	6.72
2.6	0	1.08	0	0.96	0	0.72	0	5.47
2.7	0	0.86	0	0.88	0	0.65	1	4.65
2.8	0	1.21	0	1.01	0	0.81	0	5.01
2.9	0	1.15	0	0.95	0	0.77	1	4.98
3	0	0.76	0	0.8	0	0.62	0	4.33
3.5	0	1.53	0	2.42	0	1.80	0	12.69
4	0	0.94	0	1.25	0	0.94	0	6.87
4.5	0	0.37	0	1.24	0	0.94	0	6.89
5	0	0.32	0	0.83	0	0.62	0	6.88
5.5	0	0.23	0	0.11	0	0.10	0	2.66
6	0	0.46	0	0.04	0	0.04	0	0.67
6.5	0	1.23	0	0.08	0	0.08	0	0.54
7	0	0.00	0	0.00	0	0.00	0	0.00
>7	0	0.00	0	0.00	0	0.00	0	0.00
Total	472	912.38	397	691.41	272	689.08	1020	1670.36
<=1	424	826.57	364	592.71	252	610.94	836	1257.08
>1	48	85.81	33	98.71	20	78.14	184	413.29
>2	5	18.51	1	18.47	0	14.45	4	100.14
>5	0	1.92	0	0.24	0	0.23	0	3.87
POB	7.45E-05	8.94E-04	4.38E-05	5.13E-04	2.10E-05	3.73E-04	1.42E-04	3.16E-03
Leak Rate	0.15	0.65	0.09	0.58	0.04	0.46	0.47	3.02

Figure 6-1: As-found SG 2-1 vs Projected Voltage Distributions (DCPP POPCD)

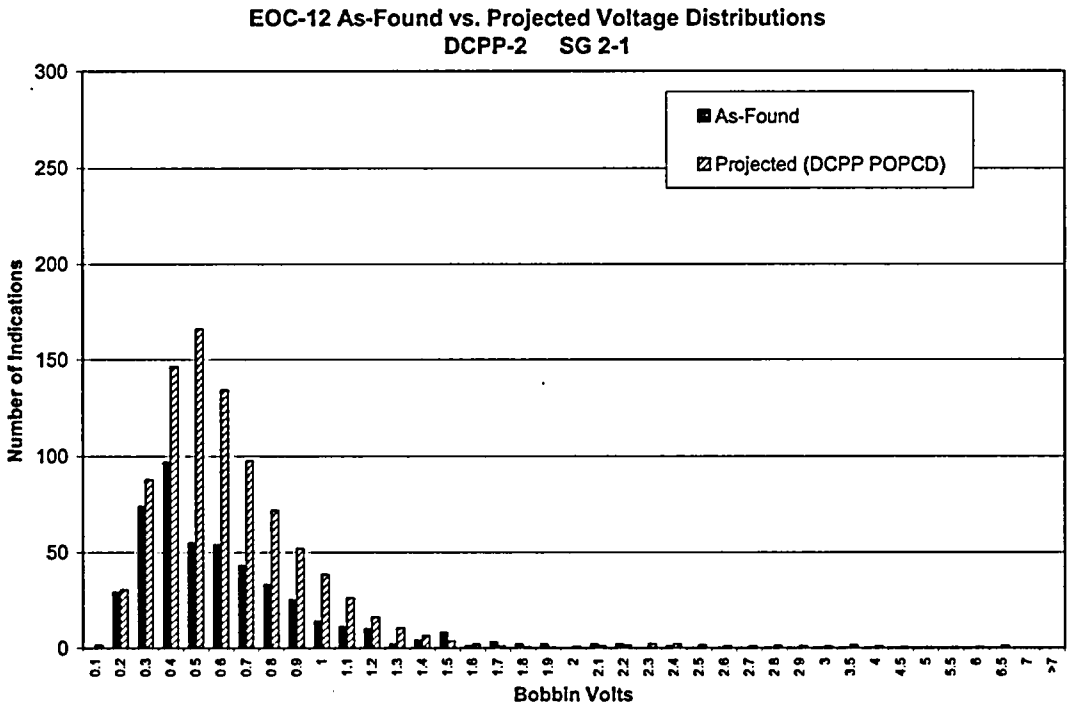


Figure 6-2: As-found SG 2-2 vs Projected Voltage Distributions (DCPP POPCD)

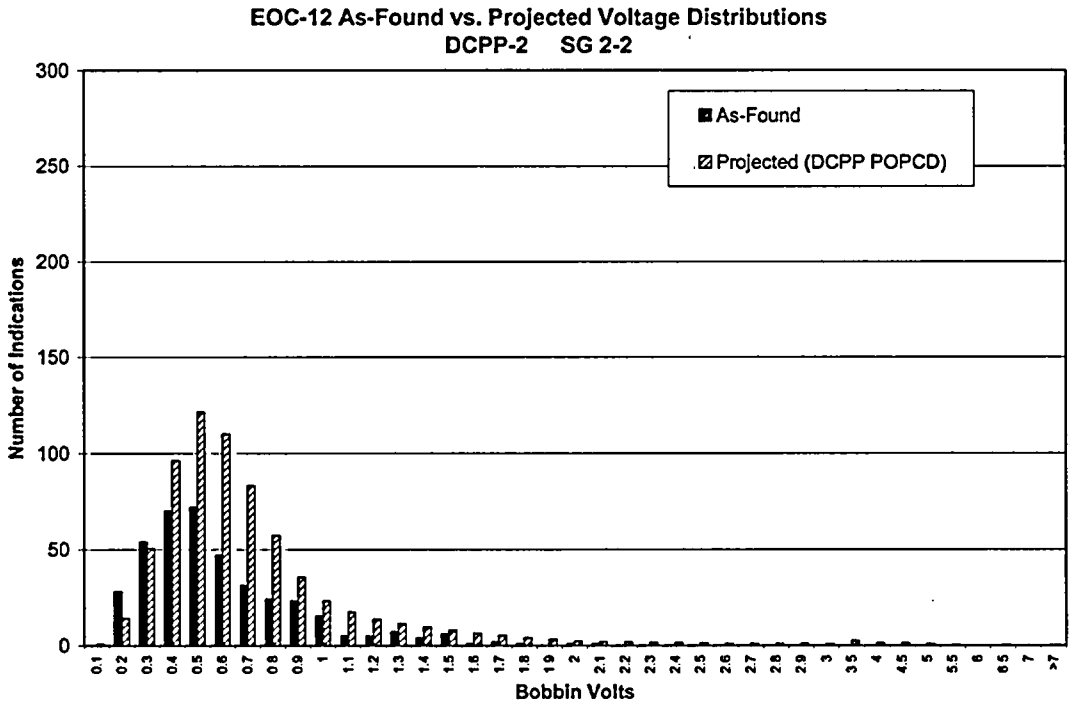


Figure 6-3: As-found SG 2-3 vs Projected Voltage Distributions (DCPP POPCD)

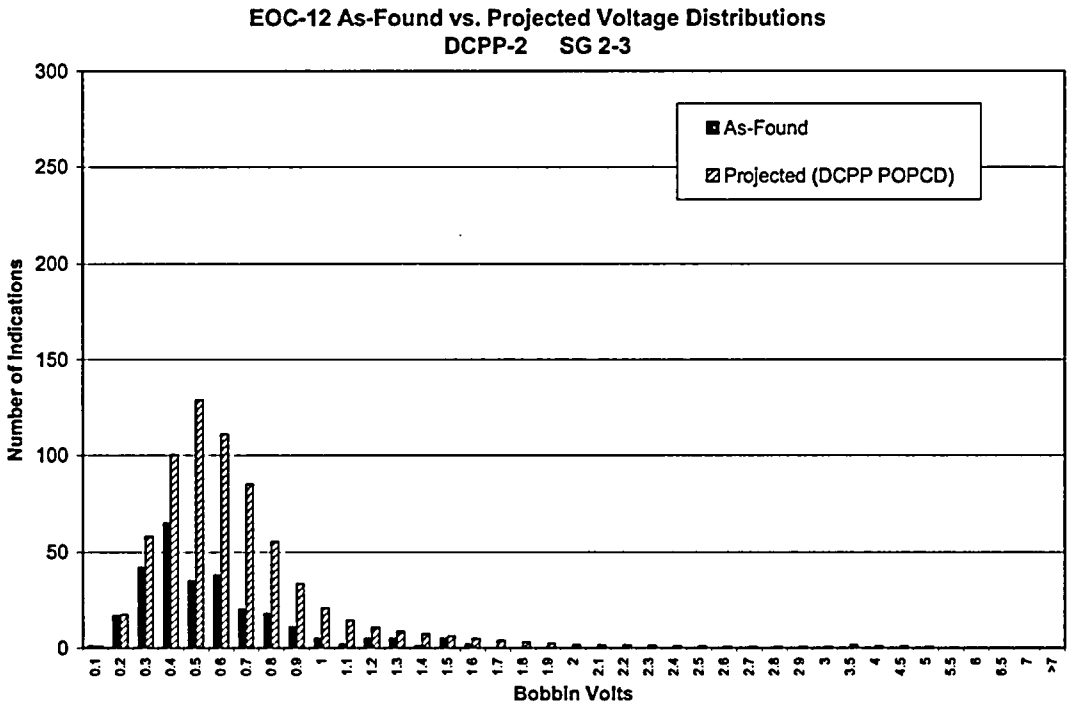
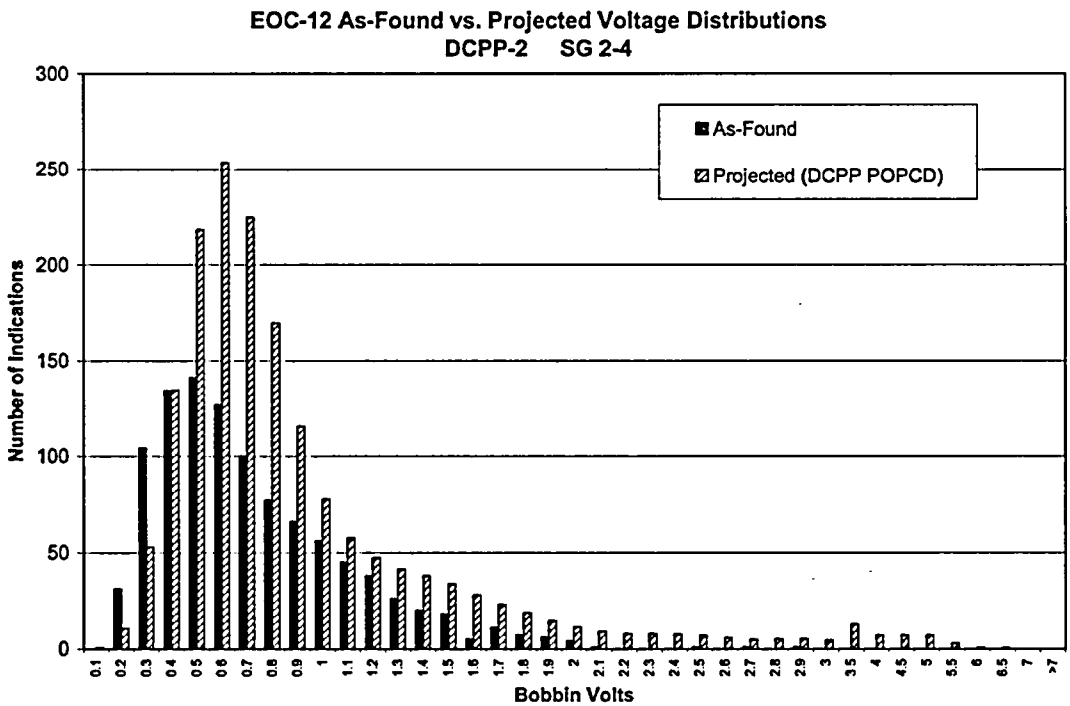


Figure 6-4: As-found SG 2-4 vs Projected Voltage Distributions (DCPP POPCD)



7.0 Probability of Prior Cycle Detection and EOC-13 Projections Using DCPP POPCD

The NRC approved use of the voltage-dependent POPCD at DCPP in Reference 29. This section provides the 2R11 POPCD results, which is based on the 2R11 and 2R12 inspections' results. This section also provides the updated POPCD correlation that was used in the EOC-13 projections provided in Section 8, as well as NRC reporting requirements for continued application of POPCD.

7.1 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 27 provided the DCPP-specific correlation through 1R12 (six inspections). The data from Reference 27 has since been updated to include the 2R12 results, also referred to as the 2R11 POPCD data. Tables 7-1 and 7-2 provide the 2R11 and composite POPCD data, respectively. The composite POPCD includes results from seven inspections (2R8, 1R9, 2R9, 1R10, 2R10, 1R11, and 2R11). Table 7-3 provides the POPCD tracking matrix with column letters that correspond to the columns in Tables 7-1 and 7-2. Table 7-4 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 7-5 provides the POPCD matrix table for the just completed cycle regardless of the beginning-of-cycle voltage. Table 7-6 provides the composite multi-cycle POPCD matrix table segregated into the three voltage bins. Table 7-7 provides the composite multi-cycle POPCD matrix table regardless of the beginning-of-cycle voltage. Table 7-8 provides the correlation parameters for the composite data set.

During the preparation of the 2R11 POPCD data tables, minor errors were found in the previous tables. These errors affected the indications that were NDD in the look-back analyses. Since no voltage reading from the previous inspection is available for these flaws, the voltage is assumed to be equal to the current voltage minus the average growth for that cycle. In some cases, the average growth rates used for these calculations were incorrect in prior POPCD tables. These errors have been corrected for all of the previous POPCD results and because the number of affected indications is very small in conjunction with the large size of the overall data set (>8000 indications) the changes did not have any affect on the POPCD determination.

The largest "undetected" POPCD indication in 2R11 was 1.16v. SG 2-2 R7C74 4H had a bobbin indication reported in 2R11 and was inspected, but not confirmed with Plus Point in 2R11 (BDD/RND in Table 7-1 Column G) and had a 1.16v DOS in 2R12 (BDD/ w/o RPC). At the NRC's request, bobbin indications that were Plus Point inspected but not confirmed at the prior outage (EOC_n) should be considered as "No Detection" at EOC_n.

7.1.1 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 7-1 shows the POPCD curves for the just completed cycle as well as three composite POPCD curves (composite data through 2R11, 1R12, and 2R12). The curve labeled "through 2R11 (five inspections)" was used for the benchmarking calculations provided in Section 6 of this document. The composite POPCD through 2R12 was used for the EOC-13 projections provided in Section 8 of this document. The 2R11 POPCD distribution for the just completed cycle (based on the 2R12 inspection results) is improved over the entire range of expected voltages compared to the composite POPCD distribution applied in the prior cycle OA. Therefore, the updated composite POPCD curve is also improved over the entire range of expected voltages. Table 7-9 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 12 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 Addendum 6. The growth rates decreased in Cycle 12 compared to Cycle 11. 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 7-1 which is the POPCD for the just completed cycle based on 2R12 inspections, the number of non-detected POPCD indications was only 724, compared to 1704 detected POPCD indications. This is a greater than 2-to-1 ratio, compared to prior inspections where the ratio of detections to non-detections was about equal to, or less than 1. Additionally, there were a large number of new indications detected in 2R11. These new indications were then re-identified in 2R12 and counted as detections at EOCn, which also improved DCPP POPCD based on larger numbers of detected indications.

7.1.2 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 Plus 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 Plus 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 2R12 inspection, there were no cases where a Plus Point confirmed indication from 2R11 was not also detected in 2R12. Thus, there were no "disappearing flaws", and no additional Plus Point inspections were required to satisfy this commitment.

7.2 Input to Industry POPCD Database

Tables 7-10 and 7-11 provide the 2R11 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 7-1 and Table 7-2), whereas the EPRI table treats these as detection.

Table 7-1: 2R11 POPCD Results

Column	A	B	C	D	E	F	G	H	I	J	K
2R11 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 [2]	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	0	0	0	3	54	0	0	3	0	57	0.000
0.11-0.20	0	46	1	5	170	0	11	21	47	186	0.202
0.21-0.30	20	192	17	5	168	15	17	28	229	205	0.528
0.31-0.40	28	210	20	7	98	14	17	28	258	136	0.655
0.41-0.50	34	198	16	2	40	8	14	17	248	64	0.795
0.51-0.60	25	149	11	2	17	7	7	7	185	33	0.849
0.61-0.70	27	111	15	1	10	3	10	6	153	24	0.864
0.71-0.80	22	90	7	1	6	0	3	4	119	10	0.922
0.81-0.90	14	62	8	0	4	0	2	3	84	6	0.933
0.91-1.00	9	34	5	0	0	0	0	0	48	0	1.000
1.01-1.10	18	22	2	0	0	0	1	1	42	1	0.977
1.11-1.20	11	26	3	0	0	0	2	0	40	2	0.952
1.21-1.30	0	0	41	0	0	0	0	1	41	0	1.000
1.31-1.40	0	0	22	0	0	0	0	0	22	0	1.000
1.41-1.50	0	0	20	0	0	0	0	0	20	0	1.000
1.51-1.60	0	0	19	0	0	0	0	0	19	0	1.000
1.61-1.70	0	0	20	0	0	0	0	0	20	0	1.000
1.71-1.80	0	0	15	0	0	0	0	0	15	0	1.000
1.81-1.90	0	0	14	0	0	0	0	0	14	0	1.000
1.91-2.00	0	0	12	0	0	0	0	0	12	0	1.000
2.01-2.10	0	0	2	0	0	0	0	0	2	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	8	0	0	0	0	0	8	0	1.000
2.31-2.40	0	0	9	0	0	0	0	0	9	0	1.000
2.41-2.50	0	0	4	0	0	0	0	0	4	0	1.000
2.51-2.60	0	0	3	0	0	0	0	0	3	0	1.000
2.61-2.70	0	0	3	0	0	0	0	0	3	0	1.000
2.71-2.80	0	0	3	0	0	0	0	0	3	0	1.000
2.81-2.90	0	0	7	0	0	0	0	0	7	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	3	0	0	0	0	0	3	0	1.000
3.11-3.20	0	0	1	0	0	0	0	0	1	0	1.000
3.21-3.30	0	0	3	0	0	0	0	0	3	0	1.000
3.31-3.40	0	0	3	0	0	0	0	0	3	0	1.000
3.41-3.50	0	0	3	0	0	0	0	0	3	0	1.000
3.51-3.60	0	0	1	0	0	0	0	0	1	0	1.000
3.61-3.70	0	0	0	0	0	0	0	0	0	0	
3.71-3.80	0	0	2	0	0	0	0	0	2	0	1.000
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	2	0	0	0	0	0	2	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	2	0	0	0	0	0	2	0	1.000
4.41-4.50	0	0	1	0	0	0	0	0	1	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
4.71-4.80	0	0	0	0	0	0	0	0	0	0	
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	3	0	0	0	0	0	3	0	1.000
5.21-5.30	0	0	1	0	0	0	0	0	1	0	1.000
5.41-5.50	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	2	0	0	0	0	0	2	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	208	1140	356	26	567	47	84	117	1704	724	

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 7-2: 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	5	1	1	29	128	0	1	10	7	158	0.042
0.11-0.20	21	102	4	117	661	9	37	51	127	824	0.134
0.21-0.30	78	446	24	148	817	125	44	92	548	1134	0.326
0.31-0.40	119	581	37	128	551	119	46	79	737	844	0.466
0.41-0.50	133	554	28	74	283	46	28	60	715	431	0.624
0.51-0.60	131	443	24	44	148	44	15	39	598	251	0.704
0.61-0.70	119	315	25	30	74	11	17	32	459	132	0.777
0.71-0.80	97	220	19	20	45	5	8	16	336	78	0.812
0.81-0.90	91	154	10	19	22	0	7	11	255	48	0.842
0.91-1.00	60	98	10	4	8	0	0	3	166	12	0.933
1.01-1.10	67	58	9	7	9	0	1	5	134	17	0.887
1.11-1.20	39	56	5	4	3	0	4	5	100	11	0.901
1.21-1.30	32	25	43	3	4	0	0	2	100	7	0.935
1.31-1.40	39	14	24	2	1	0	0	2	77	3	0.963
1.41-1.50	18	8	21	1	0	0	0	0	47	1	0.979
1.51-1.60	13	4	20	1	0	0	0	0	37	1	0.974
1.61-1.70	14	1	20	0	0	0	0	0	35	0	1.000
1.71-1.80	17	1	15	0	0	0	0	0	33	0	1.000
1.81-1.90	10	0	15	0	0	0	0	0	25	0	1.000
1.91-2.00	15	1	12	0	0	0	0	0	28	0	1.000
2.01-2.10	0	0	2	0	0	0	0	0	2	0	1.000
2.11-2.20	0	0	9	0	0	0	0	0	9	0	1.000
2.21-2.30	0	0	13	0	0	0	0	0	13	0	1.000
2.31-2.40	0	0	15	0	0	0	0	0	15	0	1.000
2.41-2.50	0	0	4	0	0	0	0	0	4	0	1.000
2.51-2.60	0	0	5	0	0	0	0	0	5	0	1.000
2.61-2.70	0	0	4	0	0	0	0	0	4	0	1.000
2.71-2.80	0	0	7	0	0	0	0	0	7	0	1.000
2.81-2.90	0	0	10	0	0	0	0	0	10	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	4	0	0	0	0	0	4	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	5	0	0	0	0	0	5	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	1	0	0	0	0	0	1	0	1.000
3.61-3.70	0	0	0	0	0	0	0	0	0	0	
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
3.91-4.00	0	0	0	0	0	0	0	0	0	0	
4.01-4.10	0	0	3	0	0	0	0	0	3	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	1	0	0	0	0	0	1	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
4.71-4.80	0	0	0	0	0	0	0	0	0	0	
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	4	0	0	0	0	0	4	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
5.61-5.70	0	0	1	0	0	0	0	0	1	0	1.000
6.11-6.20	0	0	2	0	0	0	0	0	2	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	1118	3080	497	631	2754	359	208	407	4695	3952	

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 7-3: 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 7-1 and 7-2.
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 Plus 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 Plus 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 7-4: 2R11 POPCD Voltage-Specific Summary from 2R12 Inspection Results

2R11 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	60												
		Not Plugged		6	881	7	6	0	28	0	19	0	4	0	0
	BDD w/ RDD	Plugged	40												
		Not Plugged		0	205	4	144	0	0	0	0	0	14	0	0
	BDD w/ RND	Plugged	2												
		Not Plugged		0	63	2	16	0	44	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		2	564	4	22	0	21	No Count	No Count	1	16	No Count	No Count
	BND w/ RDD	Plugged	6												
		Not Plugged		0	1	0	0	0	0	No Count	No Count	0	15	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	0	0	0	0	1	No Count	No Count	0	9	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	0												
		Not Plugged		0	0	0	0	0	0	0	0	0	0	0	0
	BDD w/ RDD	Plugged	168												
		Not Plugged		1	47	12	17	0	0	0	0	0	0	0	0
	BDD w/ RND	Plugged	1												
		Not Plugged		0	2	0	1	0	1	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

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	82												
		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 7-5: 2R11 POPCD Summary from 2R12 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	60												
		Not Plugged		6	881	7	6		28		19		4		
	BDD w/ RDD	Plugged	290												
		Not Plugged		1	252	16	161						14		
	BDD w/ RND	Plugged	3												
		Not Plugged			65	2	17		45						
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		2	564	4	22		21	No Count	No Count	1	16	No Count	No Count
	BND w/ RDD	Plugged	6												
		Not Plugged			1					No Count	No Count		15	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged							1	No Count	No Count		9	No Count	No Count

Table 7-6: DCPP Composite Voltage-Specific POPCD Summary

Composite of 1R9, 1R10, 1R11, 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	18												
		Not Plugged		57	1482	138	189	0	33	0	36	0	0	0	0
	BDD w/ RDD	Plugged	64												
		Not Plugged		1	280	26	315	0	1	0	0	0	7	0	2
	BDD w/ RND	Plugged	2												
		Not Plugged		4	72	8	35	0	57	0	36	0	3	0	3
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		50	2117	105	456	4	99	No Count	No Count	36	132	No Count	No Count
	BND w/ RDD	Plugged	39												
		Not Plugged		0	2	1	17	0	0	No Count	No Count	8	71	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	1	3	5	0	5	No Count	No Count	16	10	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	10												
		Not Plugged		2	87	167	28	0	3	0	0	0	0	0	0
	BDD w/ RDD	Plugged	6												
		Not Plugged		1	30	17	22	0	0	0	0	0	1	0	0
	BDD w/ RND	Plugged	1												
		Not Plugged		0	1	0	1	0	3	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		0	17	4	14	1	4	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

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	43												
		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 7-7: 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	28												
		Not Plugged		59	1569	305	217		36		36				
	BDD w/ RDD	Plugged	113												
		Not Plugged		2	310	43	337		1				8		2
	BDD w/ RND	Plugged	3												
		Not Plugged		4	73	8	36		60		36		3		3
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		50	2134	109	470	5	103	No Count	No Count	36	132	No Count	No Count
	BND w/ RDD	Plugged	39												
		Not Plugged			2	1	17			No Count	No Count	8	71	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged			1	3	5		5	No Count	No Count	16	10	No Count	No Count

Table 7-8: DCPP POPCD Log Logistic Parameters

Parameter	Composite POPCD Through 2R11 (5 Inspections)	Composite POPCD Through 1R12 (6 Inspections)	Updated POPCD Through 2R12 (7 Inspections)
Number of Data Points	4688	6219	8647
a.0 (intercept)	1.644	1.844	2.147
a.1 (slope)	4.659	4.781	4.846
V11	0.00522	0.00407	0.00317
V12	0.01043	0.00806	0.00607
V22	0.02654	0.02022	0.01454

Table 7-9: New POPCD Correlation Comparison to Previous POPCD Correlations (Best Estimate)

Volts	POPCD Through 2R11 (Five Inspections)*	POPCD Through 1R12 (Six Inspections)	New POPCD Through 2R12 (Seven Inspections)
0.1	0.047	0.050	0.063
0.12	0.066	0.072	0.090
0.14	0.088	0.096	0.120
0.16	0.113	0.123	0.153
0.18	0.139	0.152	0.188
0.2	0.166	0.183	0.224
0.22	0.195	0.214	0.261
0.25	0.238	0.262	0.316
0.3	0.312	0.342	0.404
0.35	0.382	0.417	0.484
0.4	0.448	0.485	0.554
0.45	0.507	0.546	0.615
0.5	0.560	0.600	0.666
0.6	0.648	0.686	0.745
0.7	0.716	0.751	0.802
0.8	0.767	0.799	0.843
0.9	0.807	0.836	0.873
1	0.838	0.863	0.895
1.1	0.863	0.885	0.913
1.2	0.882	0.902	0.926
1.4	0.911	0.927	0.946
1.6	0.931	0.944	0.958
1.8	0.944	0.955	0.967
2	0.955	0.964	0.974
2.2	0.962	0.970	0.978
2.4	0.968	0.975	0.982
2.6	0.973	0.979	0.985
2.8	0.977	0.982	0.987
3	0.980	0.984	0.989
3.5	0.985	0.988	0.992
4	0.988	0.991	0.994
4.5	0.991	0.993	0.995
5	0.9926	0.9944	0.9961
6	0.9949	0.9962	0.9973
7	0.9962	0.9972	0.9981
8	0.9971	0.9979	0.9985
9	0.9977	0.9984	0.9989
10	0.9982	0.9987	0.9991

* Used for Section 6 EOC-12 Benchmarking Projections

Table 7-10: 2R11 POPCD Results In Industry Format

Column	A	B	C	D	E	F	G	H	I	J
DCPP 2R11 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	0	0	0	3	54	0	3	0	57	0.000
0.11-0.20	0	57	1	5	170	0	21	58	175	0.249
0.21-0.30	28	201	17	5	168	15	26	246	188	0.567
0.31-0.40	33	222	20	7	98	14	28	275	119	0.698
0.41-0.50	37	209	16	2	40	8	17	262	50	0.840
0.51-0.60	26	155	11	2	17	7	7	192	26	0.881
0.61-0.70	28	120	15	1	10	3	6	163	14	0.921
0.71-0.80	22	93	7	1	6	0	4	122	7	0.946
0.81-0.90	14	64	8	0	4	0	3	86	4	0.956
0.91-1.00	9	34	5	0	0	0	0	48	0	1.000
1.01-1.10	19	22	2	0	0	0	1	43	0	1.000
1.11-1.20	11	28	3	0	0	0	0	42	0	1.000
1.21-1.30	0	0	41	0	0	0	1	41	0	1.000
1.31-1.40	0	0	22	0	0	0	0	22	0	1.000
1.41-1.50	0	0	20	0	0	0	0	20	0	1.000
1.51-1.60	0	0	19	0	0	0	0	19	0	1.000
1.61-1.70	0	0	20	0	0	0	0	20	0	1.000
1.71-1.80	0	0	15	0	0	0	0	15	0	1.000
1.81-1.90	0	0	14	0	0	0	0	14	0	1.000
1.91-2.00	0	0	12	0	0	0	0	12	0	1.000
2.01-2.10	0	0	2	0	0	0	0	2	0	1.000
2.11-2.20	0	0	2	0	0	0	0	2	0	1.000
2.21-2.30	0	0	8	0	0	0	0	8	0	1.000
2.31-2.40	0	0	9	0	0	0	0	9	0	1.000
2.41-2.50	0	0	4	0	0	0	0	4	0	1.000
2.51-2.60	0	0	3	0	0	0	0	3	0	1.000
2.61-2.70	0	0	3	0	0	0	0	3	0	1.000
2.71-2.80	0	0	3	0	0	0	0	3	0	1.000
2.81-2.90	0	0	7	0	0	0	0	7	0	1.000
2.91-3.00	0	0	3	0	0	0	0	3	0	1.000
3.01-3.10	0	0	3	0	0	0	0	3	0	1.000
3.11-3.20	0	0	1	0	0	0	0	1	0	1.000
3.21-3.30	0	0	3	0	0	0	0	3	0	1.000
3.31-3.40	0	0	3	0	0	0	0	3	0	1.000
3.41-3.50	0	0	3	0	0	0	0	3	0	1.000
3.51-3.60	0	0	1	0	0	0	0	1	0	1.000
3.61-3.70	0	0	0	0	0	0	0	0	0	
3.71-3.80	0	0	2	0	0	0	0	2	0	1.000
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	2	0	0	0	0	2	0	1.000
4.21-4.30	0	0	1	0	0	0	0	1	0	1.000
4.31-4.40	0	0	2	0	0	0	0	2	0	1.000
4.41-4.50	0	0	1	0	0	0	0	1	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	3	0	0	0	0	3	0	1.000
5.11-5.20	0	0	0	0	0	0	0	0	0	
5.21-5.30	0	0	1	0	0	0	0	1	0	1.000
5.31-5.40	0	0	0	0	0	0	0	0	0	
5.41-5.50	0	0	2	0	0	0	0	2	0	1.000
5.51-5.60	0	0	0	0	0	0	0	0	0	
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	
Total	227	1205	350	26	567	47	117	1782	640	

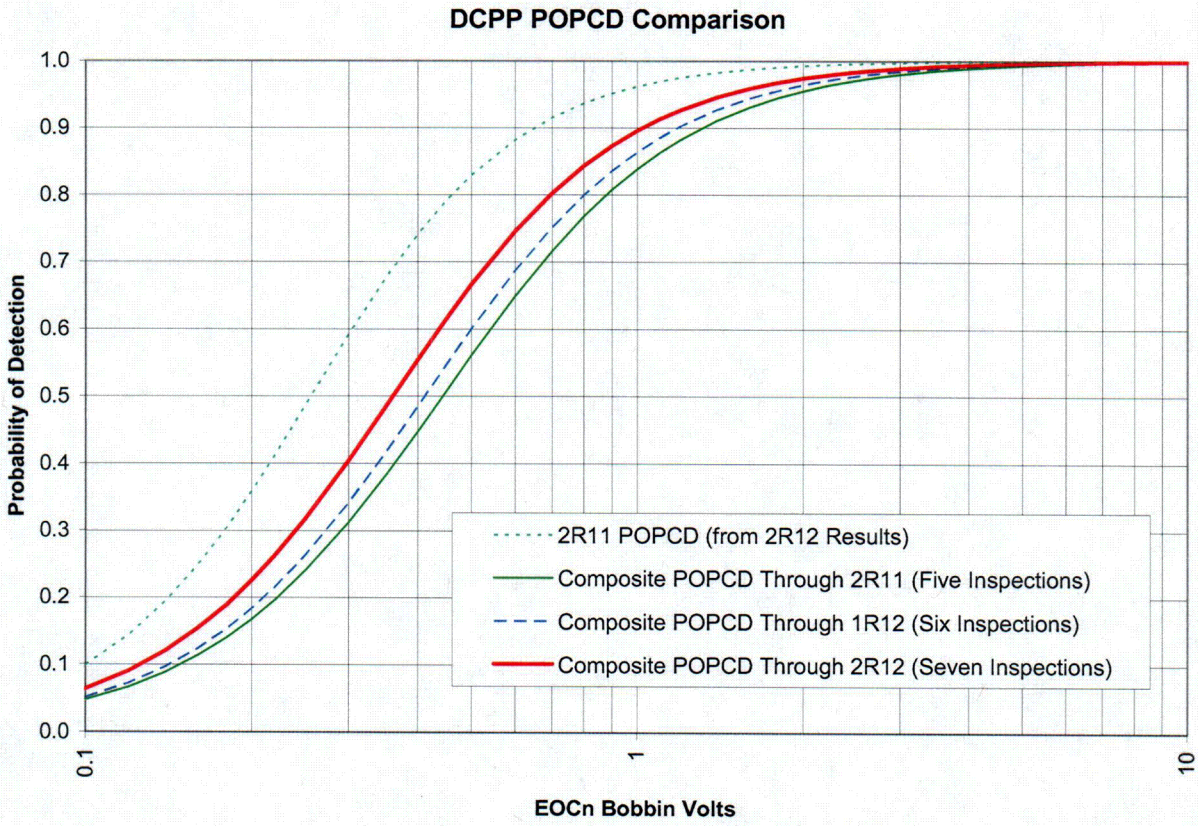
Notes:
1) POPCD for each voltage bin calculated as (Detection at EOCn)/(Detection at EOCn + No Detection at EOCn). By column, POPCD = (A+B+C)/(A+B+C+D+E+F).
2) Plant specific POPCD to be based upon voltage bins of 0.10 volt. Industry POPCD database may use 0.20 volt bins due to difficulty of adjusting 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 7-11: 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	5	2	1	29	128	0	10	8	157	0.048
0.11-0.20	42	118	4	117	661	9	51	164	787	0.172
0.21-0.30	99	469	24	148	817	125	92	592	1090	0.352
0.31-0.40	132	614	37	128	551	119	79	783	798	0.495
0.41-0.50	136	579	28	74	283	46	60	743	403	0.648
0.51-0.60	133	456	24	44	148	44	39	613	236	0.722
0.61-0.70	121	330	25	30	74	11	32	478	115	0.805
0.71-0.80	98	227	19	20	45	5	16	344	70	0.831
0.81-0.90	92	160	10	19	22	0	11	262	41	0.865
0.91-1.00	60	96	10	4	8	0	3	166	12	0.933
1.01-1.10	68	58	9	7	9	0	5	135	18	0.894
1.11-1.20	40	59	5	4	3	0	5	104	7	0.937
1.21-1.30	32	25	43	3	4	0	2	100	7	0.935
1.31-1.40	39	14	24	2	1	0	2	77	3	0.963
1.41-1.50	18	8	21	1	0	0	0	47	1	0.979
1.51-1.60	13	4	20	1	0	0	0	37	1	0.974
1.61-1.70	14	1	20	0	0	0	0	35	0	1.000
1.71-1.80	17	1	15	0	0	0	0	33	0	1.000
1.81-1.90	10	0	15	0	0	0	0	25	0	1.000
1.91-2.00	15	1	12	0	0	0	0	28	0	1.000
2.01-2.10	0	0	2	0	0	0	0	2	0	1.000
2.11-2.20	0	0	9	0	0	0	0	9	0	1.000
2.21-2.30	0	0	13	0	0	0	0	13	0	1.000
2.31-2.40	0	0	15	0	0	0	0	15	0	1.000
2.41-2.50	0	0	4	0	0	0	0	4	0	1.000
2.51-2.60	0	0	5	0	0	0	0	5	0	1.000
2.61-2.70	0	0	4	0	0	0	0	4	0	1.000
2.71-2.80	0	0	7	0	0	0	0	7	0	1.000
2.81-2.90	0	0	10	0	0	0	0	10	0	1.000
2.91-3.00	0	0	3	0	0	0	0	3	0	1.000
3.01-3.10	0	0	4	0	0	0	0	4	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	5	0	0	0	0	5	0	1.000
3.41-3.50	0	0	4	0	0	0	0	4	0	1.000
3.51-3.60	0	0	1	0	0	0	0	1	0	1.000
3.61-3.70	0	0	0	0	0	0	0	0	0	
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	3	0	0	0	0	3	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	1	0	0	0	0	1	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	4	0	0	0	0	4	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	0	0	0	0	0	0	0	
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	
Total	1184	3222	491	631	2754	359	407	4897	3744	

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 7-1: 2R11 POPCD Comparison to Composite POPCD



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8.0 EOC-13 Projections for Probability of Burst and Leak Rate

This section provides the results of the EOC-13 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 new 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.

8.1 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 8-1 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 8-1: Inputs for EOC-13 POB and Leak Rate Projections

Input Description	Section or Table Reference	Comments
BOC Voltage Distribution	Tables 3-18 and 3-19	
Repaired Voltage Distribution	Tables 3-18 and 3-19	
NDE Uncertainties	Section 3.6; Table 3-24	
POD	Table 7-5	Composite POPCD through 2R12 (7 inspections)
Growth	Section 3.2; Tables 3-15 through 3-17	Cycle 11 growth used for EOC-13 projections
Cycle Length	Section 8.1	1.33 EFPY
Tube Integrity Correlations	Tables 5-1 through 5-3	Addendum 5 plus 2R11 tube pull
Material Properties	Section 8.1	

Material Properties

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-13 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 2 Cycle 13 is 1.33 EFPY (Ref. 12). This value was used in all projections for EOC-13 conditions.

8.2 Projected EOC-13 Voltage Distributions

The EOC-13 voltage distributions are obtained by applying a Monte Carlo sampling process to the BOC-13 voltages. The process starts by selecting a random POPCD correlation based on the POPCD parameters through 2R12 shown in Table 7-5. Based on the POPCD correlation, the BOC-13 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-13 indications. The EOC-13 voltage distributions are then used to calculate a leak rate and probability of tube burst. As discussed in Section 3.2, the Cycle 11 growth rates were determined to bound the Cycle 12 growth rates. Therefore, the Cycle 11 growth rates were used for projecting the EOC-13 voltages. SG 2-1 used SG-specific Cycle 11 growth rates divided into two growth bins with a breakpoint at 1.06v. SGs 2-2 and 2-3 used composite Cycle 11 growth rates divided into three bins with breakpoints at 0.59v and 1.66v. SG 2-4 used SG-specific Cycle 11 growth rates divided into three bins with breakpoints at 0.59v and 1.66v. The "delta volts adjustment" was only required for Bin1 of the SG 2-1 growth distribution. This adjustment was very small (+0.002v). Table 8-2 and Figures 8-1 through 8-4 provide the projected EOC-13 voltage distributions.

Table 8-2: Projected EOC-13 Voltage Distributions (DCPP POPCD)

Voltage Bin	EOC-13 Projected Distributions with DCPP POPCD			
	SG 2-1	SG 2-2	SG 2-3	SG 2-4
<=0.1	1.18	1.07	7.35	0.75
0.2	23.42	20.61	34.63	15.47
0.3	102.96	85.28	71.57	88.21
0.4	158.83	122.38	99.23	171.43
0.5	171.77	137.63	110.49	226.71
0.6	137.59	126.47	93.76	240.17
0.7	101.11	96.41	70.26	209.88
0.8	76.17	63.84	45.65	156.89
0.9	59.84	40.00	27.96	106.96
1	44.11	26.76	17.89	76.05
1.1	31.12	19.97	12.78	60.88
1.2	20.75	16.26	10.13	53.83
1.3	13.43	13.75	8.38	49.91
1.4	8.42	11.49	7.03	45.04
1.5	5.47	9.62	5.85	38.91
1.6	3.85	7.82	4.75	32.33
1.7	2.96	6.21	3.85	26.28
1.8	2.91	5.18	3.22	21.83
1.9	2.91	4.43	2.79	19.00
2	2.83	3.74	2.37	16.70
2.1	2.64	3.17	2.00	14.75
2.2	2.20	2.61	1.61	12.72
2.3	1.85	2.14	1.32	10.89
2.4	1.80	1.94	1.21	9.69
2.5	1.97	1.77	1.09	8.37
2.6	1.71	1.52	0.95	7.23
2.7	1.27	1.32	0.80	6.50
2.8	0.86	1.14	0.68	5.82
2.9	0.60	0.92	0.56	4.67
3	0.42	0.77	0.46	3.85
3.1	0.34	0.69	0.42	3.41
3.2	0.37	0.63	0.39	2.97
3.3	0.41	0.55	0.34	2.60
3.4	0.39	0.44	0.27	2.23
3.5	0.35	0.39	0.23	2.20
3.6	0.30	0.44	0.27	2.67
3.7	0.24	0.48	0.30	2.81
3.8	0.18	0.47	0.29	2.72
3.9	0.13	0.43	0.25	2.56
4	0.13	0.38	0.22	2.41
4.1	0.21	0.34	0.20	2.25
4.2	0.32	0.28	0.17	1.94
4.3	0.36	0.22	0.13	1.56
4.4	0.39	0.16	0.09	1.23
4.5	0.47	0.11	0.07	0.98
4.6	0.54	0.08	0.05	0.77
4.7	0.54	0.06	0.04	0.61
4.8	0.52	0.04	0.03	0.49
4.9	0.56	0.03	0.02	0.40
5	0.60	0.02	0.01	0.36
5.1	0.57	0.01	0.01	0.34
5.2	0.49	0.01	0.00	0.33
5.3	0.41	0.01	0.00	0.31
5.4	0.32	0.00	0.00	0.28
5.5	0.23	0.00	0.00	0.26
5.6	0.16	0.00	0.00	0.25
5.7	0.11	0.00	0.00	0.24
5.8	0.07	0.00	0.00	0.21
5.9	0.04	0.00	0.00	0.17
6	0.02	0.00	0.00	0.13
7	0.03	0.00	0.00	0.20
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00
>10	0.00	0.00	0.00	0.00
Totals	996.72	842.53	654.39	1781.63

Figure 8-1: SG 2-1 EOC-13 Projected Voltage Distributions Using POPCD

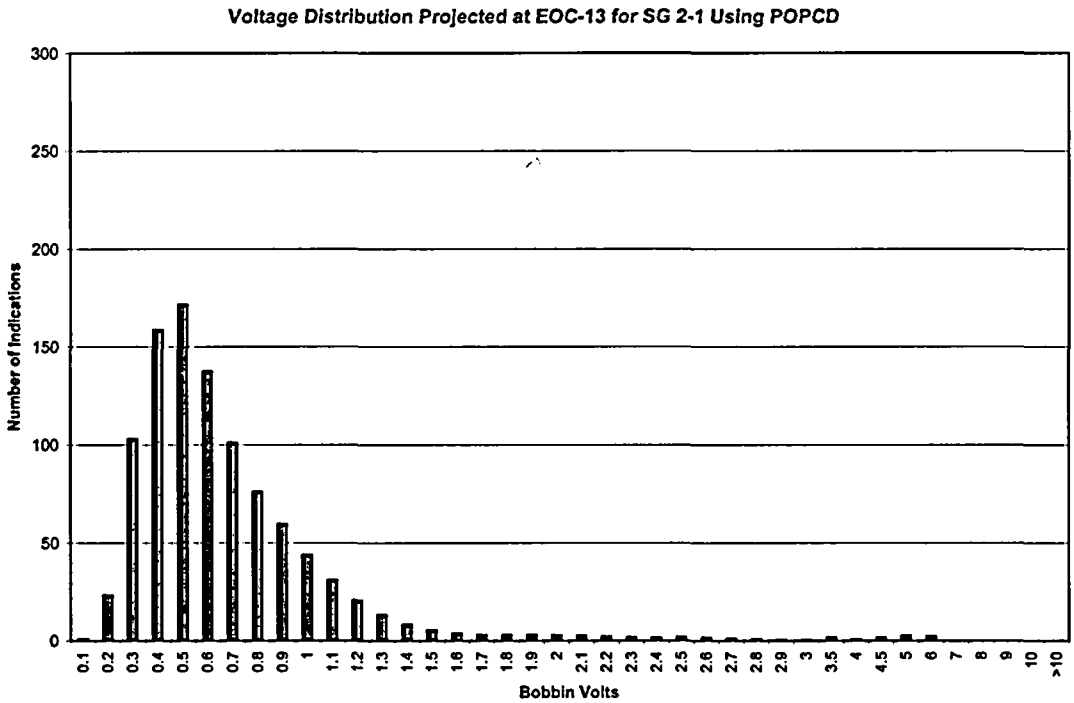


Figure 8-2: SG 2-2 EOC-13 Projected Voltage Distributions Using POPCD

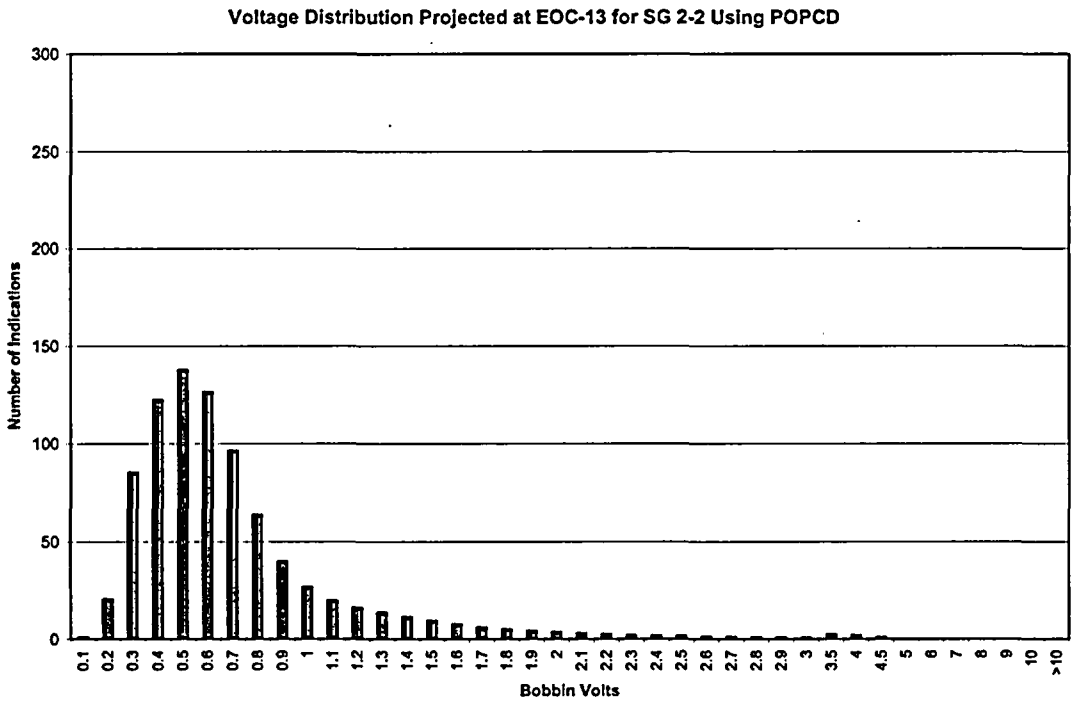


Figure 8-3: SG 2-3 EOC-13 Projected Voltage Distributions Using POPCD

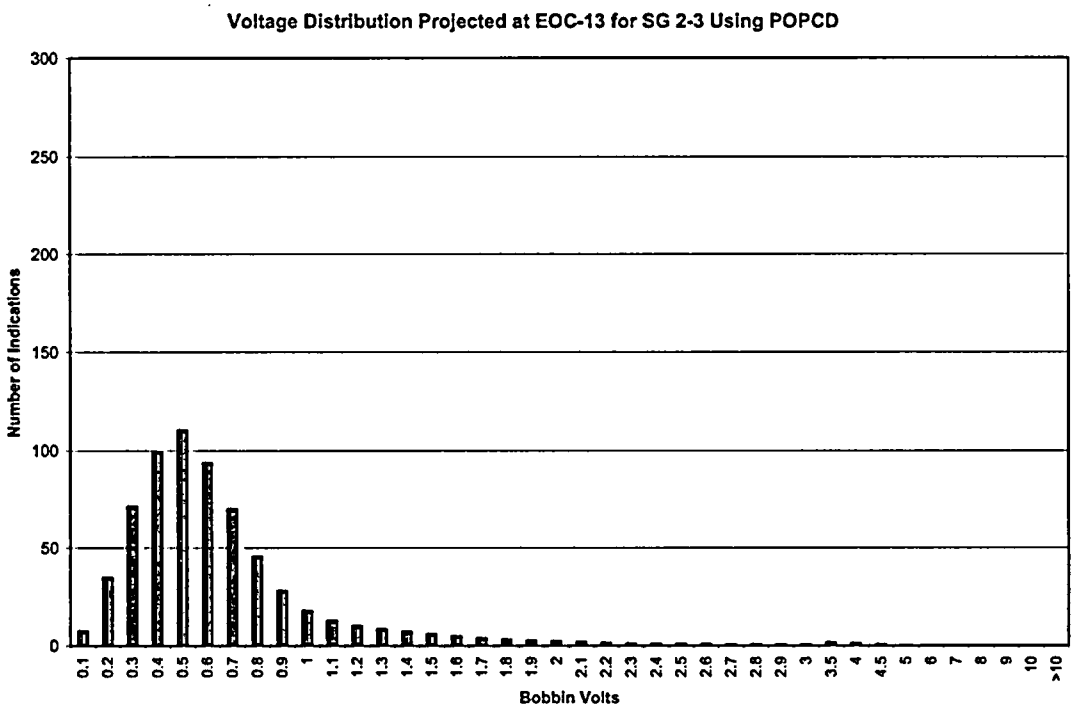
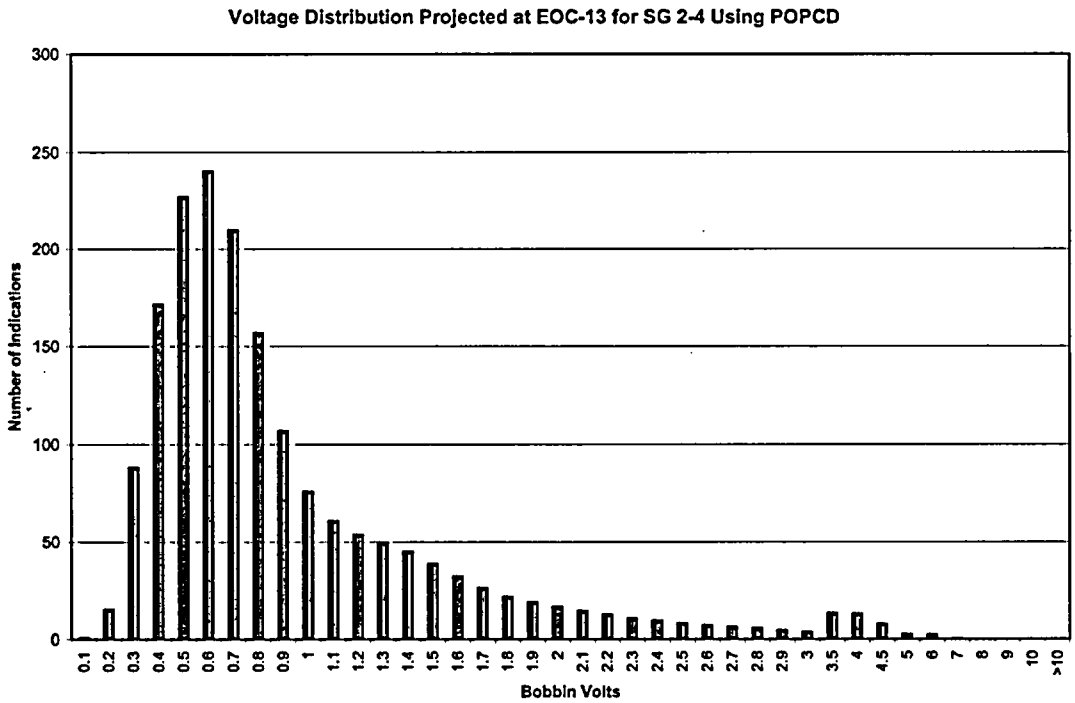


Figure 8-4: SG 2-4 EOC-13 Projected Voltage Distributions Using POPCD



8.3 Projected Tube Burst Probability and Leak Rate for EOC-13

Calculations to predict SLB leak rate and tube burst probability for each steam generator in DCPP Unit 2 at the projected EOC-13 conditions were performed using the burst pressure, leak rate, and probability of leakage correlations provided in Tables 5-1 through 5-3. The results of these calculations are shown in Table 8-3. As shown in Table 8-3, all of the results for projected EOC-13 conditions are below the acceptance criteria of 1.0×10^{-2} for POB and 10.5 gpm for leakage.

Table 8-3: Projected Leak Rate and Burst Probability at EOC-13 Using DCPP POPCD

Steam Generator	Projected Number of Indications at EOC-13	Probability of Burst		SLB Leak Rate
		Best Estimate	95% UCL (1 or More Failures)	(gpm)
SG 2-1	996.7	1.06×10^{-3}	1.14×10^{-3}	0.95
SG 2-2	842.5	4.26×10^{-4}	4.77×10^{-4}	0.64
SG 2-3	654.4	2.06×10^{-4}	2.43×10^{-4}	0.40
SG 2-4	1781.6	2.56×10^{-3}	2.75×10^{-3}	3.25
Reporting Threshold			1.0×10^{-2}	10.5

9.0 References

1. FANP Document 86-5053832-00, "DCPP Unit 2R12 Voltage-Based ARC and W-star Startup Report", November 2004.

2. NRC Generic Letter 95-05, "Voltage-Based Repair Criteria for the Repair of Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," USNRC Office of Nuclear Reactor Regulation, August 3, 1995.

3. NRC SER for Diablo Canyon Units 1 and 2 for Voltage-Based Repair Criteria, letter to PG&E dated March 12, 1998.

4. FANP Document 51-5001160-02, "Steam Generator POB Simulation Code - POB97vb_R20.F90", December 2003.

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

8. EPRI Report NP 7480-L, Addendum 5, 2002 Database Update, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits", Electric Power Research Institute, January 2003.

9. Pacific Gas and Electric, Diablo Canyon Unit 2 Refueling Outage 2R12, "Steam Generator Tubing Degradation Assessment", Revision 0, October 20, 2004.

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 5, October 26, 2004.

12. Pacific Gas and Electric Company, Diablo Canyon Power Plant, Surveillance Test Procedure, STP M-SGTI, Revision 10, "Steam Generator Tube Inspection", November 2, 2004.

13. FANP Document 51-5053831-00, "Bobbin Coil Probe Wear Monitoring for DCPP 2R12", November 2004.

14. Not Used.

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. Westinghouse Letter to Diablo Canyon (Rice to Arhar), Revised ARC Database Parameters Including Tubes Removed During 2R11, June 23, 2003.

21. Not Used.

22. NEI Letter to NRC, "Revision to ODSCC ARC Task – 'Extreme Values of ODSCC ARC Growth'", July 9, 2004.

23. FANP Document 32-5059193-00, "DCPP Unit 2 R12 Voltage-Based ARC 90-Day Report".

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.

AREVA

DESIGN VERIFICATION CHECKLIST

Document Identifier 86 - 5059194- 00

Title DCPP Unit 2 R12 Voltage-Based ARC 90-Day Report

1.	Were the inputs correctly selected and incorporated into design or analysis?	☒ Y	☐ N	☐ N/A
2.	Are assumptions necessary to perform the design or analysis activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent re-verifications when the detailed design activities are completed?	☐ Y	☐ N	☒ N/A
3.	Are the appropriate quality and quality assurance requirements specified? Or, for documents prepared per FANP procedures, have the procedural requirements been met?	☒ Y	☐ N	☐ N/A
4.	If the design or analysis cites or is required to cite requirements or criteria based upon applicable codes, standards, specific regulatory requirements, including issue and addenda, are these properly identified, and are the requirements/criteria for design or analysis met?	☐ Y	☐ N	☒ N/A
5.	Have applicable construction and operating experience been considered?	☐ Y	☐ N	☒ N/A
6.	Have the design interface requirements been satisfied?	☐ Y	☐ N	☒ N/A
7.	Was an appropriate design or analytical method used?	☒ Y	☐ N	☐ N/A
8.	Is the output reasonable compared to inputs?	☒ Y	☐ N	☐ N/A
9.	Are the specified parts, equipment and processes suitable for the required application?	☐ Y	☐ N	☒ N/A
10.	Are the specified materials compatible with each other and the design environmental conditions to which the material will be exposed?	☐ Y	☐ N	☒ N/A
11.	Have adequate maintenance features and requirements been specified?	☐ Y	☐ N	☒ N/A
12.	Are accessibility and other design provisions adequate for performance of needed maintenance and repair?	☐ Y	☐ N	☒ N/A
13.	Has adequate accessibility been provided to perform the in-service inspection expected to be required during the plant life?	☐ Y	☐ N	☒ N/A
14.	Has the design properly considered radiation exposure to the public and plant personnel?	☐ Y	☐ N	☒ N/A
15.	Are the acceptance criteria incorporated in the design documents sufficient to allow verification that design requirements have been satisfactorily accomplished?	☐ Y	☐ N	☒ N/A
16.	Have adequate pre-operational and subsequent periodic test requirements been appropriately specified?	☐ Y	☐ N	☒ N/A
17.	Are adequate handling, storage, cleaning and shipping requirements specified?	☐ Y	☐ N	☒ N/A
18.	Are adequate identification requirements specified?	☐ Y	☐ N	☒ N/A
19.	Is the document prepared and being released under the FANP Quality Assurance Program? If not, are requirements for record preparation review, approval, retention, etc., adequately specified?	☒ Y	☐ N	☐ N/A

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Comments:

Verified By: (First, MI, Last)	Jeffrey M Fleck Printed / Typed Name	Signature	3/11/05 Date

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