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PURPOSE AND SUMMARY OF RESULTS:

This report summarizes the Diablo Canyon Unit 1 – 1R14 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.

John Arhar 8/20/07

Customer Approval, John Arhar

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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
AREVA	Framatome Advanced Nuclear Power
GL	NRC Generic Letter 95-05
GPM	Gallons per Minute
INR	Indication Not Reportable
ISI	In-service Inspection
LRL	Lower Repair Limit
LU	Lookup
MSLB	Main Steam Line Break
NDE	Non Destructive Examination
NDD	No Degradation Detected
NRC	Nuclear Regulatory Commission
ODSCC	Outside Diameter Stress Corrosion Cracking
PG&E	Pacific Gas and Electric Company
POB	Probability of Burst
POD	Probability of Detection
POPCD	Probability of Prior Cycle Detection
POL	Probability of Leak
PWSCC	Primary Water Stress Corrosion Cracking
RPC	Rotating Pancake Coil
RSS	Retest Support Plate Signal
RTS	Return to Service
SG	Steam Generator
SER	Safety Evaluation Report
TS	Technical Specification
TSP	Tube Support Plate
VDG	Voltage Dependent Growth

1.0 Introduction

The Diablo Canyon Power Plant (DCPP) Unit 1 completed the fourteenth cycle of operation and subsequent steam generator ISI in May 2007. 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. It should be noted that 1R14 was the last planned inspection of these SGs, as they are to be replaced at EOC-15.

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. AREVA 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, 19, and 25, and approved by the NRC in Reference 20.

2.0 Executive Summary

During the 1R14 inspection, a total of 1936 DOS indications were detected with the bobbin coil. There were an additional 186 support plate intersections that were identified as containing AONDB (axial ODSCC not detected by bobbin). Since there were no DOS indications at these intersections, a bobbin voltage was inferred from the +Point™ results per the methodology provided in Reference 8.

There were 10 DOS indications greater than the lower repair limit of 2.0 volts. All of these indications were confirmed as axial ODSCC with +Point™ and were subsequently plugged. An additional 38 DOS and AONDB indications less than or equal to 2 volts were also plugged for other reasons, located in the wedge region, same TSP as ligament indication, ID/OD at same TSP, AONDB at dent >5 volts, or pluggable indications at another location in the same tube. No DOS indications were preventively repaired for high +Point™ volts.

A review of the growth rates over the previous cycle shows that axial ODSCC at support plates is most active in SGs 1-1 and 1-2. These two steam generators had the highest average growth rates and the six highest individual growth rates of the entire population. Cycle 14 voltage dependent growth (VDG) was not apparent in any SG based on previously established threshold criteria, although Cycle 14 VDG breakpoints were conservatively established in SGs 1-1 and 1-2. Following the DCPP Unit 2 2R11 inspection in 2003, a significant amount of analysis and evaluation was performed on voltage growth for ODSCC at TSPs (Reference 14). The evaluations primarily involved statistical breakpoint analyses to determine where the data suggests a change in the slope of the regression curve that defines the growth data. These efforts led to the development of guidelines for determining the breakpoints and growth distributions. These guidelines were provided to the NRC via Reference 24, and were used to determine the breakpoints and growth distributions for the current OA.

The POB and leak rate projections for EOC-15 provided in this report use the DCPP-specific POPCD. The use of the voltage-dependent POPCD was approved in Reference 20. The updated POPCD correlation is provided in Section 6. Using the DCPP-specific POPCD, a conservatively estimated cycle length, and the conservative growth rate analyses discussed in Section 3.2, the projected POB at EOC-14 for the limiting steam generator (SG 1-1) was determined to be 3.48 x 10^{-4}. The projected leak rate for the limiting generator (SG 1-1) was 0.68 gpm. Both of these results are below the acceptance criteria of 1 x 10^{-2} and 10.5 gpm, respectively.

Section 5 provides the as-found EOC-14 condition monitoring results and results of a benchmarking study that compares the projected EOC-14 conditions to the as-found conditions. The as-found leak rate and POB at EOC-14 for the limiting steam generator (SG 1-1) were determined to be 0.34 gpm and 1.88 x 10^{-4}, respectively, and are both below the acceptance criteria of 10.5 gpm and 1 x 10^{-2}. The prior cycle operational assessment was recalculated using the POPCD correlation from the 2R13 90-Day Report (Ref. 18) and as shown in Section 5, the recalculated EOC-14 POB, leak rate, and numbers of indications were conservative in all cases compared to EOC-14 actual conditions.

3.0 EOC-14 Inspection Results and Voltage Growth Rates

3.1 EOC-14 Inspection Results

The DCPP 1R14 bobbin coil inspection consisted of a 100% full-length bobbin coil examination of in-service tubes in all four steam generators except for Rows 1 and 2 U-bends which were inspected with +Point™. All in-service TSP intersections in the hot and cold legs were inspected with 0.720" replaceable feet bobbin probes.

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

- 100% of DOS ≥ 1.7 volts
- 100% of DOS in dented intersections
- 100% of DIS (distorted ID support signal at dented intersection)
- 100% of hot leg SPR (Support Plate Residual) ≥ 2.3 volts; minimum of five largest hot leg SPRs in each steam generator
- 100% of prior cycle AONDB indications
- 100% of new DOS in cold leg thinning region
- 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 2122 indications were identified. The results of the inspections are summarized as follows:

1) Voltage dependent growth (VDG) was not apparent in any SG based on previously established threshold criteria, although VDG breakpoints were conservatively established in SGs 1-1 and 1-2.
2) 10 DOS indications were greater than the lower repair limit (2.0 volts). Each of the indications confirmed as ODSCC, required repair by plugging, and were distributed as follows: 5 in SG 1-1, 2 in SG 1-2, 3 in 1-3, and none in SG 1-4. Table 3-1 lists the DOS indications that were above the LRL.
3) No indications were identified that exceeded the upper repair limit of 5.57 volts.
4) No indications less than or equal to 2.0 volt bobbin exceeded the 1.9 volt +Point™ threshold for preventive plugging, per industry guidance in Reference 8.
5) 215 indications at 186 TSP intersections were identified as AONDB (axial ODSCC not detected by bobbin). Table 3-2 lists the indications that were identified as AONDB. These are +Point™ indications of axial ODSCC that have no signal present in the bobbin coil data (no DOS signal). These locations are typically smaller voltage ODSCC, by +Point™, and can be accompanied by a dent that masks any bobbin signal. Per Reference 8, a methodology has been developed to assign a bobbin voltage based on a correlation to the +Point™ voltage. Once the calculated voltages are obtained per Reference 17, the locations are subjected to exclusion criteria defined in Reference 12. All inferred voltages were small, less than about 1.40 equivalent bobbin volts.

6) Overall, 48 DOS/AONDB indications were in tubes that were repaired during 1R14. The breakdown is: 13 in SG 1-1, 19 in SG 1-2, 14 in SG 1-3, and 2 in SG 1-4. This population was used in computing the BOC-15 distributions for the OA calculations.

The average voltage was 0.66 volts, including AONDB indications. The 1R13 average was also 0.66 volts. The average voltage for new DOS indications was 0.37v, excluding prior AONDB. Table 3-3 summarizes the voltage distributions for the as-found condition of the indications, the repaired indications, indications returned to service that were either confirmed by +Point™ or not inspected with +Point™ and the total indications returned to service. Ten confirmed DOS had to be repaired because they exceeded the 2-volt repair limit. The main reasons for repair of the other 38 DOS/AONDB included wedge exclusion criterion, AONDB at >5 volt dent, combined ID/OD degradation at the same intersection, or other pluggable tube degradation.

Reference 8 provides guidelines for preventive tube repair of less than or equal to 2.0 volt bobbin indications to reduce the potential for finding large voltage growth rates for indications left in service. PG&E committed to implement the guideline by performing +Point™ inspection of 100% of greater than 1.7 volt bobbin indications, and to repair any +Point™ confirmed ODSCC with +Point™ amplitude greater than 1.9 volts, as this could be near throughwall and potentially result in a large voltage growth rate in the next cycle. 31 less than 2.0 volt bobbin indications were therefore +Point™ inspected in 1R14 to meet this commitment. All of the indications were confirmed as ODSCC and the +Point™ and bobbin voltages were reviewed. Figures 3-38 to 3-41 plot all of the ODSCC +Point™ voltages versus bobbin voltages. For bobbin amplitudes less than 2.0 volts, no +Point™ amplitudes were greater than 1.9 volts. Therefore, no tubes required preventative plugging per the guideline.

The largest +Point™ amplitude found in 1R14 was 2.37 volts with a DOS voltage of 2.28, and the largest bobbin voltage growth rate was 1.68 v/EFPY.

The +Point™ inspections required for DOS indications were accomplished as a part of the special interest exams. 414 +Point™ inspections were performed where DOS indications were called by bobbin, excluding the AONDB intersections. Of these inspections, 369 were confirmed yielding an overall confirmation rate of about 89%. However, when excluding the cold leg DOS signals from this count (none of which have ever confirmed as crack-like at DCPP), the confirmation rate is 93%, which is typical at DCPP.

The 1R14 +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, and Plus Point indications found at such intersections require plugging. In Reference 9, DCPP determined that a 2.3 volt SPR is the upper 95th value that could potentially mask bobbin indications ≥ 1.0 volt. Per the inspection requirements specified in References 9 and 12, all hot leg intersections with SPRs with voltages ≥ 2.3 volts were inspected with +Point™. In addition, References 9 and 12 require that, if there are less than five hot leg SPRs ≥ 2.3 volts in a given steam generator, the five largest hot leg SPRs in that steam generator should be inspected with +Point™. A total of 6 hot leg SPRs ≥ 2.3 volts were identified and inspected, with no indications detected. Since none of the steam generators contained five SPRs ≥ 2.3 volts, the five largest hot leg SPRs were inspected in each steam generator resulting in a total of 20 inspected with +Point™. Two of the intersections with SPRs <2.3 volts confirmed with small ODSCC indications (AONDB). The +Point™ voltages for these indications were 0.34v for the indication in SG 1-2 R30C41 and 0.18v for the indication in SG 1-4 R13C26. These +Point™ voltages yield inferred bobbin voltages of 0.776v and 0.588v, respectively. These inferred voltages are less than the conservative 1 volt plugging criteria applied for indications detected at support plates with large residual signals.

Figures 3-1 and 3-2 show the as-found voltage distribution (including AONDB) for all indications detected during the 1R14 inspection. Figures 3-3 and 3-4 show the indications removed from service at 1R14. 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 1R14 ECT inspection. Table 3-1 lists all of the indications greater than the 2.0-volt lower repair limit. As previously stated, all of these indications were confirmed as axial ODSCC and were removed from service by plugging.

Of all the DOS indications returned to service, the largest bobbin voltage was 1.99 volts. This indication confirmed as two axial ODSCC indications with +Point™ voltages of 1.47 and 0.17 volts. The single largest +Point™ voltage indication returned to service was 1.65 volts, with a corresponding DOS bobbin voltage of 1.72 volts.

There were 483 intersections returned to service that contained confirmed axial ODSCC at dented TSP intersections. 172 were AONDB intersections and 311 were confirmed bobbin DOS indications. 327 of these intersections contained dents ≤2.0 v and 156 of these intersections contained dents between 2 and 5 volts, and there were no intersections containing >5 volt dent since it is an exclusion criteria. The largest bobbin voltage indication returned to service with a dent at the same TSP was 1.80 volts and confirmed as a 0.40v SAI. The largest +Point™ indication with a dent at the same TSP returned to service is 1.18v, and has a corresponding DOS of 1.40 volts.

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

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

3.2 Voltage Growth Rates

For projection of leak rates and tube burst probabilities at EOC-14, voltage growth rates were developed from the 1R13 and 1R14 inspection data. Cycle 14 was 1.39 EFPY in length per Reference 12. For repeat indications reported as DOS in both inspections, growth rates were determined based on comparison of the voltages called in 1R13 and 1R14. For indications not reported during the 1R13 inspection (i.e. new at 1R14), the indications were sized using the 1R13 ECT signals based on a lookup review. Lookups were also performed for all of the 1R14 DOS locations that were previously reported as DIS. In both of these cases, an OD component could not be always found in the bobbin lookup results, and these intersections were excluded from the growth distributions.

Table 3-4 provides a summary of indications with the largest growth during Cycle 14. 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 six 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. Figure 3-12 provides the CPDF curves of the voltage growth distributions. Reviewing the Table 3-5 average and maximum voltage growth for all indications for each SG as well as the number of new indications in each SG shows that the ODSCC mechanism is most active in SG 1-1 followed closely by SG 1-2. 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.

As discussed in Section 3.2.1 below, the average Cycle 14 growth rates for each SG were less than the average Cycle 13 growth rates. There were 298 newly reported DOS indications in 1R14, the largest of which was 1.20 volts. These values exclude those intersections which had DIS indications reported in 1R13. 297 of these new indications were detected during the 1R13 lookup, sized appropriately, and subsequently included in the growth distributions. There was one new DOS indications that was not detected during the lookup and was, therefore, not included in the growth rate analyses. This indication measured 0.29v with bobbin in SG 1-4 R10C13 3H. The upper 95% growth rates of all new and repeat indications were 0.174 and 0.201 v/EFPY, respectively. The average growth rates for new and repeat indications were 0.042 and 0.034 v/EFPY, respectively. These data show that the new indications grew at about the same rate as the repeat indications. The slow growth of the repeat indications is reflected in the VDG analysis in Section 3.2.2, which shows that no VDG is apparent in Cycle 14 based on previously established threshold criteria.

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-15 projections provided in this document. This guideline either meets, or is more conservative than the guidance provided in References 2 and 6 and Enclosure 3 of Reference 24.

The first step in determining the most conservative growth distribution for each steam generator is to compare the SG-specific and the composite growth distributions for each of the last two cycles. These comparisons are initially done without considering the impact of voltage dependent growth. In order to determine which growth distribution to use for each steam generator in the Cycle 15 operational assessment, four different growth curves must be compared (SG-specific for Cycle 13, SG-specific for Cycle 14, composite for Cycle 13, and composite for Cycle 14).

Figures 3-14 through 3-17 provide graphical comparisons of growth for each steam generator. From these figures, it appears that the Cycle 13 growth rates (either SG-specific or composite) are bounding for all cases. Closer examination of the upper tails of the curves, however, shows that the maximum growth rates for SG 1-1 and SG 1-2 and the composite were higher for Cycle 14 than Cycle 13. Therefore, it was not clearly obvious in any case which growth curve was bounding. For all eight calculations to be performed (POB and leak rate for each steam generator), multiple calculations had to be performed with different growth distributions to determine which growth distribution was bounding. There was relatively little difference in the effects of the different growth rates on the POB and leak rate results. This is evidenced by the fact that, for all four steam generators, the growth curve that gave the bounding result for POB was different than the growth rate that gave the bounding result for the leak rate. In general, Cycle 14 growth rates were more limiting for POB due to the indications in the upper tail, but Cycle 13 growth rates were bounding for the leak rate based on the higher average growth rates. The only exception to this observation is SG 1-3 POB. The limiting growth curve for this case was SG 1-3 Cycle 13 growth. Table 3-8 provides a summary showing the limiting growth curve for all calculations performed. The determination of the limiting growth distributions was performed after the voltage dependent growth analyses and application of the "delta volts adjustment" (if applicable).

3.2.2 Voltage-Dependent Growth Analyses for Cycle 14

The Cycle 14 growth rates were plotted against the BOC voltage for all steam generators, including a composite curve. Their data are shown in Figures 3-18 through 3-22. A threshold slope of 0.1 was defined in Reference 25 as the point at which voltage-dependent growth should be considered in the operational assessment. As shown in the figures, none of the steam generators exceed this value. However, since the largest growth points in both SG 1-1 and SG 1-2 were in indications in the upper BOC-14 voltage ranges, VDG analyses were conservatively performed for these two steam generators and the composite distribution. SG 1-3 and SG 1-4 both had negative slopes and also had no significant growth rates in any BOC voltage range.

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

A significant amount of analysis and evaluation was performed following the 2R11 inspection on voltage growth for ODSCC at TSPs. The evaluations primarily involved statistical breakpoint analysis to determine where the data suggests a change in the slope of the regression curve that defines the growth data. These efforts led to the development of a guidelines document for determining the breakpoints. This document was transmitted to the NRC via Enclosure 3 of Reference 24 and currently resides in Reference 8. These methods were used to determine breakpoints for the Cycle 14 growth data.

Cycle 14 VDG breakpoint analyses were performed for SGs 1-1 and 1-2 and for the composite growth distribution (including all steam generators). Figures 3-23 through 3-25 show the scatter charts and the resulting breakpoints for all of these analyses. The analysis for SG 1-1 yielded two breakpoints at 0.49v and 1.62v, and SG 1-2 yielded a single breakpoint at 0.80v. The composite analysis also yielded a single breakpoint at 0.80v. Tables 3-8 through 3-11 and Figures 3-26 through 3-28 provide the growth distributions and cumulative probability distribution function (CPDF) curves, respectively, for the Cycle 14 VDG analyses. These tables and figures reflect the results after application of the delta volts adjustments as discussed in Section 3.2.4 of this report. As shown in Figures 3-26 through 3-28, the growth rates for the higher VDG bins bound the lower bins, indicating it would be conservative to apply voltage dependent growth in EOC-15 projections when Cycle 14 growth is used.

3.2.3 Voltage-Dependent Growth Analyses for Cycle 13

As discussed in Section 3.2.1, in some cases, the Cycle 13 growth rates were determined to bound the Cycle 14 growth rates. This section provides the VDG breakpoint analyses for the Cycle 13 growth curves that were used in the EOC-15 Monte Carlo analyses.

Tables 3-12 through 3-15 and Figures 3-29 through 3-32 provide the results of the breakpoint analyses for the Cycle 13 growth rates used in the POB and leak rate calculations documented in this report. The Cycle 13 growth rates used include the composite distribution plus SG-specific distributions used for SGs 1-1, 1-3, and 1-4. These tables are identical to those provided in the 1R13 90 day report (Reference 7). As shown in the figures, SG 1-1 had two breakpoints at 0.5v and 0.98v, SG 1-3 had a single breakpoint of 0.60v, SG 1-4 had a single breakpoint of 1.00v, and the composite distribution yielded two breakpoints at 0.50v and 0.99v. The Cycle 13 CPDF curves are shown in Figures 3-33 through 3-36.

3.2.4 Delta Volts Adjustment

Another part of the growth guideline provided in Reference 25 involves implementation of a "delta volts adjustment" when implementing POPCD in operational assessment calculations. The purpose of this adjustment is to account for the possibility that the growth rates may increase over the next operating cycle. The intent of the adjustment procedure is to increase growth in a specific VDG bin when a comparison between cycle N and cycle N-1 indicates such. The growth rate guidelines that PG&E committed to utilize in combination with POPCD do not specifically address the case where growth rates decrease over subsequent cycles. The guidelines were written on the premise that once VDG is experienced, increasing growth would likely continue to occur. This is not the case in comparing Cycles 13 and 14.

The amount of the adjustment is determined by comparing the average growth from Cycle 14 to the average growth from Cycle 13 for each VDG bin. Tables 3-16 and 3-17 provide the details for the Cycle 14 and Cycle 13 breakpoints, respectively. Per the Reference 25 guideline, if the Cycle 14 data has a higher average growth rate than the Cycle 13 data, then the difference between the average growth rates would be added to each growth rate value in the distribution being used prior to binning the data. As shown in these tables, the only bin where an adjustment is required is Bin 2 for SG 1-2. This growth bin shows an increase using both the Cycle 13 and the Cycle 14 breakpoints. However, the Cycle 13 growth rates for SG 1-2 are not being used. Therefore, the 0.031 v/efpy adjustment shown in Table 3-17 was not used. The Cycle 14 growth rates for SG 1-2 were determined to be bounding for the SG 1-2 POB calculation. Therefore, an adjustment of 0.029 v/EFPY from Table 3-16 was applied to the Bin 2 growth rates for this case.

3.2.5 Growth Summary

As discussed in Section 3.2.1, multiple calculations had to be performed for each POB and leak rate calculation to determine which growth distribution provided the most limiting POB and leak rate result. The limiting growth rates are shown in Table 3-8.

Tables 3-9 through 3-15 show the growth distributions that were used in the Monte Carlo analyses for EOC-15. These curves are shown graphically in Figures 3-26 through 3-28 and Figures 3-33 through 3-36. As required by Generic Letter 95-05, the negative growth values were included as zero growth rates in the ARC calculations.

3.3 Voltage Distributions Used for Monte Carlo Analyses

Now that the breakpoints for the growth bins have been established, the BOC-15 voltage distributions to be used in the Monte Carlo simulations can be defined. Table 3-3 shows the voltage distributions for the as-found and repaired indications. However, additional voltage bins must be inserted at the value of the VDG breakpoints. For example, in Table 3-18, additional voltage bins at 0.49v and 1.62v were inserted into the SG 1-1 voltage distribution. Tables 3-18 and 3-19 show the BOC-15 voltage distributions used in the POB and leak rate calculations, respectively. Adding these additional voltage bins forces the Monte Carlo simulation codes to apply each VDG growth distribution to the correct number of indications.

3.4 Probe Wear Criteria

In order to maintain consistent detection and sizing capabilities throughout the inspection, probe wear is monitored by following the requirements of Reference 15, which is documented in Reference 13. 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 1R14 eddy current inspection resulted in 48 bobbin indications in excess of 1.5 volts that were inspected with a worn probe, termed as RSS (retest support signal) indications. Table 3-20 shows these RSS indications, including any less than 1.5 volt DOS indications in the same tube inspected with a worn probe, along with the retested DOS indications in a subsequent calibration group with a good probe. Figure 3-37 shows a comparison of the worn probe and good probe voltages. The final acceptable DOS voltage values compare reasonably well with the RSS voltages. In the majority of cases, the voltage of the DOS was lower than the corresponding RSS. The average change between the initial voltages (both DOS and RSS) relative to the final DOS call was 0.30%. There was only one instance (R26C32 in SG 1-1) where the final DOS indication (1.82 volts) exceeded the RSS indication (1.52 volts) by more than 15% (20%).

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 1R14 DOS indications that were ≥0.5 volts and were inspected on cal groups that failed the probe wear check in 1R13. As shown in Table 3-21, with the exception of R36C67 in SG 1-1 and R34C21 in SG 1-2, there are no newly reported DOS indications greater than or equal to 1 volt in tubes that were inspected with worn probes in 1R13. The lookup voltages for these tubes were 0.84 volts and 1.05 volts, respectively, showing that the voltage changes were not due to a probe wear condition, but simply a matter of POD. Additionally, about 75% of the new indications were < 0.5 volts in 1R13 based on the historical lookups performed. This also indicates that new indications are more a result of probability of detection rather than whether the tube was inspected with a worn probe in 1R13. The percentages do not indicate that a disproportionate number of new DOS >0.5 are present in tubes that were inspected with a worn probe in the previous outage.

Table 3-22 summarizes new DOS indications for probe wear comparisons. Overall there were 1936 DOS indications detected in the 1R14 inspection. 298 (about 15%) of the DOS indications were newly-reported indications (not reported as DIS or DOS in 1R13). Of the 298 total new indications, 153 (about 51%) were in tubes inspected with a worn probe in 1R13 and 145 were in tubes inspected with a good probe in 1R13. Additionally, the number of new indications ≥ 0.5 volts was determined to be 105. Out of these, 45 (about 43%) were in tubes that were inspected with a worn probe in 1R13. This confirms that a tube tested with a worn probe in 1R13 is no more likely to contain a large DOS in 1R14 than a tube tested with a good probe in 1R13.

Additionally, the 1R13 results were reviewed to determine the number of inspections performed with probes that passed and failed the probe wear check. These results are shown in Table 3-23. This review showed that the number of inspections performed with "ARC OUT" probes was 5794, compared to 9056 inspections that were performed with "ARC IN" probes. This total number of examinations is greater than the number of tubes in service because several tubes have multiple examinations. The ratio of ARC OUT tube inspections to the total number of bobbin inspections is about 0.39 (or 39%). This percentage is nearly equivalent to the percentage of new DOSs that were previously inspected with worn probes (about 51%). This demonstrates that the number of new indications is not biased towards the tubes that were inspected with worn probes in 1R13.

In summary, the NRC analysis requirements regarding probe wear monitoring were met during the 1R14 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 13 was 10.5%/EFPY (Table 3-6), the required 30%/EFPY was used for the upper repair limit calculation. The structural limit used for this calculation is based on the Addendum 6 database. Based on the following formula, the upper repair limit was calculated to be 5.57v.

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

where:
V_{URL} = upper voltage repair limit,
V_{NDE} = NDE voltage measurement uncertainty = 20%,
V_{CG} = voltage growth anticipated between inspections = 30%/EFPY x 1.63 EFPY = 48.9%,
V_{SL} = voltage structural limit from the burst pressure – Bobbin voltage correlation, where the limit of 9.40 volts was used based on Reference 8.

3.6 *NDE Uncertainty Distributions*

NDE uncertainties must be taken into account when projecting the end-of-cycle voltages for the next operating cycle. The NDE uncertainties used in the calculations of the EOC-15 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 3-38.

3.7 *+Point™ to Bobbin Voltage Correlation*

In the response (Ref. 10) to one of the NRC RAIs on the 1R13 90-Day Report, an analysis was performed comparing the +Point™ to bobbin voltage correlation using data from both DCPP units versus data from Unit 1 only. This analysis showed that the voltages obtained from the previous correlation (using data from both units) were slightly non-conservative for Unit 1. In Reference 10, PG&E committed to use the updated Unit 1 correlation during the 1R14 inspection. This correlation from Reference 17 is shown below:

$$V_{Bobbin-95UCL} = V_{+PT} * 1.194 + 0.348 + \sqrt{0.000502 + 0.00423(V_{+PT} - 0.368)^2}$$

In Reference 19, 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 1R14, 21 of the 144 1R13 returned to service AONDB indications were detected with bobbin and were reported as DOS. Table 3-25 provides the comparison of assigned voltages to bobbin voltages. Comparing the 1R13 inferred voltage to the 1R14 DOS voltage, results in an average decrease of -0.07 v/EFPY, which is less than the average growth rate for DOS indications detectable in both inspections, 0.035 v/EFPY. There are a few exceptions that have a higher change between 1R13 inferred versus 1R14 DOS voltage. The most significant of these cases is the indication at 2H in SG 1-3 R23C31. This location had an inferred 1R13 bobbin voltage of 0.73v as compared to a 1R14 DOS voltage of 2.27v, thus yielding an apparent growth rate of 1.11 v/EFPY. In this case, comparing inferred to inferred voltages between the two inspections is more appropriate, since they are from the same technique (+Point™) and are not as suspect to influence from the dent signal that exists at these TSPs. In this case, the "inferred to inferred" voltage change is 0.23 v/EFPY which is much more in line with the rest of the growth population. It should also be noted that this location was reported as a 1.75v DIS in 1R13.

As a prudent measure, the bobbin to +Point™ voltage correlation continues to be assessed by comparing the inferred bobbin voltages against the measured bobbin voltages for all of the intersections that had both bobbin DOS indications and +Point™ indications of axial ODSCC. The 1R14 +Point™ indications were assigned bobbin voltages based on the equation above.

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

These inferred bobbin voltages were then compared to the measured bobbin voltages to ensure that the inferred voltages are generally conservative relative to the measured bobbin voltages. There were a total of 369 intersections with DOS indications that were confirmed as containing axial ODSCC with +Point™. In 248 of these 369 cases (about 67%), 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 0.10v over-prediction, indicating conservatism in the voltage correlation across the entire data set.

In 1R14, the largest inferred voltage for an AONDB indication was 1.40v. Since the +Point™ to bobbin voltage correlation was only used for intersections with inferred voltages less than or equal to 1.40v, this is the voltage range of interest for this comparison. When only the inferred voltages less than or equal to 1.40v are considered, 227 of 329 (about 69%) 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 0.11v over-prediction.

Figure 3-39 shows these comparisons graphically. This figure shows the inferred voltages plotted against the measured bobbin voltages. The linear regression fit shows that, in the region of interest (<=1.40v inferred volts), the inferred bobbin voltage is comparable to the measured bobbin voltage. Based on the facts that about 69% of the voltages are over predicted and the average difference in voltages is a 0.11v over-prediction in the range of voltages where it is utilized, the +Point™ to bobbin voltage correlation is shown to provide reasonable and conservative results at 1R14.

Table 3-1: 1R14 DOS >2 Volts

SG	Row	Col	Ind	Elev	Volts
11	1	67	DOS	2H	2.06
11	3	60	DOS	1H	2.15
11	7	62	DOS	1H	2.28
11	10	39	DOS	1H	2.49
11	12	2	DOS	1H	4.2
12	21	82	DOS	1H	3.61
12	25	61	DOS	1H	2.36
13	9	58	DOS	3H	2.06
13	19	90	DOS	1H	2.01
13	23	31	DOS	2H	2.27

Table 3-2: 1R14 AONDB Indications

SG	Row	Col	Elev	Ind	+Pt Volts	Dent Voltage	Reason for Repair	Inferred Bobbin Volts	
								Indication	Intersection
SG11	2	7	3H	SAI	0.24	3.85		0.658	0.658
SG11	2	26	2H	SAI	0.29	2.33		0.717	0.928
SG11	2	26	2H	SAI	0.18	2.33		0.588	
SG11	5	91	2H	SAI	0.22	2.08		0.635	0.635
SG11	6	93	1H	SAI	0.13	0.75	SAI-OD @ 1H Wedge	0.530	0.530
SG11	7	68	1H	SAI	0.29	0.5		0.717	1.093
SG11	7	68	1H	SAI	0.38	0.5		0.824	
SG11	9	43	1H	SAI	0.2	1.04		0.612	0.612
SG11	11	85	3H	SAI	0.11	2.49		0.507	0.507
SG11	16	58	1H	SAI	0.22	3.43		0.635	0.635
SG11	16	69	2H	SAI	0.21	0.8		0.623	0.623
SG11	17	13	2H	SAI	0.32	1.04		0.753	0.753
SG11	17	28	2H	SAI	0.17	3.36		0.577	0.577
SG11	17	80	2H	SAI	0.13	2.14		0.530	0.530
SG11	18	31	2H	SAI	0.34	2.26		0.776	0.776
SG11	18	76	1H	SAI	0.13	0.79		0.530	0.734
SG11	18	76	1H	SAI	0.11	0.79		0.507	
SG11	20	40	3H	SAI	0.15	0.32		0.554	0.554
SG11	20	44	1H	SAI	0.32	0.37		0.753	1.137
SG11	20	44	1H	SAI	0.27	0.37		0.694	
SG11	20	44	1H	SAI	0.1	0.37		0.496	
SG11	20	52	1H	SAI	0.13	3.29		0.530	0.530
SG11	20	62	2H	SAI	0.22	3.28		0.635	0.635
SG11	21	77	2H	SAI	0.17	1.45		0.577	0.577
SG11	23	38	2H	SAI	0.18	4.06		0.588	0.588
SG11	23	54	1H	SAI	0.14	1.6		0.542	0.542
SG11	25	60	1H	SAI	0.17	0.98		0.577	0.792
SG11	25	60	1H	SAI	0.14	0.98		0.542	
SG11	25	71	1H	SAI	0.19	0.48		0.600	0.600
SG11	26	28	1H	SAI	0.31	4.66		0.741	0.741
SG11	26	80	1H	SAI	0.52	0.38		0.993	0.993
SG11	27	44	2H	SAI	0.33	4.34		0.765	0.986
SG11	27	44	2H	SAI	0.21	4.34		0.623	
SG11	28	36	1H	SAI	0.13	0.81		0.530	0.801
SG11	28	36	1H	SAI	0.19	0.81		0.600	
SG11	28	64	2H	SAI	0.3	1.46		0.729	0.937
SG11	28	64	2H	SAI	0.18	1.46		0.588	
SG11	33	34	1H	SAI	0.33	1.71		0.765	0.979
SG11	33	34	1H	SAI	0.2	1.71		0.612	
SG11	33	68	2H	SAI	0.19	0.19		0.600	0.600
SG11	36	42	2H	SAI	0.23	1.19		0.647	0.647
SG11	37	56	2H	SAI	0.21	1.62		0.623	0.623
SG11	38	49	2H	SAI	0.33	0.73		0.765	0.765
SG11	42	48	1H	SAI	0.22	0.42		0.635	0.635

Table 3-2: 1R14 AONDB Indications

SG	Row	Col	Elev	Ind	+Pt Volts	Dent Voltage	Reason for Repair	Inferred Bobbin Volts	
								Indication	Intersection
SG12	2	39	1H	SAI	0.17	2.3		0.577	0.577
SG12	5	20	6H	SAI	0.27	2.55		0.694	0.694
SG12	5	67	3H	SAI	0.27	1.22		0.694	0.956
SG12	5	67	3H	SAI	0.24	1.22		0.658	
SG12	5	72	2H	SAI	0.15	1.76	SAI ID/OD@2H	0.554	0.554
SG12	5	91	5H	SAI	0.24	3.1		0.658	0.658
SG12	6	14	1H	SAI	0.32	2.86		0.753	0.753
SG12	6	49	1H	SAI	0.32	2.46		0.753	0.753
SG12	6	63	2H	SAI	0.2	1.94		0.612	0.612
SG12	6	67	1H	SAI	0.31	3.87		0.741	0.946
SG12	6	67	1H	SAI	0.18	3.87		0.588	
SG12	6	81	1H	SAI	0.49	3.87		0.957	0.957
SG12	6	81	5H	SAI	0.25	4.3		0.670	0.670
SG12	6	92	1H	SAI	0.32	3.74		0.753	0.753
SG12	7	31	1H	SAI	0.2	2.25	SAI ID/AONDB@1H	0.612	0.873
SG12	7	31	1H	SAI	0.21	2.25	SAI ID/AONDB@1H	0.623	
SG12	7	54	1H	SAI	0.2	3.74		0.612	0.612
SG12	7	80	5H	SAI	0.14	2.05		0.542	0.542
SG12	7	90	2H	SAI	0.14	2.41		0.542	0.542
SG12	8	17	1H	SAI	0.23	3.66		0.647	0.647
SG12	9	33	1H	SAI	0.24	2.3		0.658	0.658
SG12	9	45	7H	SAI	0.36	2.55		0.800	0.800
SG12	9	55	1H	SAI	0.17	1.38		0.577	0.577
SG12	9	76	1H	SAI	0.26	2.3		0.682	0.682
SG12	9	84	3H	SAI	0.24	2.67		0.658	0.658
SG12	10	43	1H	SAI	0.4	1.88		0.848	0.848
SG12	10	45	2H	SAI	0.24	1.56		0.658	0.658
SG12	10	68	2H	SAI	0.13	2.07		0.530	0.530
SG12	11	18	2H	SAI	0.29	3.81		0.717	0.717
SG12	11	40	1H	SAI	0.51	4.04		0.981	0.981
SG12	11	61	1H	SAI	0.34	2.01		0.776	0.776
SG12	11	75	2H	SAI	0.39	3.86		0.836	1.102
SG12	11	75	2H	SAI	0.29	3.86		0.717	
SG12	11	75	4H	SAI	0.17	1.58		0.577	0.577
SG12	11	82	3H	SAI	0.13	2.24	SCI-OD @ 4H+0.29	0.530	0.530
SG12	11	91	1H	SAI	0.19	3.38		0.600	0.600
SG12	12	76	1H	SAI	0.13	3.34		0.530	0.530
SG12	13	66	2H	SAI	0.23	3.17		0.647	0.647
SG12	14	7	2H	SAI	0.28	3.13		0.705	0.705
SG12	14	79	4H	SAI	0.17	2.49		0.577	0.577
SG12	14	80	5H	SAI	0.31	3.59		0.741	0.741
SG12	15	85	2H	SAI	0.24	3.11		0.658	0.658
SG12	16	55	2H	SAI	0.21	2.54		0.623	0.623
SG12	17	37	2H	SAI	0.25	1.76		0.670	0.670
SG12	17	70	1H	SAI	0.25	2.38		0.670	0.670

Table 3-2: 1R14 AONDB Indications

SG	Row	Col	Elev	Ind	+Pt Volts	Dent Voltage	Reason for Repair	Inferred Bobbin Volts	
								Indication	Intersection
SG12	18	14	1H	SAI	0.28	1.56		0.705	0.705
SG12	18	22	1H	SAI	0.2	3.34		0.612	0.612
SG12	19	70	2H	SAI	0.17	3.74		0.577	0.841
SG12	19	70	2H	SAI	0.2	3.74		0.612	
SG12	20	83	1H	SAI	0.28	2.5		0.705	1.085
SG12	20	83	1H	SAI	0.38	2.5		0.824	
SG12	20	89	4H	SAI	0.33	1.82		0.765	0.765
SG12	21	68	2H	SAI	0.29	5.29	AONDB @2H & DNT>5	0.717	0.717
SG12	21	72	4H	SAI	0.26	1.08		0.682	0.682
SG12	21	87	1H	SAI	0.2	1.57		0.612	0.952
SG12	21	87	1H	SAI	0.3	1.57		0.729	
SG12	22	79	2H	SAI	0.22	1.19		0.635	0.635
SG12	22	83	1H	SAI	0.24	2.6		0.658	0.658
SG12	23	52	1H	SAI	0.17	3.52		0.577	0.577
SG12	23	71	2H	SAI	0.16	1.95		0.565	0.833
SG12	23	71	2H	SAI	0.2	1.95		0.612	
SG12	24	38	1H	SAI	0.13	1.07		0.530	0.530
SG12	24	80	3H	SAI	0.15	2.99		0.554	0.554
SG12	25	66	2H	SAI	0.1	1.04		0.496	0.496
SG12	25	77	4H	SAI	0.13	1.67		0.530	0.530
SG12	25	85	2H	SAI	0.41	1.46		0.860	0.860
SG12	27	19	1H	SAI	0.32	4.21		0.753	0.753
SG12	27	44	1H	SAI	0.21	1.53		0.623	0.623
SG12	27	44	2H	SAI	0.21	0.83		0.623	0.623
SG12	27	46	3H	SAI	0.2	2.77		0.612	0.612
SG12	27	64	1H	SAI	0.17	5.3	AONDB @1H & DNT>5	0.577	0.577
SG12	27	66	2H	SAI	0.11	2.17		0.507	0.742
SG12	27	66	2H	SAI	0.14	2.17		0.542	
SG12	27	83	2H	SAI	0.26	1.21		0.682	0.682
SG12	27	83	4H	SAI	0.13	1.07		0.530	0.530
SG12	28	36	2H	SAI	0.24	1.11		0.658	0.658
SG12	28	45	1H	SAI	0.21	2.42		0.623	0.623
SG12	28	71	2H	SAI	0.31	2.46		0.741	0.741
SG12	29	48	1H	SAI	0.18	0.78		0.588	0.588
SG12	29	49	3H	SAI	0.18	1.93		0.588	0.588
SG12	29	69	1H	SAI	0.34	4.59		0.776	0.776
SG12	30	41	1H	SAI	0.34	SPR		0.776	0.776
SG12	31	44	4H	SAI	0.22	2.63		0.635	0.635
SG12	31	63	1H	SAI	0.46	2.83		0.920	1.404
SG12	31	63	1H	SAI	0.37	2.83		0.812	
SG12	31	63	1H	SAI	0.26	2.83		0.682	
SG12	31	69	4H	SAI	0.29	3.95		0.717	0.717
SG12	31	80	4H	SAI	0.2	4		0.612	0.612
SG12	32	30	2H	SAI	0.27	2.14	SAI ID/AONDB@2H	0.694	0.694
SG12	32	59	3H	SAI	0.24	0.51		0.658	0.658

Table 3-2: 1R14 AONDB Indications

SG	Row	Col	Elev	Ind	+Pt Volts	Dent Voltage	Reason for Repair	Inferred Bobbin Volts	
								Indication	Intersection
SG12	33	40	1H	SAI	0.29	0.55		0.717	0.717
SG12	33	70	2H	SAI	0.23	4.32		0.647	0.874
SG12	33	70	2H	SAI	0.18	4.32		0.588	
SG12	33	71	4H	SAI	0.32	5.06	AONDB @4H & DNT>5	0.753	0.753
SG12	34	66	1H	SAI	0.38	3.65		0.824	1.093
SG12	34	66	1H	SAI	0.29	3.65		0.717	
SG12	34	71	2H	SAI	0.25	2.36		0.670	0.670
SG12	34	77	1H	SAI	0.11	1.54		0.507	0.925
SG12	34	77	1H	SAI	0.2	1.54		0.612	
SG12	34	77	1H	SAI	0.08	1.54		0.473	
SG12	35	50	1H	SAI	0.22	0.52		0.635	0.635
SG12	35	72	1H	SAI	0.17	1.44		0.577	0.577
SG12	36	60	1H	SAI	0.24	4.45		0.658	0.658
SG12	37	45	5H	SAI	0.22	1.26		0.635	0.635
SG12	37	54	1H	SAI	0.19	4.42		0.600	0.600
SG12	37	67	2H	SAI	0.33	5.74	AONDB @2H & DNT>5	0.765	0.765
SG12	38	60	4H	SAI	0.2	4.02		0.612	0.612
SG12	39	49	2H	SAI	0.4	1.19		0.848	0.848
SG12	39	70	1H	SAI	0.2	2.21		0.612	0.925
SG12	39	70	1H	SAI	0.27	2.21		0.694	
SG12	42	44	2H	SAI	0.19	2.07		0.600	0.600
SG12	43	34	4H	SAI	0.27	1.89		0.694	0.694
SG12	44	55	2H	SAI	0.23	2.13		0.647	0.647
SG12	45	42	1H	SAI	0.32	1.87		0.753	0.753
SG13	5	20	1H	SAI	0.2	3.41		0.612	0.612
SG13	6	36	1H	SAI	0.21	3.32		0.623	0.623
SG13	6	79	1H	SAI	0.37	4.03		0.812	0.812
SG13	8	22	1H	SAI	0.21	3.08		0.623	0.623
SG13	10	68	2H	SAI	0.2	1.92		0.612	0.612
SG13	10	79	3H	SAI	0.15	1.42		0.554	0.554
SG13	11	76	2H	SAI	0.14	2.26	SCI-OD @ TSH-0.01	0.542	0.542
SG13	12	73	3H	SAI	0.38	2.07		0.824	0.824
SG13	16	80	2H	SAI	0.25	2.23		0.670	0.670
SG13	19	80	1H	SAI	0.44	3.2		0.896	0.896
SG13	21	34	1H	SAI	0.3	2.24		0.729	0.729
SG13	22	55	1H	SAI	0.3	2.39		0.729	0.729
SG13	25	82	1H	SAI	0.14	2.83		0.542	0.542
SG13	26	41	1H	SAI	0.15	2.02		0.554	0.554
SG13	27	49	1H	SAI	0.18	1.69		0.588	0.588
SG13	29	66	1H	SAI	0.16	2.23		0.565	0.565
SG14	2	9	3H	SAI	0.1	2.28		0.496	0.496
SG14	5	72	2H	SAI	0.16	3.76		0.565	0.565
SG14	7	30	1H	SAI	0.18	3.7		0.588	0.588
SG14	7	34	1H	SAI	0.16	5.69	AONDB @ 1H & DNT>5V	0.565	0.565
SG14	7	38	1H	SAI	0.16	4.36		0.565	0.565

Table 3-2: 1R14 AONDB Indications

SG	Row	Col	Elev	Ind	+Pt Volts	Dent Voltage	Reason for Repair	Inferred Bobbin Volts	
								Indication	Intersection
SG14	8	43	1H	SAI	0.18	1.75		0.588	0.588
SG14	10	35	1H	SAI	0.16	2.48		0.565	0.565
SG14	10	93	1H	SAI	0.23	2.33		0.647	0.647
SG14	12	31	3H	SAI	0.16	1.33		0.565	0.565
SG14	12	32	1H	SAI	0.22	2.48		0.635	0.915
SG14	12	32	1H	SAI	0.24	2.48		0.658	
SG14	12	43	1H	SAI	0.12	2.3		0.519	0.519
SG14	13	10	2H	SAI	0.12	1.65		0.519	0.519
SG14	13	26	1H	SAI	0.18	SPR		0.588	0.588
SG14	13	31	1H	SAI	0.23	2.37		0.647	0.647
SG14	13	51	1H	SAI	0.21	2.15		0.623	0.623
SG14	14	7	2H	SAI	0.43	2.15		0.884	1.014
SG14	14	7	2H	SAI	0.1	2.15		0.496	
SG14	14	19	3H	SAI	0.17	2.86		0.577	0.577
SG14	15	36	1H	SAI	0.23	4.57		0.647	0.647
SG14	15	52	1H	SAI	0.16	1.89		0.565	0.565
SG14	16	51	1H	SAI	0.29	5.45	AONDB @ 1H & DNT>5V	0.717	0.717
SG14	16	65	2H	SAI	0.15	3.1		0.554	0.554
SG14	16	69	2H	SAI	0.17	3.27		0.577	0.577
SG14	17	32	1H	SAI	0.42	2.02		0.872	0.872
SG14	19	32	1H	SAI	0.64	3.78		1.141	1.141
SG14	19	40	1H	SAI	0.14	3.52		0.542	0.542
SG14	19	47	1H	SAI	0.14	0.27		0.542	0.542
SG14	22	43	1H	SAI	0.2	2.71		0.612	0.612
SG14	24	62	1H	SAI	0.31	1.79		0.741	0.741
SG14	24	68	1H	SAI	0.16	2.46		0.565	0.565
SG14	25	36	1H	SAI	0.24	3.12		0.658	0.658
SG14	30	59	1H	SAI	0.31	2.4		0.741	0.741
SG14	32	70	1H	SAI	0.15	4.35		0.554	0.554
SG14	33	58	1H	SAI	0.7	4.12		1.215	1.215
SG14	36	20	1H	SAI	0.16	3.04		0.565	0.565
SG14	36	47	1H	SAI	0.33	3.55		0.765	0.765
SG14	38	21	1H	SAI	0.19	1.94		0.600	0.600
SG14	40	27	1H	SAI	0.18	3.89		0.588	0.883
SG14	40	27	1H	SAI	0.24	3.89		0.658	
SG14	42	54	1H	SAI	0.28	3.61		0.705	0.705

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

	SG 1-1				SG 1-2				SG 1-3			
Voltage Bin	As-Found EOC-14	Repaired Tubes	DOSs Returned to Service		As-Found EOC-14	Repaired Tubes	DOSs Returned to Service		As-Found EOC-14	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	1	0	1	1	0	0	0	0
0.2	21	0	21	21	16	0	16	16	8	0	8	8
0.3	100	1	98	99	50	2	46	48	28	1	25	27
0.4	145	1	143	144	72	1	70	71	49	2	44	47
0.5	120	1	117	119	78	1	75	77	45	0	40	45
0.6	113	3	109	110	99	3	94	96	43	1	40	42
0.7	75	0	74	75	124	2	119	122	21	0	21	21
0.8	70	2	66	68	80	4	75	76	20	0	19	20
0.9	39	0	39	39	58	2	56	56	25	1	22	24
1	45	0	45	45	36	0	36	36	12	1	10	11
1.1	29	0	29	29	27	1	25	26	18	2	15	16
1.2	19	0	19	19	13	0	12	13	6	1	5	5
1.3	26	0	26	26	10	0	10	10	3	0	3	3
1.4	21	0	21	21	3	0	3	3	9	0	9	9
1.5	19	0	19	19	7	0	7	7	3	1	2	2
1.6	6	0	6	6	5	0	5	5	6	1	5	5
1.7	6	0	6	6	4	0	4	4	2	0	2	2
1.8	10	0	10	10	2	1	1	1	2	0	2	2
1.9	7	0	7	7	0	0	0	0	3	0	3	3
2	3	0	3	3	2	0	2	2	0	0	0	0
2.1	1	1	0	0	0	0	0	0	2	2	0	0
2.2	1	1	0	0	0	0	0	0	0	0	0	0
2.3	1	1	0	0	0	0	0	0	1	1	0	0
2.4	0	0	0	0	1	1	0	0	0	0	0	0
2.5	1	1	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
3.1	0	0	0	0	0	0	0	0	0	0	0	0
3.2	0	0	0	0	0	0	0	0	0	0	0	0
3.3	0	0	0	0	0	0	0	0	0	0	0	0
3.4	0	0	0	0	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0	0	0	0	0
3.6	0	0	0	0	0	0	0	0	0	0	0	0
3.7	0	0	0	0	1	1	0	0	0	0	0	0
3.8	0	0	0	0	0	0	0	0	0	0	0	0
3.9	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	1	1	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
>7	0	0	0	0	0	0	0	0	0	0	0	0
Total	879	13	858	866	689	19	657	670	306	14	275	292
>1V	151	5	146	146	75	4	69	71	55	8	46	47
>2V	5	5	0	0	2	2	0	0	3	3	0	0
>4V	1	1	0	0	0	0	0	0	0	0	0	0

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

	SG 1-4				Composite of All SGs			
Voltage Bin	As-Found EOC-14	Repaired Tubes	DOSs Returned to Service		As-Found EOC-14	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	7	0	7	7	52	0	52	52
0.3	28	0	24	28	206	4	193	202
0.4	27	0	24	27	293	4	281	289
0.5	33	0	32	33	276	2	264	274
0.6	45	1	43	44	300	8	286	292
0.7	28	0	28	28	248	2	242	246
0.8	19	1	17	18	189	7	177	182
0.9	17	0	16	17	139	3	133	136
1	10	0	10	10	103	1	101	102
1.1	8	0	8	8	82	3	77	79
1.2	7	0	7	7	45	1	43	44
1.3	5	0	5	5	44	0	44	44
1.4	5	0	5	5	38	0	38	38
1.5	2	0	2	2	31	1	30	30
1.6	3	0	3	3	20	1	19	19
1.7	2	0	2	2	14	0	14	14
1.8	1	0	1	1	15	1	14	14
1.9	0	0	0	0	10	0	10	10
2	1	0	1	1	6	0	6	6
2.1	0	0	0	0	3	3	0	0
2.2	0	0	0	0	1	1	0	0
2.3	0	0	0	0	2	2	0	0
2.4	0	0	0	0	1	1	0	0
2.5	0	0	0	0	1	1	0	0
2.6	0	0	0	0	0	0	0	0
2.7	0	0	0	0	0	0	0	0
2.8	0	0	0	0	0	0	0	0
2.9	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
3.1	0	0	0	0	0	0	0	0
3.2	0	0	0	0	0	0	0	0
3.3	0	0	0	0	0	0	0	0
3.4	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0
3.6	0	0	0	0	0	0	0	0
3.7	0	0	0	0	1	1	0	0
3.8	0	0	0	0	0	0	0	0
3.9	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	1	1	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
>7	0	0	0	0	0	0	0	0
Total	248	2	235	246	2122	48	2025	2074
>1V	34	0	34	34	315	17	295	298
>2V	0	0	0	0	10	10	0	0
>4V	0	0	0	0	1	1	0	0

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

SG	Row	Col	Elev	Volts	Prev Volts (1R13)	Growth/ EFPY	Plus Pt Results	New?
11	12	2	1H	4.20	1.86	1.683	SAI	Repeat
12	21	82	1H	3.61	1.37	1.612	SAI	Repeat
12	25	61	1H	2.36	1.03	0.957	SAI	Repeat
11	10	39	1H	2.49	1.48	0.727	SAI	Repeat
11	7	62	1H	2.28	1.30	0.705	SAI	Repeat
11	5	4	1H	1.29	0.41	0.633	Not Insp	Repeat
13	41	63	2H	1.17	0.36	0.583	SAI	Repeat

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

Tube Support Plate	SG 1-1					Tube Support Plate	SG 1-2				
	No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY		No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY
1H	502	4.20	0.75	1.68	0.05	1H	292	3.61	0.71	1.61	0.05
2H	245	2.06	0.57	0.43	0.04	2H	198	1.94	0.65	0.38	0.03
3H	80	1.48	0.54	0.21	0.03	3H	93	1.74	0.62	0.36	0.03
4H	36	1.10	0.51	0.19	0.04	4H	59	1.65	0.59	0.21	0.02
5H	4	0.60	0.46	0.12	0.06	5H	28	1.01	0.59	0.14	0.02
6H	4	0.65	0.47	0.15	0.03	6H	11	0.69	0.55	0.15	0.01
7H	1	0.28	0.28	0.04	0.04	7H	2	0.80	0.79	0.04	0.04
CL	7	0.73	0.51	0.11	0.02	CL	6	1.02	0.59	0.08	0.02
All Inds	879	4.20	0.67	1.68	0.04	All Inds	689	3.61	0.66	1.61	0.04

Tube Support Plate	SG 1-3					Tube Support Plate	SG 1-4				
	No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY		No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY
1H	148	2.01	0.69	0.50	0.01	1H	136	1.74	0.68	0.29	0.03
2H	70	2.27	0.66	0.58	0.02	2H	51	1.37	0.61	0.27	0.02
3H	29	2.06	0.82	0.21	0.02	3H	26	1.65	0.69	0.13	0.03
4H	22	1.59	0.59	0.09	0.01	4H	17	1.96	0.54	0.33	0.06
5H	19	1.83	0.59	0.22	0.01	5H	7	0.74	0.45	0.05	-0.01
6H	6	0.78	0.46	0.06	0.00	6H	3	0.59	0.42	0.04	0.01
7H	1	0.71	0.71	0.03	0.03	7H	0	0.00	0.00	0.00	0.00
CL	11	1.01	0.52	0.10	0.02	CL	8	0.71	0.40	0.07	0.03
All Inds	306	2.27	0.67	0.58	0.02	All Inds	248	1.96	0.64	0.33	0.03

Tube Support Plate	Composite of All Four SGs				
	No. of Indications	Max Voltage	Average Voltage	Max Growth/ EFPY	Average Growth/ EFPY
1H	1078	4.20	0.72	1.68	0.04
2H	564	2.27	0.61	0.58	0.03
3H	228	2.06	0.63	0.36	0.03
4H	134	1.96	0.56	0.33	0.03
5H	58	1.83	0.57	0.22	0.01
6H	24	0.78	0.50	0.15	0.01
7H	4	0.80	0.64	0.04	0.04
CL	32	1.02	0.50	0.11	0.02
All Inds	2122	4.20	0.66	1.68	0.04

Table 3-6: DCPP-1 Voltage Growth for Cycles 9 through 14

		SG 1-1	SG 1-2	SG 1-3	SG 1-4	All
Cycle 9	Avg BOC Volts	0.281	0.307	0.457	0.327	0.343
	Average Growth Per EFPY	0.113	0.072	0.127	0.151	0.102
	Average Percent Growth Per EFPY	40.2%	23.3%	27.8%	46.0%	29.6%
Cycle 10	Avg BOC Volts	0.350	0.405	0.602	0.546	0.437
	Avg Growth Per EFPY	0.171	0.135	0.123	0.108	0.143
	Average Percent Growth Per EFPY	49.0%	33.3%	20.4%	19.8%	32.8%
Cycle 11	Avg BOC Volts	0.440	0.548	0.653	0.500	0.515
	Avg Growth Per EFPY	0.127	0.091	0.066	0.085	0.102
	Average Percent Growth Per EFPY	28.8%	16.6%	10.1%	17.0%	19.8%
Cycle 12	Avg BOC Volts	0.488	0.565	0.664	0.484	0.535
	Avg Growth Per EFPY	0.178	0.091	0.068	0.132	0.130
	Average Percent Growth Per EFPY	36.4%	16.0%	10.6%	27.2%	24.3%
Cycle 13	Avg BOC Volts	0.589	0.589	0.621	0.555	0.590
	Avg Growth Per EFPY	0.070	0.043	0.061	0.079	0.062
	Average Percent Growth Per EFPY	11.9%	7.3%	9.8%	14.2%	10.5%
Cycle 14	Avg BOC Volts	0.605	0.603	0.653	0.598	0.611
	Avg Growth Per EFPY	0.043	0.037	0.015	0.028	0.035
	Average Percent Growth Per EFPY	7.1%	6.1%	2.3%	4.7%	5.7%

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

Delta Volts per EFPY	SG 1-1		SG 1-2		SG 1-3		SG 1-4		Total	
	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF	No. of Obs.	CPDF
<=0.0	286	0.339	220	0.376	133	0.460	73	0.349	712	0.369
0.1	400	0.813	245	0.795	121	0.879	105	0.852	871	0.821
0.2	108	0.941	94	0.956	20	0.948	26	0.976	248	0.950
0.3	33	0.980	18	0.986	8	0.976	4	0.995	63	0.983
0.4	10	0.992	5	0.995	3	0.986	1	1.000	19	0.993
0.5	3	0.995	1	0.997	3	0.997	0	1.000	7	0.996
0.6	0	0.995	0	0.997	1	1.000	0	1.000	1	0.997
0.7	1	0.996	0	0.997	0	1.000	0	1.000	1	0.997
0.8	2	0.999	0	0.997	0	1.000	0	1.000	2	0.998
0.9	0	0.999	0	0.997	0	1.000	0	1.000	0	0.998
1	0	0.999	1	0.998	0	1.000	0	1.000	1	0.999
1.1	0	0.999	0	0.998	0	1.000	0	1.000	0	0.999
1.2	0	0.999	0	0.998	0	1.000	0	1.000	0	0.999
1.3	0	0.999	0	0.998	0	1.000	0	1.000	0	0.999
1.4	0	0.999	0	0.998	0	1.000	0	1.000	0	0.999
1.5	0	0.999	0	0.998	0	1.000	0	1.000	0	0.999
1.6	0	0.999	0	0.998	0	1.000	0	1.000	0	0.999
1.7	1	1.000	1	1.000	0	1.000	0	1.000	2	1.000
1.8	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
1.9	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.1	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.2	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.3	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.4	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.5	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.6	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.7	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.8	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
2.9	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.1	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.2	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.3	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.4	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
3.5	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
>3.5	0	1.000	0	1.000	0	1.000	0	1.000	0	1.000
Total	844	NA	585	NA	289	NA	209	NA	1927	NA
Upper 95% Growth	0.209		0.194		0.203		0.144		0.194	

Table 3-8: Summary of Bounding Growth Distributions

SG	Bounding Growth Rates Used in Monte Carlo Simulations	
	POB	Leak Rate
SG 1-1	SG 1-1 Cycle 14	SG 1-1 Cycle 13
SG 1-2	SG 1-2 Cycle 14	Composite Cycle 13
SG 1-3	SG 1-3 Cycle 13	Composite Cycle 13
SG 1-4	Composite Cycle 14	SG 1-4 Cycle 13

Table 3-9: Cycle 14 Voltage Dependent Growth for SG 1-1 (used for SG 1-1 POB)

Growth per EFPY	BOC Voltage		
	<=0.49v	0.5to1.62v	>1.62v
<=0	140	141	5
0.1	222	170	8
0.2	42	64	2
0.3	16	17	0
0.4	1	9	0
0.5	0	3	0
0.6	0	0	0
0.7	1	0	0
0.8	0	2	0
0.9	0	0	0
1	0	0	0
1.1	0	0	0
1.2	0	0	0
1.3	0	0	0
1.4	0	0	0
1.5	0	0	0
1.6	0	0	0
1.7	0	0	1
1.8	0	0	0
1.9	0	0	0
2	0	0	0
>2	0	0	0
Total	422	406	16

Table 3-10: Cycle 14 Voltage Dependent Growth for SG 1-2 (used for SG 1-2 POB)

Growth per EFPY	BOC Voltage	
	<=0.8v	>0.8v
<=0	161	37
0.1	205	50
0.2	74	30
0.3	13	7
0.4	4	1
0.5	0	0
0.6	0	1
0.7	0	0
0.8	0	0
0.9	0	0
1	0	1
1.1	0	0
1.2	0	0
1.3	0	0
1.4	0	0
1.5	0	0
1.6	0	0
1.7	0	1
1.8	0	0
1.9	0	0
2	0	0
>2	0	0
Total	457	128

Table 3-11: Cycle 14 Voltage Dependent Growth for All SGs (used for SG 1-4 POB)

Growth per EFPY	BOC Voltage	
	<=0.8v	>0.8v
<=0	520	192
0.1	730	179
0.2	153	57
0.3	42	21
0.4	9	10
0.5	3	4
0.6	1	0
0.7	1	0
0.8	0	2
0.9	0	0
1	0	1
1.1	0	0
1.2	0	0
1.3	0	0
1.4	0	0
1.5	0	0
1.6	0	0
1.7	0	2
1.8	0	0
1.9	0	0
2	0	0
>2	0	0
Total	1459	468

Table 3-12: Cycle 13 Voltage Dependent Growth for SG 1-1 (Used for SG 1-1 Leak Rate)

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

Table 3-13: Cycle 13 Voltage Dependent Growth for SG 1-3 (Used for SG 1-3 POB)

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

Table 3-14: Cycle 13 Voltage Dependent Growth for SG 1-4 (Used for SG 1-4 Leak Rate)

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

Table 3-15: Cycle 13 Voltage Dependent Growth for All SGs (Used for SGs 1-2 and 1-3 Leak Rate)

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

Table 3-16: Delta Volts Adjustments Based on Cycle 14 Breakpoints

SG	Cycle	Breakpoint(s)	Average Growth (Volts per EFPY)		
			Bin1	Bin2	Bin3
SG11	Cycle 13	0.49/1.62	0.049	0.088	0.192
	Cycle 14		0.036	0.047	0.112
	Delta		<0	<0	<0
SG12	Cycle 13	0.8	0.053	0.004	NA
	Cycle 14		0.038	0.033	
	Delta		<0	0.029	
SG13	Cycle 13	NA	0.061	NA	NA
	Cycle 14		0.015		
	Delta		<0		
SG14	Cycle 13	NA	0.079	NA	NA
	Cycle 14		0.028		
	Delta		<0		
Composite	Cycle 13	0.8	0.056	0.081	NA
	Cycle 14		0.034	0.040	
	Delta		<0	<0	

Table 3-17: Delta Volts Adjustments Based on Cycle 13 Breakpoints

SG	Cycle	Breakpoint(s)	Average Growth (Volts per EFPY)		
			Bin1	Bin2	Bin3
	Cycle 13		0.049	0.072	0.146
SG11	Cycle 14	0.50 / 0.98	0.036	0.030	0.090
	Delta		<0	<0	<0
	Cycle 13		0.042	0.062	
SG12	Cycle 14	1.25	0.035	0.093	NA
	Delta		<0	0.031	
	Cycle 13		0.060	0.063	
SG13	Cycle 14	0.6	0.029	-0.001	NA
	Delta		<0	<0	
	Cycle 13		0.065	0.170	
SG14	Cycle 14	1	0.029	0.023	NA
	Delta		<0	<0	
	Cycle 13		0.052	0.063	0.095
Composite	Cycle 14	0.50 / 0.99	0.039	0.021	0.059
	Delta		<0	<0	<0

Table 3-18: BOC-15 Voltage Distributions Used for POB Calculations

SG 1-1			SG 1-2			SG 1-3		SG 1-4	
Voltage Bin	As-Found	Repaired	Voltage Bin	As-Found	Repaired	As-Found	Repaired	As-Found	Repaired
0.1	0	0	0.1	1	0	0	0	0	0
0.2	21	0	0.2	16	0	8	0	7	0
0.3	100	1	0.3	50	2	28	1	28	0
0.4	145	1	0.4	72	1	49	2	27	0
0.49	113	1	0.5	78	1	45	0	33	0
0.5	7	0	0.6	99	3	43	1	45	1
0.6	113	3	0.7	124	2	21	0	28	0
0.7	75	0	0.8	80	4	20	0	19	1
0.8	70	2	0.9	58	2	25	1	17	0
0.9	39	0	1	36	0	12	1	10	0
1	45	0	1.1	27	1	18	2	8	0
1.1	29	0	1.2	13	0	6	1	7	0
1.2	19	0	1.3	10	0	3	0	5	0
1.3	26	0	1.4	3	0	9	0	5	0
1.4	21	0	1.5	7	0	3	1	2	0
1.5	19	0	1.6	5	0	6	1	3	0
1.6	6	0	1.7	4	0	2	0	2	0
1.62	3	0	1.8	2	1	2	0	1	0
1.7	3	0	1.9	0	0	3	0	0	0
1.8	10	0	2	2	0	0	0	1	0
1.9	7	0	2.1	0	0	2	2	0	0
2	3	0	2.2	0	0	0	0	0	0
2.1	1	1	2.3	0	0	1	1	0	0
2.2	1	1	2.4	1	1	0	0	0	0
2.3	1	1	2.5	0	0	0	0	0	0
2.4	0	0	2.6	0	0	0	0	0	0

Table 3-18: BOC-15 Voltage Distributions Used for POB Calculations

SG 1-1		
Voltage Bin	As-Found	Repaired
2.5	1	1
2.6	0	0
2.7	0	0
2.8	0	0
2.9	0	0
3	0	0
3.1	0	0
3.2	0	0
3.3	0	0
3.4	0	0
3.5	0	0
3.6	0	0
3.7	0	0
3.8	0	0
3.9	0	0
4	0	0
4.1	0	0
4.2	1	1
4.3	0	0
4.4	0	0
4.5	0	0
Total	**879**	**13**

	SG 1-2		SG 1-3		SG 1-4	
Voltage Bin	As-Found	Repaired	As-Found	Repaired	As-Found	Repaired
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
3.3	0	0	0	0	0	0
3.4	0	0	0	0	0	0
3.5	0	0	0	0	0	0
3.6	0	0	0	0	0	0
3.7	1	1	0	0	0	0
3.8	0	0	0	0	0	0
3.9	0	0	0	0	0	0
4	0	0	0	0	0	0
Total	**689**	**19**	**306**	**14**	**248**	**2**

Table 3-19: BOC-15 Voltage Distributions Used for Leak Rate Calculations

SG 1-1			SG 1-2			SG 1-3		SG 1-4		
Voltage Bin	As-Found	Repaired	Voltage Bin	As-Found	Repaired	As-Found	Repaired	Voltage Bin	As-Found	Repaired
0.1	0	0	0.1	1	0	0	0	0.1	0	0
0.2	21	0	0.2	16	0	8	0	0.2	7	0
0.3	100	1	0.3	50	2	28	1	0.3	28	0
0.4	145	1	0.4	72	1	49	2	0.4	27	0
0.5	120	1	0.5	78	1	45	0	0.5	33	0
0.6	113	3	0.6	99	3	43	1	0.6	45	1
0.7	75	0	0.7	124	2	21	0	0.7	28	0
0.8	70	2	0.8	80	4	20	0	0.8	19	1
0.9	39	0	0.9	58	2	25	1	0.9	17	0
0.98	34	0	0.99	35	0	12	1	1	10	0
1	11	0	1	1	0	18	2	1.1	8	0
1.1	29	0	1.1	27	1	6	1	1.2	7	0
1.2	19	0	1.2	13	0	3	0	1.3	5	0
1.3	26	0	1.3	10	0	9	0	1.4	5	0
1.4	21	0	1.4	3	0	3	1	1.5	2	0
1.5	19	0	1.5	7	0	6	1	1.6	3	0
1.6	6	0	1.6	5	0	2	0	1.7	2	0
1.7	6	0	1.7	4	0	2	0	1.8	1	0
1.8	10	0	1.8	2	1	3	0	1.9	0	0
1.9	7	0	1.9	0	0	0	0	2	1	0
2	3	0	2	2	0	2	2	2.1	0	0
2.1	1	1	2.1	0	0	0	0	2.2	0	0
2.2	1	1	2.2	0	0	1	1	2.3	0	0
2.3	1	1	2.3	0	0	0	0	2.4	0	0
2.4	0	0	2.4	1	1	0	0	2.5	0	0
2.5	1	1	2.5	0	0	0	0	2.6	0	0
2.6	0	0	2.6	0	0	0	0	2.7	0	0

Table 3-19: BOC-15 Voltage Distributions Used for Leak Rate Calculations

SG 1-1		
Voltage Bin	As-Found	Repaired
2.7	0	0
2.8	0	0
2.9	0	0
3	0	0
3.1	0	0
3.2	0	0
3.3	0	0
3.4	0	0
3.5	0	0
3.6	0	0
3.7	0	0
3.8	0	0
3.9	0	0
4	0	0
4.1	0	0
4.2	1	1
4.3	0	0
4.4	0	0
4.5	0	0
Total	**879**	**13**

SG 1-2			SG 1-3	
Voltage Bin	As-Found	Repaired	As-Found	Repaired
2.7	0	0	0	0
2.8	0	0	0	0
2.9	0	0	0	0
3	0	0	0	0
3.1	0	0	0	0
3.2	0	0	0	0
3.3	0	0	0	0
3.4	0	0	0	0
3.5	0	0	0	0
3.6	0	0	0	0
3.7	1	1	0	0
3.8	0	0	0	0
3.9	0	0	0	0
4	0	0	0	0
Total	**689**	**19**	**306**	**14**

SG 1-4		
Voltage Bin	As-Found	Repaired
2.8	0	0
2.9	0	0
3	0	0
3.1	0	0
3.2	0	0
3.3	0	0
3.4	0	0
3.5	0	0
3.6	0	0
3.7	0	0
3.8	0	0
3.9	0	0
4	0	0
Total	**248**	**2**

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

SG	Row	Col	Elev	Worn Probe			Good Probe			% Diff
				Ind	Volts	Cal	Ind	Volts	Cal	
SG 1-1	7	62	1H	RSS	2.19	CL-23	DOS	2.28	CL-29	4.1%
	9	67	1H	RSS	1.52	CL-23	DOS	1.46	CL-30	-3.9%
	10	39	1H	RSS	2.52	CL-27	DOS	2.49	CL-40	-1.2%
	10	39	2H	DOS	0.56	CL-27	DOS	0.56	CL-40	0.0%
	10	39	3H	DOS	0.71	CL-27	DOS	0.71	CL-40	0.0%
	10	68	1H	RSS	1.57	CL-24	DOS	1.57	CL-40	0.0%
	10	68	4C	DOS	0.56	CL-24	DOS	0.54	CL-40	-3.6%
	11	65	1H	RSS	1.95	CL-23	DOS	1.99	CL-29	2.1%
	15	65	1H	RSS	1.71	CL-15	DOS	1.72	CL-30	0.6%
	19	44	1H	RSS	1.64	CL-18	DOS	1.57	CL-40	-4.3%
	19	44	2H	DOS	0.58	CL-18	DOS	0.49	CL-40	-15.5%
	19	60	1H	RSS	1.54	CL-15	DOS	1.43	CL-40	-7.1%
	20	47	1H	RSS	1.71	CL-18	DOS	1.76	CL-40	2.9%
	23	28	1H	RSS	1.89	CL-17	DOS	1.74	CL-40	-7.9%
	23	41	1H	RSS	1.67	CL-17	DOS	1.72	CL-40	3.0%
	23	51	1H	RSS	1.83	CL-21	DOS	1.71	CL-29	-6.6%
	24	17	1H	RSS	1.85	CL-20	DOS	1.93	CL-39	4.3%
	25	39	1H	RSS	1.7	CL-17	DOS	1.75	CL-40	2.9%
	25	44	1H	RSS	1.82	CL-17	DOS	1.81	CL-40	-0.5%
	25	69	1H	RSS	1.7	CL-15	DOS	1.86	CL-29	9.4%
	26	32	1H	RSS	1.52	HL-9	DOS	1.82	CL-29	19.7%
	26	46	1H	RSS	1.9	HL-11	DOS	1.76	CL-40	-7.4%
	26	60	1H	RSS	1.81	CL-13	DOS	1.66	CL-40	-8.3%
	26	60	2H	DOS	0.25	CL-13	DOS	0.3	CL-40	20.0%
	29	29	2H	RSS	1.73	HL-9	DOS	1.62	CL-40	-6.4%
	29	41	1H	RSS	1.84	HL-11	DOS	1.87	CL-40	1.6%
	29	43	1H	RSS	1.77	HL-11	DOS	1.86	CL-30	5.1%
	30	31	1H	RSS	1.54	HL-10	DOS	1.46	CL-40	-5.2%
	30	31	2H	DOS	0.68	HL-10	DOS	0.7	CL-40	2.9%
	33	43	1H	RSS	1.59	HL-11	DOS	1.79	CL-29	12.6%
	35	61	2H	RSS	1.6	CL-13	DOS	1.46	CL-29	-8.8%
	37	41	1H	RSS	1.69	HL-11	DOS	1.6	CL-40	-5.3%
	37	41	2H	DOS	0.43	HL-11	DOS	0.34	CL-40	-20.9%
	37	41	3H	DOS	0.28	HL-11	DOS	0.35	CL-40	25.0%
	37	41	6H	DOS	0.37	HL-11	DOS	0.42	CL-40	13.5%
	38	36	1H	RSS	1.59	HL-11	DOS	1.5	CL-40	-5.7%
	38	36	2H	DOS	0.55	HL-11	DOS	0.59	CL-40	7.3%
	41	36	1H	RSS	1.55	HL-12	DOS	1.58	CL-40	1.9%
	41	41	3H	RSS	1.69	HL-11	DOS	1.48	CL-29	-12.4%
	42	36	1H	RSS	1.83	HL-11	DOS	1.91	CL-40	4.4%

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

SG	Row	Col	Elev	Worn Probe			Good Probe			% Diff
				Ind	Volts	Cal	Ind	Volts	Cal	
SG 1-2	5	20	2H	RSS	1.51	HL-3	DOS	1.6	HL-11	6.0%
	5	20	4H	DOS	0.57	HL-3	DOS	0.68	HL-11	19.3%
	7	49	1H	RSS	1.89	CL-24	DOS	1.7	CL-48	-10.1%
	12	46	2H	RSS	1.81	CL-25	DOS	1.78	CL-48	-1.7%
	16	90	1H	RSS	1.6	CL-10	DOS	1.7	CL-32	6.2%
	20	89	3H	RSS	1.62	CL-10	DOS	1.74	CL-48	7.4%
	21	82	1H	RSS	3.43	CL-12	DOS	3.61	CL-32	5.2%
	25	61	1H	RSS	2.25	CL-11	DOS	2.36	CL-48	4.9%
	26	27	1H	RSS	1.95	HL-7	DOS	1.96	CL-26	0.5%
	26	52	1H	DOS	0.28	CL-7	DOS	0.35	CL-26	25.0%
	26	52	2H	RSS	2.06	CL-7	DOS	1.94	CL-26	-5.8%
	30	30	1H	RSS	1.69	HL-7	DOS	1.58	CL-26	-6.5%
	35	55	1H	RSS	1.73	CL-7	DOS	1.68	CL-26	-2.9%
SG 1-3	7	75	2H	RSS	1.54	CL-23	DOS	1.59	CL-39	3.2%
	7	75	4H	DOS	0.27	CL-23	DOS	0.24	CL-39	-11.1%
	10	10	2H	RSS	1.54	CL-27	DOS	1.53	CL-38	-0.6%
	19	90	1H	RSS	1.8	CL-15	DOS	2.01	CL-39	11.7%
	25	81	1H	RSS	1.55	CL-15	DOS	1.36	CL-39	-12.3%
SG 1-4	11	25	1H	RSS	1.67	CL-20	DOS	1.55	CL-64	-7.2%
	11	25	1H	RSS	1.59	CL-39	DOS	1.55	CL-64	-2.5%
	25	60	1H	RSS	1.53	CL-16	DOS	1.14	CL-32	-25.5%

Table 3-21: New 1R14 DOSs >=0.5 Volts In Tubes Inspected With a Worn Probe In 1R13

SG	Row	Col	Ind	Elev	Volts	Cal	New?	ARC Out 1R14	ARC Out 1R13
1-1	36	67	DOS	2H	1	CL-13	New	Yes	Yes
	16	34	DOS	2H	0.76	CL-18	New	Yes	Yes
	6	67	DOS	1H	0.74	CL-24	New	Yes	Yes
	21	64	DOS	2H	0.73	CL-16	New		Yes
	27	70	DOS	3H	0.73	CL-13	New	Yes	Yes
	10	39	DOS	3H	0.71	CL-27	New	Yes	Yes
	10	39	DOS	3H	0.71	CL-40	New		Yes
	31	28	DOS	1H	0.7	HL-10	New	Yes	Yes
	18	11	DOS	3H	0.69	CL-20	New	Yes	Yes
	6	7	DOS	4H	0.68	CL-26	New		Yes
	21	55	DOS	3H	0.67	CL-21	New	Yes	Yes
	19	46	DOS	2H	0.64	CL-18	New	Yes	Yes
	9	11	DOS	2H	0.6	CL-28	New	Yes	Yes
	31	28	DOS	2H	0.6	HL-10	New	Yes	Yes
	19	44	DOS	2H	0.58	CL-18	New	Yes	Yes
	29	22	DOS	3H	0.52	HL-10	New	Yes	Yes
	10	11	DOS	1H	0.51	CL-27	New	Yes	Yes
	10	9	DOS	2H	0.51	CL-26	New		Yes
1-2	24	31	DOS	2H	1.02	CL-16	New	Yes	Yes
	6	20	DOS	1H	0.87	CL-22	New		Yes
	21	64	DOS	1H	0.82	CL-11	New	Yes	Yes
	23	36	DOS	1H	0.77	CL-15	New	Yes	Yes
	21	64	DOS	3H	0.76	CL-11	New	Yes	Yes
	36	46	DOS	4H	0.74	HL-10	New		Yes
	35	64	DOS	4H	0.73	CL-10	New	Yes	Yes
	22	36	DOS	1H	0.73	CL-16	New	Yes	Yes
	25	62	DOS	1H	0.71	CL-11	New	Yes	Yes
	12	64	DOS	2H	0.68	CL-19	New	Yes	Yes
	5	62	DOS	4H	0.66	HL-1	New	Yes	Yes
	6	58	DOS	4H	0.63	CL-19	New	Yes	Yes
	14	63	DOS	3H	0.62	CL-12	New	Yes	Yes
	7	62	DOS	6H	0.59	CL-18	New	Yes	Yes
	35	63	DOS	2H	0.56	CL-8	New	Yes	Yes
	24	18	DOS	1H	0.56	CL-17	New		Yes
	25	82	DOS	1H	0.55	CL-11	New	Yes	Yes
	6	66	DOS	3H	0.53	CL-18	New	Yes	Yes
	12	85	DOS	4H	0.52	CL-21	New		Yes
	20	21	DOS	5H	0.52	CL-17	New		Yes
	36	49	DOS	6H	0.51	HL-10	New		Yes
	13	74	DOS	3H	0.51	CL-18	New	Yes	Yes
	8	63	DOS	2H	0.5	CL-19	New	Yes	Yes
	18	27	DOS	1H	0.5	CL-16	New	Yes	Yes

Table 3-21: New 1R14 DOSs >=0.5 Volts in Tubes Inspected With a Worn Probe in 1R13

SG	Row	Col	Ind	Elev	Volts	Cal	New?	ARC Out 1R14	ARC Out 1R13
1-3	7	8	DOS	1H	0.51	CL-27	New	Yes	Yes
1-4	19	45	DOS	2H	0.85	CL-14	New		Yes
	18	47	DOS	1H	0.53	CL-15	New		Yes
	16	55	DOS	2H	0.51	CL-19	New		Yes

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

SG	1R14 DOSs in Active Tubes (Total)	New 1R14 DOS (Not Detected in 1R13)	New 1R14 DOS In Tubes Insp. w/ Worn Probe in 1R13	New 1R14 DOS In Tubes Insp. w/ Good Probe in 1R13	New 1R14 DOS >=0.5 Volts	New 1R14 DOS >=0.5 Volts in Tubes Insp. w/ Worn Probe in 1R13
SG 1-1	845	122	88	34	29	17
SG 1-2	591	94	49	45	44	24
SG 1-3	290	45	5	40	18	1
SG 1-4	210	37	11	26	14	3
Total	1936	298	153	145	105	45

Table 3-23: Summary of ARC In and Out Tube Inspections in 1R13

SG	# ARC Out Tubes (1R13)	# ARC In Tubes (1R13)	Total # of Inspections
SG 1-1	1761	1921	3682
SG 1-2	1605	2008	3613
SG 1-3	1311	2499	3810
SG 1-4	1117	2628	3745
Total	5794	9056	14850

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%

Table 3-25: 1R13 AONDB to DOS in 1R14

Indication Location				1R14 Bobbin			1R14 +Point™			1R13 AONDB Results			Change from 1R13 to 1R14 (v/EFPY)		Cycle 14 Avg Voltage Change (v/EFPY)	1R13 Postulated AONDB Voltage **	Delta Volts ***
SG	Row	Col	Elev	Ind	DOS Volts	DNT Volts	Ind	+Point™ Volts	Inferred Bobbin Volts *	Ind	+Point™ Volts	Inferred Bobbin Volts *	Inferred to DOS	Inferred to Inferred			
SG 1-1	6	67	1H	DOS	0.74	0.59	SAI	0.19 / 0.22	0.874	SAI	0.14	0.542	0.14	0.24	0.043	0.680	-0.138
	11	15	3H	DOS	0.39	2.35	SAI	0.29	0.717	SAI	0.29	0.717	-0.24	0.00	0.043	0.330	0.387
	21	31	2H	DOS	0.24	0.44	SAI	0.1	0.496	SAI	0.13	0.530	-0.21	-0.02	0.043	0.180	0.350
	24	12	2H	DOS	0.17	0.46	SAI	0.21	0.623	SAI	0.15	0.554	-0.28	0.05	0.043	0.110	0.443
	26	41	2H	DOS	0.66	1.35	SAI	0.13 / 0.20	0.810	SAI	0.12 / 0.18	0.785	-0.09	0.02	0.043	0.600	0.184
	27	35	1H	DOS	0.67	0.45	SAI	0.09 / 0.34	0.915	SAI	0.24	0.658	0.01	0.18	0.043	0.610	0.048
	42	46	1H	DOS	0.13	0.3	SAI	0.17	0.577	SAI	0.14	0.542	-0.30	0.03	0.043	0.070	0.472
SG 1-2	1	56	2H	DOS	0.3	0.29	SAI	0.22	0.635	SAI	0.21	0.623	-0.23	0.01	0.037	0.249	0.375
	4	72	1H	DOS	0.23	0.46	SAI	0.18	0.588	SAI	0.16	0.565	-0.24	0.02	0.037	0.179	0.387
	7	65	2H	DOS	0.88	0.91	SAI	0.36	0.800	SAI	0.30	0.729	0.11	0.05	0.037	0.829	-0.100
	19	57	2H	DOS	0.36	2.28	SAI	0.27 / 0.37	1.068	SAI	0.26 / 0.37	1.061	-0.50	0.01	0.037	0.309	0.752
	22	62	1H	DOS	0.58	0.9	SAI	0.35	0.788	SAI	0.34	0.776	-0.14	0.01	0.037	0.529	0.248
	45	52	2H	DOS	0.5	2.11	SAI	0.29	0.717	SAI	0.2	0.612	-0.08	0.08	0.037	0.449	0.163
SG 1-3	7	93	2H	DOS	0.2	1.07	SAI	0.2	0.612	SAI	0.16	0.565	-0.26	0.03	0.015	0.179	0.386
	23	31	2H	DOS	2.27	2.2	SAI	0.56	1.042	SAI	0.30	0.729	1.11	0.23	0.015	2.249	-1.520
SG 1-4	10	13	3H	DOS	0.29	3.45	SAI	0.12	0.519	SAI	0.14	0.542	-0.18	-0.02	0.028	0.251	0.291
	15	29	1H	DOS	1.03	2.41	SAI	0.48	0.945	SAI	0.47	0.933	0.07	0.01	0.028	0.991	-0.059
	19	45	2H	DOS	0.85	1.86	SAI	0.23	0.647	SAI	0.22	0.635	0.15	0.01	0.028	0.811	-0.176
	21	51	1H	DOS	0.47	3.29	SAI	0.27	0.694	SAI	0.24	0.658	-0.14	0.03	0.028	0.431	0.227
												Averages	-0.07	0.05			0.14

Notes:
* Inferred voltage based on new correlation using only DCPP Unit 1 data
** "1R13 Postulated AONDB Voltage" equals "1R14 Bobbin Volts" minus "Cycle 14 Avg Voltage Change (v/EFPY)" multiplied by 1.39 EFPY
*** "Delta Volts" equals "1R13 Inferred Bobbin Volts" minus "1R13 Postulated AONDB Voltage"

Figure 3-1: 1R14 As-Found Voltage Distributions SGs 1-1 and 1-2

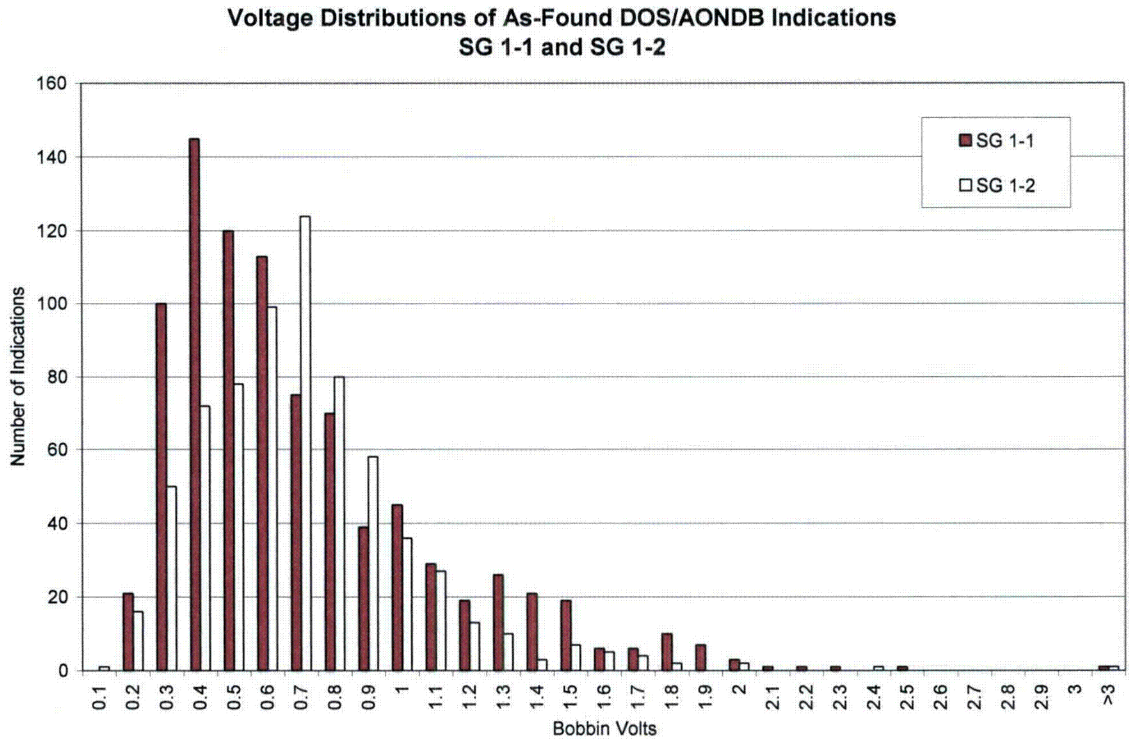


Figure 3-2: 1R14 As-Found Voltage Distributions SGs 1-3 and 1-4

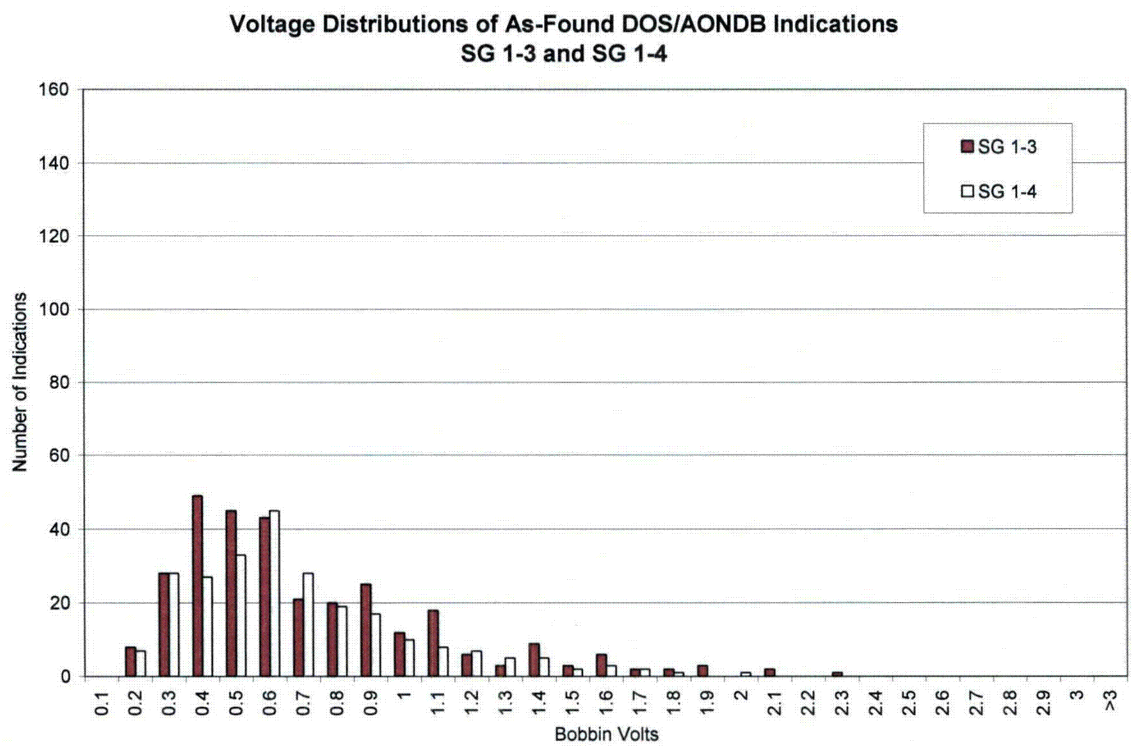


Figure 3-3: 1R14 Repaired Voltage Distributions SGs 1-1 and 1-2

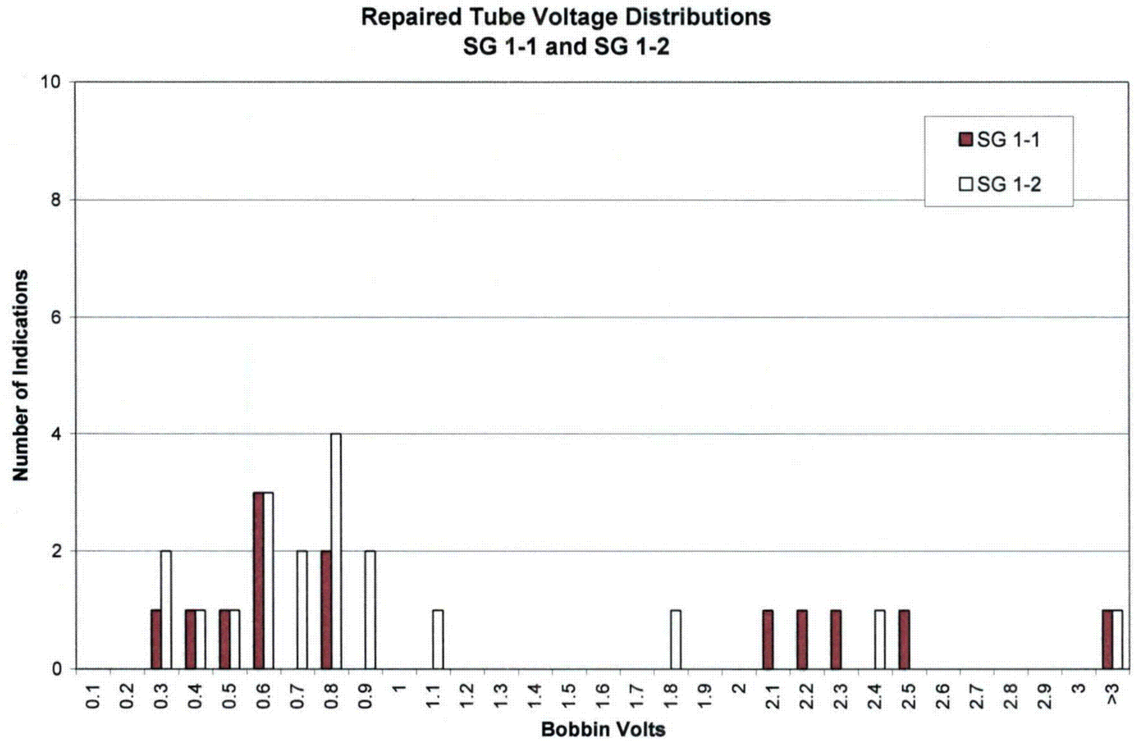


Figure 3-4: 1R14 Repaired Voltage Distributions SGs 1-3 and 1-4

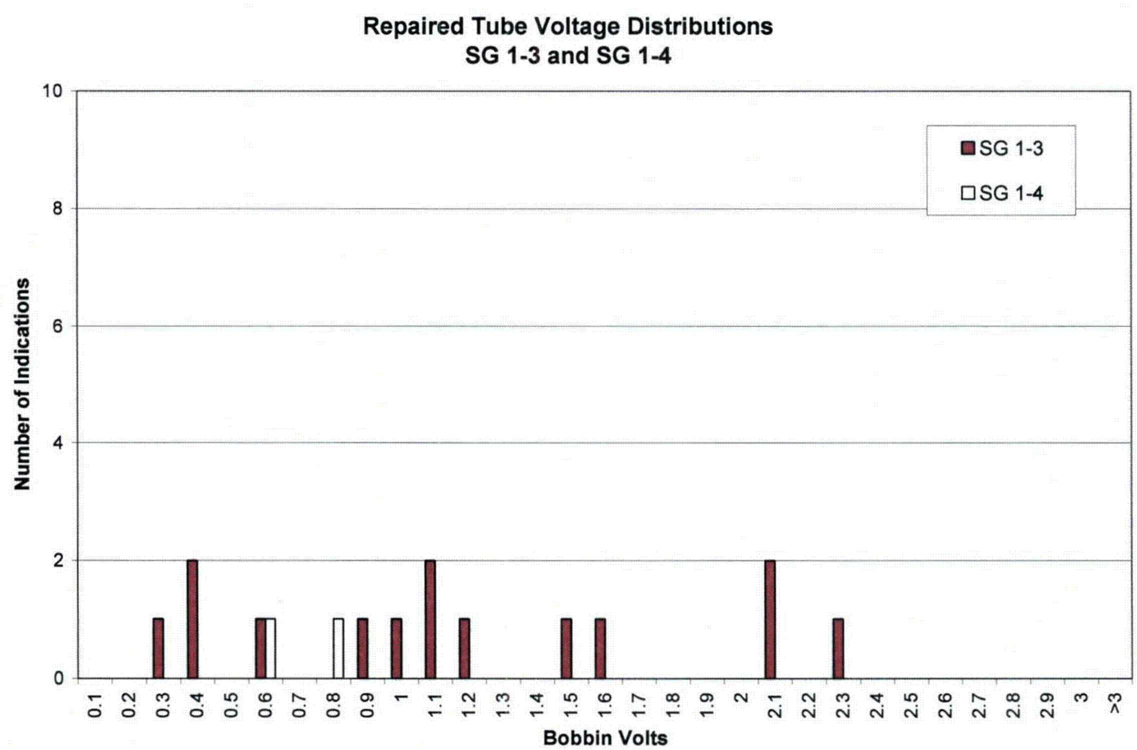


Figure 3-5: 1R14 RTS Voltage Distributions for RPC Confirmed or Not Inspected SGs 1-1 and 1-2

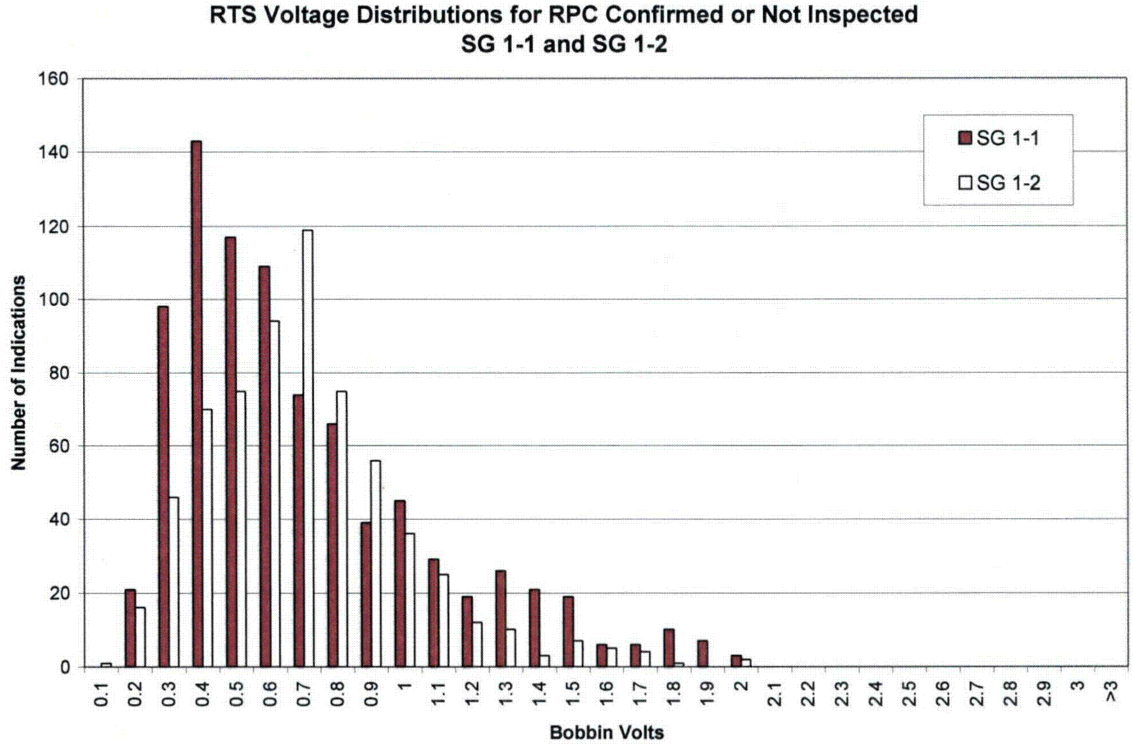


Figure 3-6: 1R14 RTS Voltage Distributions for RPC Confirmed or Not Inspected SGs 1-3 and 1-4

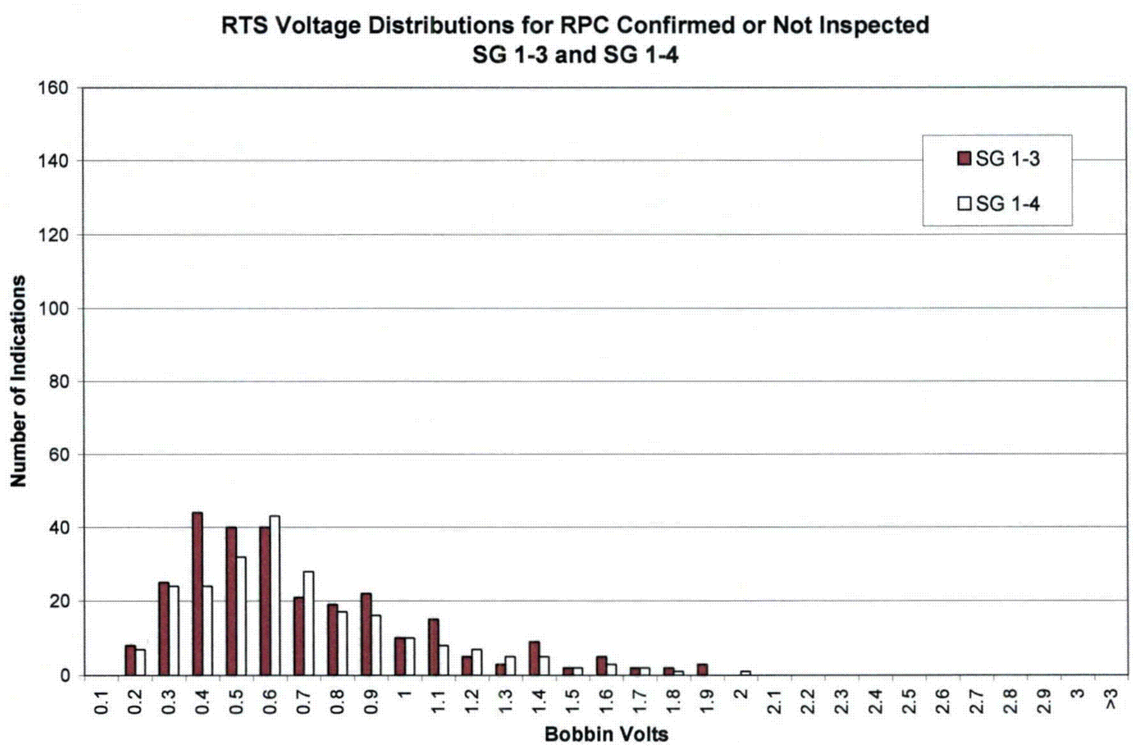


Figure 3-7: 1R14 RTS Voltage Distributions SGs 1-1 and 1-2

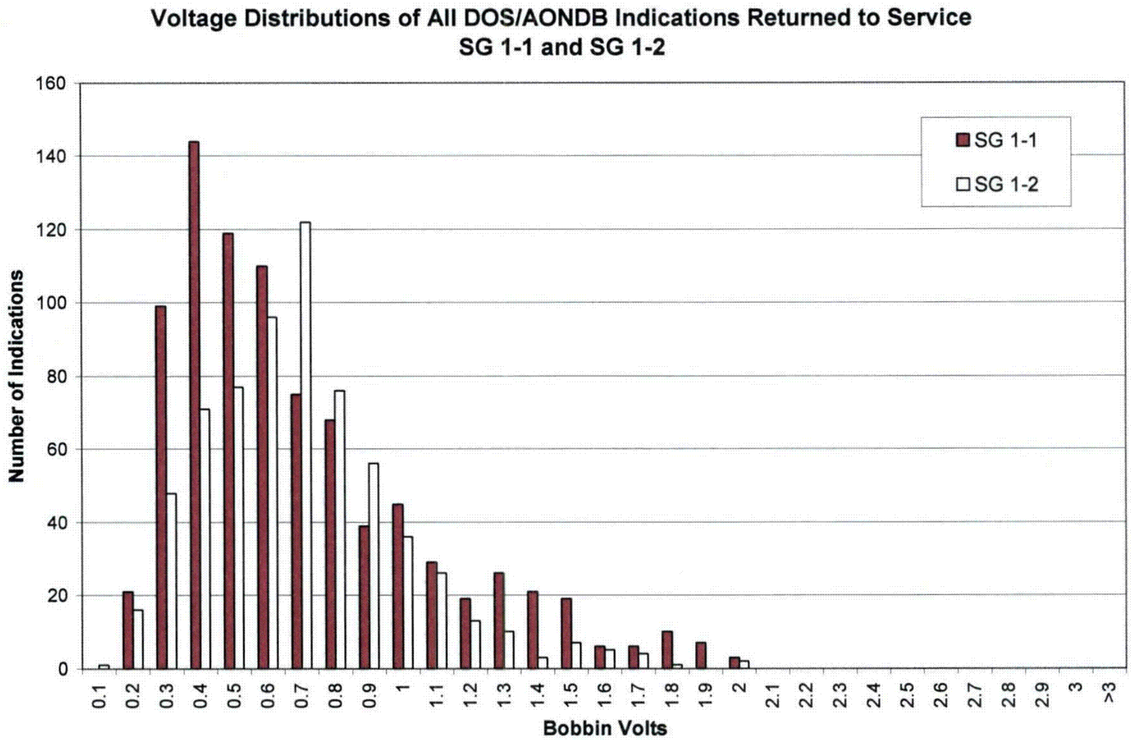


Figure 3-8: 1R14 RTS Voltage Distributions SGs 1-3 and 1-4

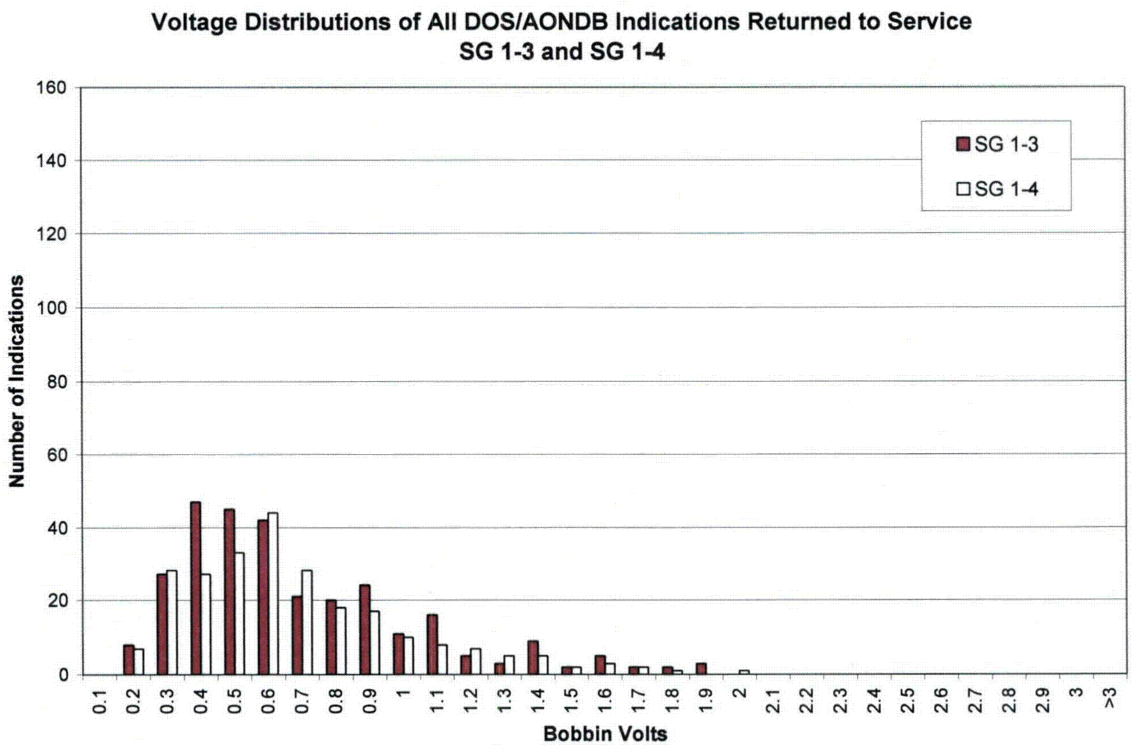
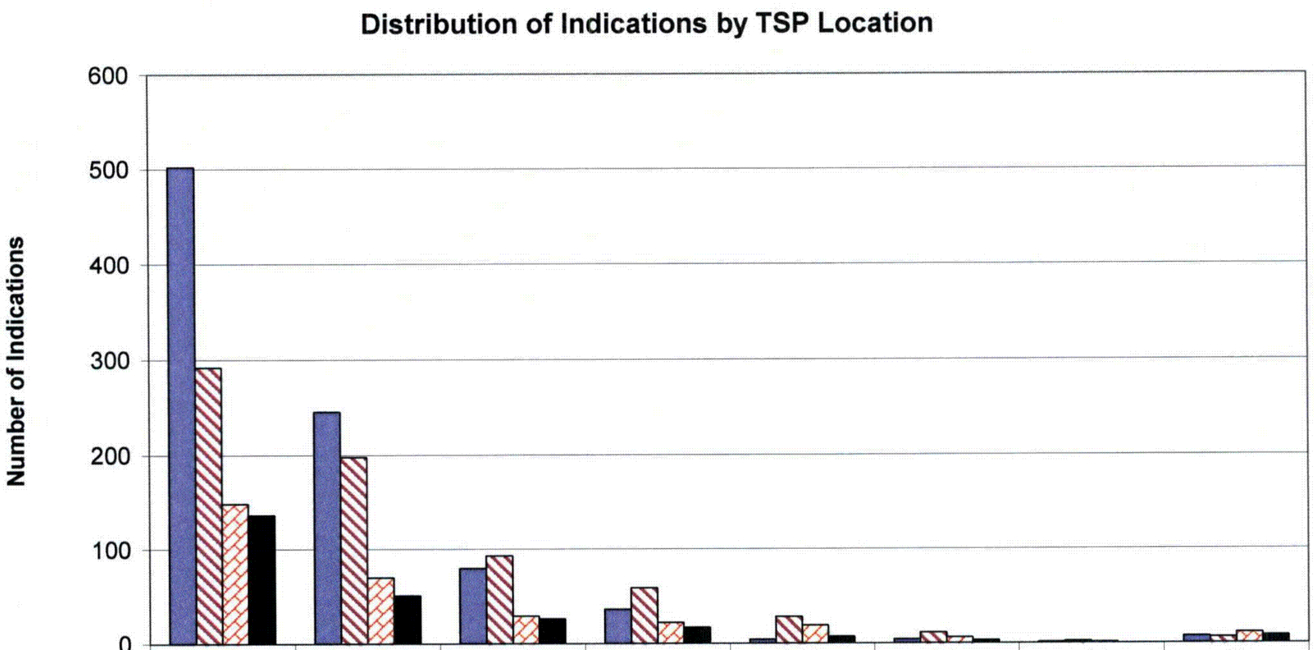


Figure 3-9: 1R14 DOS and AONDB vs. TSP Elevation



	1H	2H	3H	4H	5H	6H	7H	CL
SG 1-1	502	245	80	36	4	4	1	7
SG 1-2	292	198	93	59	28	11	2	6
SG 1-3	148	70	29	22	19	6	1	11
SG 1-4	136	51	26	17	7	3	0	8

Tube Support Plate

Figure 3-10: Cycle 14 Growth Distributions SGs 1-1 and 1-2

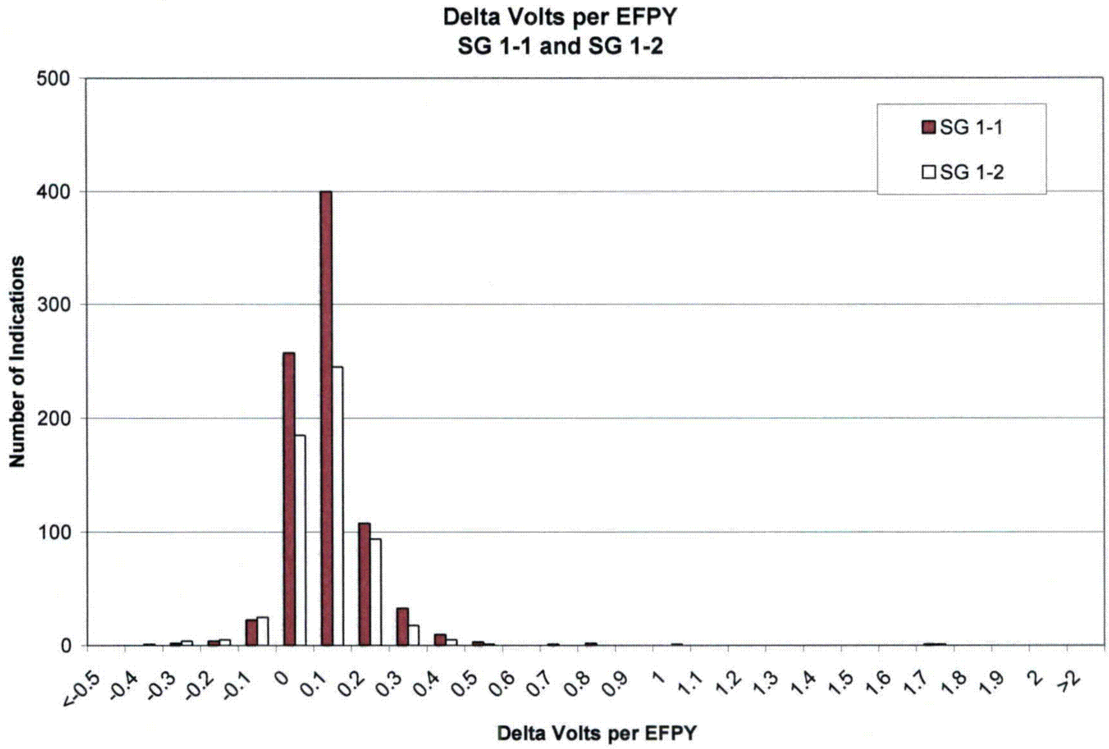


Figure 3-11: Cycle 14 Growth Distributions SGs 1-3 and 1-4

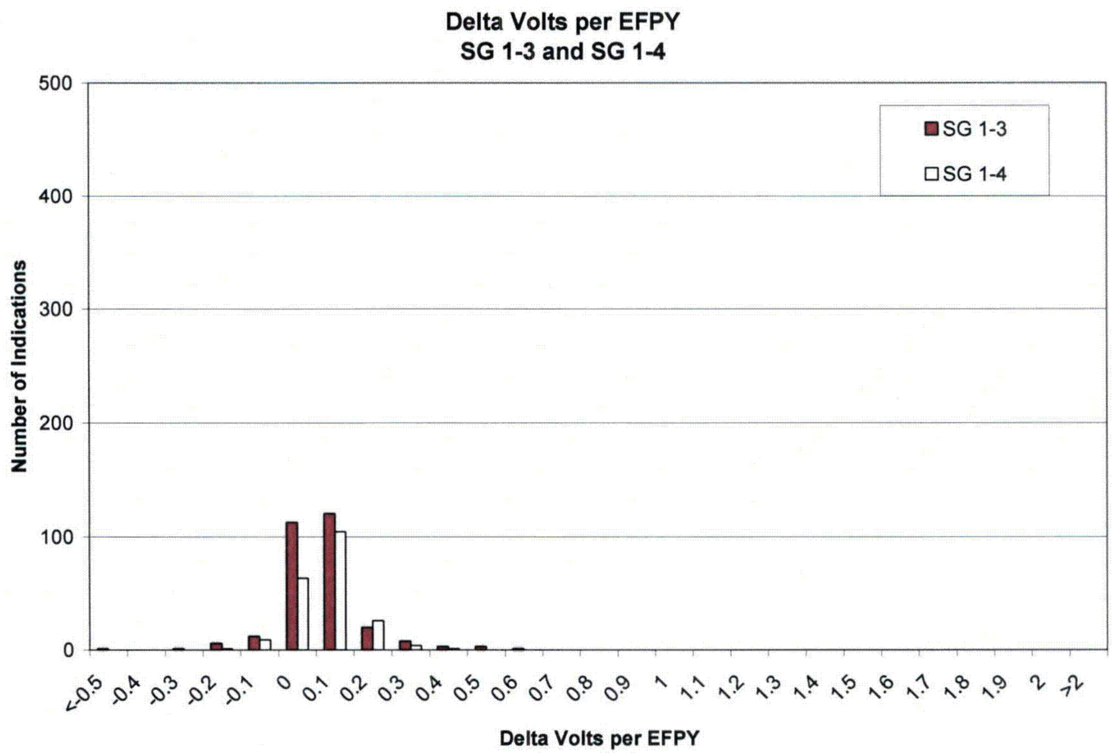


Figure 3-12: Cycle 14 Independent Growth Curves – All SGs

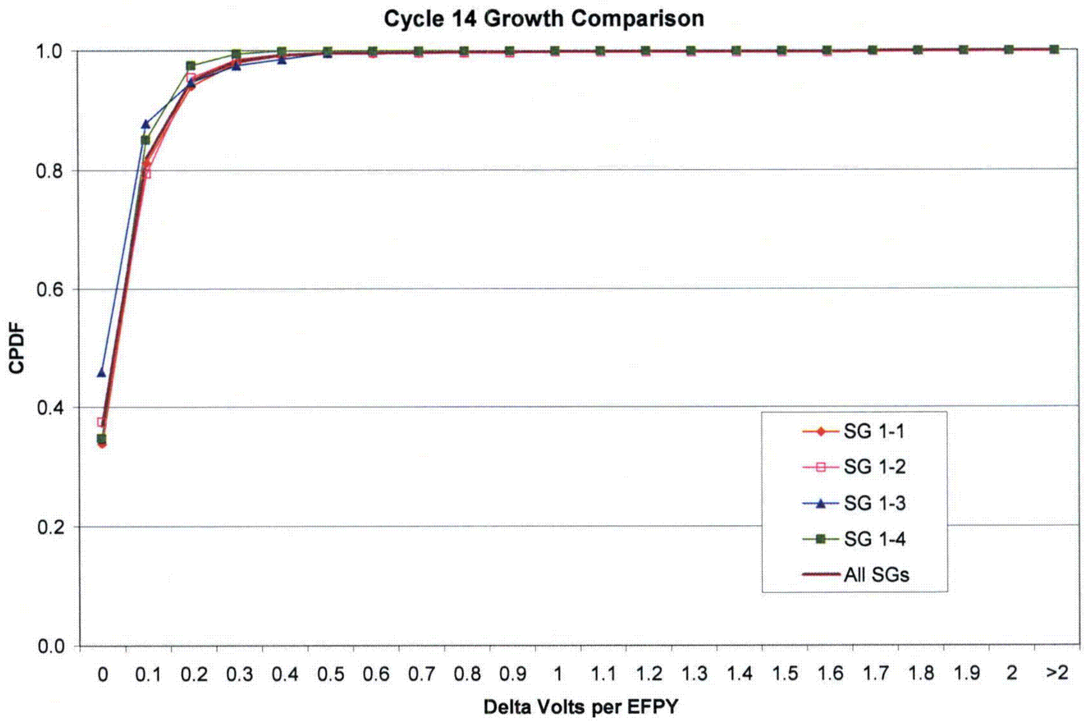


Figure 3-13: Historical Change in Growth and BOC Voltage - All SGs

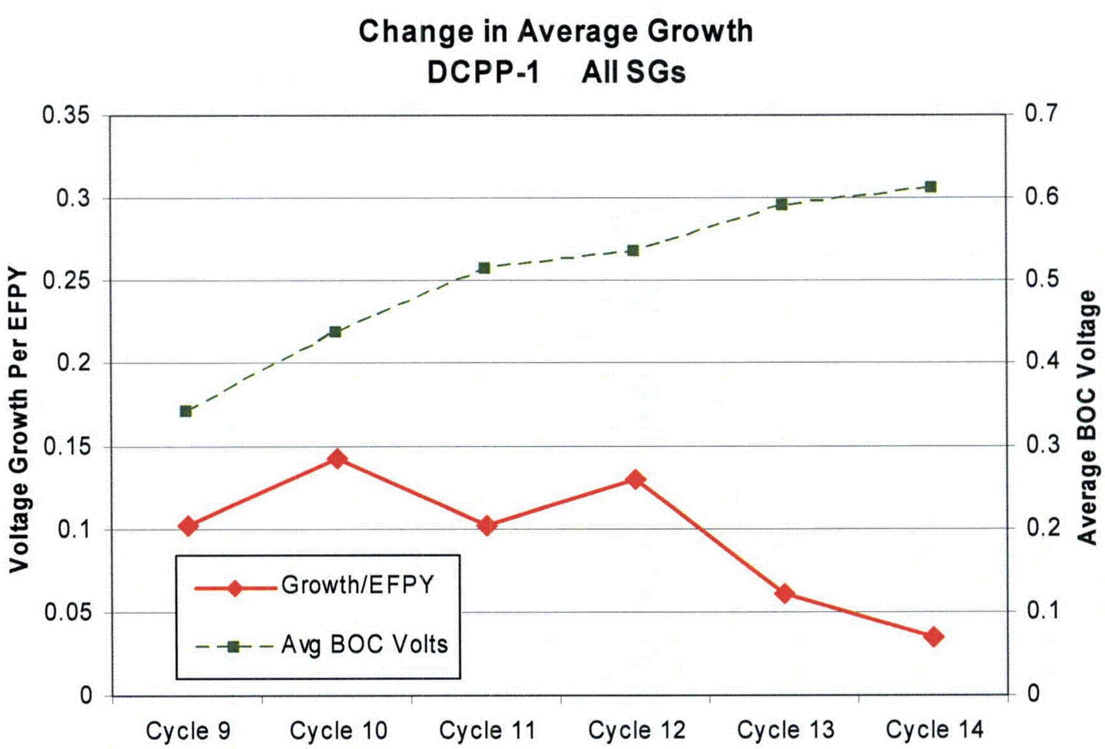


Figure 3-14: Cycle 13 vs. Cycle 14 Growth Comparison for SG 1-1

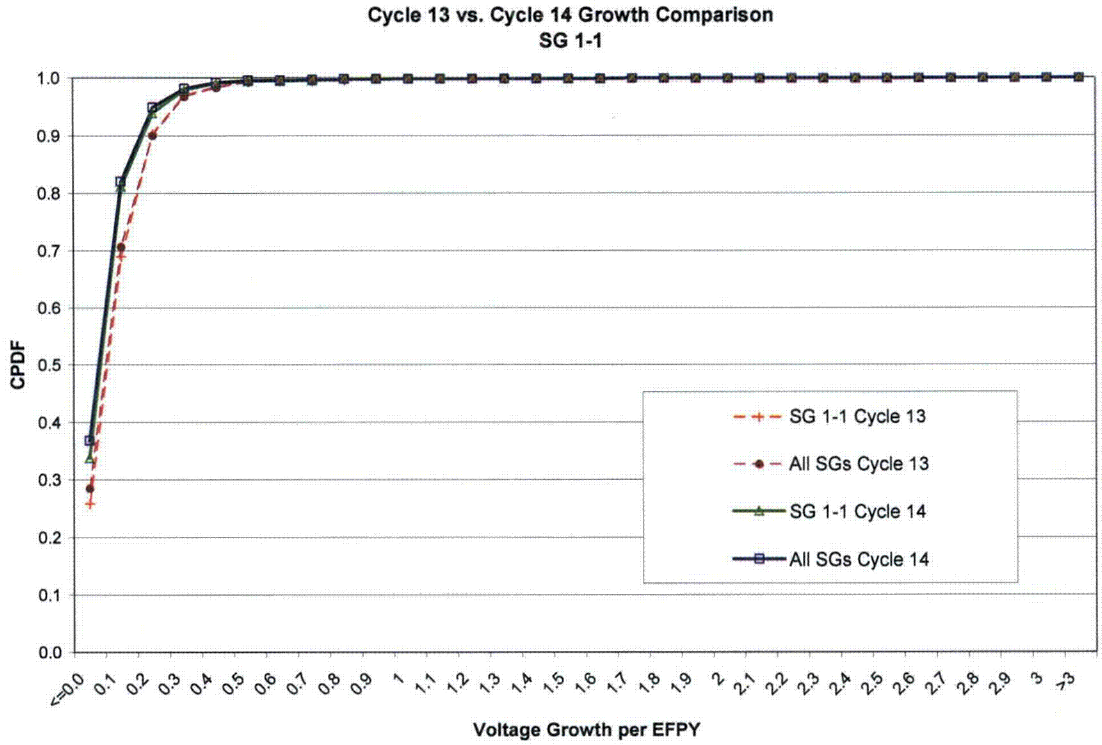


Figure 3-15: Cycle 13 vs. Cycle 14 Growth Comparison for SG 1-2

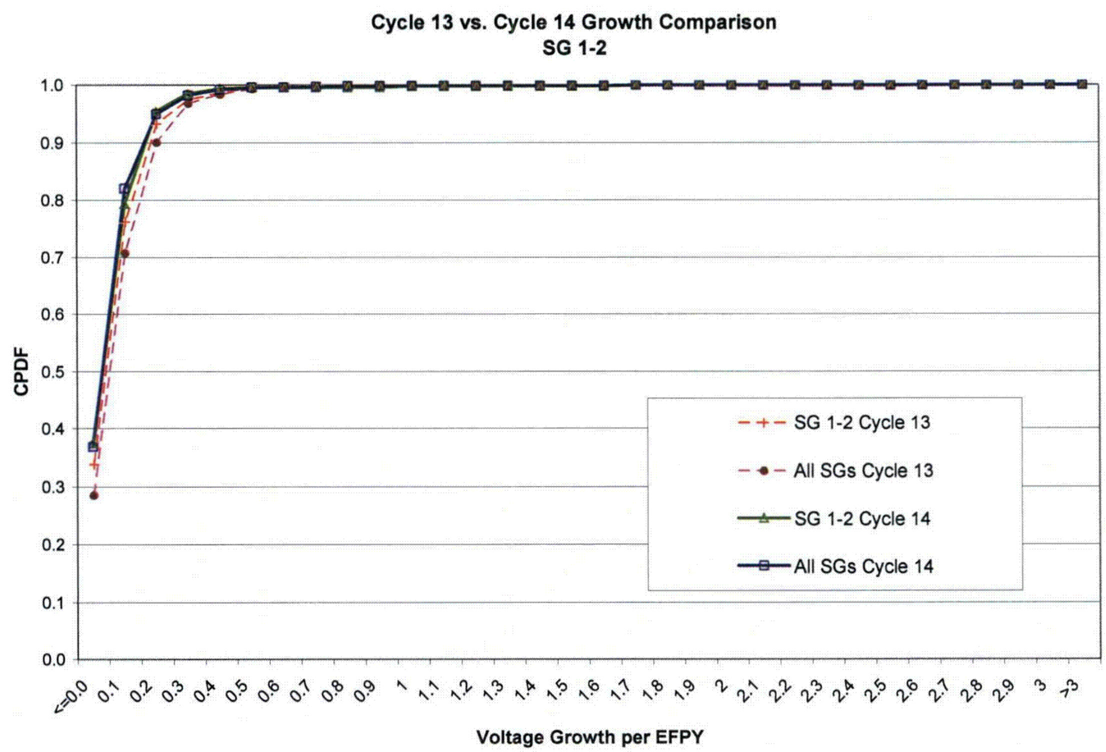


Figure 3-16: Cycle 13 vs. Cycle 14 Growth Comparison for SG 1-3

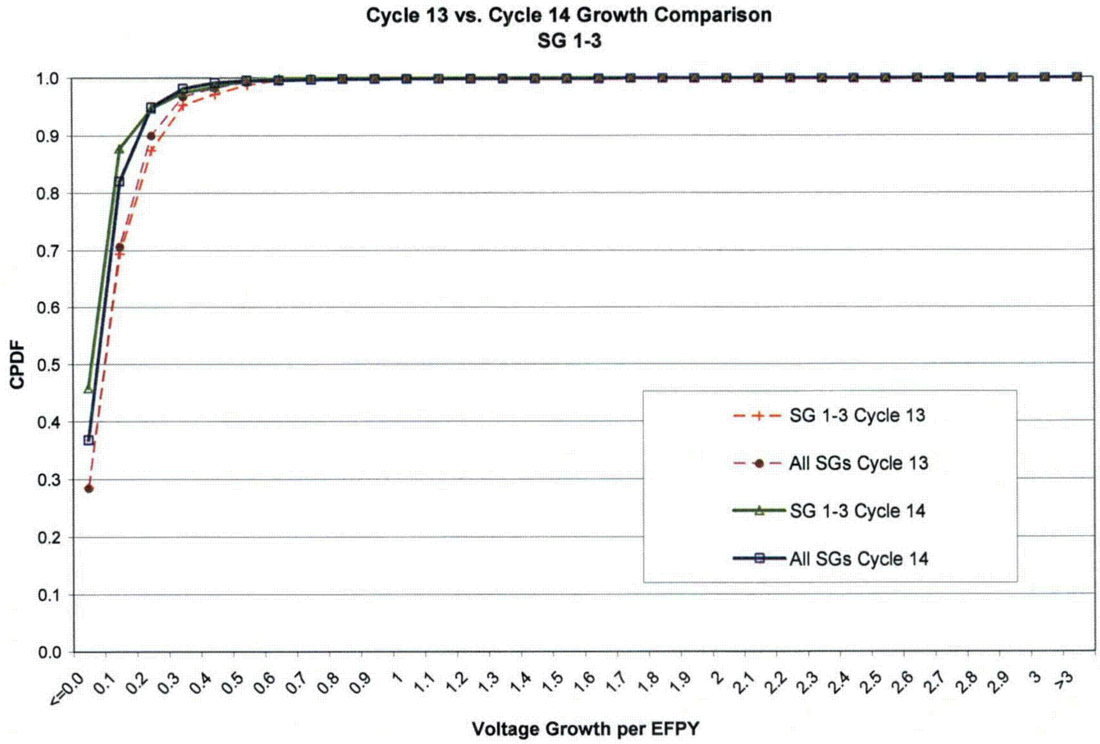


Figure 3-17: Cycle 13 vs. Cycle 14 Growth Comparison for SG 1-4

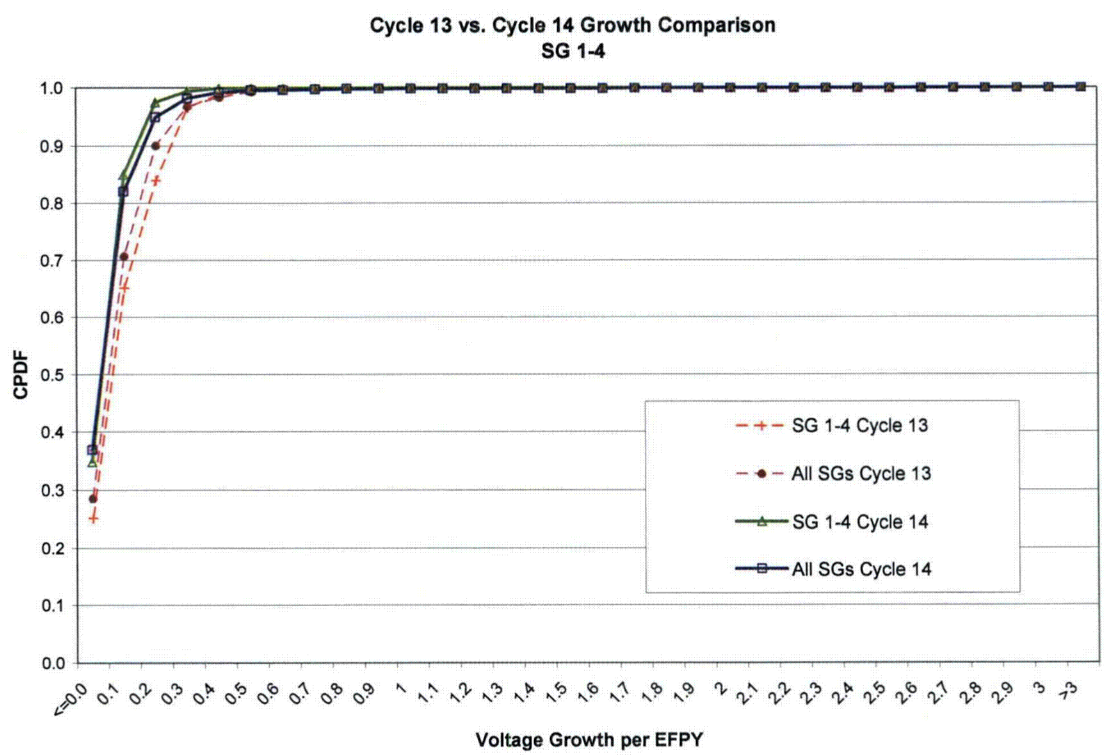


Figure 3-18: SG 1-1 Cycle 14 Growth vs. BOC Voltage

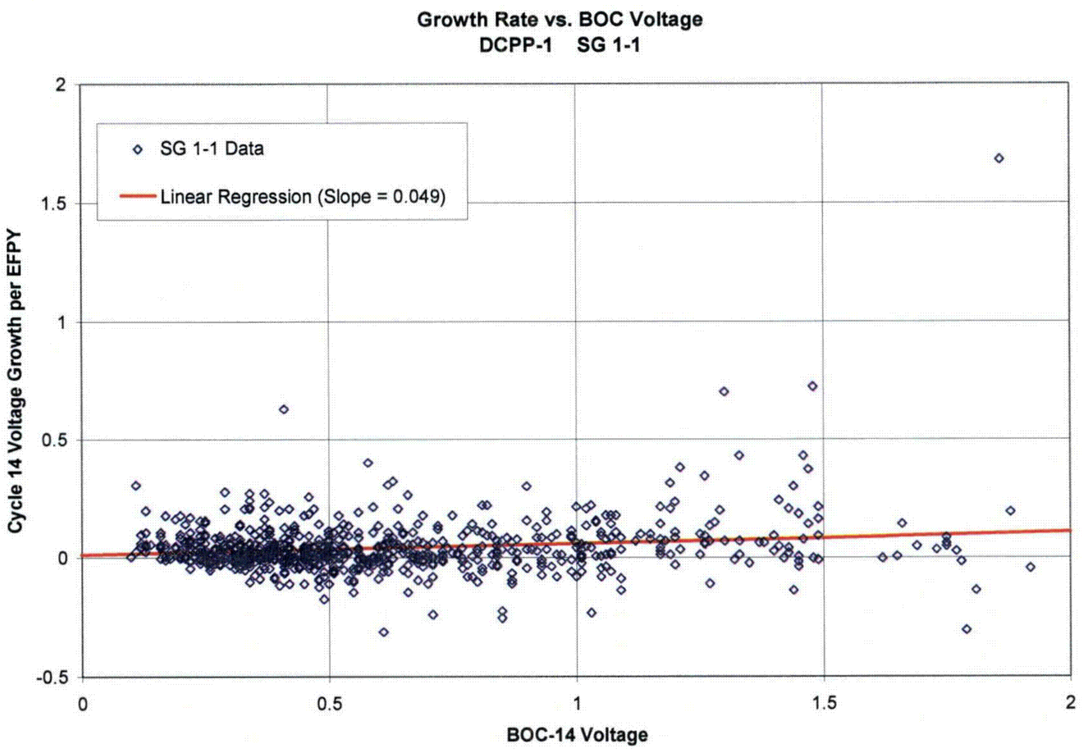


Figure 3-19: SG 1-2 Cycle 14 Growth vs. BOC Voltage

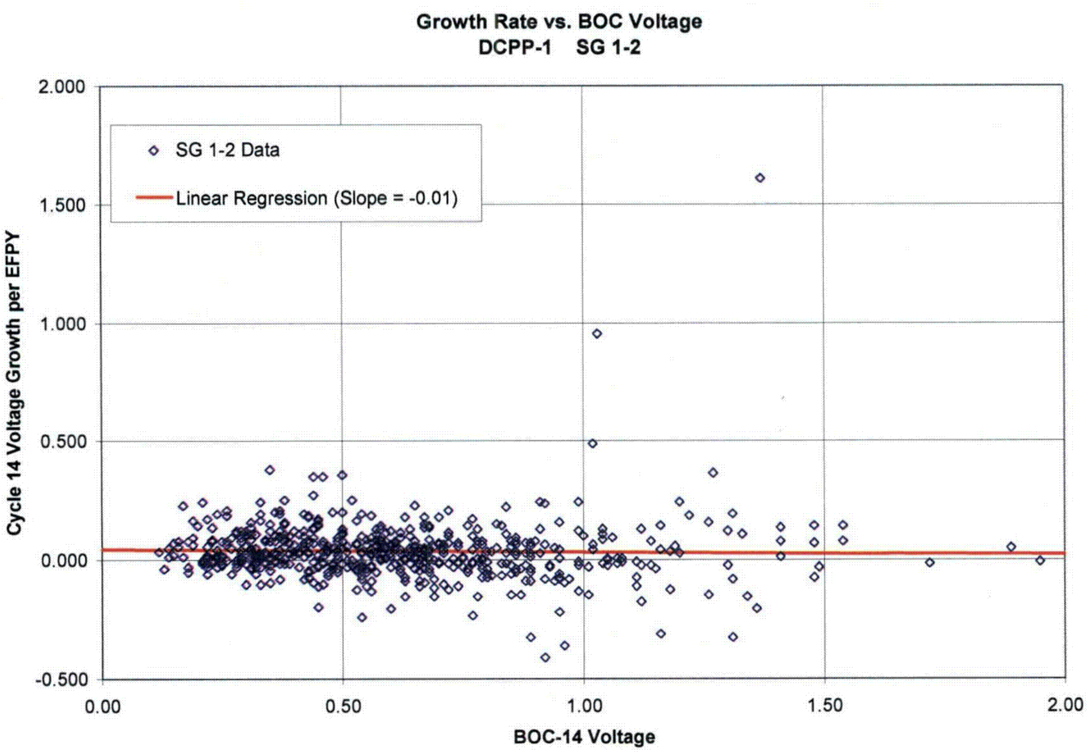


Figure 3-20: SG 1-3 Cycle 14 Growth vs. BOC Voltage

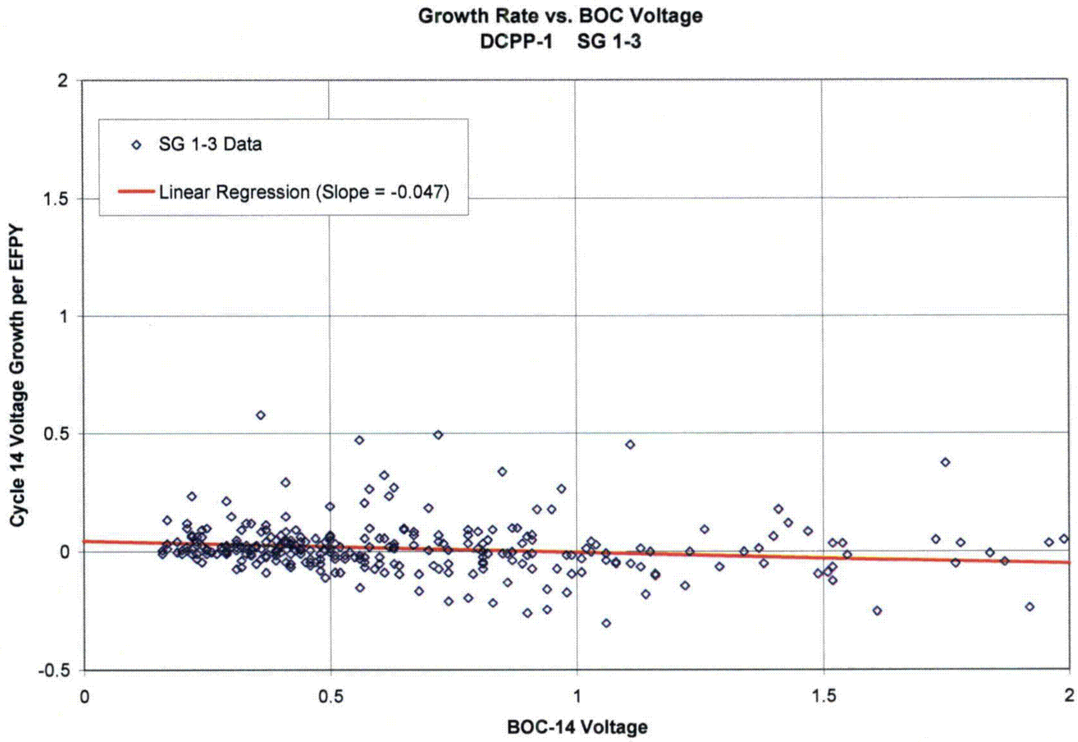


Figure 3-21: SG 1-4 Cycle 14 Growth vs. BOC Voltage

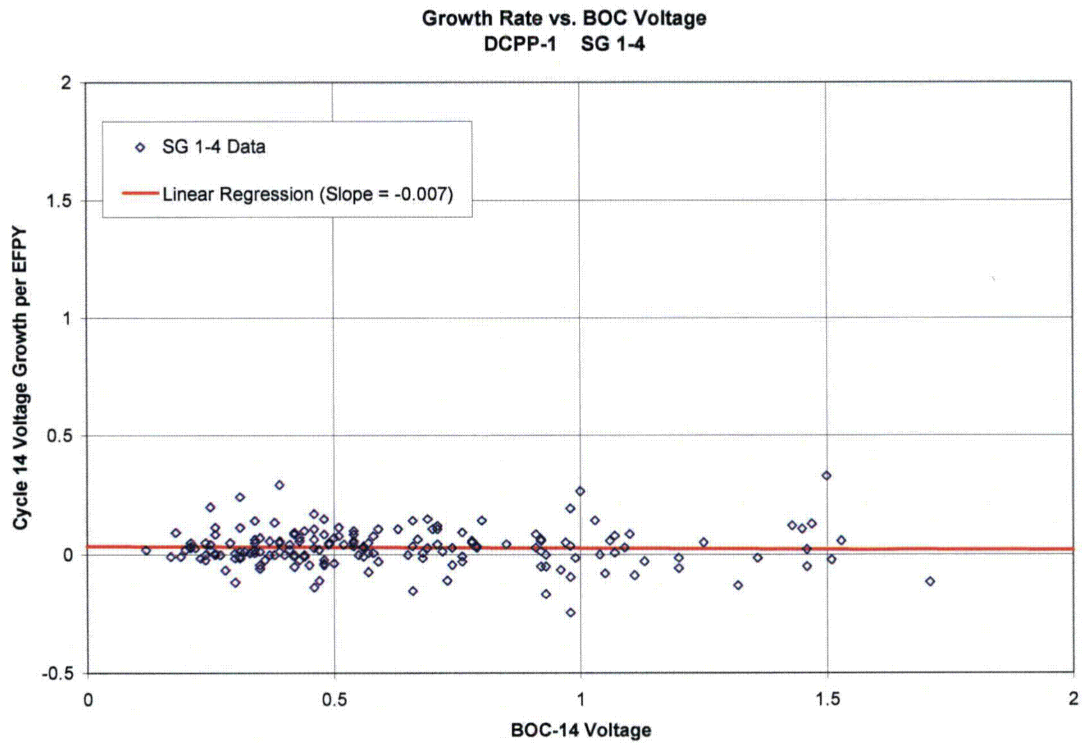


Figure 3-22: Cycle 14 Growth vs. BOC Voltage for All Steam Generators

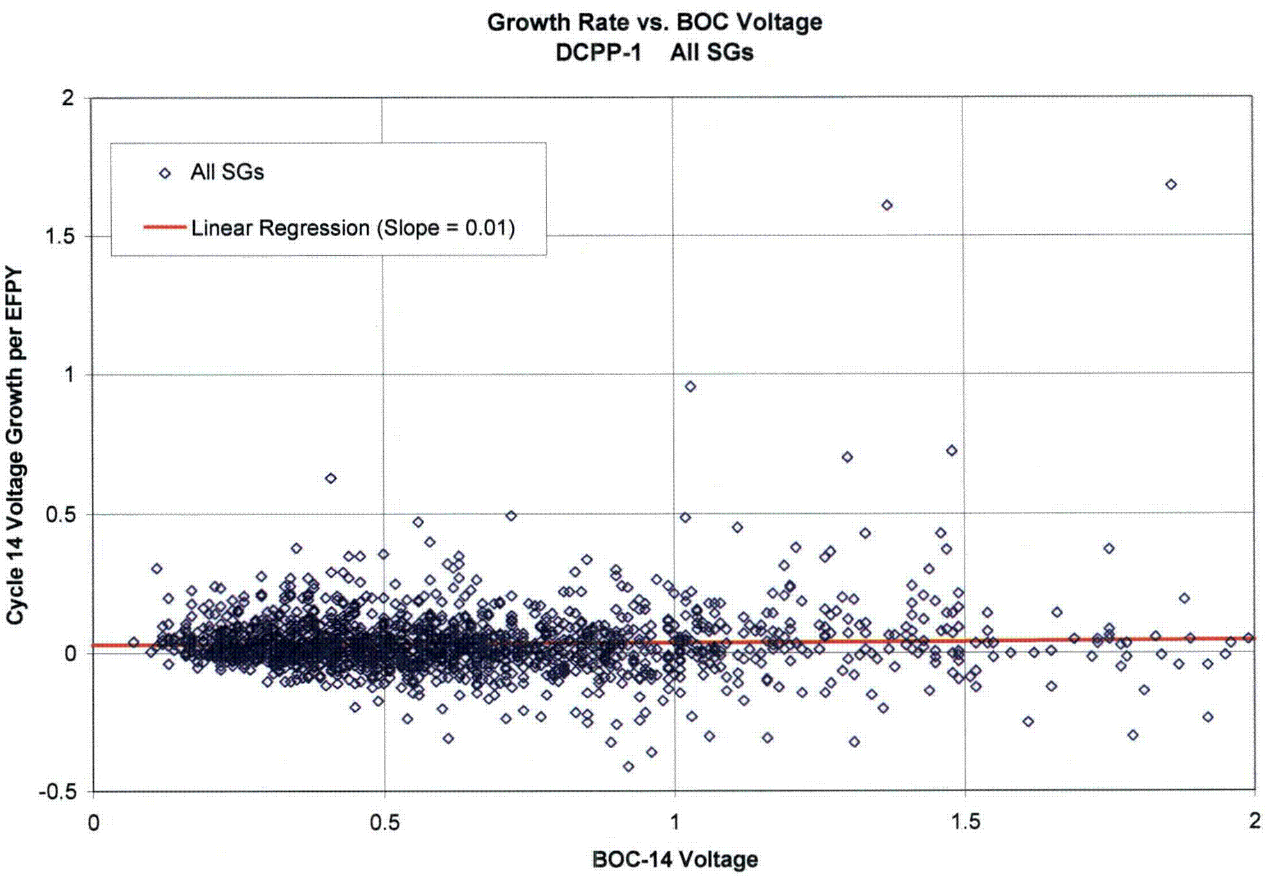


Figure 3-23: SG 1-1 Cycle 14 VDG Breakpoint Analysis Results

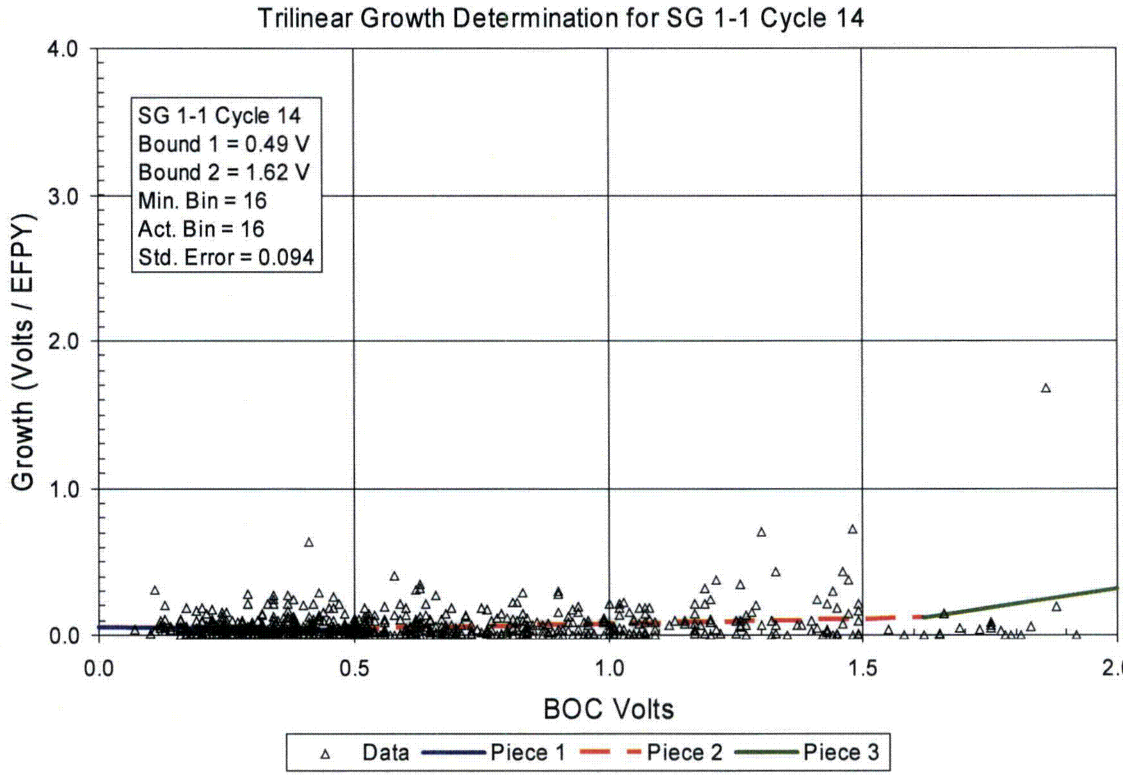


Figure 3-24: SG 1-2 Cycle 14 VDG Breakpoint Analysis Results

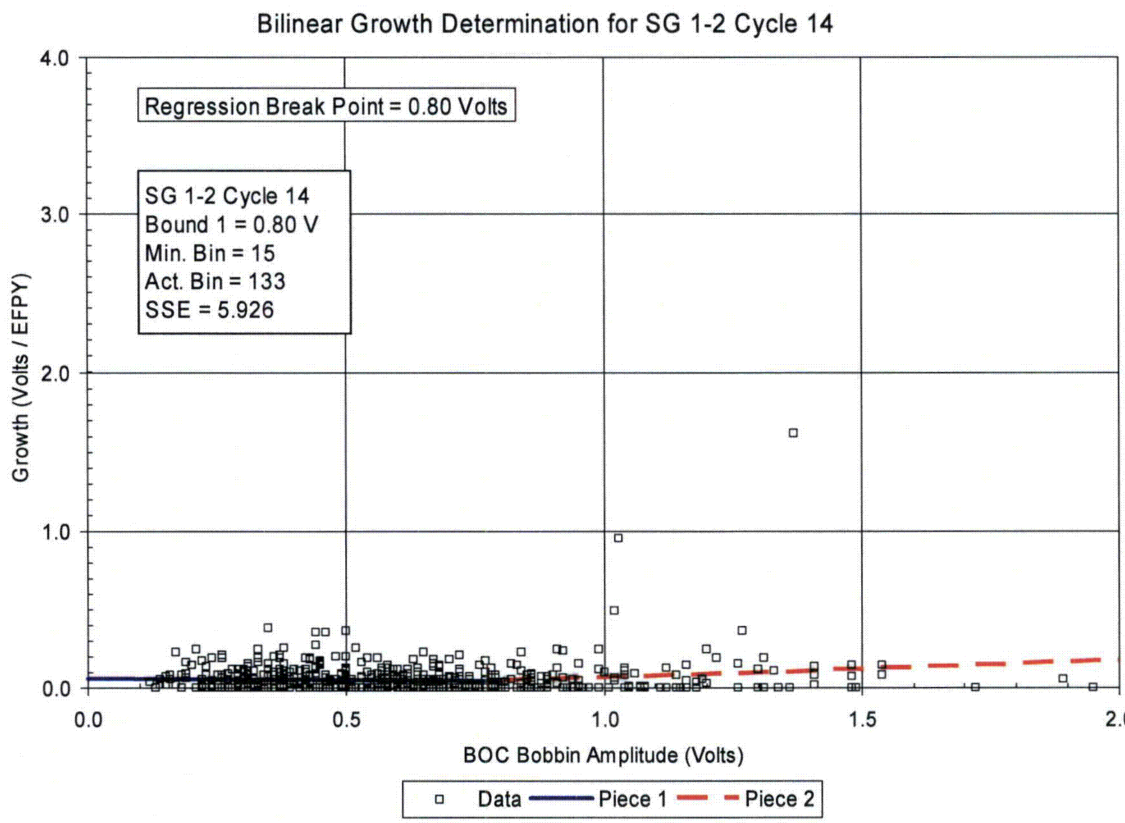


Figure 3-25: Composite Cycle 14 VDG Breakpoint Analysis Results

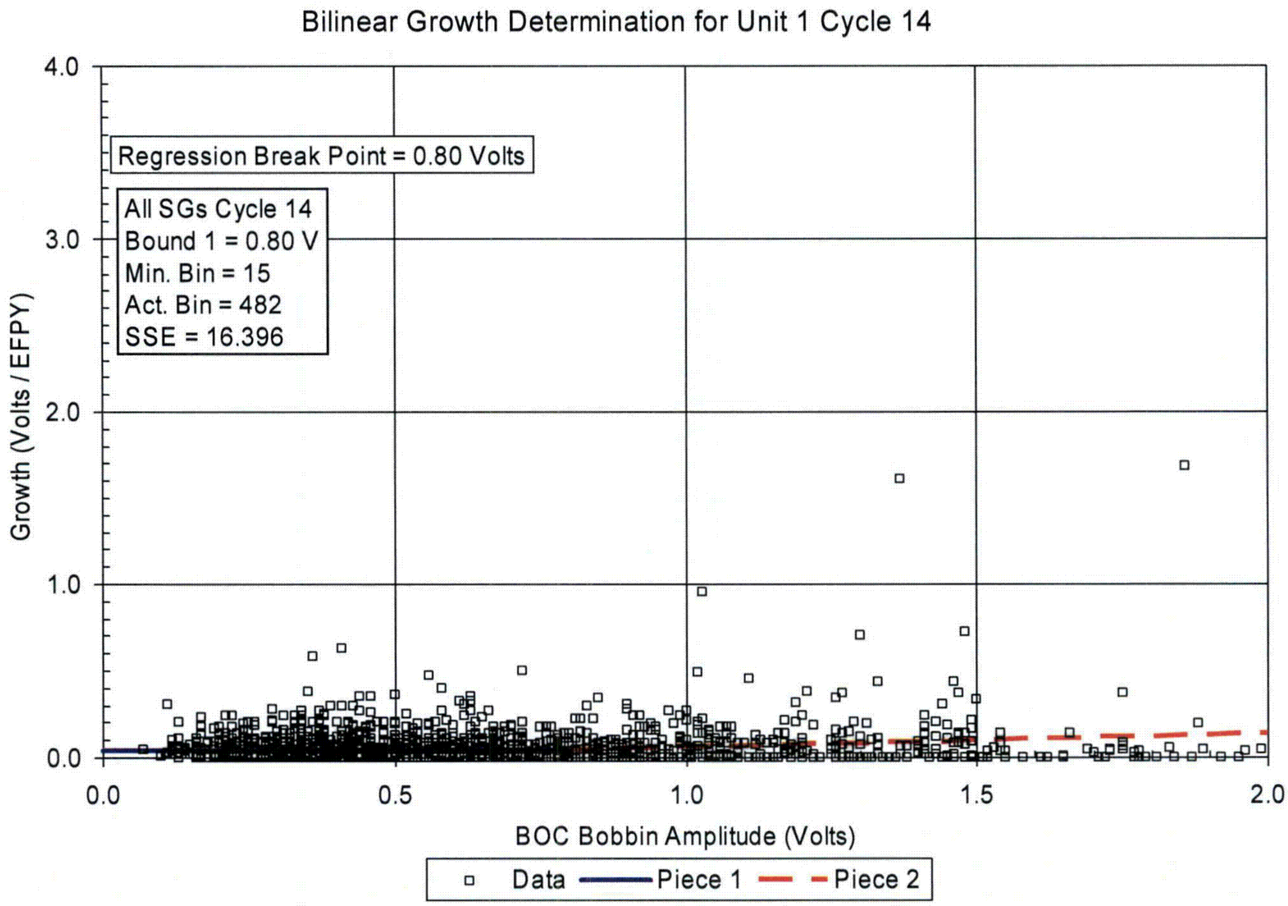


Figure 3-26: Cycle 14 VDG for SG 1-1

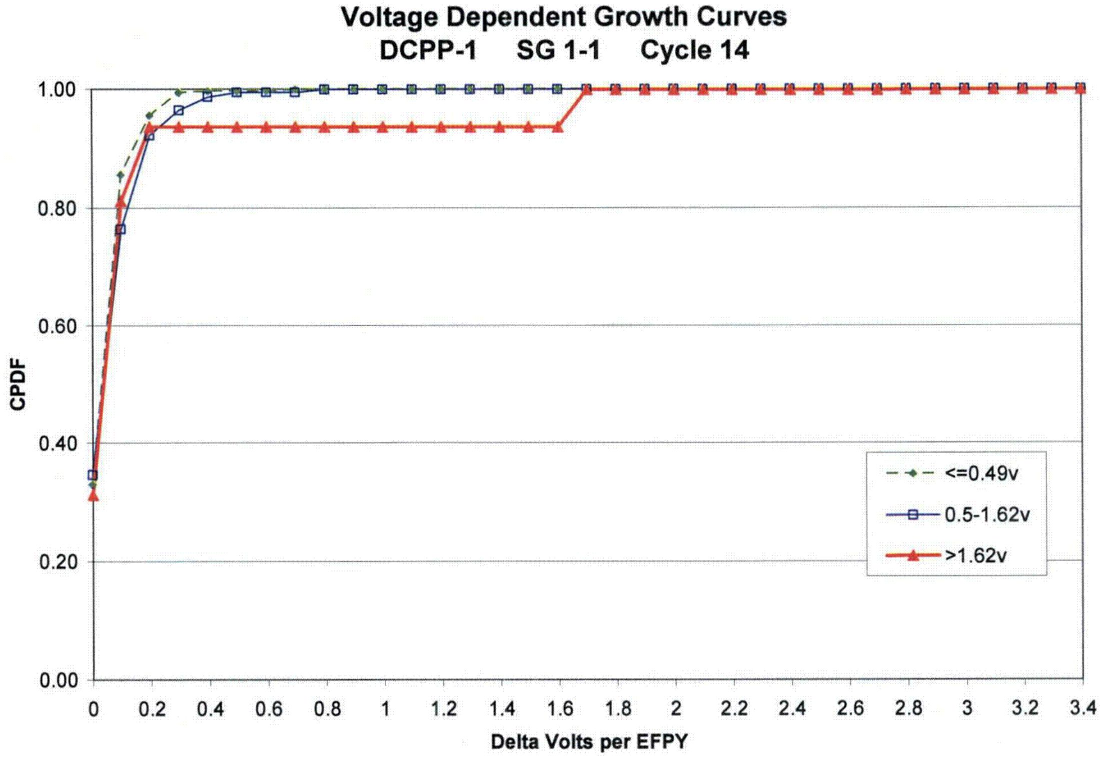


Figure 3-27: Cycle 14 VDG for SG 1-2

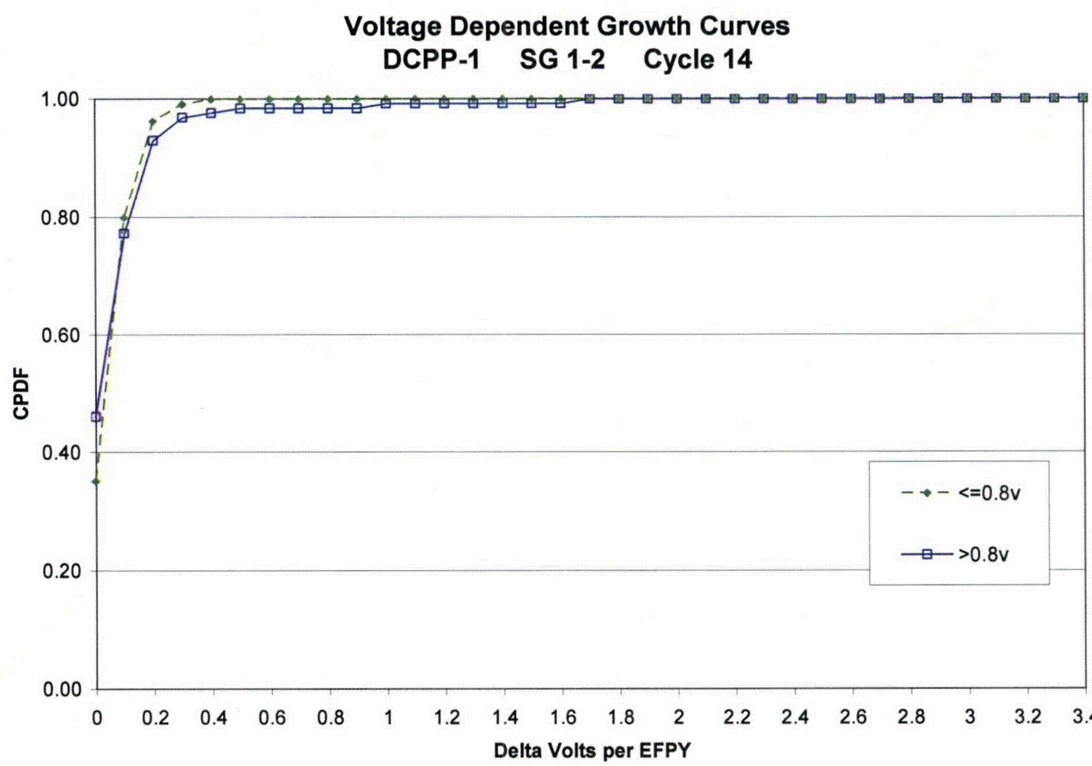


Figure 3-28: Cycle 13 VDG for All SGs

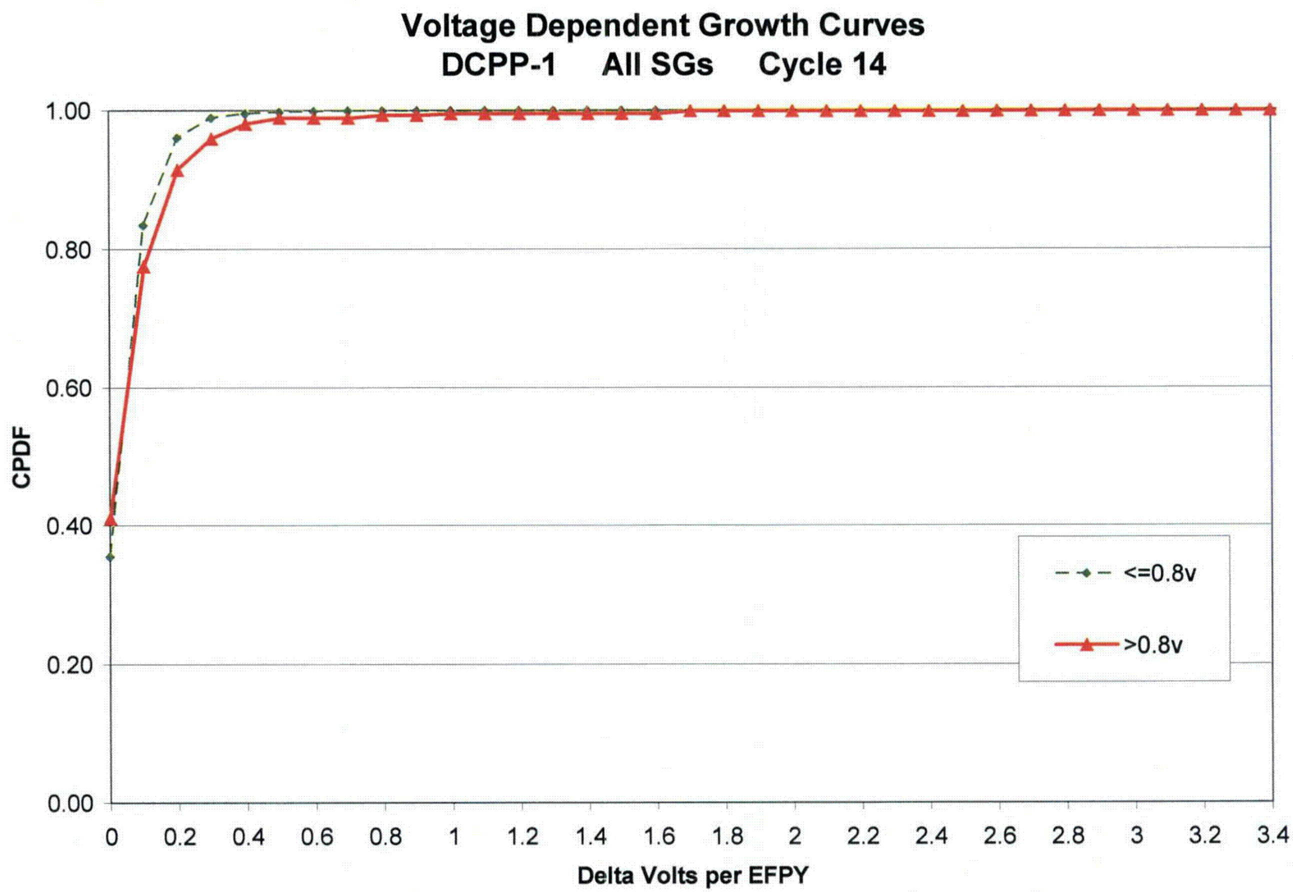


Figure 3-29: SG 1-1 Cycle 13 VDG Breakpoint Analysis Results

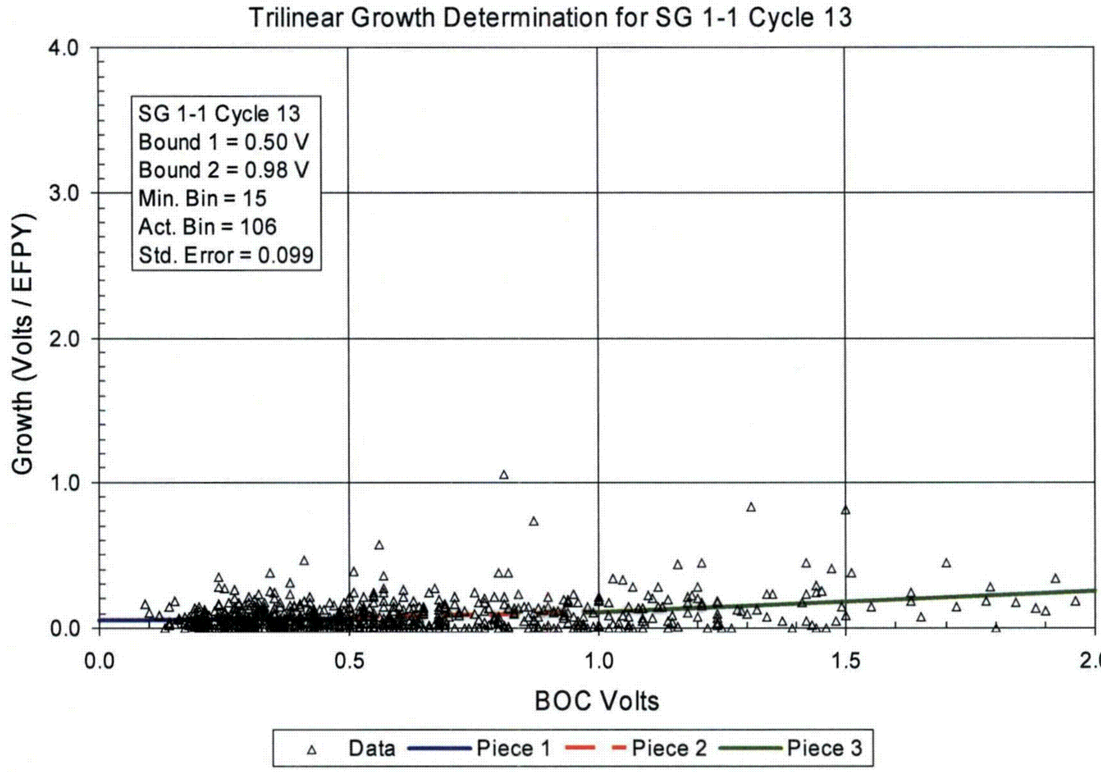


Figure 3-30: SG 1-3 Cycle 13 VDG Breakpoint Analysis Results

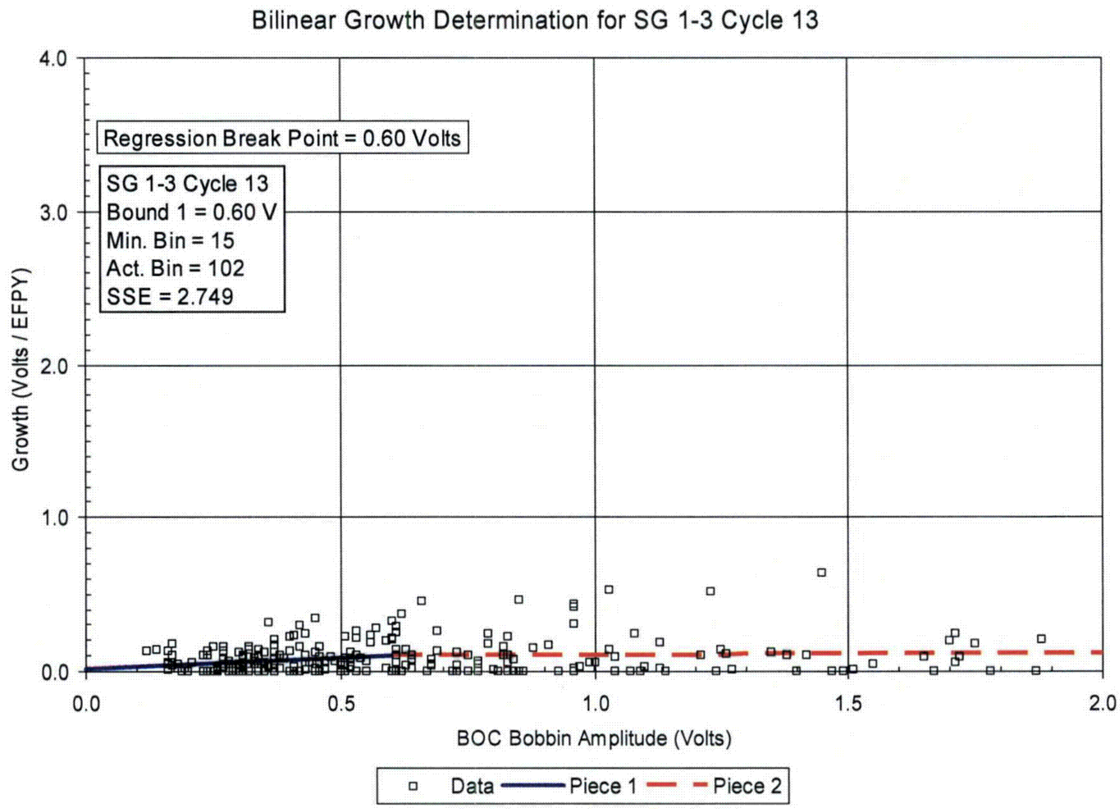


Figure 3-31: SG 1-4 Cycle 13 VDG Breakpoint Analysis Results

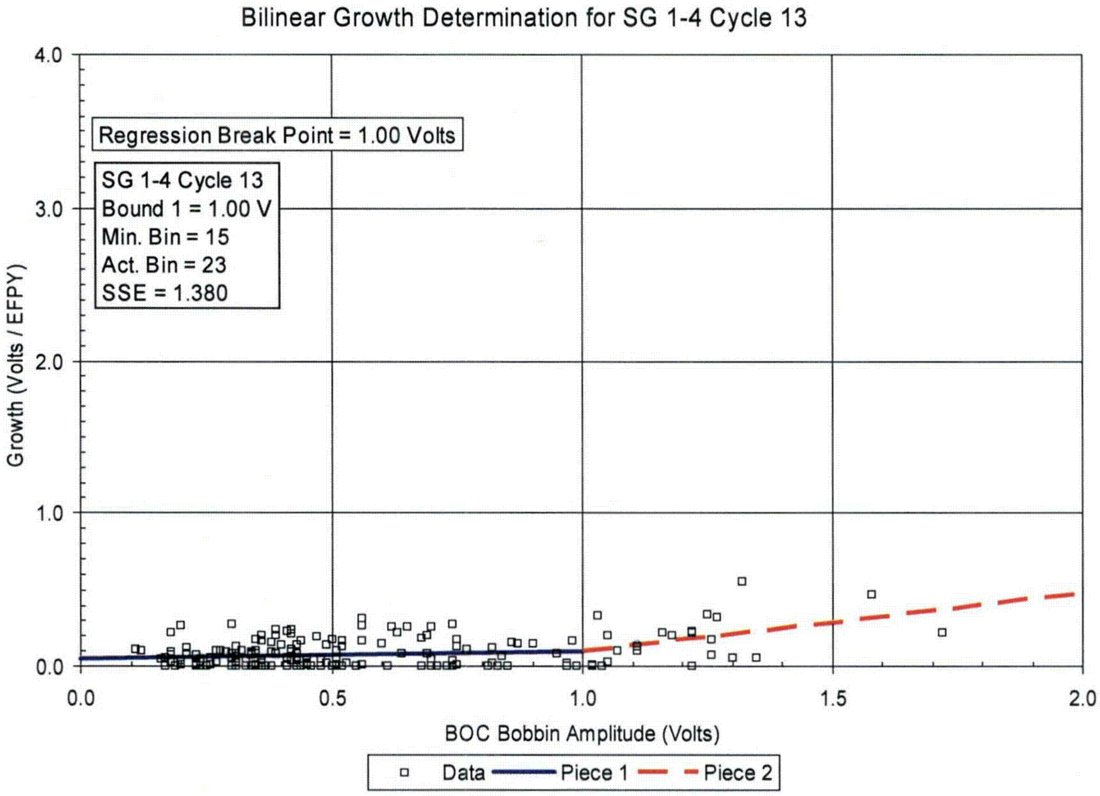


Figure 3-32: Composite Cycle 13 VDG Breakpoint Analysis Results

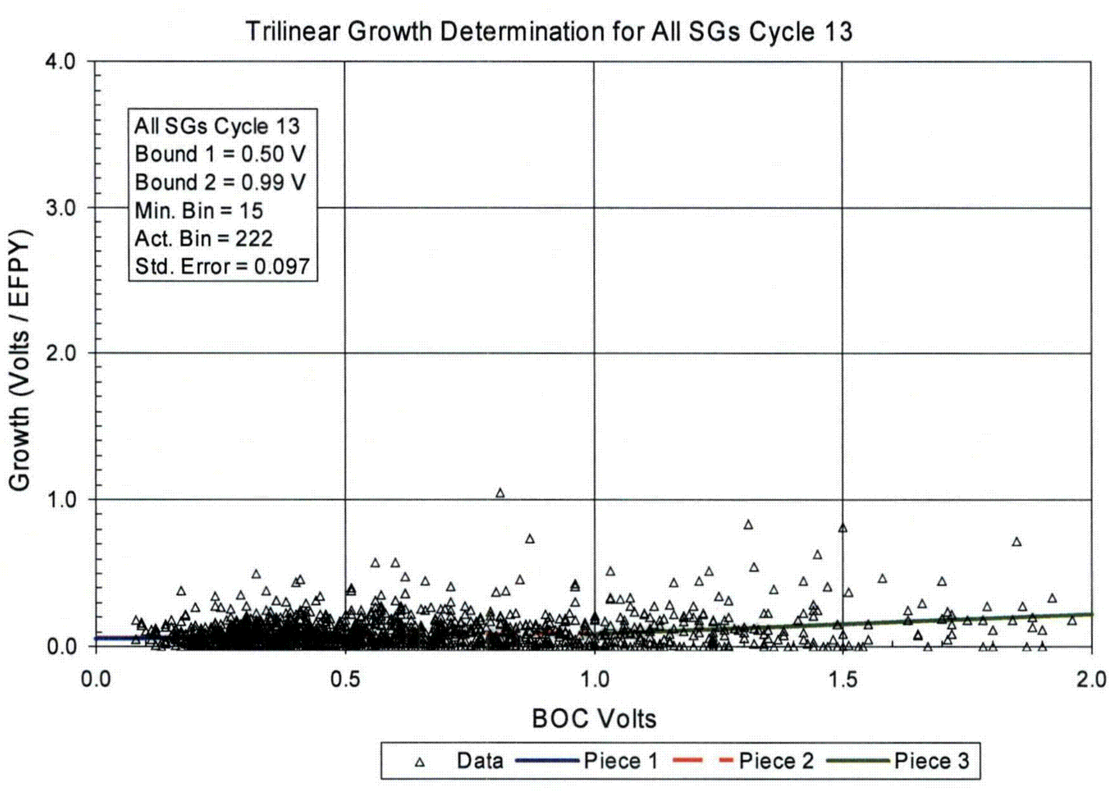


Figure 3-33: Cycle 13 VDG for SG 1-1

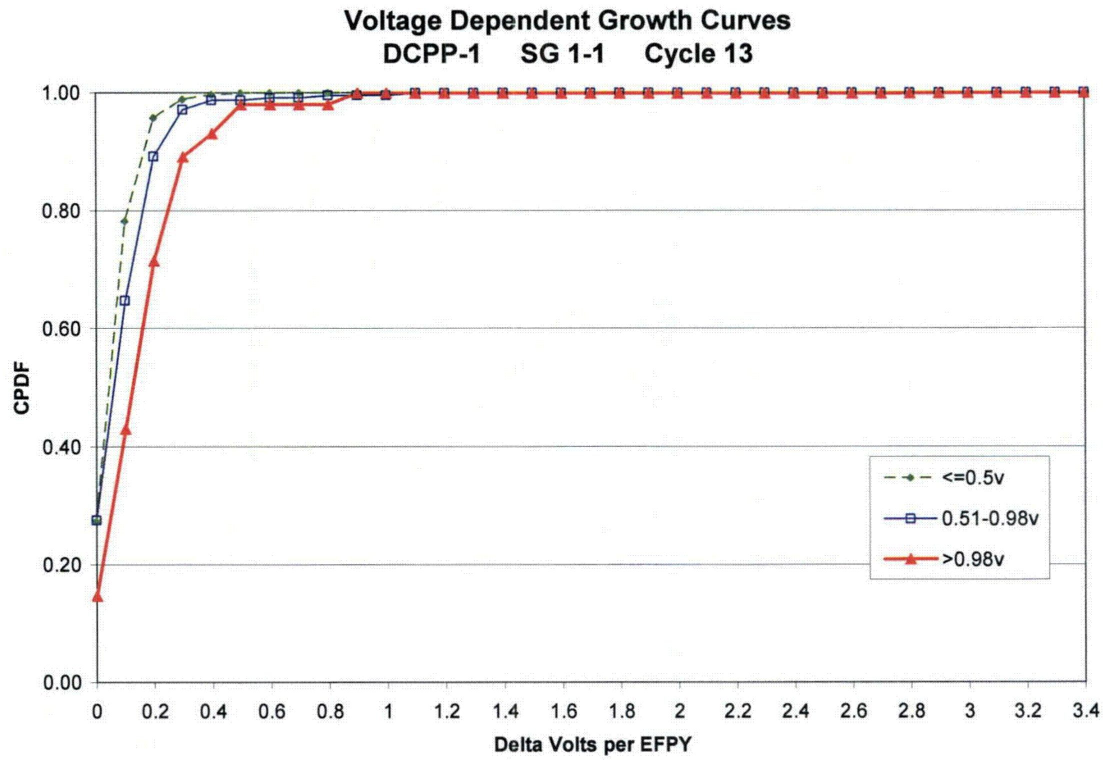


Figure 3-34: Cycle 13 VDG for SG 1-3

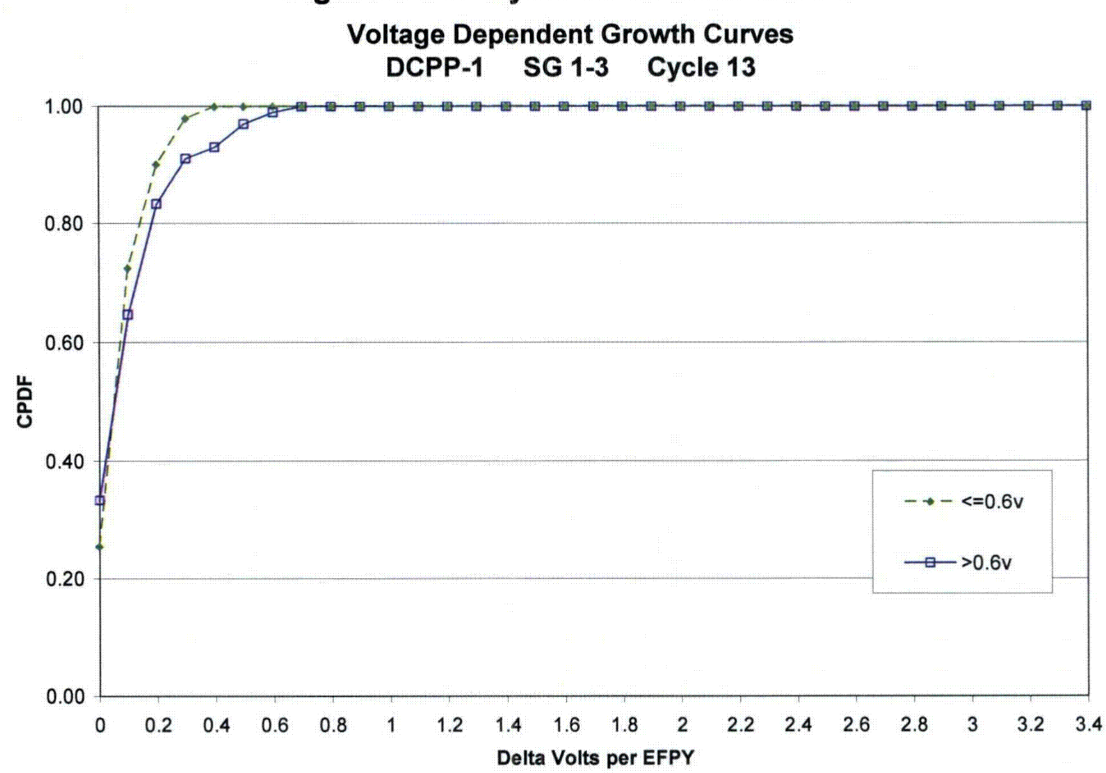


Figure 3-35: Cycle 13 VDG for SG 1-4

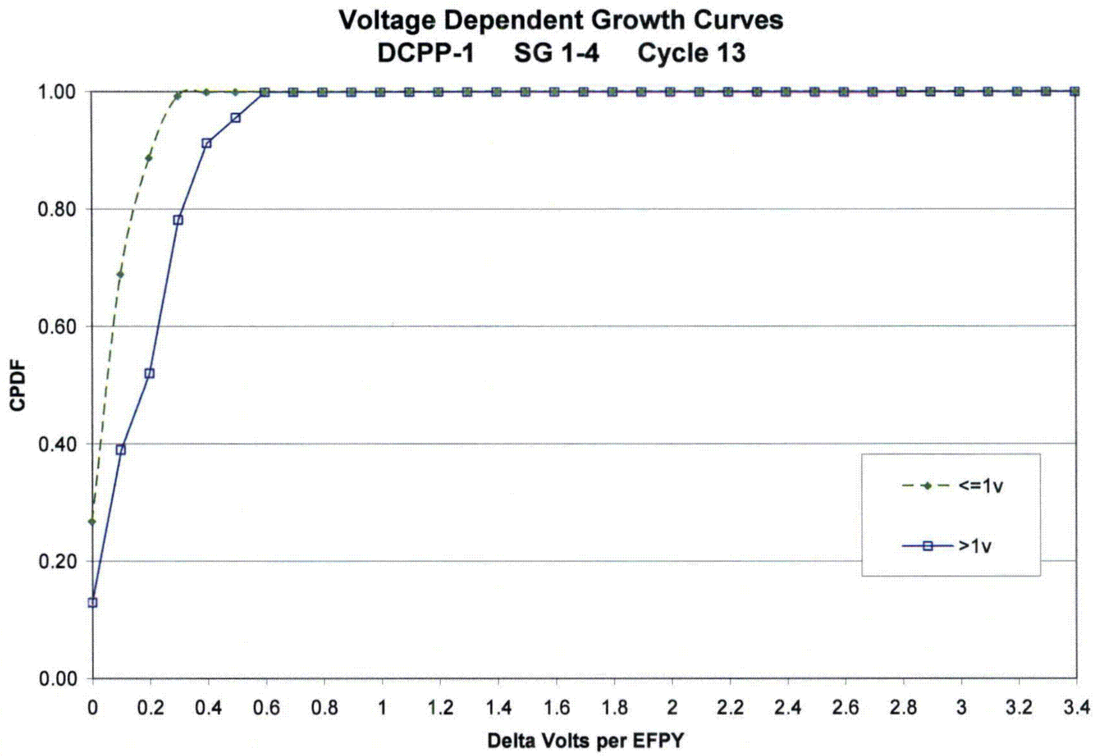


Figure 3-36: Cycle 13 VDG for All SGs

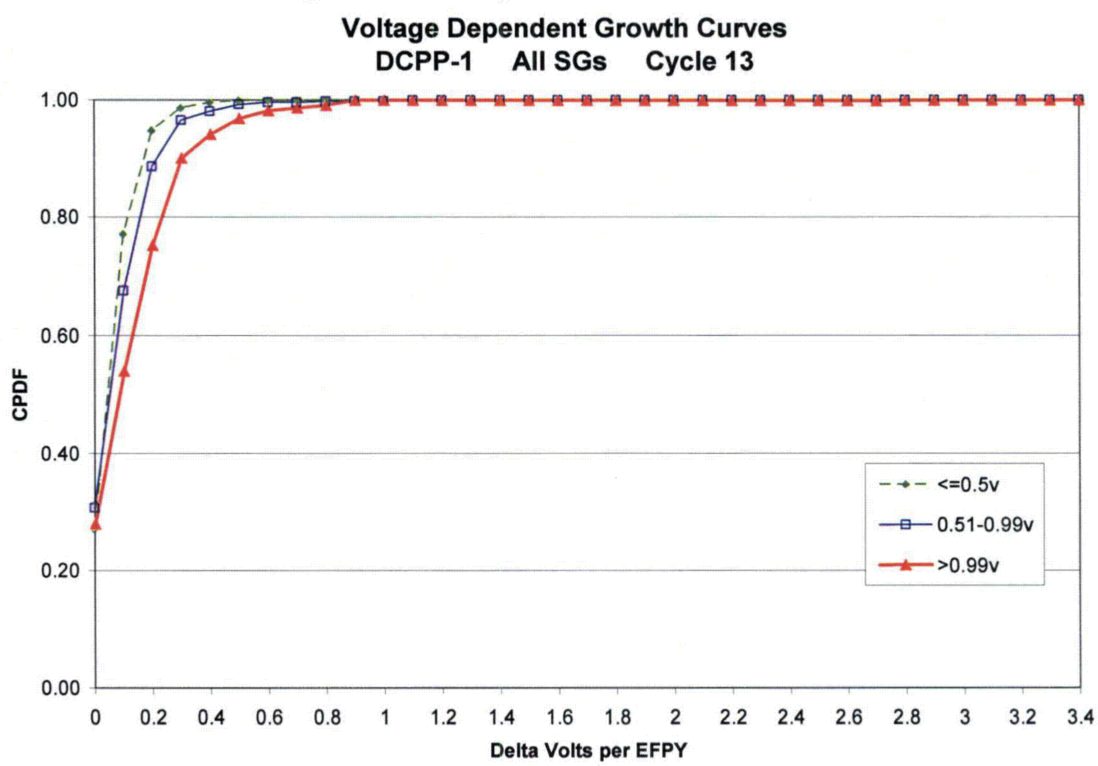


Figure 3-37: 1R14 Probe Wear Voltage Comparison

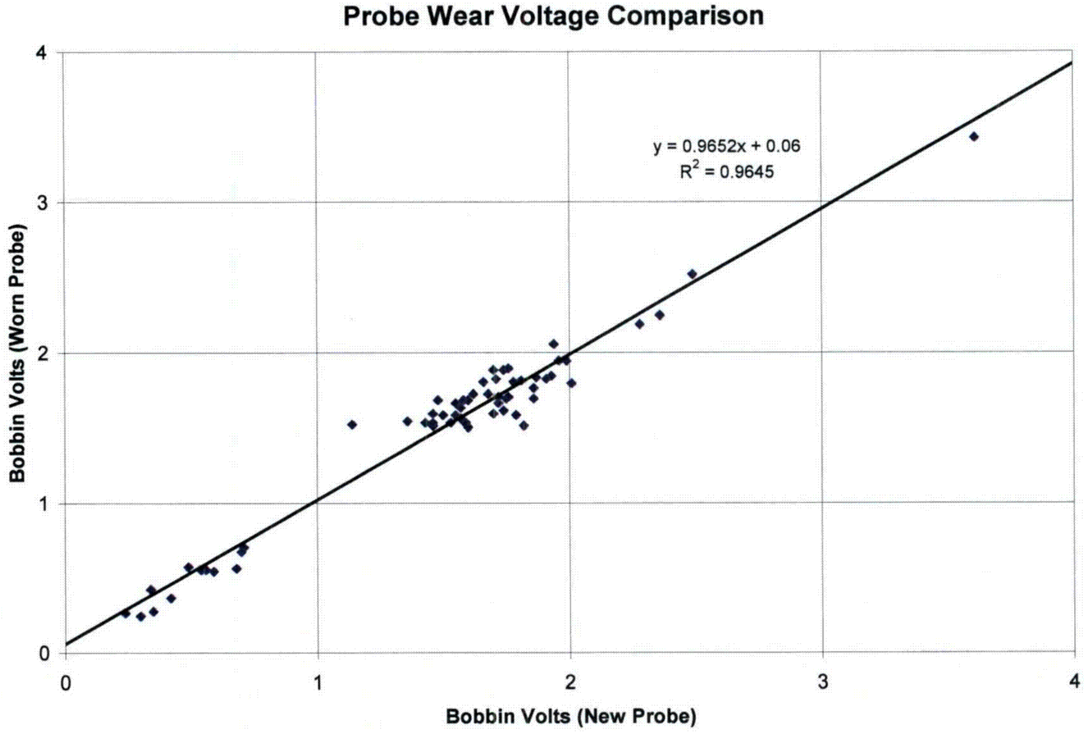


Figure 3-38: Bobbin Voltage Uncertainty Distributions

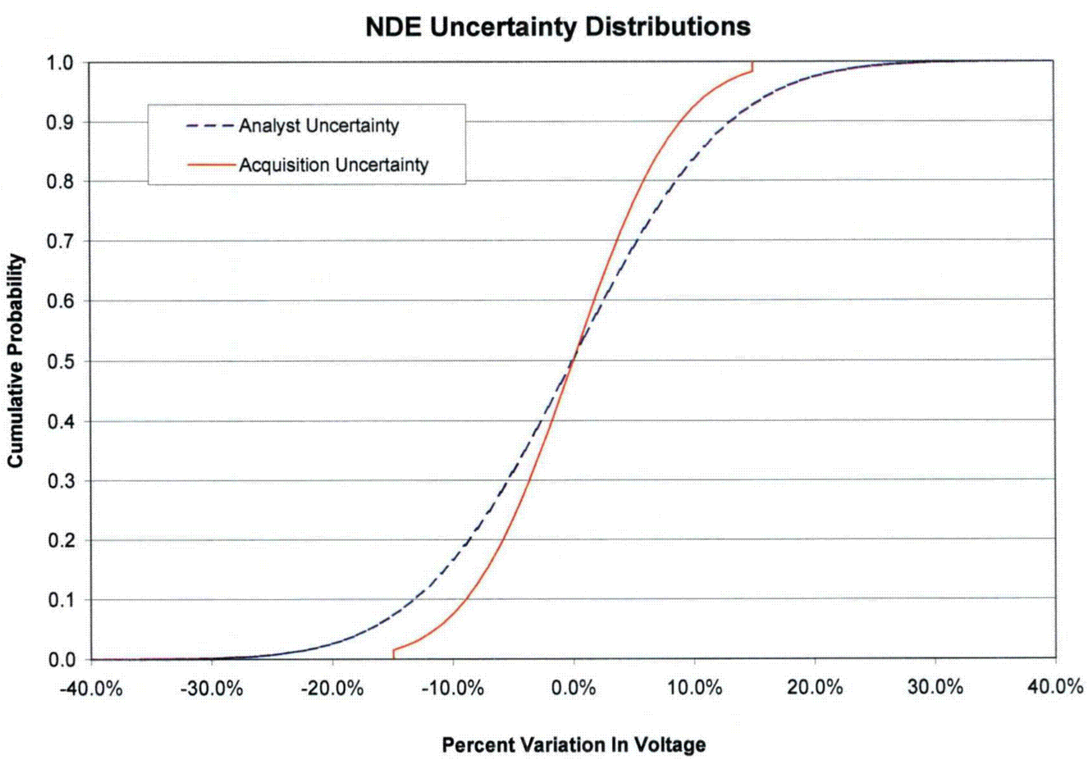


Figure 3-39: Inferred Voltage / Measured Voltage Comparison

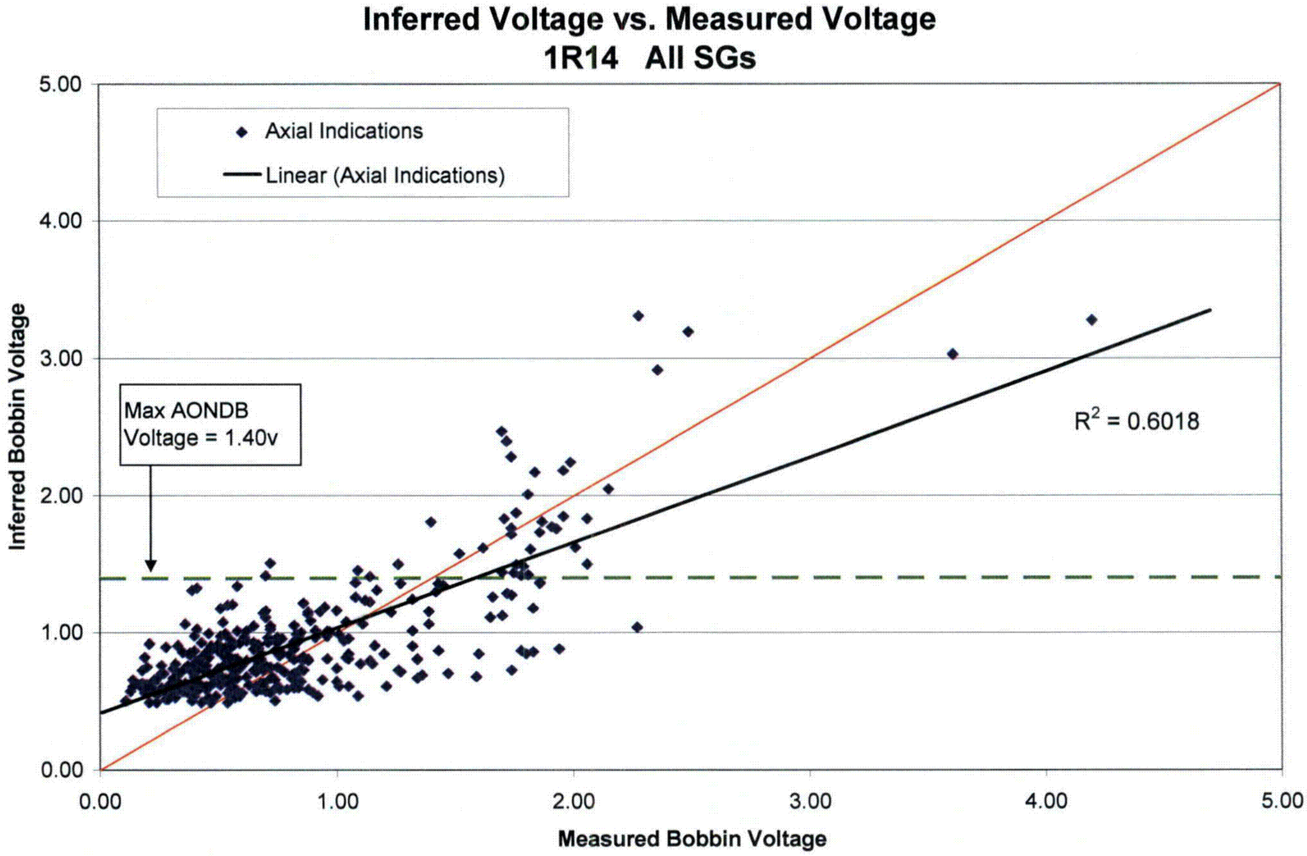


Figure 3-40: +Point™ Indication to Bobbin Voltage Comparison for SG 1-1

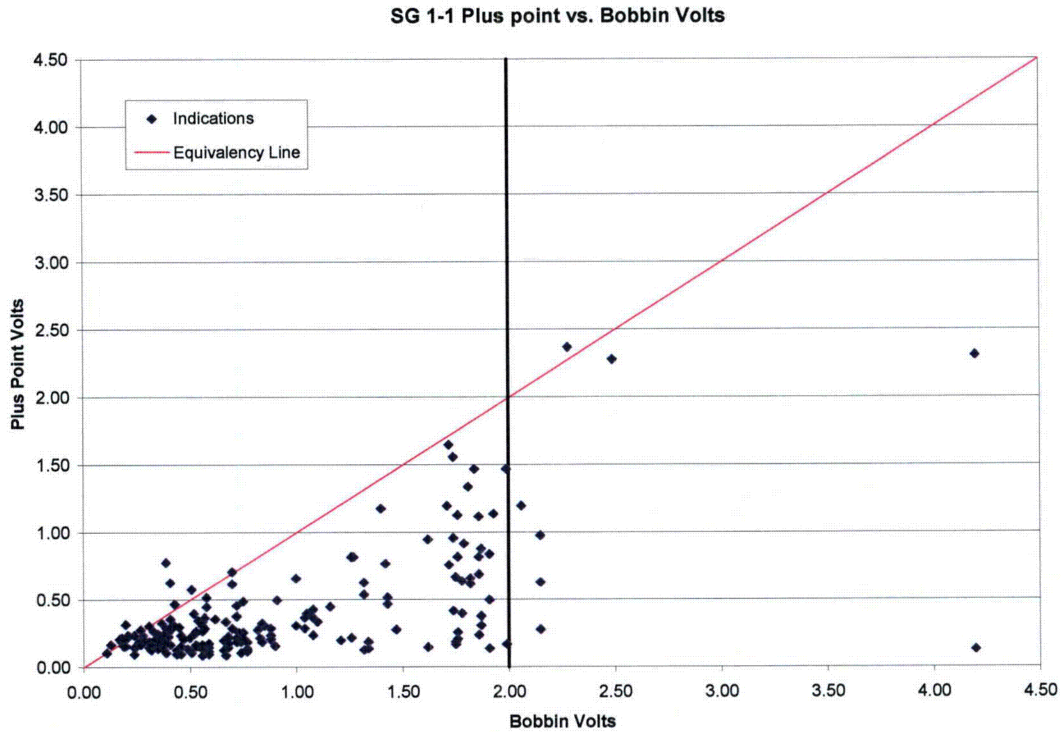


Figure 3-41: +Point™ Indication to Bobbin Voltage Comparison for SG 1-2

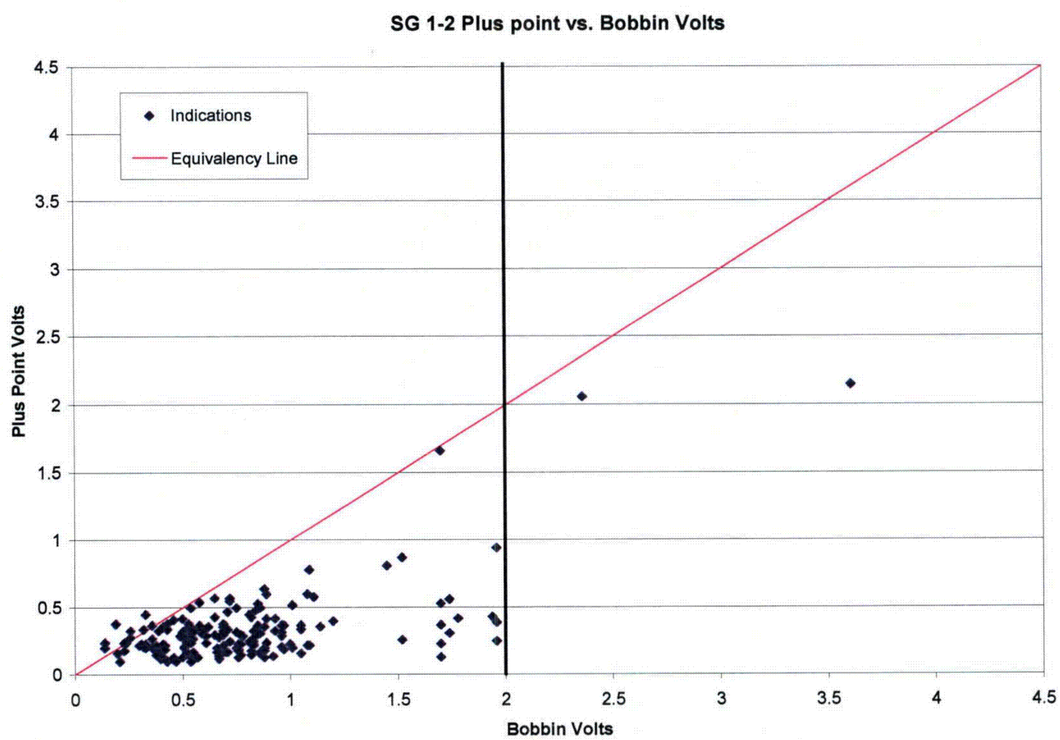


Figure 3-42: +Point™ Indication to Bobbin Voltage Comparison for SG 1-3

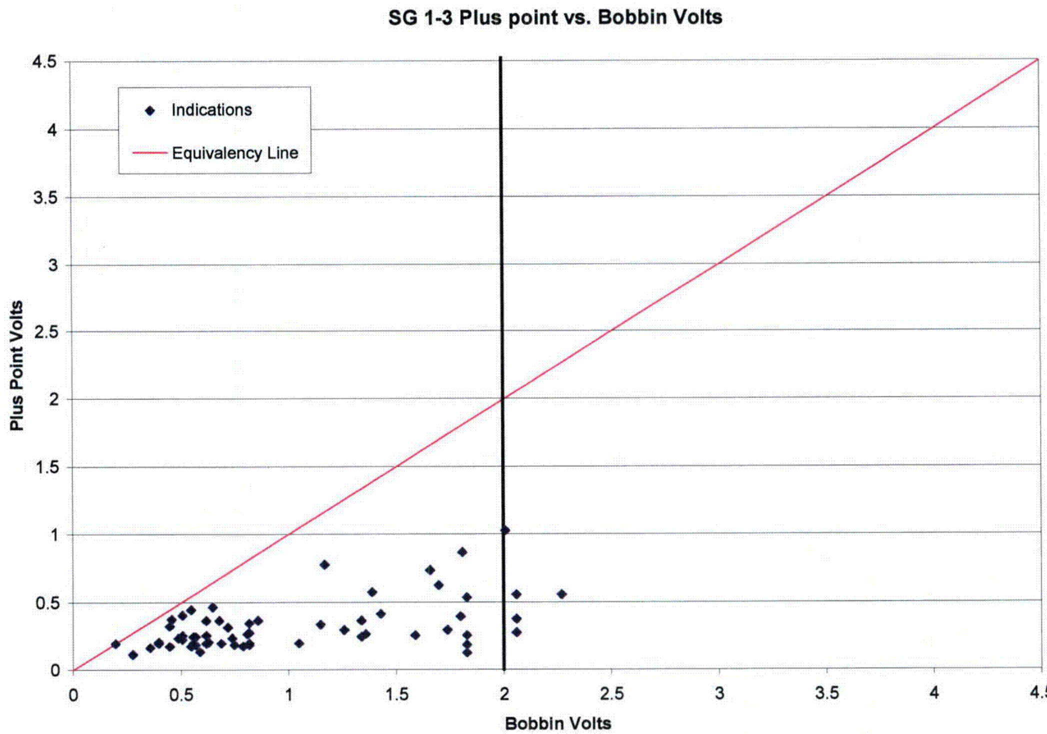
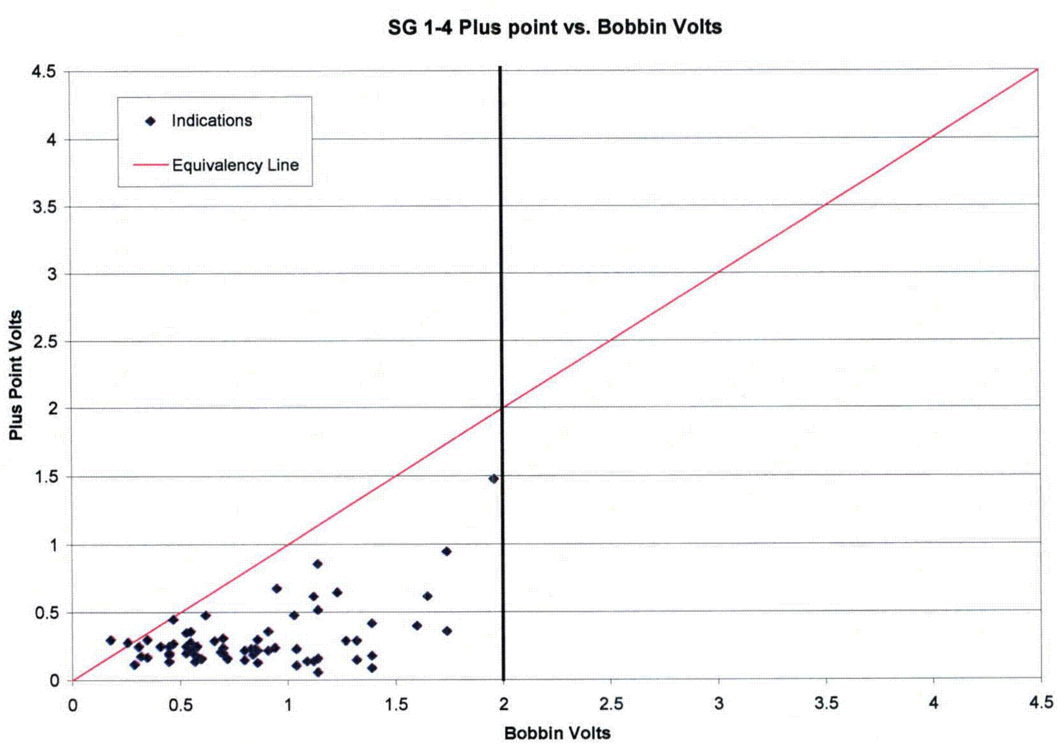


Figure 3-43: +Point™ Indication to Bobbin Voltage Comparison for SG 1-4



4.0 Database Applied for Leak and Burst Correlations

Per GL 95-05, the databases used to perform the tube integrity evaluations should be the latest NRC approved industry database. The updated leak and burst correlations in Reference 8 for the ODSCC database include the 2R11 and 1R12 tube pull results from Diablo Canyon, as well as other recent industry tube pulls.

4.1 Conditional Probability of Burst

For the case of the burst pressure versus voltage correlation, the Addendum 6 database contained in Reference 8, meets all GL 95-05 requirements and was used in the as-found EOC-14 calculations and the EOC-15 projections, as well as the benchmarking of the prior cycle operational assessment. The correlation parameters were taken from Reference 8 and are shown in Table 4-1.

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

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

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

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

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

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

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

4.2 Probability of Leak and Conditional Leak Rate

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

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

Table 4-2: Probability of Leak Correlation

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

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

Notes:

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

2) Degrees of freedom.

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

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

Parameter	Addendum 6
Intercept, b_3	-0.8039
Slope, b_4	1.2077
Index of Deter., r^2	20.0%
Std. Error	0.7774
Mean of Log(Q)	0.5090
Std. Dev. of Log(Q)	22.6667
p Value for b_4	0.5%
Data Pairs, N	32
Mean of Log(V)	1.0871
SS of Log(V)	3.1116

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

5.0 EOC-14 Condition Monitoring, Benchmarking of EOC-14 Conditions and Assessment of Potential Underpredictions

This section provides the EOC-14 condition monitoring, the results of a benchmarking study that compares the projected EOC-14 conditions to the as-found conditions, and an assessment of potential underpredictions as committed to the NRC.

5.1 EOC-14 Condition Monitoring Results

EOC-14 as found conditions were evaluated to ensure that CM burst and leakage requirements were not exceeded. The burst probabilities and leak rates are shown in Table 5-2 and at the bottom of Table 5-7. The requirements for burst probabilities are met for all of the SGs, and for the leak rate, the plant-specific value of 10.5 gpm for the faulted steam generator was not exceeded in any steam generator.

5.2 EOC-14 Benchmark Calculations

EOC-14 projections using the composite DCPP POPCD through 8 inspections have been previously provided to the NRC in the 1R13 90 day report (Reference 7). The actual Cycle 14 operating interval (1.39 EFPY) was consistent with that used in the Reference 7 analyses. The Addendum 6 correlations are also consistent with that used in Reference 7. Therefore, the only change in these benchmark calculations is the use of the composite DCPP POPCD through 9 inspections (which includes results from 2R13 inspections).

Table 5-1 provides a summary of the inputs required and the corresponding section(s) or table(s) that provide these data. If the input was unchanged relative to the input used in the 1R13 90 day report projections, then "no change" is noted in the comment field. For example, the growth distributions used in the benchmark calculations were the same as used in the 1R13 90 day report, and followed the guidelines provided in References 19 and 25.

Table 5-1: Inputs for EOC-14 Benchmark Projections

Input Description	Section or Table Reference	Comments
BOC Voltage Distribution	Tables 5-3 and 5-4	No change
Repaired Voltage Distribution	Tables 5-3 and 5-4	No change
NDE Uncertainties	Section 3.6 and Table 3-23	No change
POD	Table 6-8	Composite POPCD through 9 inspections
Growth	Table 5-5 and 5-6	No change
Cycle Length	Section 5.2	1.39 EFPY; No change
Tube Integrity Correlations	Tables 4-1 to 4-3	Addendum 6; No change
Material Properties	Section 7.1	No change

Table 5-7 provides a comparison of the EOC-14 benchmarking projections to the as-found EOC-14 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. Therefore, the EOC-14 projections using DCPP POPCD correlation and the growth guidelines provided conservative results relative to the as-found conditions, and no adjustments to either of the methodologies are warranted.

5.3 *Assessment of Potential Underpredictions*

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

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

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

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

As discussed above, EOC-14 benchmark projections were performed using the DCPP POPCD through 9 inspections. As shown in Table 5-7, the POBs, leak rates, and numbers of indications (also shown graphically in Figures 5-1 through 5-4) were overestimated in all cases for EOC-14. Therefore, there is no need to perform a method adjustment assessment.

Table 5-2: Summary of 95-05 ARC Calculations As-found vs. Projected EOC-14

		SG 1-1	SG 1-2	SG 1-3	SG 1-4
Number of DOS Plus AONDB	As-Found	879	689	306	248
	Projected (1)	1204	855	403	332
Leak Rate (gpm)	As-Found	0.34	0.19	0.10	0.06
	Projected (1)	1.80	0.58	0.41	0.26
POB	As-Found	1.88×10^{-4}	1.13×10^{-4}	3.64×10^{-5}	2.37×10^{-5}
	Projected (1)	2.53×10^{-3}	4.62×10^{-4}	4.22×10^{-4}	2.45×10^{-4}
Acceptance Criteria		1.0×10^{-2}		10.5 gpm	

Notes:
(1) Used actual cycle length of 1.39 EFPY and DCPP POPCD through 9 inspections.
(2) The 95% Upper Confidence Limit (UCL) is based on the number of trials with one or more failures.
(3) Equivalent volumetric rate at room temperature.
(4) The calculated total leak rate reflects the upper 95% quantile value at an upper 95% confidence bound.
(5) The reference leak limits (10.5 gpm) consider contributions from other ARCs. Therefore other ARC leak rates should be added to the results in this table to assess total leakage.

Table 5-3: SG 1-1 BOC-14 Voltage Distribution Used for EOC-14 Benchmark Projections

Voltage Bin	SG 1-1	
	As-Found EOC-13	Repaired
0.1	0	0
0.2	23	1
0.3	79	1
0.4	128	0
0.5	116	1
0.6	85	4
0.7	86	7
0.8	41	2
0.9	47	1
0.99	30	0
1	4	0
1.1	42	0
1.2	19	1
1.3	16	0
1.4	11	0
1.5	23	0
1.6	2	0
1.7	5	0
1.8	7	0
1.9	4	0
2	2	1
2.1	7	7
2.2	1	1
2.3	3	3
2.4	1	1
2.5	1	1
2.6	1	1
2.7	0	0
2.8	0	0
2.9	0	0
3	0	0
Total	**784**	**33**

Table 5-4: SGs 1-2, 1-3, and 1-4 BOC-14 Voltage Distributions Used for EOC-14 Benchmark Projections

Voltage Bin	SG 1-2		SG 1-3		SG 1-4	
	As-Found EOC-13	Repaired	As-Found EOC-13	Repaired	As-Found EOC-13	Repaired
0.1	0	0	0	0	0	0
0.2	10	0	6	0	5	0
0.3	48	0	28	1	21	0
0.4	73	1	34	0	27	0
0.5	104	6	47	1	49	2
0.6	91	5	30	3	29	0
0.7	76	3	24	0	14	0
0.8	49	1	16	2	22	0
0.9	39	0	23	0	2	0
1	26	0	12	1	17	0
1.02	5	0	3	0	0	0
1.1	13	0	8	0	9	0
1.2	16	0	8	0	4	0
1.3	6	0	4	0	2	0
1.4	7	0	4	0	3	0
1.5	7	0	4	0	6	0
1.6	3	1	6	0	2	0
1.7	0	0	2	1	1	0
1.8	1	0	3	0	1	0
1.9	1	0	2	0	0	0
2	1	0	3	0	0	0
2.1	1	1	1	1	2	2
2.2	0	0	1	1	0	0
2.3	1	1	1	1	1	1
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	1	1	0	0	0	0
3	0	0	0	0	0	0
Total	**579**	**20**	**270**	**12**	**217**	**5**

Table 5-5: Cycle 12 Growth Distributions for SG 1-1
(Used for EOC-14 Benchmark Projections for SG 1-1)

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

Table 5-6: Composite Cycle 12 Growth Distributions for All SGs
(Used for EOC-14 Benchmark Projections for SGs 1-2, 1-3, and 1-4)

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

Table 5-7: As-found EOC-14 vs. Projected EOC-14 Conditions

Voltage Bin	SG 1-1		SG 1-2		SG 1-3		SG 1-4	
	As-Found	Projected	As-Found	Projected	As-Found	Projected	As-Found	Projected
0.1	0	0.88	1	0.44	0	0.27	0	0.22
0.2	21	18.58	16	9.99	8	5.94	7	4.86
0.3	100	57.64	50	35.25	28	20.30	28	16.17
0.4	145	103.57	72	69.58	49	37.95	27	30.29
0.5	120	142.40	78	99.79	45	49.91	33	41.76
0.6	115	153.60	102	118.03	43	54.28	46	48.34
0.7	73	135.08	121	108.15	21	45.70	27	41.68
0.8	70	108.83	80	89.75	20	35.78	19	32.03
0.9	39	85.81	58	72.81	25	28.55	17	24.44
1	45	68.82	36	57.97	12	23.31	10	19.11
1.1	29	56.21	27	45.63	18	19.00	8	15.24
1.2	19	45.43	13	34.83	6	14.96	7	11.82
1.3	26	35.80	10	25.75	3	11.51	5	9.06
1.4	21	28.66	3	19.20	9	9.04	5	7.04
1.5	19	23.03	7	14.34	3	7.22	2	5.50
1.6	6	18.35	5	10.59	6	5.81	3	4.35
1.7	6	15.37	4	7.83	2	4.79	2	3.47
1.8	10	13.74	2	6.06	2	4.13	1	2.85
1.9	7	12.34	0	4.93	3	3.65	0	2.37
2	3	10.66	2	4.08	0	3.19	1	1.94
2.1	1	8.80	0	3.18	2	2.67	0	1.51
2.2	1	7.11	0	2.48	0	2.21	0	1.19
2.3	1	5.76	0	1.96	1	1.82	0	0.96
2.4	0	4.78	1	1.49	0	1.46	0	0.75
2.5	1	4.22	0	1.18	0	1.20	0	0.61
2.6	0	3.94	0	1.08	0	1.04	0	0.54
2.7	0	3.70	0	1.06	0	0.92	0	0.49
2.8	0	3.23	0	0.95	0	0.79	0	0.43
2.9	0	2.95	0	0.91	0	0.70	0	0.41
3	0	2.63	0	0.83	0	0.61	0	0.36
3.5	0	5.56	0	1.90	0	1.71	0	0.93
4	0	2.66	1	0.63	0	0.64	0	0.32
4.5	1	3.46	0	0.49	0	0.40	0	0.26
5	0	5.73	0	0.92	0	0.65	0	0.45
5.5	0	2.97	0	0.37	0	0.40	0	0.22
6	0	1.64	0	0.25	0	0.22	0	0.13
6.5	0	0.33	0	0.03	0	0.07	0	0.02
7	0	0.03	0	0.00	0	0.01	0	0.00
>7	0	0.00	0	0.00	0	0.00	0	0.00
Total	879	1204.35	689	854.73	306	402.84	248	332.15
<=1	728	875.22	614	661.77	251	302.00	214	258.90
>1	151	329.12	75	192.96	55	100.84	34	73.25
>2	5	69.50	2	19.71	3	17.54	0	9.59
>5	0	4.97	0	0.66	0	0.70	0	0.37
POB	1.88E-04	2.53E-03	1.13E-04	4.62E-04	3.64E-05	4.22E-04	2.37E-05	2.45E-04
Leak Rate	0.34	1.8	0.19	0.58	0.1	0.41	0.06	0.26

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

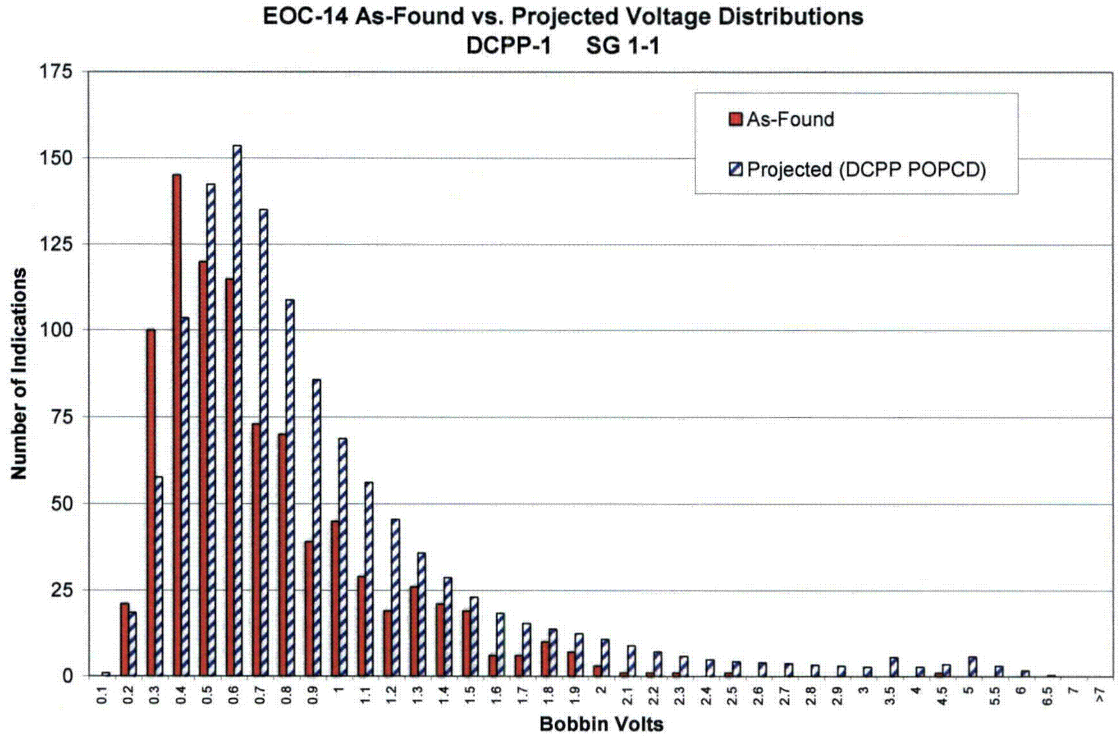


Figure 5-2: As-found SG 1-2 vs Projected Voltage Distributions (DCPP POPCD)

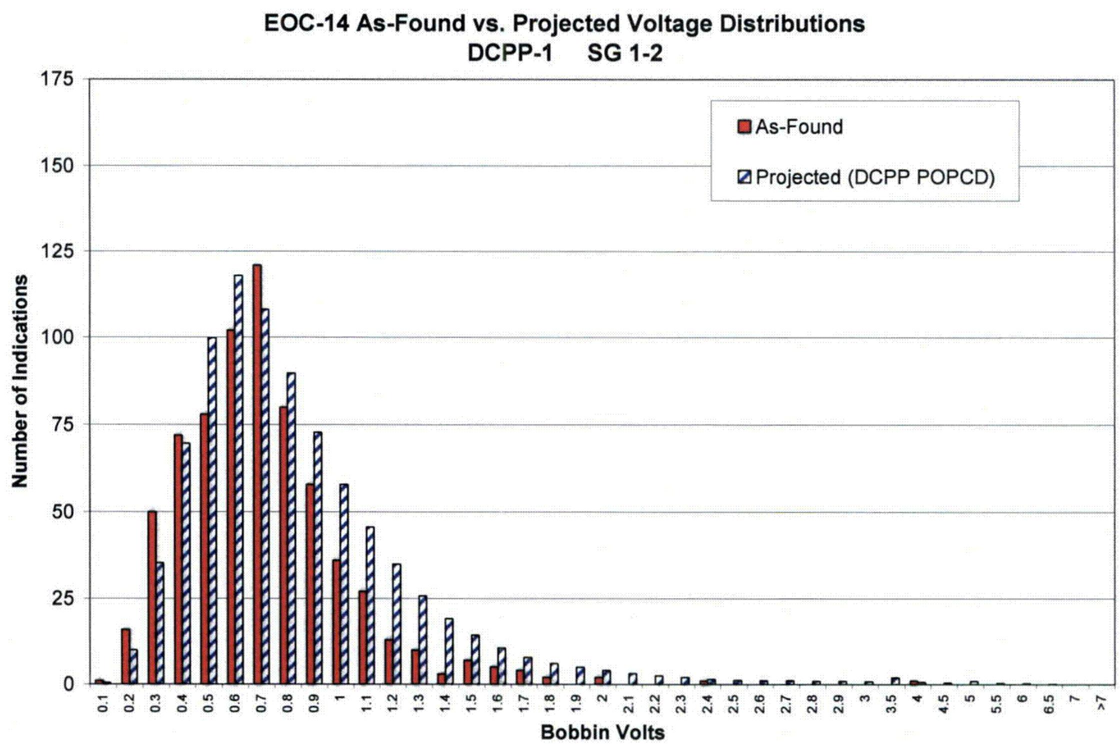


Figure 5-3: As-found SG 1-3 vs Projected Voltage Distributions (DCPP POPCD)

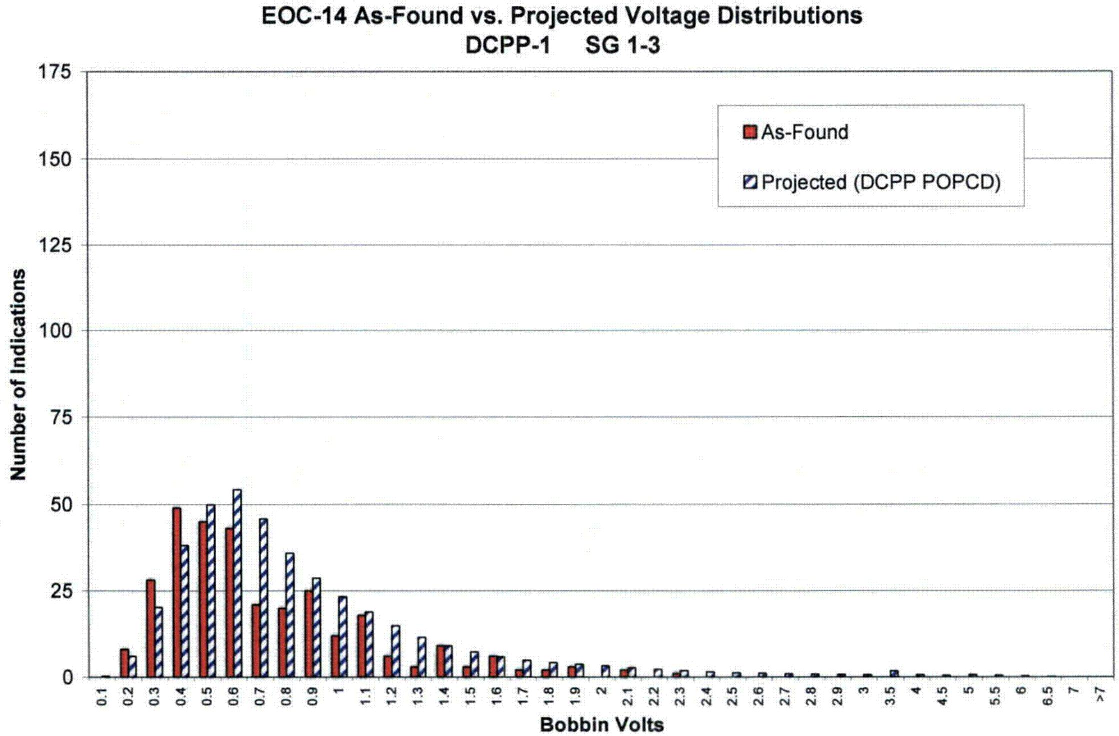
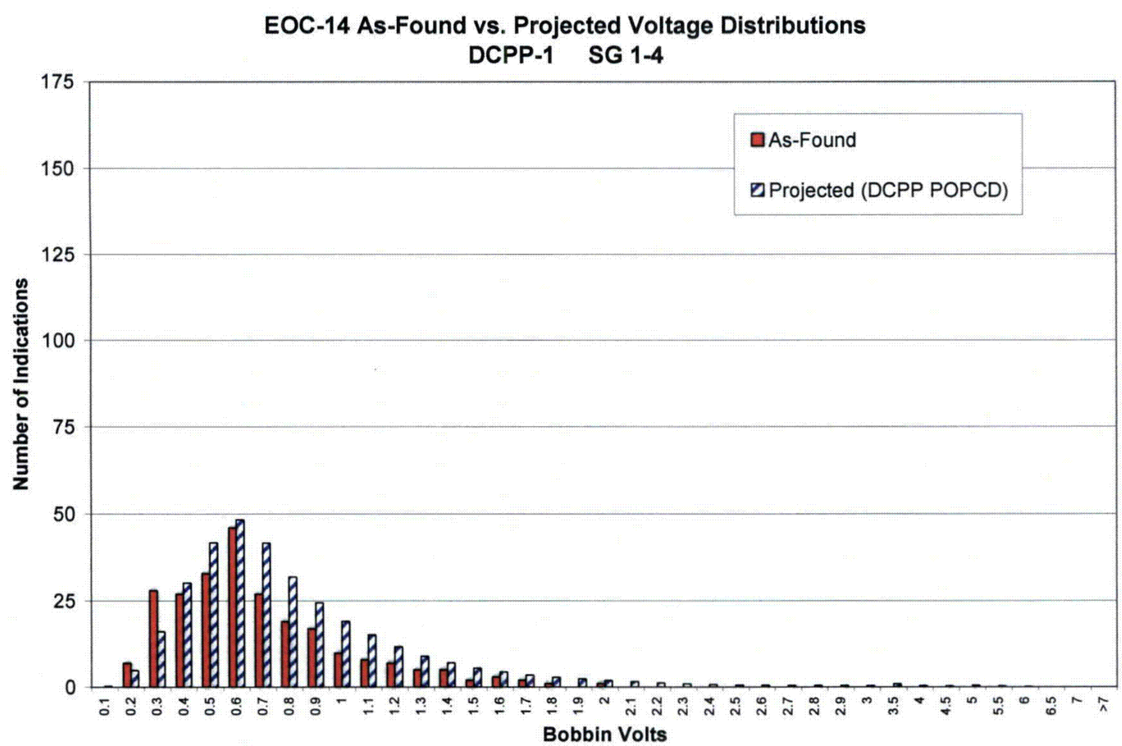


Figure 5-4: As-found SG 1-4 vs Projected Voltage Distributions (DCPP POPCD)



6.0 Probability of Prior Cycle Detection

The NRC approved use of the voltage-dependent POPCD at DCPP in Reference 20. This section provides the 1R13 POPCD results, which is based on the results of the 1R14 inspection. This section also provides the updated POPCD correlation that was used in the EOC-15 projections provided in Section 7, as well as NRC reporting requirements for continued application of POPCD.

6.1 Updated DCPP POPCD Correlation

The POPCD method, which is based on results from actual field inspections, reflects the DCPP detection results that approach 1.0 at bobbin voltages above 1.9 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. The 2R13 90 day report (Reference 18) provided the DCPP-specific correlation through nine inspections. The data from Reference 18 has since been updated to include the 1R14 inspection results, referred to as the 1R13 POPCD data. Tables 6-1 and 6-2 provide the 1R13 POPCD and composite POPCD data, respectively. The composite POPCD includes results from ten inspections. Table 6-3 provides the POPCD tracking matrix with column letters that correspond to the columns in Tables 6-1 and 6-2. Table 6-4 provides the POPCD matrix table including data from only the just completed cycle segregated into voltage bins of <=1.00v, 1.01-2.00v, and >2.00v based on the beginning-of-cycle (BOC) voltage. Table 6-5 provides the POPCD matrix table for the just completed cycle regardless of the beginning-of-cycle voltage. Table 6-6 provides the composite multi-cycle POPCD matrix table segregated into the three voltage bins. Table 6-7 provides the composite multi-cycle POPCD matrix table regardless of the beginning-of-cycle voltage. Table 6-8 provides the correlation parameters for the composite data set.

The largest "undetected" POPCD indication in 1R13 was 1.29v. SG 1-3 R9C58 4H had a 1.20 volt DOS reported in 1R14 that was not reported in 1R13. The location was not inspected with +Point™ in either inspection (BND w/o RPC to BDD w/o RPC in Table 6-1 Column E) and had a 1.29v DOS look-up in 1R13.

6.1.1 Assessment of POPCD Changes

NRC requires an assessment of the POPCD method for potential changes over time, that is, the multi-cycle POPCD distribution applied for the last operational assessment must be compared with the POPCD distribution obtained for only the last operating cycle. Differences in the two POPCD distributions must be assessed relative to the potential for significant changes in detection capability. Figure 6-1 shows the POPCD curves for the just completed cycle as well as three prior composite POPCD curves (POPCD through 1R12, 2R12, and 1R13). The curve labeled "through 1R12 (eight inspections)" was used in the 1R13 90 day report operational assessment for EOC-14 projections. The curve labeled "through 2R12 (nine inspections)" was used for the benchmarking calculations for EOC-14 projections provided in Section 5 of this document. The composite POPCD through 1R13 was used for the EOC-15 projections provided in Section 7 of this document.

The 1R13 POPCD correlation for the just completed cycle (based on the 1R14 inspection results) is significantly improved for voltages less than 1 volt compared to the previous composite POPCD distributions. For indications above about 1.5 volts, it appears that the 1R13 POPCD correlation gives a slightly lower POD than the composite POPCD through 1R12, which was the POPCD distribution used for the EOC-14 operational assessment. The POPCD voltage bins for the 1R13 POPCD (Table 6-1) and the 1R12 composite POPCD (Reference 7) were compared and the 1R13 POPCD was higher (or equal) in all bins except for the 0.01 to 0.10 volt bin and the 0.91 to 1.00 volt bin. The 1R13 POPCD in thee 0.01 to 0.10 volt bin was 0.00 and the 1R13 POPCD in the 0.91 to 1.00 volt bin was 0.878. These values are slightly lower than the 1R12 composite POPCD values of 0.05 and 0.906 for the same bins, respectively. These differences are negligible and do not represent a change in detection capability. The regression curve for the 1R13 POPCD gives a slightly lower POD for indications above about 1.5 volts compared to the composite curves due to the lack of data in the upper voltage bins for the 1R13 POPCD evaluation. As shown in Table 6-1, there were no indications (detected or non-detected) above 3.00 volts in the 1R13 POPCD evaluation. In contrast, the composite POPCD through 1R12 contains a total of 74 indications above 3 volts (all of which were detected). This lack of data in the upper voltage ranges allows the slope of the 1R13 POPCD to decrease since there are no upper voltage detections to "pull" the curve upward. This reasoning for the "apparent" decrease in the POD in the upper bins is also supported by the fact that there were no "misses" above 1.30 volts. Finally, the use of a log-logistic curve fit to the data also contributes to this apparent decrease in the POD in the upper tail, because there is an inflection point where the curve will react differently on each side, depending on the data distribution used in the fit.

The POPCD voltage bins for the 1R13 POPCD and 1R13 composite POPCD were also compared and the 1R13 POPCD was higher (or equal) in all bins except for the 0.01 to 0.10 volt bin and the 0.91 to 1.00 volt bin, where the 1R13 composite POPCD values were 0.049 and 0.910, respectively. Again, these differences are negligible and use of the 1R13 composite POPCD for the EOC-15 operational assessment is justified. Application of composite POPCD distributions for operational assessments, as committed to the NRC, has continually resulted in conservative projections of tube integrity at subsequent cycles. This was verified by performing additional probability of burst and leak rate calculations for the limiting steam generator (SG 1-1) using the 1R13 POPCD curve. In both cases, the analysis using the composite POPCD was bounding over the cycle POPCD.

6.1.2 Assessment of Disappearing Flaws

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

All 1R13 +Point™ indications were detected by +Point™ and/or bobbin during the 1R14 inspection. Therefore, there were no "disappearing flaws" and an assessment is not required.

6.2 Input to Industry POPCD Database

Tables 6-10 and 6-11 provide the 1R13 and the composite POPCD results in the format of EPRI ODSCC Database Report Addendum 6, Table 7-2, for eventual inclusion in the next addendum of the database report. The EPRI format differs slightly from the DCPP format in that DCPP treats EOC_n RPC NDD indications as no detection as requested by the NRC (listed in Column G of Table 6-1 and Table 6-2), whereas the EPRI table treats these as detection.

Table 6-1: 1R13 POPCD Results

Column	A	B	C	D	E	F	G	H	I	J	K
1R13 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	0	0	0	2	0	0	0	0	0	2	0.000
0.11-0.20	7	33	1	5	27	0	0	2	41	32	0.562
0.21-0.30	22	142	2	7	65	0	5	8	166	77	0.683
0.31-0.40	28	221	1	6	62	0	3	7	250	71	0.779
0.41-0.50	41	193	6	8	41	10	6	6	240	65	0.787
0.51-0.60	35	141	10	7	20	22	2	7	186	51	0.785
0.61-0.70	34	126	8	1	9	12	2	6	168	24	0.875
0.71-0.80	32	85	5	2	8	10	0	3	122	20	0.859
0.81-0.90	17	85	1	1	5	4	1	3	103	11	0.904
0.91-1.00	19	66	1	2	4	5	1	2	86	12	0.878
1.01-1.10	18	60	0	0	1	1	0	2	78	2	0.975
1.11-1.20	8	38	1	0	1	0	0	0	47	1	0.979
1.21-1.30	6	22	0	0	1	0	0	0	28	1	0.966
1.31-1.40	6	19	0	0	0	0	0	0	25	0	1.000
1.41-1.50	20	20	0	0	0	0	0	0	40	0	1.000
1.51-1.60	3	9	1	0	0	0	0	0	13	0	1.000
1.61-1.70	5	2	1	0	0	0	0	0	8	0	1.000
1.71-1.80	10	2	0	0	0	0	0	0	12	0	1.000
1.81-1.90	6	1	0	0	0	0	0	0	7	0	1.000
1.91-2.00	5	0	1	0	0	0	0	0	6	0	1.000
2.01-2.10	0	0	11	0	0	0	0	0	11	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	6	0	0	0	0	0	6	0	1.000
2.31-2.40	0	0	1	0	0	0	0	0	1	0	1.000
2.41-2.50	0	0	1	0	0	0	0	0	1	0	1.000
2.51-2.60	0	0	1	0	0	0	0	0	1	0	1.000
2.61-2.70	0	0	0	0	0	0	0	0	0	0	
2.71-2.80	0	0	0	0	0	0	0	0	0	0	
2.81-2.90	0	0	1	0	0	0	0	0	1	0	1.000
2.91-3.00	0	0	0	0	0	0	0	0	0	0	
3.01-3.10	0	0	0	0	0	0	0	0	0	0	
3.11-3.20	0	0	0	0	0	0	0	0	0	0	
3.21-3.30	0	0	0	0	0	0	0	0	0	0	
3.31-3.40	0	0	0	0	0	0	0	0	0	0	
3.41-3.50	0	0	0	0	0	0	0	0	0	0	
3.51-3.60	0	0	0	0	0	0	0	0	0	0	
3.61-3.70	0	0	0	0	0	0	0	0	0	0	
3.71-3.80	0	0	0	0	0	0	0	0	0	0	
3.81-3.90	0	0	0	0	0	0	0	0	0	0	
3.91-4.00	0	0	0	0	0	0	0	0	0	0	
Total	322	1265	62	41	244	64	20	46	1649	369	

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

Table 6-2: DCPP Composite POPCD Results (through 10 Inspections)

Column	A	B	C	D	E	F	G	H	I	J	K
DCPP Specific POPCD Data Table											
	Detection at EOC_n			No Detection at EOCn (New Indications)							
	EOC_n Bobbin Ind. RPC Confirmed at EOC_{n+1}	EOC_n Bobbin Ind. Not RPC Inspected at EOC_{n+1}	EOC_n Bobbin Ind. Repaired at EOC_n	New EOC_{n+1} Bobbin RPC Confirmed	New EOC_{n+1} Bobbin Not RPC Inspected	Ind. Found Only by RPC at EOC_{n+1} or at EOC_n & Plugged at EOC_n (3)	EOC_n RPC NDD Bobbin Indications (2)	Excluded from POPCD	Totals for POPCD Evaluation		
Voltage Bin	BDD / RDD → BDD / RDD BDD / RDD → BND / RDD BDD w/o RPC → BDD / RDD BDD w/o RPC → BND / RDD	BDD w/o RPC → BDD w/o RPC BDD / RDD → BDD w/o RPC	BDD / RDD → Plugged at EOCn BDD w/o RPC → Plugged at EOCn	BND w/o RPC → BDD / RDD BND / RDD → BDD / RDD BND / RND → BDD / RDD	BND w/o RPC → BDD w/o RPC BND / RDD → BDD w/o RPC BND / RND → BDD w/o RPC	BND w/o RPC → BND / RDD BND / RDD → BND / RDD BND / RND → BND / RDD BND / RDD → Plugged at EOCn	BDD / RND → BDD w/o RPC BDD / RND → BDD / RDD BDD / RND → BND / RDD	All RND AT EOC_{n+1} All BND w/o RPC at EOCn+1 BDD/RND/Plugged at EOCn	Detection at EOCn	No Detection at EOCn	POPCD for Voltage Bin Note (1)
0.01-0.10	6	2	1	33	139	0	1	13	9	173	0.049
0.11-0.20	37	256	7	128	815	8	40	63	300	991	0.232
0.21-0.30	123	936	34	166	1094	126	57	129	1093	1443	0.431
0.31-0.40	195	1286	52	150	772	192	66	125	1533	1180	0.565
0.41-0.50	242	1110	51	92	417	136	41	84	1403	686	0.672
0.51-0.60	225	906	50	58	218	101	23	58	1181	400	0.747
0.61-0.70	197	705	41	36	106	34	23	45	943	199	0.826
0.71-0.80	162	503	32	25	74	17	12	25	697	128	0.845
0.81-0.90	141	402	15	23	37	8	9	21	558	77	0.879
0.91-1.00	100	291	15	11	20	6	3	6	406	40	0.910
1.01-1.10	107	217	9	7	11	1	1	9	333	20	0.943
1.11-1.20	64	169	8	4	6	0	4	5	241	14	0.945
1.21-1.30	61	102	43	4	5	0	0	2	206	9	0.958
1.31-1.40	62	65	25	2	2	0	0	2	152	4	0.974
1.41-1.50	63	62	22	1	0	0	0	0	147	1	0.993
1.51-1.60	26	19	22	1	0	0	0	0	67	1	0.985
1.61-1.70	37	8	22	0	0	0	0	0	67	0	1.000
1.71-1.80	42	3	21	2	0	0	0	0	66	2	0.971
1.81-1.90	26	2	19	0	0	0	1	0	47	1	0.979
1.91-2.00	24	1	16	0	0	0	0	0	41	0	1.000
2.01-2.10	0	0	29	0	0	0	0	0	29	0	1.000
2.11-2.20	0	0	15	0	0	0	0	0	15	0	1.000
2.21-2.30	0	0	24	0	0	0	0	0	24	0	1.000
2.31-2.40	0	0	23	0	0	0	0	0	23	0	1.000
2.41-2.50	0	0	7	0	0	0	0	0	7	0	1.000
2.51-2.60	0	0	10	0	0	0	0	0	10	0	1.000
2.61-2.70	0	0	6	0	0	0	0	0	6	0	1.000
2.71-2.80	0	0	8	0	0	0	0	0	8	0	1.000
2.81-2.90	0	0	13	0	0	0	0	0	13	0	1.000
2.91-3.00	0	0	3	0	0	0	0	0	3	0	1.000
3.01-3.10	0	0	8	0	0	0	0	0	8	0	1.000
3.11-3.20	0	0	2	0	0	0	0	0	2	0	1.000
3.21-3.30	0	0	4	0	0	0	0	0	4	0	1.000
3.31-3.40	0	0	6	0	0	0	0	0	6	0	1.000
3.41-3.50	0	0	4	0	0	0	0	0	4	0	1.000
3.51-3.60	0	0	2	0	0	0	0	0	2	0	1.000
3.61-3.70	0	0	2	0	0	0	0	0	2	0	1.000
3.71-3.80	0	0	2	0	0	0	0	0	2	0	1.000
3.81-3.90	0	0	2	0	0	0	0	0	2	0	1.000
4.01-4.10	0	0	5	0	0	0	0	0	5	0	1.000
4.11-4.20	0	0	3	0	0	0	0	0	3	0	1.000
4.21-4.30	0	0	1	0	0	0	0	0	1	0	1.000
4.31-4.40	0	0	4	0	0	0	0	0	4	0	1.000
4.41-4.50	0	0	2	0	0	0	0	0	2	0	1.000
4.51-4.60	0	0	2	0	0	0	0	0	2	0	1.000
4.61-4.70	0	0	1	0	0	0	0	0	1	0	1.000
4.81-4.90	0	0	1	0	0	0	0	0	1	0	1.000
4.91-5.00	0	0	3	0	0	0	0	0	3	0	1.000
5.01-5.10	0	0	5	0	0	0	0	0	5	0	1.000
5.21-5.30	0	0	2	0	0	0	0	0	2	0	1.000
5.41-5.50	0	0	3	0	0	0	0	0	3	0	1.000
5.51-5.60	0	0	2	0	0	0	0	0	2	0	1.000
5.61-5.70	0	0	1	0	0	0	0	0	1	0	1.000
6.11-6.20	0	0	3	0	0	0	0	0	3	0	1.000
6.31-6.40	0	0	1	0	0	0	0	0	1	0	1.000
6.51-6.60	0	0	1	0	0	0	0	0	1	0	1.000
6.61-6.70	0	0	1	0	0	0	0	0	1	0	1.000
21.41-21.50	0	0	1	0	0	0	0	0	1	0	1.000
Total	1940	7045	717	743	3716	629	281	587	9702	5369	

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

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

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

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

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

Table 6-4: 1R13 POPCD Voltage-Specific Summary from 1R14 Inspection Results

1R13 POPCD Results

POPCD Matrix for Indications <=1.00v at EOCn

EOCn				BDD at EOCn+1						BND at EOCn+1					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	24												
		Not Plugged		11	1074	0	4	0	0	0	0	0	0	0	0
	BDD w/ RDD	Plugged	11												
		Not Plugged		0	7	4	227	0	0	0	0	0	0	0	0
	BDD w/ RND	Plugged	1												
		Not Plugged		1	12	0	7	0	30	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		2	239	2	30	0	13	No Count	No Count	2	17	No Count	No Count
	BND w/ RDD	Plugged	7												
		Not Plugged		0	0	0	9	0	0	No Count	No Count	0	35	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	0	0	0	0	0	No Count	No Count	1	1	No Count	No Count

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

EOCn				BDD at EOCn+1						BND at EOCn+1					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	3												
		Not Plugged		4	165	4	15	0	0	0	0	0	1	0	0
	BDD w/ RDD	Plugged	1												
		Not Plugged		1	3	6	61	0	0	0	0	0	0	0	0
	BDD w/ RND	Plugged	0												
		Not Plugged		0	0	0	0	0	2	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		1	2	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	1	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	23												
		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

* = Letters in Table columns correspond to the column identifiers in Tables 2 and 3 where the indications are included in the numbers of indications for each voltage bin.
** = If indications are RPC confirmed at EOCn but RPC NDD or not RPC inspected at at EOCn+1, the causative factors for this change in RPC detection should be discussed in the ARC 90 day report.
BDD = Bobbin detected indication
BND = Bobbin NDD intersection
RDD = RPC detected indication
RND = RPC NND intersection
No Count = Intersections having no bobbin or RPC indication at either EOCn or EOCn+1. Number of intersectionS not reported in data tables.
BDD + BND = Total Intersections
POPCD = (bobbin detected at N)/[(bobbin detected at N) + (detected at N+1 but not bobbin detected at N)]
POPCD = (B+C+D)/[(B+C+D)+(G+H+I+J)]

Table 6-5: 1R13 POPCD Summary from 1R14 Inspection Results Regardless of Voltage

POPCD Matrix for All Indications Regardless of Voltage															
EOCn				BDD at EOCn+1						BND at EOCn+1					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	27												
		Not Plugged		15	1239	4	19						1		
	BDD w/ RDD	Plugged	35												
		Not Plugged		1	10	10	288								
	BDD w/ RND	Plugged	1												
		Not Plugged		1	12		7		32						
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		3	241	2	30		13	No Count	No Count	2	17	No Count	No Count
	BND w/ RDD	Plugged	7												
		Not Plugged					9			No Count	No Count		36	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged								No Count	No Count	1	1	No Count	No Count

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

Composite of 1R9, 1R10, 1R11, 1R12, 1R13, 2R8, 2R9, 2R10, 2R11 & 2R12 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	134												
		Not Plugged		106	5759	146	225	2	73	1	67	0	8	0	0
	BDD w/ RDD	Plugged	164												
		Not Plugged		2	530	41	982	0	2	0	0	0	26	0	2
	BDD w/ RND	Plugged	5												
		Not Plugged		6	187	10	69	0	192	0	40	0	3	0	3
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		63	3625	117	553	4	172	No Count	No Count	50	234	No Count	No Count
	BND w/ RDD	Plugged	54												
		Not Plugged		0	3	1	43	0	0	No Count	No Count	10	234	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged		0	1	3	5	0	6	No Count	No Count	20	26	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	17												
		Not Plugged		10	538	193	73	0	4	0	0	0	1	0	0
	BDD w/ RDD	Plugged	190												
		Not Plugged		3	97	68	176	0	0	0	0	0	1	0	0
	BDD w/ RND	Plugged	2												
		Not Plugged		0	4	0	2	0	7	0	0	0	0	0	0
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		1	23	4	15	1	4	No Count	No Count	0	0	No Count	No Count
	BND w/ RDD	Plugged	0												
		Not Plugged		0	0	1	1	0	0	No Count	No Count	0	1	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	212												
		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

* = Letters in Table columns correspond to the column identifiers in Tables 2 and 3 where the indications are included in the numbers of indications for each voltage bin.
** = If indications are RPC confirmed at EOCn but RPC NDD or not RPC inspected at at EOCn+1, the causative factors for this change in RPC detection should be discussed in the ARC 90 day report.
BDD = Bobbin detected indication
BND = Bobbin NDD intersection
RDD = RPC detected indication
RND = RPC NND intersection
No Count = Intersections having no bobbin or RPC indication at either EOCn or EOCn+1. Number of intersectionS not reported in data tables.
BDD + BND = Total Intersections
POPCD = (bobbin detected at N)/[(bobbin detected at N) + (detected at N+1 but not bobbin detected at N)]
POPCD = (B+C+D)/[(B+C+D)+(G+H+I+J)]

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

POPCD Matrix for All Indications Regardless of Voltage															
EOCn				BDD at EOCn+1						BND at EOCn+1					
				BDD w/o RPC		BDD w/RDD		BDD w/RND		BND w/o RPC		BND w/RDD		BND w/RND	
				Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged	Plugged	Not Plugged
BDD at EOCn	BDD w/o RPC	Plugged	151												
		Not Plugged		116	6297	339	298	2	77	1	67		9		
	BDD w/ RDD	Plugged	566												
		Not Plugged		5	627	109	1158		2				27		2
	BDD w/ RND	Plugged	7												
		Not Plugged		6	191	10	71		199		40		3		3
BND at EOCn	BND w/o RPC	Plugged													
		Not Plugged		64	3648	121	568	5	176	No Count	No Count	50	234	No Count	No Count
	BND w/ RDD	Plugged	54												
		Not Plugged			3	2	44			No Count	No Count	10	235	No Count	No Count
	BND w/ RND	Plugged													
		Not Plugged			1	3	5		6	No Count	No Count	20	26	No Count	No Count

Table 6-8: DCPP POPCD Log Logistic Parameters

Parameter	POPCD Through 1R12 (8 Inspections)	POPCD Through 2R12 (9 Inspections)	Updated POPCD Through 1R13 (10 Inspections)
Number of Data Points	10566	13053	15071
a.0 (intercept)	2.125	2.258	2.308
a.1 (slope)	4.634	4.466	4.371
V_{11}	0.00245	0.00203	0.00175
V_{12}	0.00471	0.00383	0.00330
V_{22}	0.01146	0.00909	0.00786

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

Volts	POPCD Through 1R12 (Eight Inspections)	POPCD Through 2R12 (Nine Inspections)	New POPCD Through 1R13 (Ten Inspections)
0.1	0.075	0.099	0.113
0.12	0.105	0.135	0.152
0.14	0.138	0.174	0.194
0.16	0.173	0.215	0.237
0.18	0.210	0.256	0.279
0.2	0.247	0.297	0.321
0.22	0.285	0.337	0.362
0.25	0.340	0.394	0.420
0.3	0.426	0.481	0.506
0.35	0.503	0.555	0.578
0.4	0.570	0.618	0.638
0.45	0.627	0.670	0.688
0.5	0.675	0.714	0.730
0.6	0.750	0.780	0.792
0.7	0.803	0.827	0.836
0.8	0.842	0.861	0.868
0.9	0.871	0.886	0.892
1	0.893	0.905	0.910
1.1	0.910	0.920	0.923
1.2	0.924	0.932	0.934
1.4	0.943	0.948	0.950
1.6	0.956	0.960	0.961
1.8	0.965	0.968	0.968
2	0.971	0.973	0.974
2.2	0.976	0.978	0.978
2.4	0.980	0.981	0.981
2.6	0.983	0.984	0.984
2.8	0.985	0.986	0.986
3	0.9871	0.9877	0.9878
3.5	0.9905	0.9909	0.9909
4	0.9927	0.9929	0.9929
4.5	0.9942	0.9944	0.9943
5	0.9953	0.9954	0.9953
6	0.9968	0.9968	0.9967
7	0.9976	0.9976	0.9975
8	0.9982	0.9982	0.9981
9	0.9986	0.9985	0.9985
10	0.9988	0.9988	0.9987

Table 6-10: 1R13 POPCD Results In Industry Format

Column	A	B	C	D	E	F	G	H	I	J
DCPP 1R13 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	2	0	0	0	0	2	0.000
0.11-0.20	7	33	1	5	27	0	2	41	32	0.562
0.21-0.30	24	145	2	7	65	0	8	171	72	0.704
0.31-0.40	29	223	1	6	62	0	7	253	68	0.788
0.41-0.50	43	197	6	8	41	10	6	246	59	0.807
0.51-0.60	35	143	10	7	20	22	7	188	49	0.793
0.61-0.70	35	127	8	1	9	12	6	170	22	0.885
0.71-0.80	32	85	5	2	8	10	3	122	20	0.859
0.81-0.90	17	86	1	1	5	4	3	104	10	0.912
0.91-1.00	20	66	1	2	4	5	2	87	11	0.888
1.01-1.10	18	60	0	0	1	1	2	78	2	0.975
1.11-1.20	8	38	1	0	1	0	0	47	1	0.979
1.21-1.30	6	22	0	0	1	0	0	28	1	0.966
1.31-1.40	6	19	0	0	0	0	0	25	0	1.000
1.41-1.50	20	20	0	0	0	0	0	40	0	1.000
1.51-1.60	3	9	1	0	0	0	0	13	0	1.000
1.61-1.70	5	2	1	0	0	0	0	8	0	1.000
1.71-1.80	10	2	0	0	0	0	0	12	0	1.000
1.81-1.90	6	1	0	0	0	0	0	7	0	1.000
1.91-2.00	5	0	1	0	0	0	0	6	0	1.000
2.01-2.10	0	0	11	0	0	0	0	11	0	1.000
2.11-2.20	0	0	2	0	0	0	0	2	0	1.000
2.21-2.30	0	0	6	0	0	0	0	6	0	1.000
2.31-2.40	0	0	1	0	0	0	0	1	0	1.000
2.41-2.50	0	0	1	0	0	0	0	1	0	1.000
2.51-2.60	0	0	1	0	0	0	0	1	0	1.000
2.61-2.70	0	0	0	0	0	0	0	0	0	
2.71-2.80	0	0	0	0	0	0	0	0	0	
2.81-2.90	0	0	1	0	0	0	0	1	0	1.000
2.91-3.00	0	0	0	0	0	0	0	0	0	
3.01-3.10	0	0	0	0	0	0	0	0	0	
3.11-3.20	0	0	0	0	0	0	0	0	0	
3.21-3.30	0	0	0	0	0	0	0	0	0	
3.31-3.40	0	0	0	0	0	0	0	0	0	
3.41-3.50	0	0	0	0	0	0	0	0	0	
3.51-3.60	0	0	0	0	0	0	0	0	0	
3.61-3.70	0	0	0	0	0	0	0	0	0	
3.71-3.80	0	0	0	0	0	0	0	0	0	
3.81-3.90	0	0	0	0	0	0	0	0	0	
3.91-4.00	0	0	0	0	0	0	0	0	0	
Total	329	1278	62	41	244	64	46	1669	349	

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

Table 6-11: DCPP Composite POPCD Results (10 Inspections) In Industry Format

Column	A	B	C	D	E	F	G	H	I	J
	DCPP Total Input to Generic POPCD Data Table									
	Detection at EOC_n			No Detection at EOCn (New Indications)						
	EOC_n Bobbin Ind. RPC Confirmed at EOC_{n+1}	EOC_n Bobbin Ind. Not RPC Inspected at EOC_{n+1}	EOC_n Bobbin Ind. Repaired at EOC_n	New EOC_{n+1} Bobbin RPC Confirmed	New EOC_{n+1} Bobbin Not RPC Inspected	Ind. Found Only by RPC at EOC_{n+1} or at EOC_n & Plugged at EOC_n (3)	Excluded from POPCD	Totals for POPCD Evaluation		
Voltage Bin	BDD / RDD → BDD / RDD BDD / RDD → BND / RDD BDD / RND → BDD / RDD BDD / RND → BND / RDD BDD w/o RPC → BDD / RDD BDD w/o RPC → BND / RDD	BDD w/o RPC → BDD w/o RPC BDD / RDD → BDD w/o RPC BDD / RND → BDD w/o RPC	BDD / RDD → Plugged at EOCn BDD w/o RPC → Plugged at EOCn	BND w/o RPC → BDD / RDD BND / RDD → BDD / RDD BND / RND → BDD / RDD	BND w/o RPC → BDD w/o RPC BND / RDD → BDD w/o RPC BND / RND → BDD w/o RPC	BND w/o RPC → BND / RDD BND / RDD → BND / RDD BND / RND → BND / RDD BND / RDD → Plugged at EOCn	All RND AT EOC_{n+1} All BND w/o RPC at EOC_{n+1} BDD/RND/Plugged at EOCn	Detection at EOCn	No Detection at EOCn	POPCD for Voltage Bin (Note 1)
0.01-0.10	6	3	1	33	139	0	13	10	172	0.055
0.11-0.20	58	275	7	128	815	8	63	340	951	0.263
0.21-0.30	148	968	34	166	1094	126	129	1150	1386	0.453
0.31-0.40	214	1333	52	150	772	192	125	1599	1114	0.589
0.41-0.50	248	1145	51	92	417	136	84	1444	645	0.691
0.51-0.60	227	927	50	58	218	101	58	1204	377	0.762
0.61-0.70	201	724	41	36	106	34	45	966	176	0.846
0.71-0.80	164	513	32	25	74	17	25	709	116	0.859
0.81-0.90	143	409	15	23	37	8	21	567	68	0.893
0.91-1.00	101	293	15	11	20	6	6	409	37	0.917
1.01-1.10	108	217	9	7	11	1	9	334	19	0.946
1.11-1.20	65	172	8	4	6	0	5	245	10	0.961
1.21-1.30	61	102	43	4	5	0	2	206	9	0.958
1.31-1.40	62	65	25	2	2	0	2	152	4	0.974
1.41-1.50	63	62	22	1	0	0	0	147	1	0.993
1.51-1.60	26	19	22	1	0	0	0	67	1	0.985
1.61-1.70	37	8	22	0	0	0	0	67	0	1.000
1.71-1.80	42	3	21	2	0	0	0	66	2	0.971
1.81-1.90	26	3	19	0	0	0	0	48	0	1.000
1.91-2.00	24	1	16	0	0	0	0	41	0	1.000
2.01-2.10	0	0	29	0	0	0	0	29	0	1.000
2.11-2.20	0	0	15	0	0	0	0	15	0	1.000
2.21-2.30	0	0	24	0	0	0	0	24	0	1.000
2.31-2.40	0	0	23	0	0	0	0	23	0	1.000
2.41-2.50	0	0	7	0	0	0	0	7	0	1.000
2.51-2.60	0	0	10	0	0	0	0	10	0	1.000
2.61-2.70	0	0	6	0	0	0	0	6	0	1.000
2.71-2.80	0	0	8	0	0	0	0	8	0	1.000
2.81-2.90	0	0	13	0	0	0	0	13	0	1.000
2.91-3.00	0	0	3	0	0	0	0	3	0	1.000
3.01-3.10	0	0	8	0	0	0	0	8	0	1.000
3.11-3.20	0	0	2	0	0	0	0	2	0	1.000
3.21-3.30	0	0	4	0	0	0	0	4	0	1.000
3.31-3.40	0	0	6	0	0	0	0	6	0	1.000
3.41-3.50	0	0	4	0	0	0	0	4	0	1.000
3.51-3.60	0	0	2	0	0	0	0	2	0	1.000
3.61-3.70	0	0	2	0	0	0	0	2	0	1.000
3.71-3.80	0	0	2	0	0	0	0	2	0	1.000
3.81-3.90	0	0	2	0	0	0	0	2	0	1.000
3.91-4.00	0	0	0	0	0	0	0	0	0	
4.01-4.10	0	0	5	0	0	0	0	5	0	1.000
4.11-4.20	0	0	3	0	0	0	0	3	0	1.000
4.21-4.30	0	0	1	0	0	0	0	1	0	1.000
4.31-4.40	0	0	4	0	0	0	0	4	0	1.000
4.41-4.50	0	0	2	0	0	0	0	2	0	1.000
4.51-4.60	0	0	2	0	0	0	0	2	0	1.000
4.61-4.70	0	0	1	0	0	0	0	1	0	1.000
4.71-4.80	0	0	0	0	0	0	0	0	0	
4.81-4.90	0	0	1	0	0	0	0	1	0	1.000
4.91-5.00	0	0	3	0	0	0	0	3	0	1.000
5.01-5.10	0	0	5	0	0	0	0	5	0	1.000
5.11-5.20	0	0	0	0	0	0	0	0	0	
5.21-5.30	0	0	2	0	0	0	0	2	0	1.000
5.31-5.40	0	0	0	0	0	0	0	0	0	
5.41-5.50	0	0	3	0	0	0	0	3	0	1.000
5.51-5.60	0	0	2	0	0	0	0	2	0	1.000
5.61-5.70	0	0	1	0	0	0	0	1	0	1.000
5.71-5.80	0	0	0	0	0	0	0	0	0	
5.81-5.90	0	0	0	0	0	0	0	0	0	
5.91-6.00	0	0	0	0	0	0	0	0	0	
>6.00	0	0	7	0	0	0	0	7	0	1.000
Total	2024	7242	717	743	3716	629	587	9983	5088	

Notes:

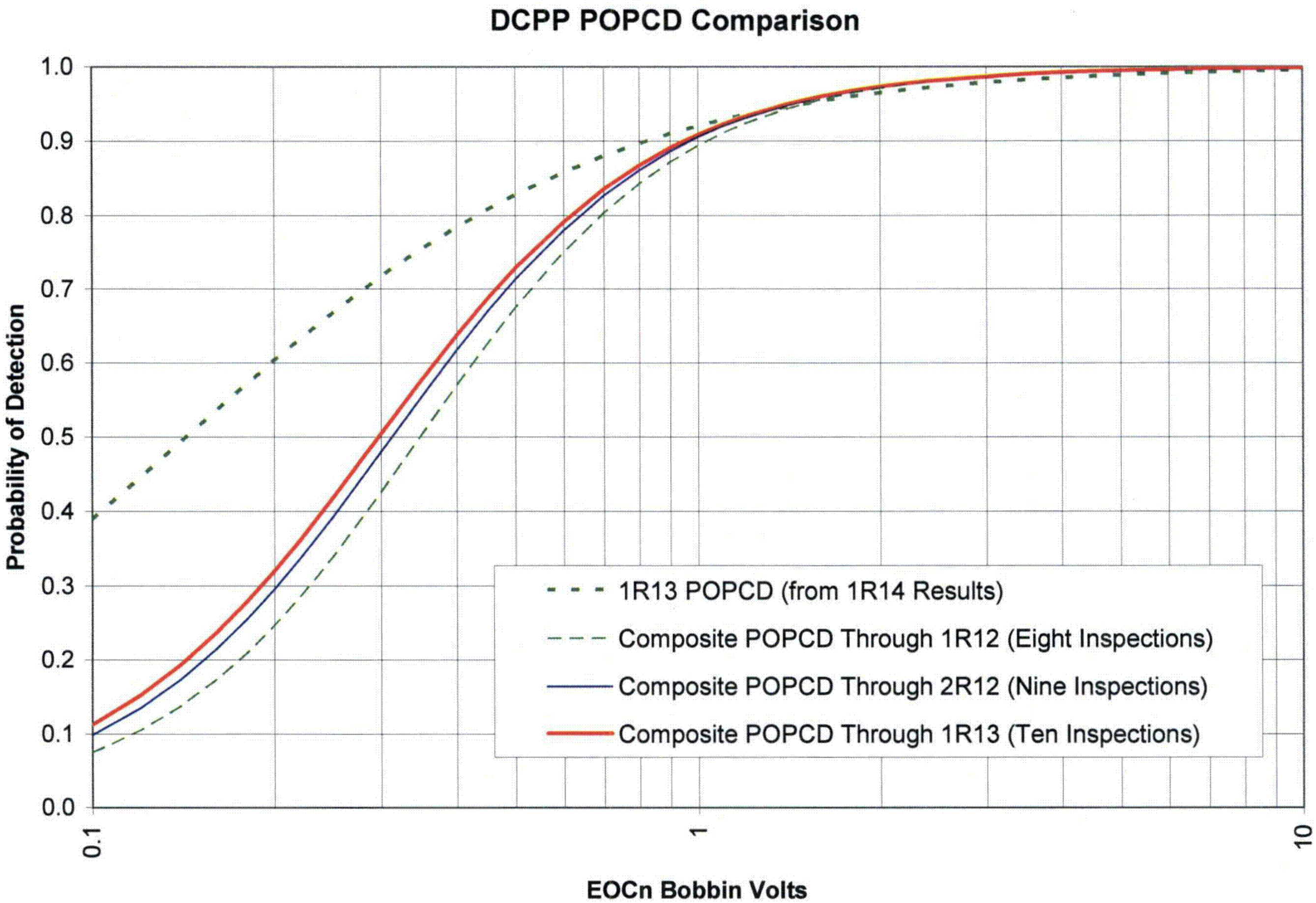
1) POPCD for each voltage bin calculated as (Detection at EOCn)/(Detection at EOCn + No Detection at EOCn). By column, POPCD = (A+B+C)/(A+B+C+D+E+F).

2) Plant specific POPCD to be based upon voltage bins of 0.10 volt. Industry POPCD database may use 0.20 volt bins due to difficulty of adjusting existing database to smaller bins.

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

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

Figure 6-1: 1R13 POPCD Comparison to Composite POPCDs



7.0 EOC-15 Projections for Probability of Burst and Leak Rate

This section provides the results of the EOC-15 POB and leak rate projections. AREVA uses Monte Carlo codes, as described in References 4 and 5, to provide the burst and leak rate analysis simulations. These evaluations are based on the methods in Reference 6 (for burst) and the slope sampling method for calculating the leak rate as defined in Section 9 of Reference 8. In addition, these evaluations use the POPCD and growth methodologies as described in Reference 16, as updated in References 19 and 25.

7.1 Inputs for Calculations

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

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

Input Description	Section or Table Reference	Comments
BOC Voltage Distribution	Table 3-17 and 3-18	
Repaired Voltage Distribution	Table 3-17 and 3-18	
NDE Uncertainties	Section 3.6; Table 3-23	
POD	Table 6-8	Composite POPCD through 1R13 (10 inspections)
Growth	Section 3.2; Tables 3-8 through 3-14	
Cycle Length	Section 7.1	1.63 EFPY
Tube Integrity Correlations	Tables 4-1 through 4-3	Addendum 6
Material Properties	Section 7.1	

<u>Material Properties</u>

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

<u>Cycle Length</u>

The estimated cycle length for Unit 1 Cycle 15 is 1.63 EFPY (Ref. 12). This value was used in all projections for EOC-15 conditions.

7.2 Projected EOC-15 Voltage Distributions

The EOC-15 voltage distributions are obtained by applying a Monte Carlo sampling process to the BOC-15 voltages. The process starts by selecting a random POPCD correlation based on the POPCD parameters through 1R13 shown in Table 6-8. Based on the POPCD correlation, the BOC-15 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-15 indications. The EOC-15 voltage distributions are then used to calculate a leak rate and probability of tube burst. Section 3.2 discusses the growth distributions that were used in the calculations. The only "delta volts adjustment" required was for Bin2 of the SG 1-2 growth distribution. Table 7-2 and Figures 7-1 through 7-4 provide the projected EOC-15 voltage distributions.

Table 7-2: Projected EOC-15 Voltage Distributions from POB Calculations (DCPP POPCD)

	EOC-15 Projected Distributions			
Voltage Bin	SG 1-1	SG 1-2	SG 1-3	SG 1-4
<=0.1	1.57	11.47	0.46	0.56
0.2	35.3	31.96	9.72	12.21
0.3	93.83	61.09	23.16	27.59
0.4	157.24	86.78	42.22	40.54
0.5	194.15	105.39	55.6	49.43
0.6	180.8	116.65	58.84	47.63
0.7	141	119.63	54.64	44.88
0.8	107.54	113.26	44.39	38.32
0.9	85.7	96.1	34.04	29.02
1	66.74	73.88	26.38	20.98
1.1	51.5	53.74	20.5	15.06
1.2	41.47	38.8	15.62	11.12
1.3	34.35	27.8	11.91	8.54
1.4	28.88	19.47	9.32	6.71
1.5	23.97	13.34	7.78	5.33
1.6	19.38	9.17	6.64	4.2
1.7	15.28	6.51	5.66	3.25
1.8	12.12	4.81	4.74	2.45
1.9	9.76	3.62	3.83	1.78
2	7.49	2.63	2.95	1.27
2.1	5.44	1.83	2.2	0.9
2.2	3.74	1.22	1.59	0.63
2.3	2.44	0.81	1.13	0.43
2.4	1.51	0.61	0.79	0.29
2.5	0.91	0.57	0.55	0.2
2.6	0.54	0.49	0.38	0.14
2.7	0.32	0.35	0.26	0.09
2.8	0.18	0.23	0.17	0.06
2.9	0.1	0.14	0.11	0.04
3	0.06	0.09	0.07	0.03
3.1	0.03	0.06	0.04	0.02
3.2	0.01	0.05	0.02	0.01
3.3	0.01	0.03	0.01	0.01
3.4	0	0.03	0.01	0.01
3.5	0	0.07	0	0.01
3.6	0	0.21	0	0.03
3.7	0	0.3	0	0.05
3.8	0	0.27	0	0.05
3.9	0	0.19	0	0.04
4	0	0.13	0	0.03
4.1	0.01	0.08	0	0.02
4.2	0.04	0.06	0	0.02
4.3	0.1	0.04	0	0.01
4.4	0.18	0.03	0	0.01
4.5	0.24	0.02	0	0.01
4.6	0.25	0.02	0	0.01
4.7	0.22	0.01	0	0
4.8	0.17	0.01	0	0
4.9	0.12	0	0	0
5	0.07	0	0	0
>5	0.09	0	0	0
Totals	1324.86	1004.08	445.73	374.04

Figure 7-1: SG 1-1 EOC-15 Projected Voltage Distribution

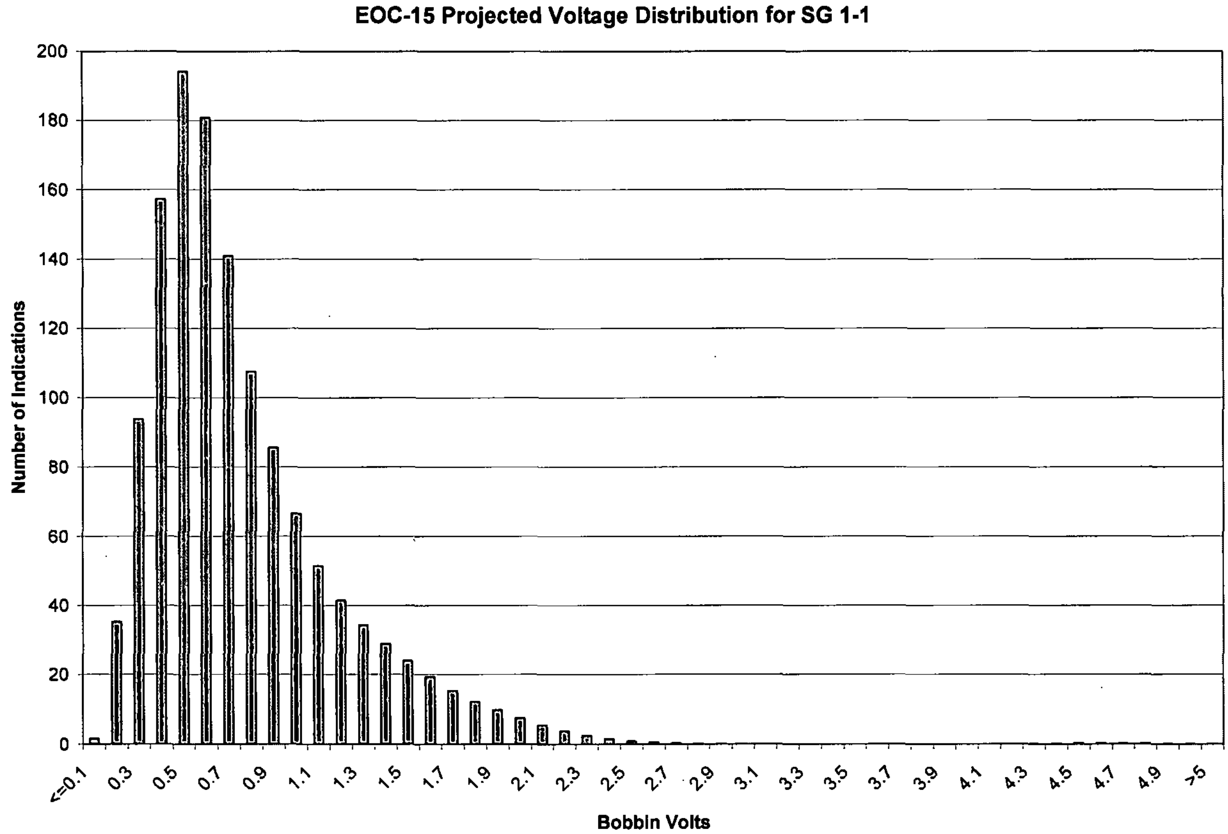


Figure 7-2: SG 1-2 EOC-15 Projected Voltage Distribution

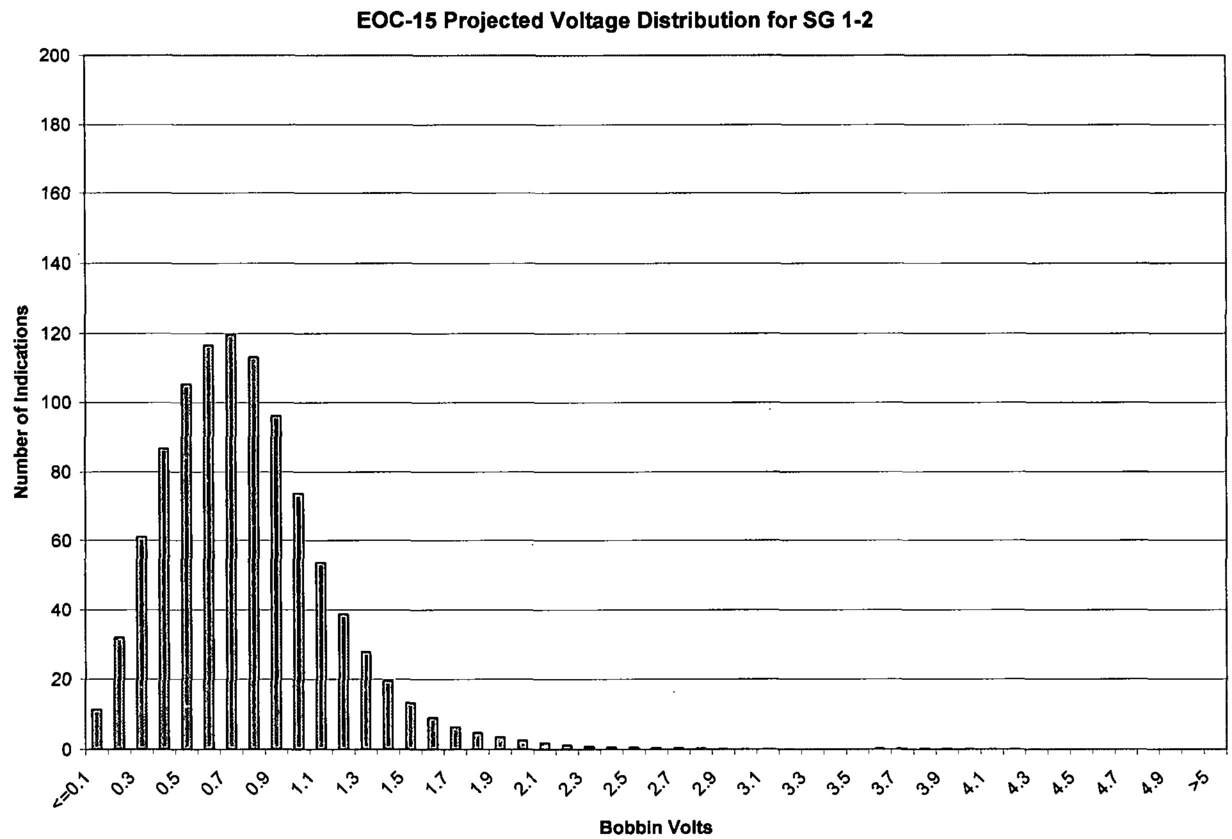


Figure 7-3: SG 1-3 EOC-15 Projected Voltage Distribution

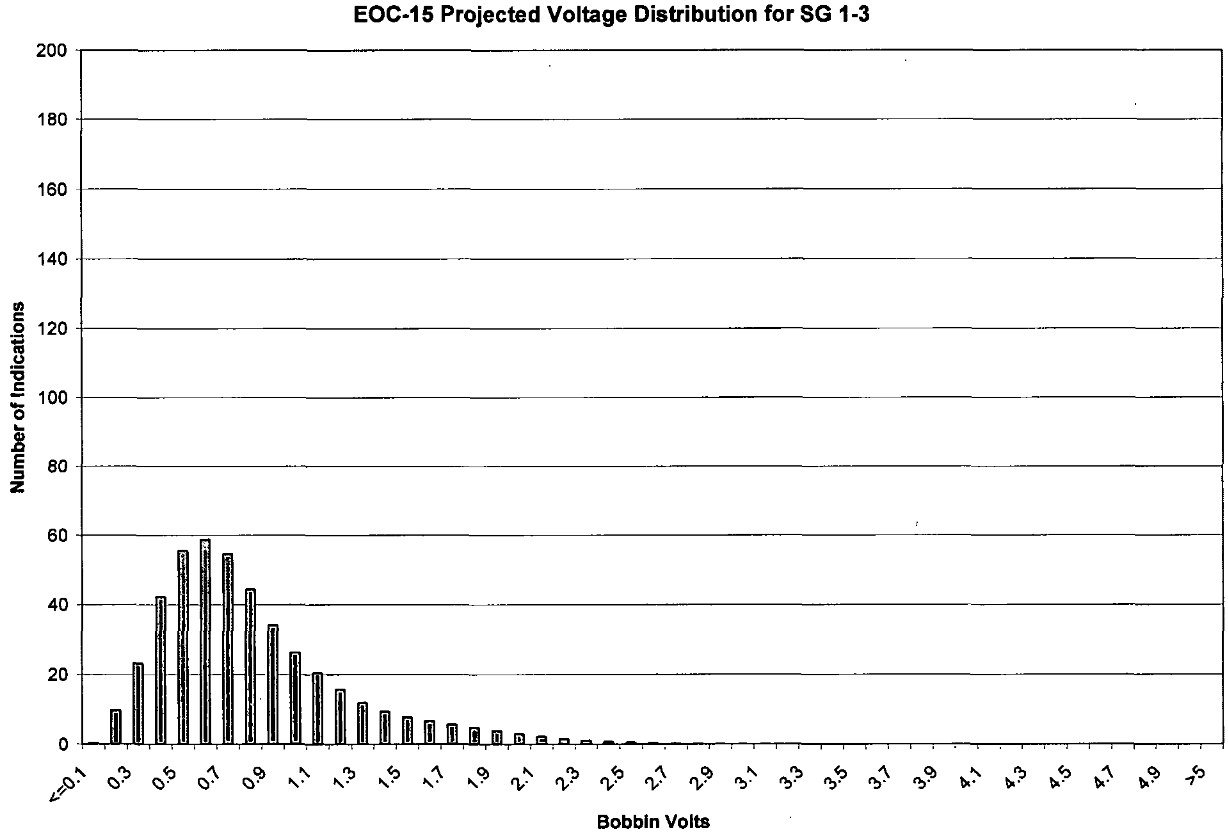
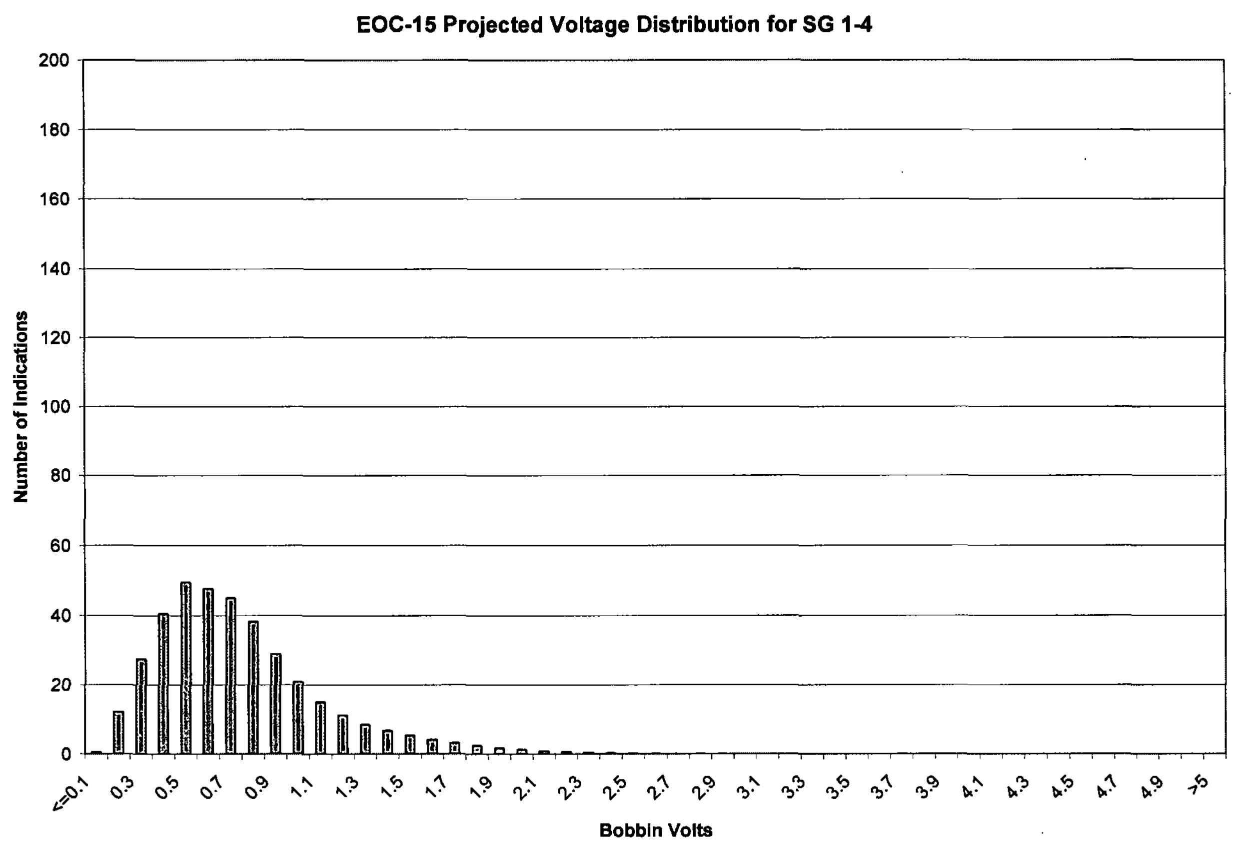


Figure 7-4: SG 1-4 EOC-15 Projected Voltage Distribution



7.3 Projected Tube Burst Probability and Leak Rate for EOC-15

Calculations to predict SLB leak rate and tube burst probability for each steam generator in DCPP Unit 1 at the projected EOC-15 conditions were performed using the burst pressure, leak rate, and probability of leakage correlations provided in Tables 4-1 through 4-3. The results of these calculations are shown in Table 7-3. As shown in Table 7-3, all of the results for projected EOC-15 conditions are below the acceptance criteria of 1.0×10^{-2} for POB and 10.5 gpm for leakage.

Table 7-3: Projected Leak Rate and Burst Probability at EOC-15 Using DCPP POPCD

Steam Generator	Projected Number of Indications	Probability of Burst		SLB Leak Rate
		Best Estimate	95% UCL (1 or More Failures)	(gpm)
SG 1-1	1324.86	3.04×10^{-4}	3.48×10^{-4}	0.68
SG 1-2	1004.08	1.44×10^{-4}	1.75×10^{-4}	0.38
SG 1-3	445.73	1.10×10^{-4}	1.38×10^{-4}	0.20
SG 1-4	374.04	8.00×10^{-5}	1.04×10^{-4}	0.16
Reporting Threshold			$\mathbf{1.0 \times 10^{-2}}$	**10.5**

8.0 References

1. AREVA Document 86-9050290-000, "DCPP Unit 1R14 Voltage-Based ARC and W-star ARC Startup Report", May 2007.

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

5. AREVA 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. AREVA Document 86-9011354-000, "DCPP 1R13 Bobbin Voltage ARC 90-Day Summary Report", February 2006.

8. EPRI Report NP 7480-L, Addendum 6, 2004 Database Update, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits", Electric Power Research Institute, January 2005.

9. Pacific Gas and Electric, Diablo Canyon Unit 1 Refueling Outage 1R14, "Steam Generator Degradation Assessment", Revision 1, May 9, 2007.

10. PG&E Letter DCL-06-080, "PG&E Response to NRC Request for Additional Information Regarding, "Special Report 06-01 – Results of Steam Generator (SG) Tube Inspections for Diablo Canyon Power Plant Unit 1 Thirteenth Refueling Outage"", June 23, 2006.

11. Pacific Gas and Electric NDE Procedure, NDE ET-7, "Eddy Current Examination of SG Tubing", Revision 10, May 1, 2007.

12. Pacific Gas and Electric Company, Diablo Canyon Power Plant, Surveillance Test Procedure, STP M-SGTI, Revision 14, "Steam Generator Tube Inspection", May 7, 2007.

13. AREVA Document 51-9050289-000, "Bobbin Coil Probe Wear Monitoring for DCPP 1R14", May 2007.

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

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

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

17. AREVA Document 51-5039454-001, "Bobbin/+Point™ Correlation for AONDB Indications at DCPP", June 2006.

18. AREVA Document 86-9024635-000, "DCPP Unit 2 R13 Voltage-Based ARC 90-Day Report", July 2006.

19. 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.

20. 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.

21. Not used.

22. Not used.

23. AREVA Document 32-9055671-000, "DCPP Unit 1 R14 Voltage-Based ARC 90-Day Report Calculations".

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.