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Ref. # 10CFR50.55a(g)

CPSES # 200101708
Log # TXX-01125
File # 10010.1
905.2 (clo)

July 25, 2001

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
UNIT 1- DOCKET NOS. 50-445
SUBMITTAL OF UNIT 1 EIGTH REFUELING OUTAGE (1RF08)
GL 95-05 REPORT

Gentlemen;

Enclosed is the 90-day report pursuant to the guidance of Attachment 1 to the Generic Letter (GL) 95-05 "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking".

This report provides justification for continued application of the voltage-based repair criteria for outside diameter stress corrosion crack (ODSCC) indications at support plate intersections. The report summarizes bobbin and rotating pancake probe data at support plate intersections from the end of cycle eight (EOC-8) inspection and presents Monte Carlo analysis results for steam line break (SLB) leak rates and conditional burst probabilities based on the actual measured EOC-8 voltage and projected EOC-9 voltage distributions. Additionally, the enclosed report concludes that the EOC-8 inspection results and estimated SLB leak rates and tube burst probabilities meet the requirements for full cycle operation of the steam generators during cycle 9.

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This communication contains no new licensing basis commitments regarding CPSES Unit 1. If you have any questions, please contact Mr. Obaid Bhatty at (254) 897-5839.

Sincerely,

C. L. Terry

By: Roger D. Walker
Roger D. Walker
Regulatory Affairs Manager

OAB/oab
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cc: E. W. Merschoff, Region IV
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ENCLOSURE TO TXX-01125

COMANCHE PEAK STEAM ELECTRIC STATION
UNIT - 1

CYCLE 9 VOLTAGE-BASED REPAIR CRITERIA
90-DAY REPORT

July 2001

Table of Contents

Comanche Peak Unit - 1

Cycle 9 Voltage-Based Repair Criteria Report

1.0 Introduction

This report provides a summary of the results for the recent (EOC-8) Comanche Peak Unit-1 steam generator (SG) bobbin and rotating pancake coil (RPC) probe inspections at tube support plate (TSP) intersections, together with leak rate and tube burst probability analysis results for a postulated steam line break (SLB) accident. The results support continued implementation of the voltage-based repair criteria as outlined in the NRC Generic Letter 95-05 (Reference 8-1). A 1.0-volt repair criterion for outside diameter stress corrosion cracking (ODSCC) indications at the TSP intersections was implemented first time for Comanche Peak Unit-1 during the EOC-7 outage (Reference 8-2). Information required by the Generic Letter to support a 1-volt repair criterion is provided in this report.

As in the last inspection, a relatively small number of ODSCC indications were detected during the EOC-8 inspection (a total of 260 indications from all 4 SGs combined), and a majority of those indications (195) were found in SG-4. Analyses for leak rates and burst probabilities at SLB conditions based on the actual bobbin voltage distribution (condition monitoring analysis) were carried for all 4 SGs and compared with the projections performed after the last outage. Leak rates and burst probabilities at the end of the ongoing cycle (Cycle 9) were also estimated. Westinghouse generic methodology based on Monte Carlo simulations presented in Reference 8-3 was used, and this methodology has been utilized for all leak and burst analyses performed todate by the industry in support of Generic Letter 95-05.

Eddy current and repair data for EOC-8 TSP indications are provided in Section 3. The leak and burst database applied and the Monte Carlo analysis methodology used to estimate leak rate and tube burst probability are briefly described in Sections 4 and 5. The projected EOC-9 voltage distributions are presented in Section 6. Leak rates and burst probabilities for the actual EOC-8 voltage distributions and projected EOC-9 voltage distributions are reported in Section 7 and compared with allowable limits.

2.0 Summary and Conclusions

A total of 260 indications were found in the EOC-8 inspection, the majority of which (195) were found in SG-4. All indications detected were on the hot leg side. Only one indication over 1 volt (1.09 volts in SG-4) was detected in all 4 SGs combined. It was inspected with a RPC probe and no degradation was detected; so, the tube containing this indication was left in service. No indications with an ID phase angle or circumferential indications were found at any TSP intersections. Also, no indications extending outside the TSP edges were found. There were no mixed residual signals at TSP intersections that could potentially mask a 1.0 volt bobbin indication (residual signal voltage 1.5 volts or greater).

SLB leak rate and tube burst probability analyses were performed using the actual EOC-8 bobbin voltage distributions (condition monitoring analysis) and compared with the results of the projection analysis performed after the last (EOC-7) outage. The SLB leak rates and tube burst probabilities projected for the EOC-8 conditions were small relative to their acceptance limits, and those based on the actual measured EOC-8 voltages are even smaller. The significant differences noted between the projected and condition monitoring results for the EOC-8 conditions are attributed to the conservative growth distribution applied for the EOC-8 projections. (Since sufficient plant-specific growth data was not yet available, a bounding growth distribution for ¾" tubes was applied for the EOC-8 projections.) The limiting SLB leak rate (3.0×10^{-4}) and tube burst probability (1.9×10^{-5}) values obtained using the actual measured EOC-8 voltages are 3 to 5 orders of magnitude below the corresponding acceptance limits (27.79 gpm at room temperature and 10^{-2}, respectively).

The projected leak rates and tube burst probabilities at the EOC conditions for the current cycle (Cycle 9) are also well within their acceptable limits. Limiting EOC-9 SLB leak rate and burst probability is predicted for SG-4 that had the largest number of indications among the 4 SGs in the EOC-8 inspection. Since we now have Comanche Peak Unit-1 specific growth data for 2 cycles and the Cycle 8 growth distribution contains more than the minimum number of data points required per GL 95-05 (200 points), the limiting growth distribution for the last two cycles was applied for Cycle 9 projections. The limiting EOC-9 leak rate thus projected (0.0011 gpm, in SG-4) is more than 4 orders of magnitude below the allowable EOC-9 leakage limit of 27.79 gpm (room temperature). The corresponding tube burst probability, 4.7×10^{-5}, is 2 orders of magnitude below the NRC reporting guideline of 10^{-2}.

An additional analysis was also performed for the limiting SG (SG-4) using the same bounding growth distribution for ¾" tube plants that was used for the EOC-8 projections. This bounding growth distribution is very conservative, and the actual growth during Cycle 9 is expected to be substantially below this growth distribution. Even with this conservative growth distribution, the limiting EOC-9

leak rate projected (0.38 gpm, in SG-4) is nearly 2 orders of magnitude below the allowable EOC-9 leakage limit of 27.79 gpm (room temperature), and the corresponding tube burst probability, 6.7×10^{-3}, is also below the NRC reporting guideline of 10^{-2}. Thus, the GL 95-05 requirements for continued plant operation for the projected duration of Cycle 9 are met.

3.0 EOC-8 Inspection Results and Voltage Growth Rates

3.1 EOC-8 Inspection Results

According to the guidance provided by the NRC Generic Letter 95-05, the EOC-8 inspection of the Comanche Peak Unit-1 SGs consisted of a 100% eddy current (EC) bobbin probe full length examination (the Plus Point probe was used in lieu of the bobbin probe for the row 1 and 2 U-bend regions) of the tube bundles in all four SGs. A 0.610 inch diameter probe was used for hot and cold leg TSPs where a voltage-based repair criterion was applied. Only one indication in the combined population from all 4 SGs exceeded the bobbin voltage threshold for RPC inspection (1 volt). It was inspected with a RPC probe and no degradation was detected; therefore, the tube containing this flaw was left in service. All ODSCC indications detected at TSPs were on the hot leg side and no indications were detected on the cold leg side.

No indications with an ID phase angle or circumferential indications were found at the TSP intersections. Also, no indications extending outside the TSP edges were found. There were no mixed residual signals at TSP intersections that could potentially mask a 1.0 volt bobbin indication (residual signal voltage 1.5 volts or greater). No signal interference was found from copper deposits. All dents over 5 volts on the hot leg side identified in the last (EOC-7) inspection were also RPC inspected in the present inspection, and no degradation was detected.

A summary of EC indications for all four SGs is provided in Table 3-1, which lists the number of field bobbin indications, the number of those indications that were RPC inspected, the number of RPC confirmed indications, and the number of indications removed from service due to tube repairs. The indications that remain active for Cycle 9 operation is the difference between the observed and the ones removed from service. No tubes had to be repaired to meet the GL 95-05 requirements. Figure 3-1 shows the actual bobbin voltage distribution determined from the EOC-8 EC inspection. Since only a total 5 ODSCC indications were removed from service because of tube repairs for all causes, the distribution in Figure 3-1 also approximates the distribution for indications returned to service for Cycle 9.

A review of Table 3-1 indicates that SG-4 had the highest number of indications returned to service for Cycle 9 operation (191 indications, only one above 1.0 volt). Therefore, SG-4 is very likely to be the limiting SG at EOC-9 from the standpoint of SLB leak rate and tube burst probability.

The distribution of EOC-8 indications as a function of support plate location is summarized in Table 3-2 and plotted in Figure 3-2. The data show a strong predisposition of ODSCC to occur in the first few hot leg TSPs (242 out of 260

indications occurred at the hot leg intersections in the two TSPs above the flow distribution baffle plate), although the mechanism extended to higher TSPs. No ODSCC indications were found on the cold leg side. In summary, the distribution of indication population at TSPs in Comanche Peak Unit-1 show the predominant temperature dependence of ODSCC, similar to that observed at other plants.

The TSP ODSCC mechanism at Comanche Peak Unit-1 is still relatively benign. As a comparison, a plant with Model E2 steam generators reported 3580 indications, with 102 indications over 3 volts after 8 cycles of operation, and another plant with Model D4 steam generators reported 5719 indications, with 7 indications over 3 volts, after 7 cycles of operation. The application of chemical cleaning at Comanche Peak Unit-1 1RF05 outage appears to have had a significant beneficial impact upon ODSCC initiation and growth rates.

3.2 Voltage Growth Rates

Voltage growth rates during Cycle 8 were developed from EOC-8 (April 2001) inspection data and a reevaluation of the EOC-7 (September 1999) inspection EC signals for the same indications. Table 3-3 shows the cumulative probability distribution (CPDF) for growth rate in each Comanche Peak Unit-1 steam generator during Cycle 8 on an EFPY basis, along with the corresponding Cycle 7 growth distributions. The Cycle 8 data for the individual SGs are also plotted on Figure 3-3. The curve labeled 'cumulative' on Figure 3-3 represents composite growth data from all four SGs.

Average growth rates for each SG during Cycle 8 are summarized in Table 3-4. It is evident that the absolute magnitude of average voltage growth in all SGs is relatively small (about 0.03 volt or less). In terms of growth as a percent of the BOC voltage, SG-3 has a larger value than the other 3 SGs (5.3%/EFPY), but it is based on data from only 19 indications. Table 3-5 shows the average composite voltage growth data from all four steam generators for the last two operating periods. The average growth rate during Cycle 8 is slightly smaller than that during Cycle 7.

The NRC guidelines in Generic Letter 95-05 stipulate that the growth rate distribution used in the SLB leak rate and tube probability analyses to support voltage-based repair criteria must contain at least 200 data points that are established using bobbin voltages measured in two consecutive inspections. Plant-specific growth data for 2 cycles is available, and the Cycle 8 growth data contains more than 200 data points. As evident from Table 3-3 and Figure 3-4, the growth distribution for Cycles 7 and 8 are nearly the same, with the Cycle 7 distribution enveloping the Cycle 8 distribution. Therefore, Cycle 7 growth data was used for Cycle 9 projections. As a bounding analysis, an additional EOC-9 projection was also performed for the limiting SG using the bounding growth distribution

presented in the last 90-day report (Reference 8-4) for plants with ¾ inch diameter tubes.

Table 3-6 lists the largest 30 indications on the basis of Cycle 8 growth rates in the descending order. The largest growth during Cycle 8 was below 0.3 volts. The EOC-7 voltages used to estimate growth rates for new indications were obtained by revaluating the last inspection data.

3.3 NDE Uncertainties

The NDE uncertainties applied for the Cycle 8 voltage distributions in the Monte Carlo analyses for leak rate and burst probabilities are consistent with the requirements of the NRC Generic Letter 95-05 (Reference 8-1). They are presented in Table 3-7 as well as graphically illustrated on Figure 3-5. The probe wear uncertainty has a standard deviation of 7.0% about a mean of zero and has a cutoff at 15% based on implementation of the probe wear standard. The analyst variability uncertainty has a standard deviation of 10.3% about a mean of zero with no cutoff. These NDE uncertainty distributions are included in the Monte Carlo analyses for SLB leak rates and tube burst probabilities based on the EOC-8 actual voltage distributions as well as for the EOC-9 projections.

3.4 Probability of Prior Cycle Detection (POPCD)

Since the ODSCC indication population in Comanche Peak Unit-1 is still relatively small, adequate data does not exist to establish a POPCD distribution. If a significantly larger number of indications are detected in future inspections, then a POPCD evaluation may be performed.

3.5 Probe Wear Criteria

An alternate probe wear criteria approved by the NRC (Reference 8-5) was applied during the EOC-8 inspection. When a probe does not pass the 15% wear limit, this alternate criteria requires that only tubes with indications above 75% of the repair limit since the last successful probe wear check be reinspected. As the repair limit is 1 volt, all tubes containing indications for which worn probe voltage was above 0.75 volt require reinspection. Only 11 indications detected had a field bobbin voltage over 0.75 volts and none of those indications were inspected with a worn probe. Therefore, no reinspection was required.

The alternate probe wear criteria used in the EOC-8 inspection is consistent with the NRC guidance provided in Reference 8-5.

Table 3-1
Comanche Peak Unit 1 April 01 Outage
Summary of Inspection and Repair For Tubes in Service During Cycle 8

Voltage Bin	Steam Generator 1						Steam Generator 2						Steam Generator 3					
	In-Service During Cycle 8				RTS for Cycle 9		In-Service During Cycle 8				RTS for Cycle 9		In-Service During Cycle 8				RTS for Cycle 9	
	Field Bobbin Indications	RPC Inspected	RPC Confirmed	Indications Repaired	All Indications	Confirmed & Not Inspected Indications Only	Field Bobbin Indications	RPC Inspected	RPC Confirmed	Indications Repaired	All Indications	Confirmed & Not Inspected Indications Only	Field Bobbin Indications	RPC Inspected	RPC Confirmed	Indications Repaired	All Indications	Confirmed & Not Inspected Indications Only
0.2	2	0	0	0	2	2	1	0	0	0	1	1	1	0	0	0	1	1
0.3	10	0	0	0	10	10	6	0	0	0	6	6	5	0	0	0	5	5
0.4	7	0	0	0	7	7	5	0	0	0	5	5	4	0	0	0	4	4
0.5	3	0	0	0	3	3	2	0	0	0	2	2	1	0	0	0	1	1
0.6	1	0	0	0	1	1	3	0	0	0	3	3	5	0	0	0	5	5
0.7	0	0	0	0	0	0	6	0	0	0	6	6	2	0	0	0	2	2
0.8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	23	0	0	0	23	23	23	0	0	0	23	23	19	0	0	0	19	19
>1v	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Voltage Bin	Steam Generator 4						Composite of All SGs					
	In-Service During Cycle 8				RTS for Cycle 9		In-Service During Cycle 8				RTS for Cycle 9	
	Field Bobbin Indications	RPC Inspected	RPC Confirmed	Indications Repaired	All Indications	Confirmed & Not Inspected Indications Only	Field Bobbin Indications	RPC Inspected	RPC Confirmed	Indications Repaired	All Indications	Confirmed & Not Inspected Indications Only
0.2	3	0	0	0	3	3	7	0	0	0	7	7
0.3	52	0	0	2	51	51	74	0	0	2	71	71
0.4	38	0	0	1	37	37	53	0	0	1	53	53
0.5	42	0	0	0	42	42	48	0	0	0	48	48
0.6	31	0	0	0	31	31	40	0	0	0	40	40
0.7	13	0	0	1	12	12	21	0	0	1	20	20
0.8	7	0	0	0	7	7	8	0	0	0	8	8
0.9	4	0	0	1	3	3	4	0	0	1	3	3
1	4	2	0	0	4	2	4	2	0	0	4	2
1.1	1	1	0	0	1	0	1	1	0	0	1	0
Total	195	3	0	5	190	187	260	3	0	5	255	252
>1v	1	1	0	0	1	0	1	1	0	0	1	0

Table 3-2
Comanche Peak Unit 1 April 2001
TSP ODSCC Indication Distributions for Tubes in Service During Cycle 8

Tube Support Plate	Steam Generator 1					Steam Generator 2					Steam Generator 3				
	Number of Indications	Maximum Voltage	Average Voltage	Largest Growth	Average Growth	Number of Indications	Maximum Voltage	Average Voltage	Largest Growth	Average Growth	Number of Indications	Maximum Voltage	Average Voltage	Largest Growth	Average Growth
H3	12	0.47	0.27	0.06	-0.02	17	0.70	0.48	0.19	0.00	16	0.80	0.42	0.29	0.03
H5	10	0.55	0.34	0.03	-0.04	5	0.39	0.32	0.21	0.03	2	0.66	0.46	0.09	0.05
H7	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-
H8	1	0.49	0.49	-0.05	-0.05	0	-	-	-	-	1	0.50	0.50	-0.06	-0.06
H10	0	-	-	-	-	1	0.22	0.22	-0.22	-0.22	0	-	-	-	-
Total	23					23					19				

Tube Support Plate	Steam Generator 4					Composite of All SGs				
	Number of Indications	Maximum Voltage	Average Voltage	Largest Growth	Average Growth	Number of Indications	Maximum Voltage	Average Voltage	Largest Growth	Average Growth
H3	115	1.09	0.46	0.21	-0.01	160	1.09	0.45	0.29	0.00
H5	65	0.79	0.42	0.26	-0.01	82	0.79	0.41	0.26	-0.01
H7	14	0.53	0.30	0.08	-0.01	14	0.53	0.30	0.08	-0.01
H8	1	0.21	0.21	0.01	0.01	3	0.50	0.40	0.01	-0.03
H10	0	-	-	-	-	1	0.22	0.22	-0.22	-0.22
Total	195					260				

Table 3-3
Comanche Peak Unit 1 April 2001
Signal Growth Statistics For Cycle 8 on an EFPY Basis

Delta Volts	Steam Generator 1			Steam Generator 2			Steam Generator 3			Steam Generator 4			Cumulative		
	Cycle 7	Cycle 8		Cycle 7	Cycle 8		Cycle 7	Cycle 8		Cycle 7	Cycle 8		Cycle 7	Cycle 8	
	CPDF	No. of Inds	CPDF	CPDF	No. of Inds	CPDF	CPDF	No. of Inds	CPDF	CPDF	No. of Inds	CPDF	CPDF	No. of Inds	CPDF
-0.1	0.0	1	0.043	0.0	3	0.13	0.0	0	0.0	0.015	7	0.036	0.01	11	0.042
0	0.636	18	0.826	0.526	8	0.478	0.111	6	0.316	0.6	107	0.587	0.548	139	0.577
0.1	1.0	4	1.0	0.947	9	0.87	0.889	12	0.947	0.938	75	0.969	0.942	100	0.962
0.2		0		1.0	3	1.0	0.889	0	0.947	1.0	6	1.0	0.99	9	0.996
0.3		0			0		1.0	1	1.0		0		1.0	1	1.0
Total		23			23			19			195			260	

Table 3-4
Comanche Peak Unit 1 - April 2001 Outage
Average Voltage Growth During Cycle 8

Voltage Range	Number of Indications	Average Voltage BOC	Average Voltage Growth		Percent Growth	
			Entire Cycle	Per EFPY #	Entire Cycle	Per EFPY #
	Composite of All Steam Generator Data					
Entire Voltage Range	260	0.43	-0.005	-0.004	-1.2%	-0.9%
V_{BOC} < .75 Volts	243	0.40	-0.004	-0.003	-1.0%	-0.7%
≥ .75 Volts	17	0.86	-0.024	-0.017	-2.7%	-2.0%
	Steam Generator 1					
Entire Voltage Range	23	0.34	-0.030	-0.022	-8.9%	-6.4%
V_{BOC} < .75 Volts	23	0.34	-0.030	-0.022	-8.9%	-6.4%
≥ .75 Volts	0	-	-	-	-	-
	Steam Generator 2					
Entire Voltage Range	23	0.44	0.001	0.001	0.2%	0.1%
V_{BOC} < .75 Volts	22	0.41	0.013	0.010	3.2%	2.3%
≥ .75 Volts	1	0.92	-0.270	-0.195	-29.3%	-21.2%
	Steam Generator 3					
Entire Voltage Range	19	0.40	0.029	0.021	7.4%	5.3%
V_{BOC} < .75 Volts	18	0.38	0.028	0.020	7.4%	5.4%
≥ .75 Volts	1	0.75	0.050	0.036	6.7%	4.8%
	Steam Generator 4					
Entire Voltage Range	195	0.44	-0.006	-0.005	-1.4%	-1.0%
V_{BOC} < .75 Volts	180	0.41	-0.006	-0.004	-1.4%	-1.0%
≥ .75 Volts	15	0.86	-0.012	-0.009	-1.4%	-1.0%

Based on Cycle 8 duration of 506.3 EFPD (1.386 EFPY)

Table 3-5
Comanche Peak Unit 1 April 2001
Average Voltage Growth Statistics
Composite of All Steam Generator Data

Bobbin Voltage Range	Number of Indications	Average Voltage BOC	Average Voltage Growth		Average Percentage Growth	
			Entire Cycle	Per EFPY	Entire Cycle	Per EFPY
	Cycle 8 (1999 - 2001) - 506.3 EFPD					
Entire Voltage Range	260	0.43	-0.005	-0.004	-1.2%	-0.9%
V_{BOC} < .75 Volts	243	0.40	-0.004	-0.003	-1.0%	-0.7%
≥ .75 Volts	17	0.86	-0.024	-0.017	-2.7%	-2.0%
	Cycle 7 (1998 - 1999) - 510 EFPD					
Entire Voltage Range	104	0.49	0.003	0.002	0.6%	0.4%
V_{BOC} < .75 Volts	90	0.43	0.012	0.009	2.8%	2.0%
≥ .75 Volts	14	0.89	-0.056	-0.040	-6.4%	-4.6%

Table 3-6
Comanche Peak Unit 1 April 2001
Summary of Largest Voltage Growth Rates for BOC-8 to EOC-8

Steam Generator				Bobbin Voltage			RPC	New
SG	Row	Col	Elevation	EOC	BOC	Growth	Confirmed ?	Indication ?
3	25	74	03H	0.57	0.28	0.29	N	N
4	37	79	05H	0.7	0.44	0.26	N	Y
2	34	82	05H	0.37	0.16	0.21	N	Y
4	17	20	05H	0.52	0.31	0.21	N	N
4	28	52	03H	1	0.79	0.21	Y	N
2	31	62	03H	0.7	0.51	0.19	N	N
4	38	36	03H	1	0.82	0.18	Y	N
4	20	16	03H	0.39	0.21	0.18	N	N
2	26	91	03H	0.42	0.26	0.16	N	Y
4	28	91	05H	0.43	0.27	0.16	N	Y
3	17	27	03H	0.54	0.4	0.14	N	Y
4	35	81	05H	0.55	0.44	0.11	N	Y
4	21	76	05H	0.33	0.22	0.11	N	Y
4	29	80	03H	0.44	0.33	0.11	N	Y
2	28	86	03H	0.58	0.48	0.1	N	N
2	29	65	03H	0.3	0.2	0.1	N	N
4	28	48	03H	0.52	0.42	0.1	N	Y
4	30	28	03H	0.4	0.3	0.1	N	N
3	24	62	05H	0.66	0.57	0.09	N	Y
2	26	65	03H	0.69	0.61	0.08	N	N
4	26	43	07H	0.32	0.24	0.08	N	Y
4	27	74	03H	0.39	0.31	0.08	N	Y
4	37	75	05H	0.51	0.43	0.08	N	Y
4	27	66	03H	0.89	0.81	0.08	N	N
4	37	38	03H	0.65	0.58	0.07	N	N
4	37	81	05H	0.38	0.31	0.07	N	Y
4	28	44	05H	0.57	0.5	0.07	N	Y
1	15	17	03H	0.22	0.16	0.06	N	N
3	20	88	03H	0.4	0.34	0.06	N	Y
3	22	81	03H	0.25	0.19	0.06	N	Y

Table 3-7
Probe Wear and Analyst Variability - Tabulated Values

Analyst Variability Std. Dev = 10.3% Mean = 0.0% No Cutoff	
Value	Cumul. Prob.
-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

Probe Wear Variability Std. Dev = 7.0% Mean = 0.0% Cutoff at +/- 15%	
Value	Cumul. Prob.
< -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

Figure 3-1
Comanche Peak Unit 1 April 2001 Outage
Bobbin Voltage Distributions at EOC-8 for Tubes in Service During Cycle 8

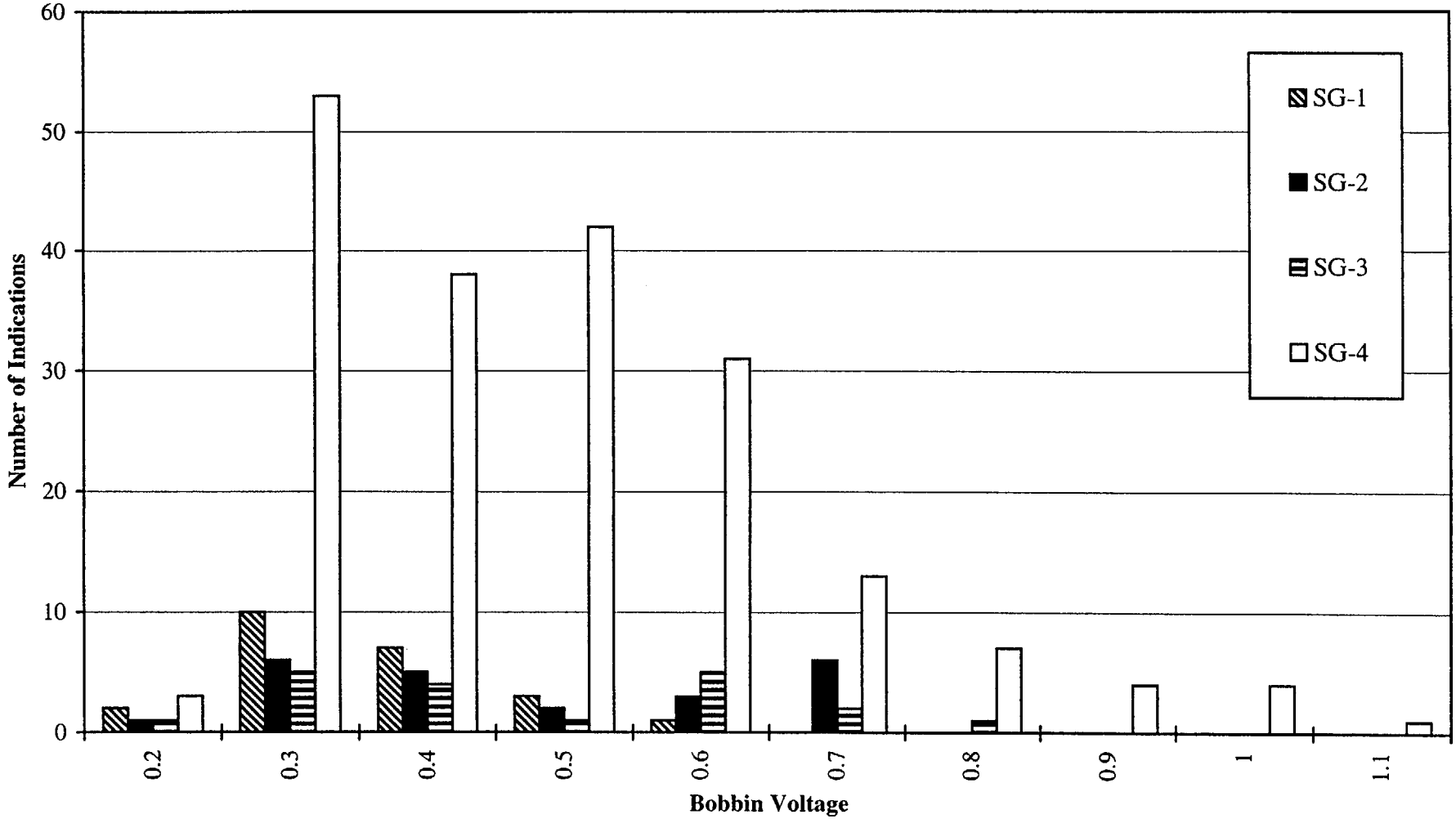


Figure 3-2
Comanche Peak Unit 1 - April 2001
ODSCC Axial Distributions for Tubes in Service During Cycle 8

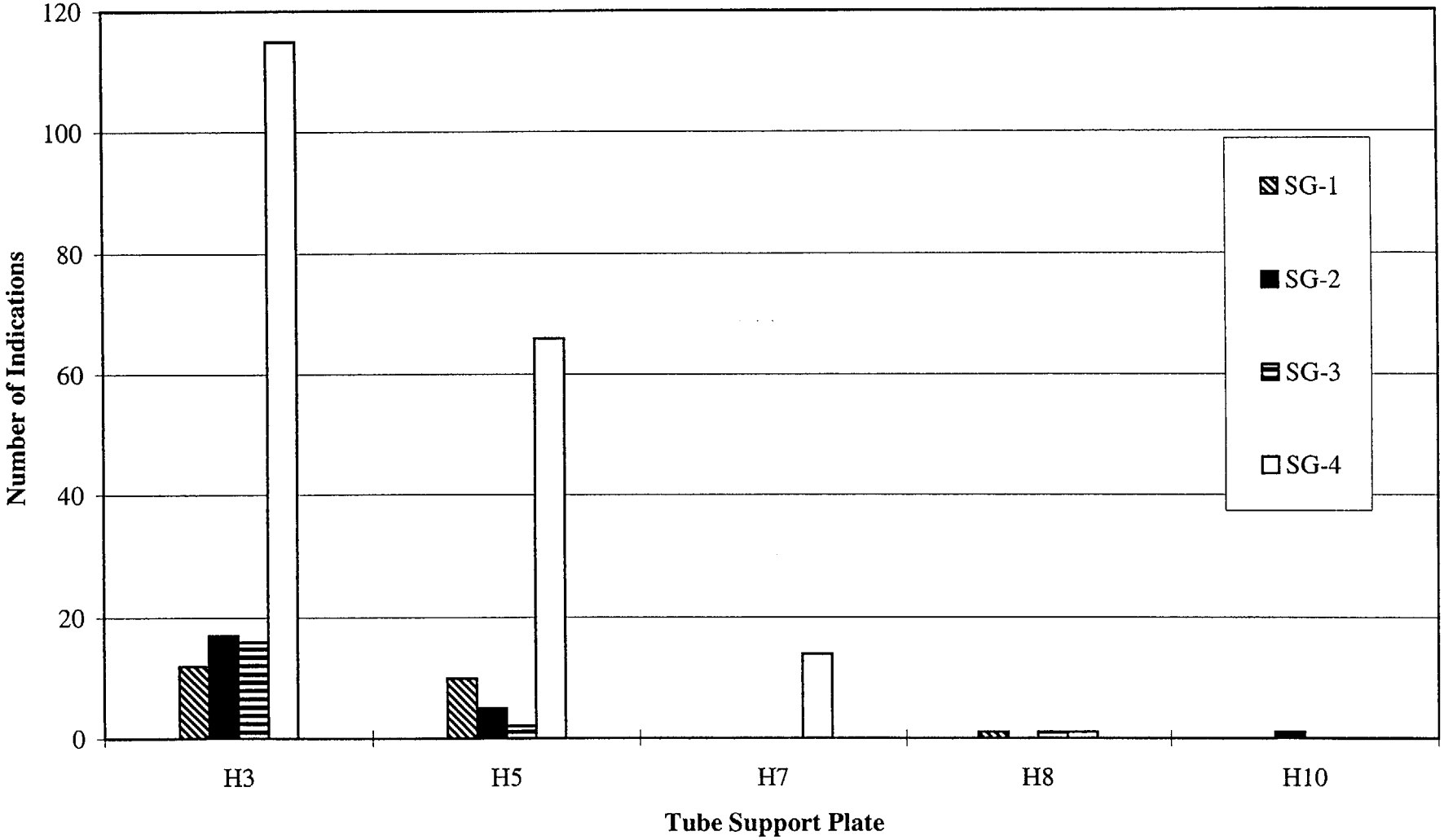


Figure 3-3
Comanche Peak Unit 1Cycle 8 (November 1999 to April 2001)
Cumulative Probability Distributions for Voltage Growth on an EFPY Basis

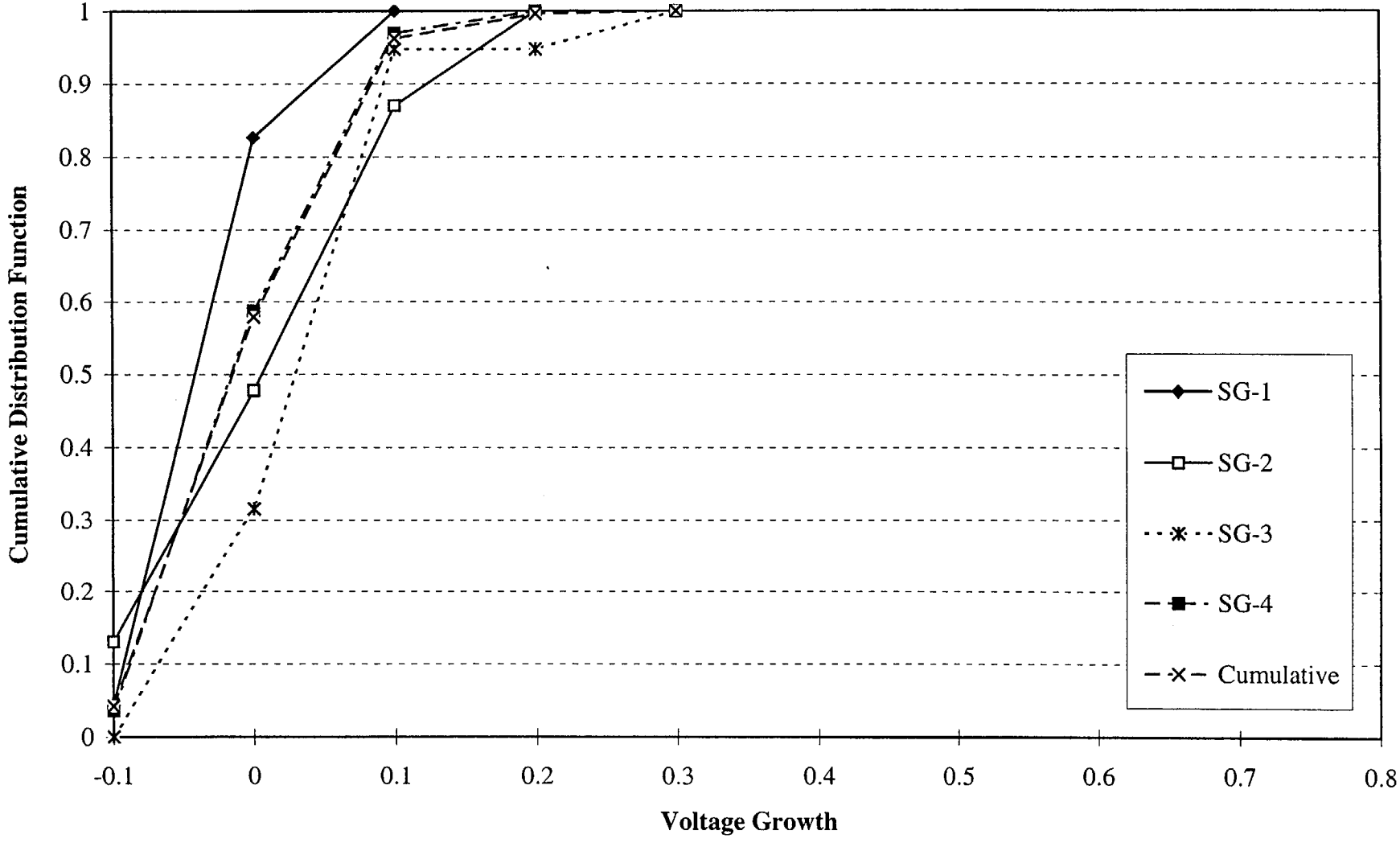


Figure 3-4
Comanche Peak Unit 1 - April 2001
Bobbin Signal Growth History - Cumulative Probability Distributions on an EFPY Basis
Composite of All Steam Generators

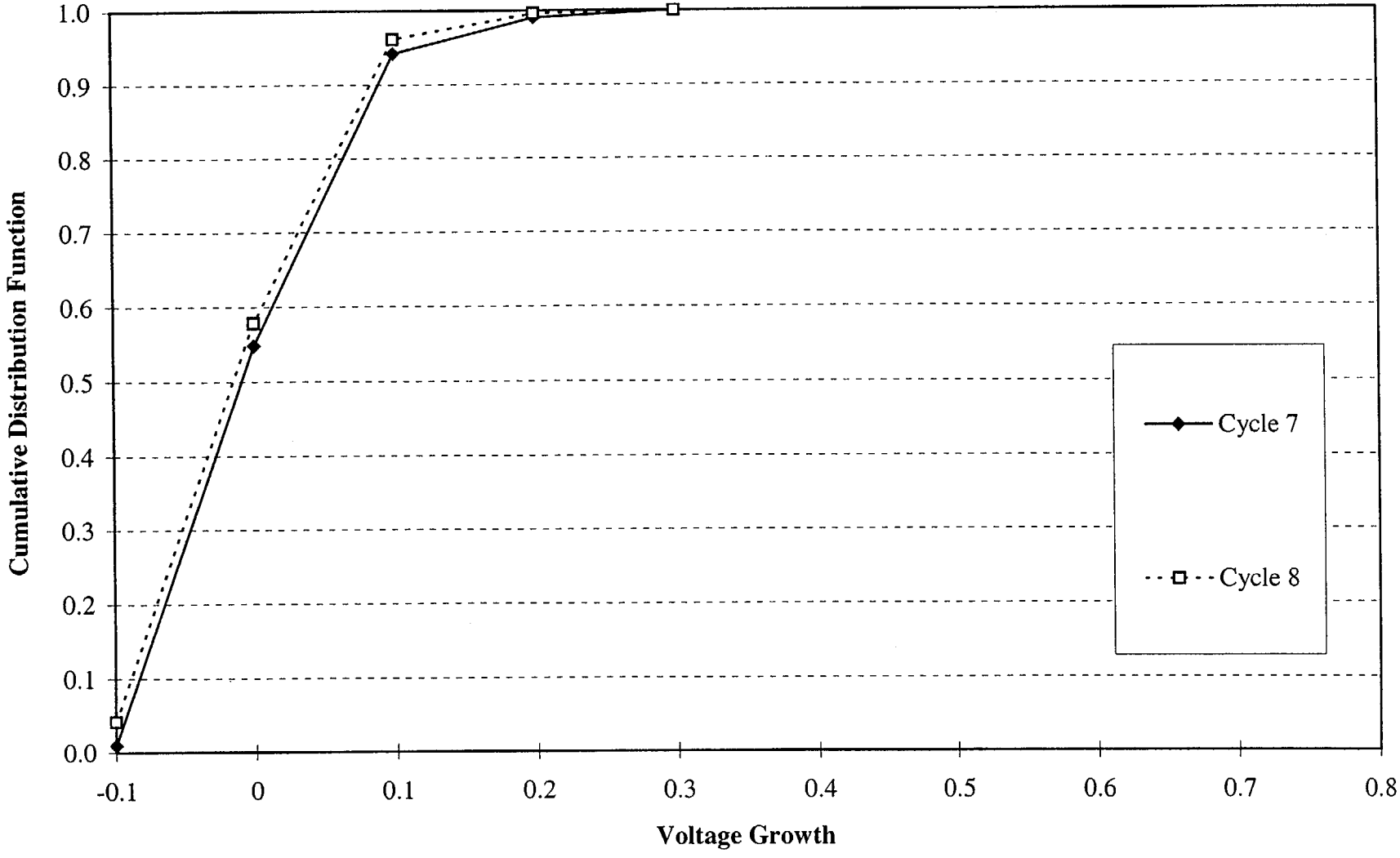
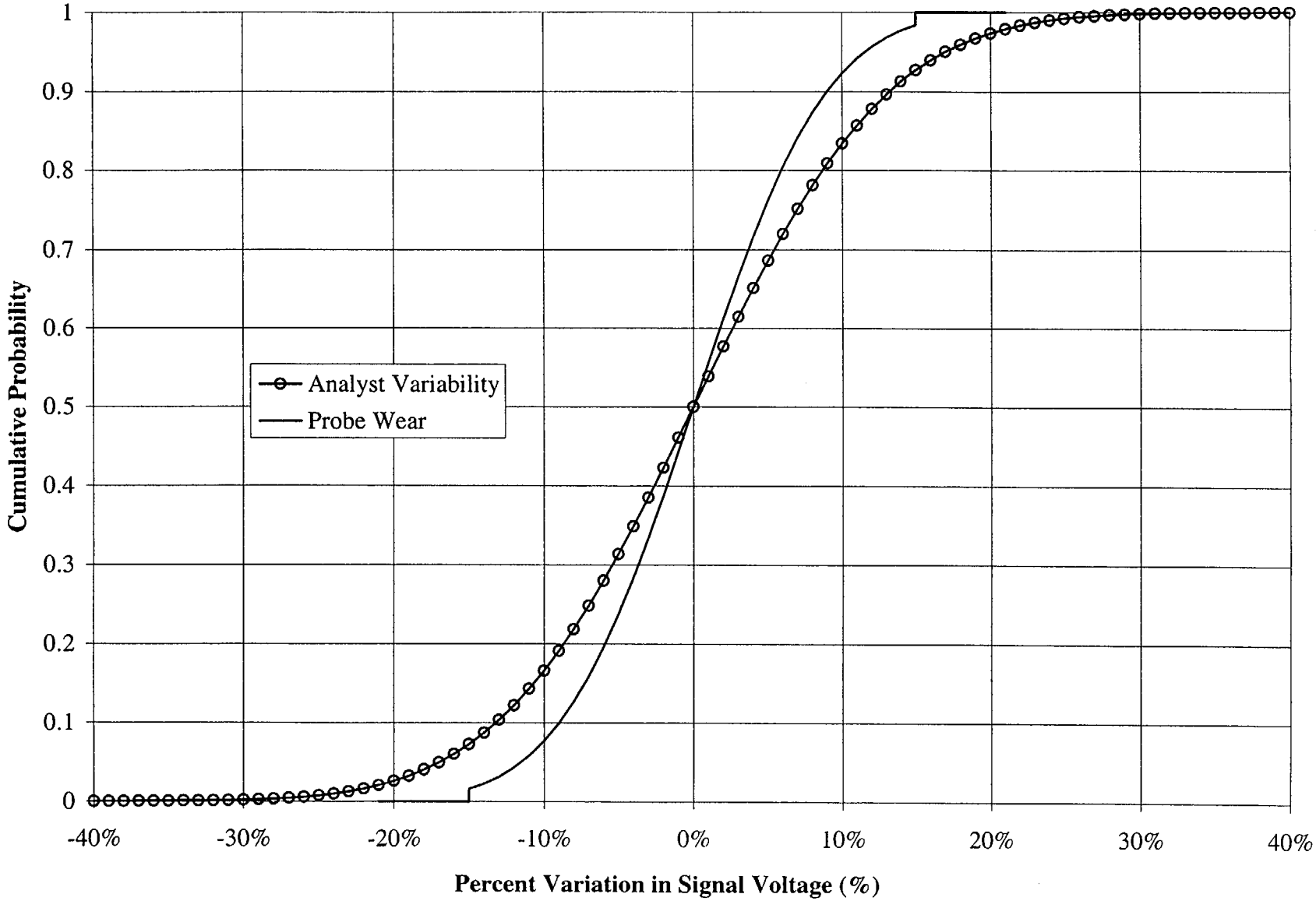


Figure 3-5
NDE Uncertainty Distributions



4.0 Database Applied for Leak and Burst Correlations

Leak and burst correlations based on the latest available database for ¾" tubes are applied for the EOC-9 projections (operational assessment), and these correlations are documented in Reference 8-6. The latest database is currently under NRC review (the last database reviewed by the NRC is documented in Reference 8-8), and it was used because it includes leak and burst data for the tubes pulled during the last Comanche Peak Unit-1 (EOC-7) outage. As noted in the last 90-day report (Reference 8-4), new data in the latest database have not significantly changed the leak and burst correlations, and therefore leak rate and burst probability results obtained with correlations in Reference 8-6 are not expected to be differ significantly from those based on the correlations in Reference 8-8. The EOC-8 projections (presented in Reference 8-4) utilized the leak and burst correlations documented in Reference 8-8; therefore, leak rates and burst probabilities based on the measured EOC-8 voltages (condition monitoring assessment) were also calculated using the correlations in Reference 8-8. Both databases mentioned above meet the NRC requirement that the p value obtained from the regression analysis of leak rate be less than or equal to 5%. Therefore, a SLB leak rate versus voltage correlation is applied obtain leak rate in both condition monitoring and operational assessments.

The following are the correlations for burst pressure, probability of leakage and leak rate used for the EOC-9 operational assessment (Reference 8-6).

$$\text{Burst Pressure } (ksi) = 7.4580 - 2.9540 \times \log(volts)$$

$$\text{Probability of Leak} = \frac{1}{1 + e^{\left(4.8271 - 8.4489 \times \log(volts)\right)}}$$

$$\text{Leak Rate } (l/hr) = 10^{\left(-1.6384 + 2.9409 \times \log(volts)\right)}$$

The upper voltage repair limit applied at the EOC-8 inspection, documented in Reference 8-7, was developed using NRC-reviewed database presented in Reference 8-8. The leak and burst correlations in Reference 8-8 do not differ significantly from the correlations based on the more recent database in Reference 8-6; therefore, there is no need to revise upper voltage repair limit data presented in Reference 8-7, which is summarized below. The structural limit (V_{sl}) for the TSP indications established using 1.43 times the SLB ΔP of 2560 psid is 4.7 volts, and V_{sl} for the FDB intersections using 3 times normal operation ΔP value (3816 psid) is 4.0 volts. Using the minimum growth rate specified in the Generic Letter 95-05

(30%/EFPY) and a expected duration of 1.41 EFPY (515 EFPD) for Cycle 9, the growth allowance becomes 42.3%. The allowance for NDE uncertainty is 20% per Generic Letter 95-05. The upper voltage repair limits then become 2.90 volts for TSP indications and 2.46 volts for FDB indications. The bobbin voltage for the largest ODSCC indication found during the EOC-8 inspection (1.09 volts) is substantially below the above upper repair limits.

5.0 SLB Analysis Methods

Monte Carlo analyses are used to calculate the SLB leak rates and tube burst probabilities for both actual EOC-8 and projected EOC-9 voltage distributions. The Monte Carlo analyses account for parameter uncertainty. The analysis methodology is described in the Westinghouse generic methods report of Reference 8-3, and it is consistent with the guidelines provided in the Generic Letter 95-05 (Reference 8-1).

In general, the methodology involves application of correlations for burst pressure, probability of leak and leak rate to a measured or calculated EOC distribution to estimate the likelihood of tube burst and primary-to-secondary leakage during a postulated SLB event. NDE uncertainties and uncertainties associated with burst pressure, leak rate probability and leak rate correlations are explicitly included by considering many thousands of voltage distributions through a Monte Carlo sampling process. The voltage distributions used in the projection analyses for the next operating cycle are obtained by applying growth data to the BOC distribution. The BOC voltage distributions include an adjustment for detection uncertainty and occurrence of new indications, in addition to the adjustments for NDE uncertainties. Comparisons of projected EOC voltage distributions with actual distributions after a cycle of operation have shown that the Monte Carlo analysis technique yields conservative estimates for EOC voltage distributions; therefore, leak and burst results based on those distributions are also conservative. Equation 3.5 in Reference 8-3 was used to determine the true BOC voltage.

6.0 Bobbin Voltage Distributions

This section describes the salient input data used to calculate EOC bobbin voltage distributions and presents projected EOC-9 voltage distributions. Also, actual measured voltage distributions from the EOC-8 inspection are compared with the projections performed after the last (EOC-8) outage.

6.1 Calculation of Voltage Distributions

The analysis for the EOC voltage distribution starts with a beginning of cycle (BOC) voltage distribution. The BOC distribution is projected to the EOC conditions by applying growth appropriate for the anticipated cycle operating period. The numbers of indications assumed in the analysis to project the EOC voltage distributions, and to perform tube leak rate and burst probability analyses, are obtained by adjusting the numbers of reported indications to account for detection uncertainty and initiation of new indications over the projected period. This is accomplished by using a POD factor, which is defined as the ratio of the actual number of indications detected to total number of indications present. A conservative value is assigned to the POD based on historic data, and the value used herein is discussed in Section 6.2. The calculation of projected bobbin voltage frequency distribution is based on a net total number of indications returned to service, defined as follows.

$$N_{Tot\ RTS} = N_i / POD - N_{repaired} + N_{deplugged}$$

where,

$N_{Tot\ RTS}$	=	Number of bobbin indications being returned to service for the next cycle,
N_i	=	Number of bobbin indications (in tubes in service) identified after the previous cycle,
POD	=	Probability of detection,
$N_{repaired}$	=	Number of N_i which are repaired (plugged) after the last cycle,
$N_{deplugged}$	=	Number of indications in tubes deplugged after the last cycle and returned to service in accordance with voltage-based repair criteria.

There are no deplugged tubes returned to service at BOC-8; therefore, $N_{deplugged} = 0$.

The methodology used in the projection of bobbin voltage frequency predictions is described in Reference 8-3. Salient input data used for projecting EOC-9 bobbin voltage frequency are further discussed below.

6.2 Probability of Detection (POD)

The Generic Letter 95-05 (Reference 8-1) requires the application of a constant POD value of 0.6 to define the BOC distribution for EOC voltage projections, unless an alternate POD is approved by the NRC. A POD value of 1.0 represents the ideal situation where all indications are detected. A voltage-dependent POD would yield a more accurate prediction of voltage distributions consistent with voltage-based repair criteria experience. Since the absolute magnitude of EOC-9 SLB leak rates and burst probabilities are expected to be small, the differences in the projections based on constant POD=0.6 and voltage-dependent POPCD are not expected to be significant. Therefore, only analyses based on the NRC required constant POD of 0.6 were performed.

6.3 Growth Rate Distribution

As discussed in Section 3.2, the NRC guidelines in Generic Letter 95-05 stipulate that the growth rate distribution used in the SLB leak rate and tube probability analyses must contain at least 200 data points that are established using bobbin voltages measured in two consecutive inspections. The Cycle 8 growth distribution contains more than 200 data points, but not the Cycle 7 distribution. However, Cycle 7 distribution envelopes Cycle 8 distribution; therefore, Cycle 7 growth distribution was applied for EOC-9 projections. Since all SG composite growth distribution does not differ significantly from the limiting SG growth distribution for both Cycle 7 and 8, the Cycle 7 composite growth distribution was applied for all SGs. An additional EOC-9 projection analysis was also performed for the limiting SG using the bounding distribution for ¾" plants presented in the last 90-day report (Reference 8-4).

6.4 Cycle Operating Period

The operating periods used in the growth rate/EFPY calculations and voltage projections are as follows.

Cycle 8 - BOC-8 to EOC-8 - 506.3 EFPD or 1.39 EFPY (actual)
Cycle 9 - BOC-9 to EOC-9 - 498 EFPD or 1.36 EFPY (estimated)

6.5 Projected EOC-9 Voltage Distribution

Calculations for the EOC-9 bobbin voltage projections were performed for all four SGs using the measured EOC-8 voltage data. The BOC distributions were adjusted to account for probability of detection as described above, and the adjusted number of indications at BOC-9 are also shown in Table 7-1. Although leak rate and burst probability calculations were performed using a constant POD

of 0.6 only, adjusted number of indications at BOC-9 based on EPRI POPCD distribution (presented in Reference 8-6) are also shown in Table 7-1. As discussed in Section 7-2, all SG composite growth distribution for Cycle 7, shown in Table 3-3, was applied to all SGs. The EOC-9 voltage distributions thus projected for all four SGs are summarized on Table 6-2. These results are also shown graphically on Figures 6-1 and 6-2. The largest voltage projected at EOC-9 is only 1.6 volts and is predicted for SG-4.

6.6 Comparison of Actual and Projected EOC-8 Voltage Distributions

Table 6-3, and Figures 6-3 and 6-4 provide a comparison of the EOC-8 actual measured bobbin voltage distributions with the corresponding projections performed using the last (EOC-7) inspection bobbin voltage data. EOC-8 projections based on a constant POD of 0.6 as well as the voltage-dependent EPRI POPCD distribution are shown for all 4 SGs. As reported in the last 90-day report (Reference 8-4), SG-4 was projected to have the highest number of indications, which is consistent with the EOC-8 inspections data. However, the projections underestimated the total number of indications for SG-4 because of underestimation of indication population below 0.7 volts. The projections for all 4 SGs overestimate the number of indications over 0.7 volts, see Figures 6-3 and 6-4. The largest indication found in each SG in the EOC-8 inspection (in the range 0.6 to 1.1 volts) are substantially below their projected values (2.8 to 4.7 volts). Overestimation of the indication population in the upper end of the distribution tail is due to the use of a bounding growth distribution for ¾" plants for the EOC-9 projections. The actual EOC-8 growth rates are very small compared to this bounding distribution.

Table 6-1
Comanche Peak Unit 1 April 2001
EOC-8 Bobbin and Assumed BOC-9 Bobbin Distributions in SLB Leak Rate and Tube Burst Analyses

Voltage Bin	Steam Generator 1				Steam Generator 2			
	EOC - 8		BOC - 9		EOC - 8		BOC - 9	
	Field Bobbin Indications	Indications Repaired	POD 0.6	POPCD	Field Bobbin Indications	Indications Repaired	POD 0.6	POPCD
0.2	2	0	3.33	5.00	1	0	1.67	2.50
0.3	10	0	16.67	20.00	6	0	10.00	12.00
0.4	7	0	11.67	12.28	5	0	8.33	8.77
0.5	3	0	5.00	4.62	2	0	3.33	3.08
0.6	1	0	1.67	1.43	3	0	5.00	4.29
0.7	0	0	0.00	0.00	6	0	10.00	7.89
0.8	0	0	0.00	0.00	0	0	0.00	0.00
0.9	0	0	0.00	0.00	0	0	0.00	0.00
1	0	0	0.00	0.00	0	0	0.00	0.00
1.1	0	0	0.00	0.00	0	0	0.00	0.00
Total	23	0	38.33	43.32	23	0	38.33	38.53
> 1V	0	0	0	0	0	0	0	0

Voltage Bin	Steam Generator 3				Steam Generator 4			
	EOC - 8		BOC - 9		EOC - 8		BOC - 9	
	Field Bobbin Indications	Indications Repaired	POD 0.6	POPCD	Field Bobbin Indications	Indications Repaired	POD 0.6	POPCD
0.2	1	0	1.67	2.50	3	0	5.00	7.50
0.3	5	0	8.33	10.00	52	2	84.67	102.00
0.4	4	0	6.67	7.02	38	1	62.33	65.67
0.5	1	0	1.67	1.54	42	0	70.00	64.62
0.6	5	0	8.33	7.14	31	0	51.67	44.29
0.7	2	0	3.33	2.63	13	1	20.67	16.11
0.8	1	0	1.67	1.27	7	0	11.67	8.86
0.9	0	0	0.00	0.00	4	1	5.67	3.82
1	0	0	0.00	0.00	4	0	6.67	4.71
1.1	0	0	0.00	0.00	1	0	1.67	1.16
Total	19	0	31.67	32.10	195	5	320.00	318.72
> 1V	0	0	0	0	1	0	1.67	1.16

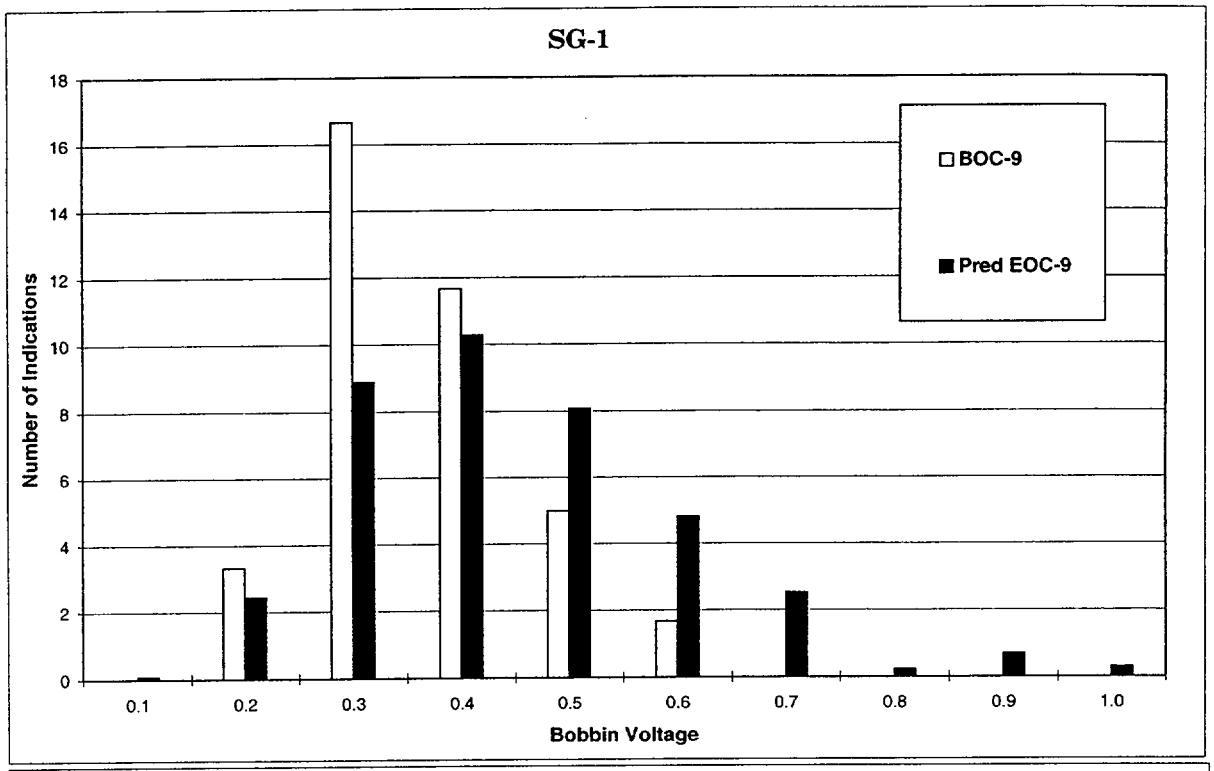
Table 6-2
Comanche Peak Unit 1 April 2001
Voltage Distribution Projection for EOC - 9

Voltage Bin	Steam Generator 1	Steam Generator 2	Steam Generator 3	Steam Generator 4
	Projected Number of Indications at EOC - 9 POD = 0.6			
0.1	0.09	0.00	0.04	0.13
0.2	2.45	0.45	1.22	6.84
0.3	8.88	3.19	4.50	41.76
0.4	10.28	6.11	5.61	58.47
0.5	8.07	7.12	5.17	64.31
0.6	4.81	5.87	4.94	55.20
0.7	2.53	5.68	4.31	39.41
0.8	0.23	4.94	3.02	23.73
0.9	0.70	3.11	1.64	13.44
1.0	0.30	0.88	0.20	7.78
1.1		0.70	0.70	4.49
1.2		0.30	0.30	2.43
1.3				1.01
1.5				0.70
1.6				0.30
TOTAL	38.34	38.35	31.65	320.00
> 1 V	0.00	1.00	1.00	8.93
> 2 V	0	0	0	0

Table 6-3
Comanche Peak Unit 1 April 2001
Comparison of Predicted and Actual EOC-8 Voltage Distributions

Voltage Bin	Steam Generator 1			Steam Generator 2			Steam Generator 3			Steam Generator 4		
	Number of Indications											
	EOC-8 Prediction		EOC-8 Actual	EOC-8 Prediction		EOC-8 Actual	EOC-8 Prediction		EOC-8 Actual	EOC-8 Prediction		EOC-8 Actual
	POD = 0.6	POPCD		POD = 0.6	POPCD		POD = 0.6	POPCD		POD = 0.6	POPCD	
0.1	0.00	0.00	0	0.01	0.01	0	0.00	0.00	0	0.01	0.01	0
0.2	0.28	0.49	2	0.20	0.31	1	0.19	0.34	1	0.38	0.54	3
0.3	0.44	0.70	10	0.69	0.96	6	0.31	0.51	5	2.22	2.95	52
0.4	1.42	2.05	7	1.38	1.75	5	0.72	1.09	4	4.30	5.46	38
0.5	1.96	2.71	3	2.15	2.53	2	1.15	1.58	1	5.79	6.90	42
0.6	2.03	2.62	1	2.95	3.26	3	1.33	1.64	5	7.94	8.80	31
0.7	2.06	2.50	0	3.38	3.51	6	1.55	1.76	2	10.00	10.36	13
0.8	2.05	2.48	0	3.38	3.36	0	1.66	1.82	1	10.42	10.10	7
0.9	1.60	1.89	0	3.12	3.02	0	1.50	1.59	0	10.17	9.42	4
1.0	1.23	1.41	0	2.69	2.56	0	1.25	1.28	0	9.53	8.64	4
1.1	1.01	1.14	0	2.23	2.10	0	1.04	1.04	0	8.32	7.40	1
1.2	0.86	1.02	0	1.81	1.69	0	0.87	0.91	0	6.87	6.04	0
1.3	0.65	0.75	0	1.47	1.37	0	0.65	0.67	0	5.59	4.89	0
1.4	0.50	0.57	0	1.18	1.10	0	0.51	0.51	0	4.50	3.90	0
1.5	0.39	0.45	0	0.93	0.86	0	0.42	0.42	0	3.59	3.07	0
1.6	0.32	0.37	0	0.73	0.67	0	0.33	0.34	0	2.86	2.43	0
1.7	0.24	0.29	0	0.57	0.53	0	0.25	0.26	0	2.26	1.93	0
1.8	0.19	0.22	0	0.45	0.43	0	0.20	0.20	0	1.80	1.57	0
1.9	0.11	0.20	0	0.37	0.34	0	0.06	0.12	0	1.41	1.22	0
2.0	0.00	0.12	0	0.30	0.28	0	0.00	0.00	0	1.14	0.99	0
2.1	0.00	0.00	0	0.25	0.24	0	0.00	0.00	0	0.96	0.85	0
2.2	0.70	0.00	0	0.22	0.21	0	0.70	0.70	0	0.81	0.72	0
2.3	0.00	0.70	0	0.18	0.16	0	0.00	0.00	0	0.67	0.59	0
2.4	0.00	0.00	0	0.04	0.00	0	0.00	0.00	0	0.54	0.47	0
2.5	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.44	0.37	0
2.6	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.39	0.34	0
2.7	0.00	0.00	0	0.70	0.70	0	0.00	0.00	0	0.29	0.25	0
2.8	0.00	0.00	0	0.00	0.00	0	0.30	0.30	0	0.23	0.20	0
2.9	0.30	0.00	0	0.00	0.00	0			0	0.21	0.19	0
3.0		0.00	0	0.00	0.00	0			0	0.16	0.14	0
3.1		0.30	0	0.00	0.00	0			0	0.14	0.12	0
3.2			0	0.00	0.00	0			0	0.13	0.12	0
3.3			0	0.00	0.00	0			0	0.11	0.11	0
3.4			0	0.00	0.00	0			0	0.10	0.09	0
3.5			0	0.00	0.00	0			0	0.07	0.00	0
3.6			0	0.30	0.30	0			0	0.00	0.00	0
3.9			0			0			0	0.00	0.70	0
4.0			0			0			0	0.70	0.00	0
4.7			0			0			0	0.30	0.30	0
TOTAL	18.3	23.0	23.0	31.7	32.3	23.0	15.0	17.1	19.0	105.4	102.2	195.0
> 1 V	5.3	6.1	0.0	11.7	11.0	0.0	5.3	5.5	0.0	44.6	39.0	1.0
> 2 V	1.0	1.0	0.0	1.7	1.6	0.0	1.0	1.0	0.0	6.3	5.6	0.0

Figure 6-1
Comanche Peak Unit 1 SG-1
Predicted Bobbin Voltage Distribution for Cycle 9
SG-1 and SG-2



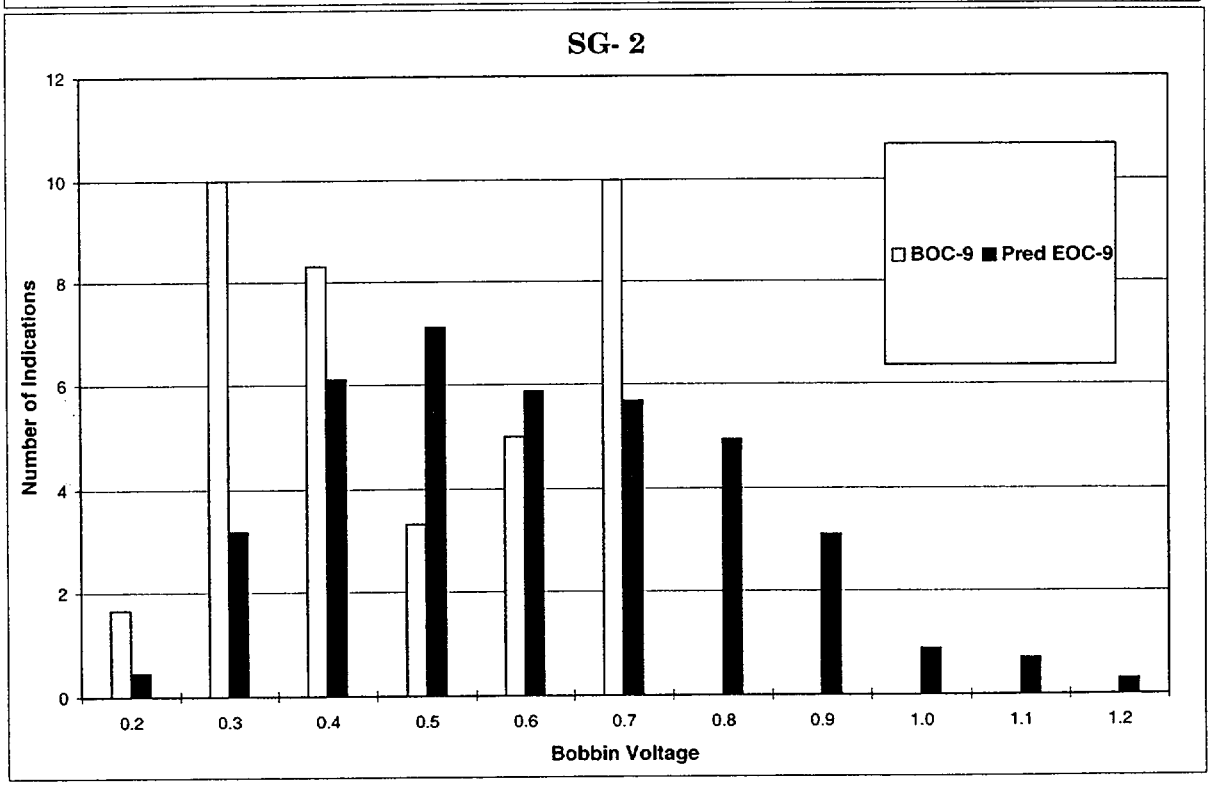


Figure 6-2
Comanche Peak Unit 1 SG-3
Predicted Bobbin Voltage Distribution for Cycle 9
SG 3 and SG 4

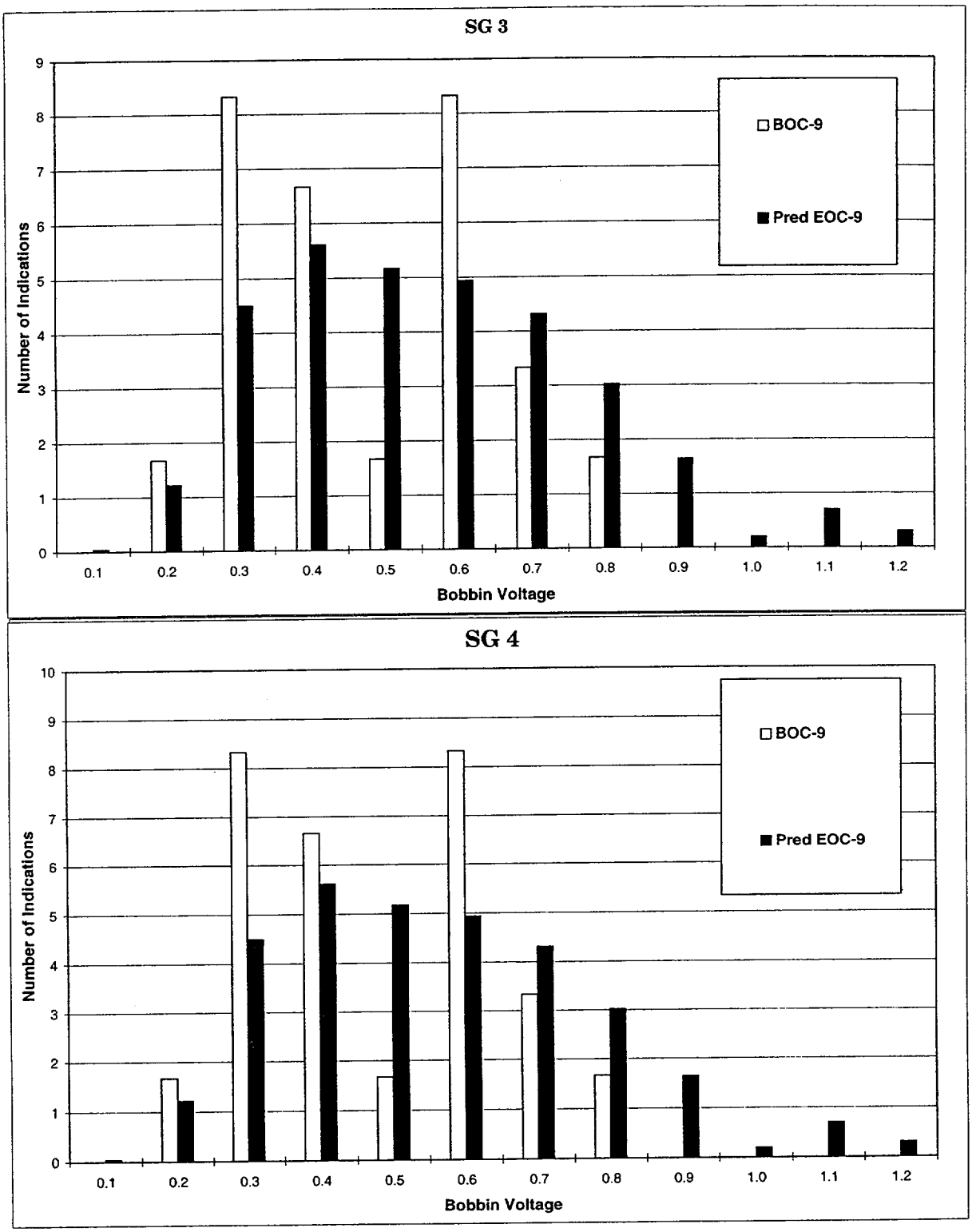


Figure 6-3
Comanche Peak Unit 1 April 2001
Bobbin Voltage Distributions for Cycle 8

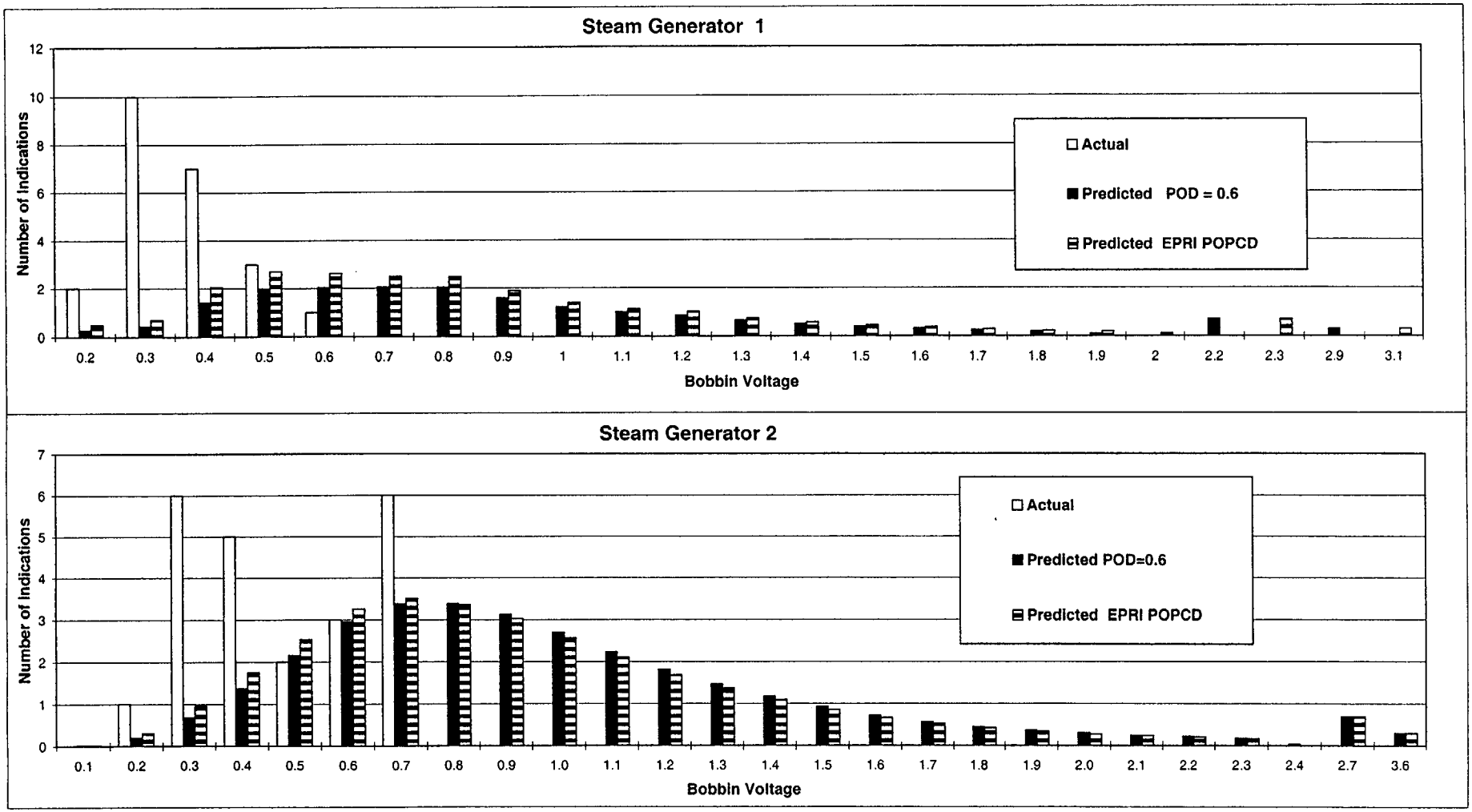
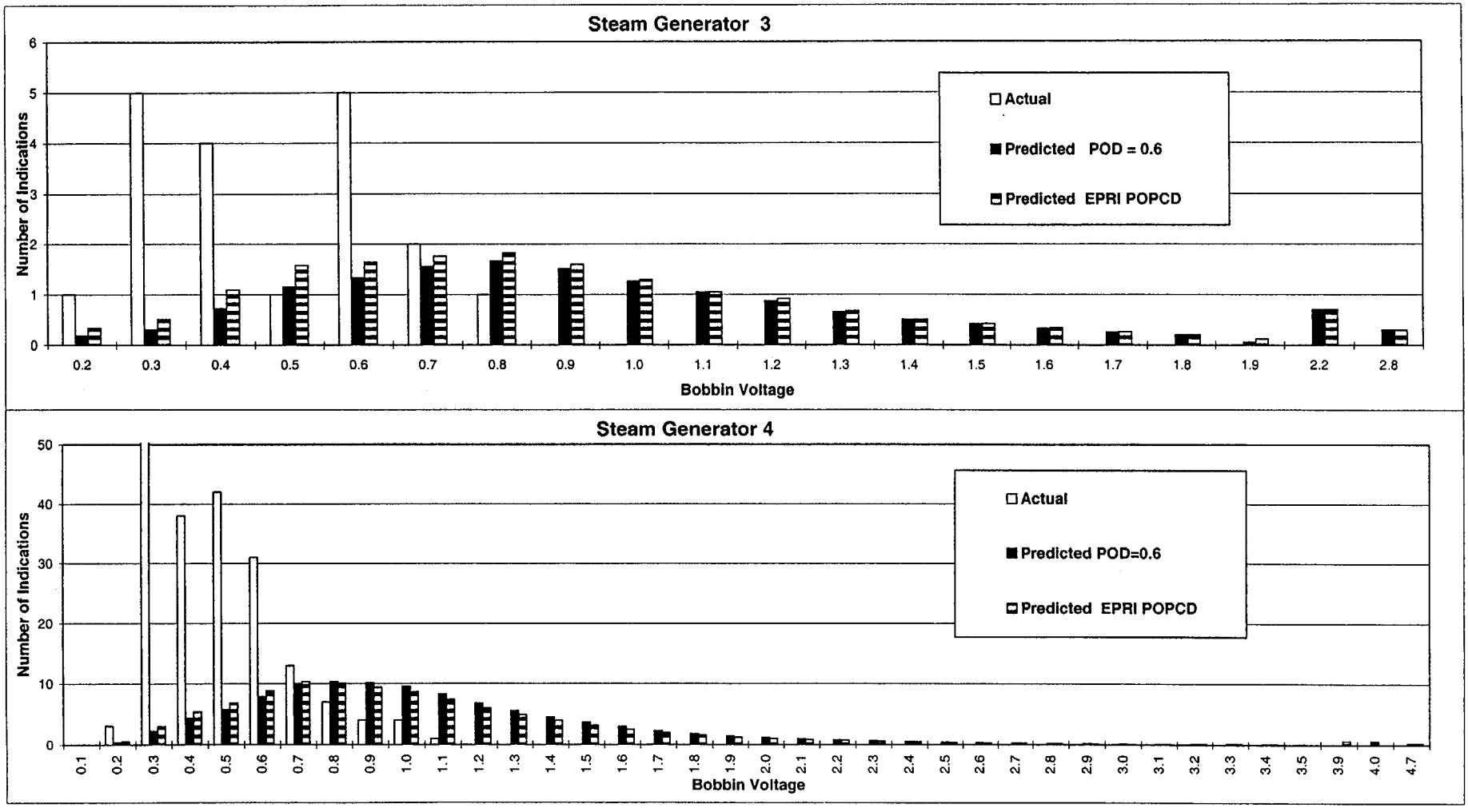


Figure 6-4
Comanche Peak Unit 1 April 2001
Bobbin Voltage Distributions for Cycle 8



7.0 SLB Leak Rate and Tube Burst Probability Analyses

This section presents the results of the analyses carried out to predict leak rates and tube burst probabilities for postulated SLB conditions using the actual voltage distributions from EOC-8 inspection (condition monitoring analysis) as well as the projected EOC-9 voltage distributions (operational assessment evaluation). The methodology used in these analyses is described in Section 5.0. About 75% of all the TSP ODSCC indications found in all 4 SGs during the EOC-8 inspection (195 out of a total of 260) were in SG-4; hence, SG-4 is expected to yield the limiting SLB leak rate and burst probability for Cycle 9.

7.1 Leak Rate and Tube Burst Probability for EOC-8

Condition monitoring analyses for leak rates and burst probabilities were performed for all 4 SGs and the results compared with the projections performed after the last (EOC-7) outage. These results are shown in Table 7-1. SLB leak rates and tube burst probabilities projected for the EOC-8 condition were small relative to their acceptance limits, and those based on the actual measured EOC-8 voltages are even smaller. The significant differences noted between the projected and condition monitoring results for EOC-8 are attributed to the conservative growth distribution applied for the EOC-8 projections. (Since sufficient plant-specific growth data were not available, a bounding growth distribution for ¾" tubes was applied for the EOC-8 projections.) The limiting SLB leak rate (3.0×10^{-4}) and tube burst probability (1.9×10^{-5}) values obtained using the actual measured EOC-8 voltages are 3 to 5 orders of magnitude below the corresponding acceptance limits (27.79 gpm at room temperature and 10^{-2}).

In summary, the condition monitoring analysis results meet the requirements of the Generic Letter 95-05.

7.2 Leak Rate and Tube Burst Probability for EOC-9

Calculations to predict SLB leak rates and tube burst probabilities for all 4 SGs in Comanche Peak Unit-1 at the EOC-9 conditions (operational assessment) were carried out using the NRC required constant value of 0.6 and Cycle 7 growth distribution. The projected results for the EOC-9 conditions are summarized in Table 7-2. With the standard calculation methodology presented in Reference 8-3 and a constant POD of 0.6, the largest EOC-9 SLB leak rate projected is 1.1×10^{-3} gpm (room temperature), and it is predicted for SG-4 which had the largest number of indications returned to service for Cycle 9 operation. This limiting SLB leak rate value is 4 orders of magnitude below the allowable SLB leakage limit for Cycle 9 of 27.79 gpm (room temperature). The highest tube burst probability, also predicted for SG-4, is 4.7×10^{-5}, which is 2 orders of magnitude below the NRC reporting guideline of 10^{-2}.

The additional projection analysis for SG-4 based on the bounding growth distribution for ¾" diameter tubes yields a leak rate of 0.38 gpm, which still about 2 orders of magnitude below the acceptance limit. The corresponding burst probability, 6.7×10^{-3}, is also below the acceptance limit.

In summary, SLB leak rates and tube burst probabilities predicted for EOC-9 are well below their respective limits.

Table 7-1
Comanche Peak Unit-1 March 2001 Outage
Comparison of EOC-8 Projected Tube Leak Rates and Burst Probabilities
With Results Based on Actual Measured Voltage Data

Steam Generator	POD	No. of Indications[1]	Max. Volts[2]	Burst Probability		SLB Leak Rate (gpm)[3]	Comments
				1 Tube	1 or More Tubes		
EOC - 8 PROJECTIONS (Based on a projected Cycle 8 duration of 496 EFPD)							
A	0.6	18.3	2.9	3.5×10^{-4}	3.5×10^{-4}	1.5×10^{-2}	Standard leak rate and tube burst probability methodology
B		31.7	3.6	5.5×10^{-4}	5.5×10^{-4}	3.4×10^{-2}	
C		15.0	2.8	3.5×10^{-4}	3.5×10^{-4}	1.2×10^{-2}	
D		105.3	4.7	1.9×10^{-3}	1.9×10^{-3}	0.14	Addendum-3 database
D		105.3	4.7	2.3×10^{-3}	2.3×10^{-3}	0.14	Addendum 4 database
A	POPCD	23	3.1	4.2×10^{-4}	4.2×10^{-4}	1.9×10^{-2}	Standard leak rate and tube burst probability methodology
B		32.2	3.6	5.6×10^{-4}	5.6×10^{-4}	3.3×10^{-2}	
C		17.1	2.8	3.3×10^{-4}	3.3×10^{-4}	1.4×10^{-2}	
D		102.2	4.7	1.61×10^{-3}	1.6×10^{-3}	0.13	Addendum-3 database
EOC-8 ACTUAL							
A	1	23	0.47	$<1.2\times10^{-5}$	$<1.2\times10^{-5}$	0[4]	Standard leak rate and tube burst probability methodology
B		23	0.70	$<1.2\times10^{-5}$	$<1.2\times10^{-5}$	0[4]	
C		19	0.80	$<1.2\times10^{-5}$	$<1.2\times10^{-5}$	0[4]	
D		195	1.09	1.9×10^{-5}	1.9×10^{-5}	3.1×10^{-4}	Addendum-4 database

Notes:
(1) Number of indications adjusted for POD.
(2) Voltages include NDE uncertainties from Monte Carlo analyses and exceed measured voltages.
(3) Equivalent volumetric rate at room temperature.
(4) No leakage predicted at 95%/95% probability and confidence.

Table 7-2
Comanche Peak Unit-1 April 2001 Outage
Summary of Projected Tube Leak Rate and Burst Probability
for EOC-9 - 250k Simulations

Steam Generator	POD	No. of Indications[1]	Max. Volts[2]	Burst Probability		SLB Leak Rate (gpm)[3]	Comments
				1 Tube	1 or More Tubes		
EOC - 9 PROJECTIONS (Based on a projected Cycle 9 duration of 496 EFPD)							
A	0.6	38.3	1.0	$<1.2\times10^{-5}$	$<1.2\times10^{-5}$	$<1.0\times10^{-4}$	Standard leak rate and tube burst probability methodology Addendum-4 database
B		38.3	1.2	$<1.2\times10^{-5}$	$<1.2\times10^{-5}$	1.0×10^{-4}	
C		31.7	1.2	$<1.2\times10^{-5}$	$<1.2\times10^{-5}$	1.0×10^{-4}	
D		320.0	1.6	4.7×10^{-5}	4.7×10^{-5}	1.1×10^{-3}	
D		320.0	5.8	6.7×10^{-3}	6.7×10^{-3}	0.38	Bounding growth distribution for ¾" tube plants

Notes: (1) Number of indications adjusted for POD.
(2) Voltages include NDE uncertainties from Monte Carlo analyses.
(3) Equivalent volumetric rate at room temperature.

8.0 References

8-1 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.

8-2 NRC Letter "Comanche Peak Steam Electric Station (CPSES), Unit-1 – Issuance of Amendments Re: Implementation of the 1.0 Volt Steam Generator Tube Criteria (TAC Nos. MA 4843 and MA 4844," September 22, 1999.

8-3 WCAP-14277, Revision 1, "SLB Leak Rate and Tube Burst Probability Analysis Methods for ODSCC at TSP Intersections", Westinghouse Nuclear Services Division, December.1996.

8-4 SG-00-02-001, "Comanche Peak Unit-1, Cycle 8 Voltage-Based Repair Criteria Report," Westinghouse Electric Company, February 2000.

8-5 Letter from B. W. Sheron, Nuclear Regulatory Commission, to A. Marion, Nuclear Energy Institute, dated February 9, 1996.

8-6 EPRI Report NP 7480-L, Addendum 4, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate repair Limits, " Electric Power Research Institute, May 2001.

8-7 SG-01-02-004, "Comanche Peak Steam Electric Station Unit 1, Steam Generator Degradation Assessment 1RF08 Refueling Outage," Westinghouse Electric Company, February 2001.

8-8 EPRI Report NP 7480-L, Addendum 3, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits, " Electric Power Research Institute, May 1999.