February 11, 2002

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

Gentlemen:

In the Matter of	)	Docket No. 50-327
Tennessee Valley Authority	)	

SEQUOYAH NUCLEAR PLANT (SQN) - STEAM GENERATOR (SG) 90-DAY REPORT FOR VOLTAGE-BASED ALTERNATE REPAIR CRITERIA (ARC)

Enclosed is the SQN Unit 1 90-Day SG Report that supports continued implementation of the voltage-based ARC.

The ARC has been utilized on SQN Unit 1 SGs for operational Cycles 8 through 11. The enclosed report provides a condition monitoring assessment that demonstrates that the NRC Generic Letter (GL) 95-05 acceptance criteria are satisfied at the end of operational Cycle 11 and an operational assessment that demonstrates that the GL 95-05 acceptance criteria will continue to be satisfied throughout operational Cycle 12.

This report is submitted to you in accordance with SQN Unit 1 License Condition 2.C.(9)(d). This letter is being provided in accordance with NRC RIS 2001-05.

Please direct questions concerning this issue to me at (423) 843-7170 or J. D. Smith at (423) 843-6672.

Sincerely,

Original signed by

Pedro Salas
Licensing and Industry Affairs Manager

Enclosure

ENCLOSURE

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT (SQN)
UNIT 1

UNIT 1 CYCLE 11 STEAM GENERATOR (SG) 90-DAY REPORT FOR VOLTAGE-BASED ALTERNATE REPAIR CRITERIA (ARC)

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Appendix A Indication List
Appendix B Voltage Growth vs BOC Voltage

0.0 Glossary of Acronyms

ARC Alternate repair criteria

BOC Beginning of operation cycle. The current inspection is just prior to BOC-12.

EOC End of operation cycle. The current inspection is at EOC-11. The prior inspection results are from EOC-10. The end of the next cycle is EOC-12

POB Probability of burst

POD Probability of detection. This value is set equal to 0.60 for the GL-95-05 predictive analysis for the condition of the steam generators at the end of the next cycle.

EFPD Effective full power days

ODSCC Outside diameter stress corrosion cracking

SG Steam generator - specifically SG 1, SG 2, SG 3 and SG 4.

TSP Tube support plate. The Generic letter 95-05 Alternate Repair Criterion applies to ODSCC in the tubes at the TSPs

EFPY Effective full power year

RPC Rotating pancake coil

NDE Nondestructive examination

1.0 Introduction

Sequoyah Unit 1 completed the 11th cycle of operation and subsequent steam generator tube inspection in October and November, 2001. Axial ODSCC has been confirmed within the TSP regions of the steam generators and is a current degradation mechanism at Sequoyah Unit 1. The alternate repair criterion (ARC) defined in NRC Generic Letter 95-05 (Reference 1) has been implemented at Sequoyah Unit 1 for several operational cycles (References 2,3,4,5,6). This report provides a condition monitoring assessment that demonstrates that the GL-95-05 acceptance criteria are satisfied at the end of operational cycle 11 (EOC-11), and an operational assessment that demonstrates that the GL-95-05 acceptance criteria will continue to be satisfied throughout operational cycle 12.

The operation cycle just completed, cycle 11, was 526.9 EFPD. The next cycle, cycle 12, is estimated to be 466.4 EFPD.

2.0 Summary and Conclusions

Bobbin voltage indications of ODSCC at the tube support plates were detected and measured in all four steam generators. Based on this voltage distribution, using the methodology of References 1 and 7, a Condition Monitoring evaluation including the computation of the probability of tube burst (POB) and the amount of leakage predicted for steam line break conditions at EOC-11 was performed. The results indicated that the previous predictions for EOC-11, Reference 5, were conservative for POB and leakage for all four steam generators. The acceptance criteria on POB and leakage are satisfied with significant margin.

The number of indications identified at EOC-11 was greater than the number identified at EOC-10, but was significantly less than predicted in Reference 5. This is due to several phenomena. First, during the EOC-10 inspection, many low voltage indications were conservatively called. The occurrence of these low voltage indications can be observed in the voltage distribution plots in Reference 5. Second, during the EOC-11 inspection many more intersections were inspected by plus point probe due to concern about inside diameter flaws in dents. Bobbin signals indicative of ODSCC which were not confirmed by plus point were included in the indication list at EOC-11. Lastly, the voltage growth rate observed in cycles 10 and 11 is very small indicating that growth to detectable levels would be slow, and therefore the large number of indications predicted in Reference 6 based the conservative POD value of 0.6 is too great.

The change in voltage from the previous inspection was determined by historical review for each indication detected. The apparent voltage growth rate per EFPY in cycle 11 was essentially the same for each of the steam generators, and was slightly higher than the apparent voltage growth during cycle 10. Therefore a bound to the cycle 11 voltage growth rate, which also bounds the cycle 10 voltage growth rate, was used for the Operational Assessment prediction for EOC-12. The prediction of the POB and leakage at steam line break conditions at EOC-12 was performed. The results indicate that the acceptance criteria on POB and leakage at EOC-12 are satisfied with significant margin. Therefore, the Reference 1 acceptance criteria will be satisfied throughout cycle 12.

3.0 EOC-11 Inspection Results

3.1 Voltage Distributions at EOC-11

A summary of eddy current signal voltage distributions at the drilled support plates for all steam generators is shown in Tables 3.1 through 3.4 for steam generators 1 through 4 respectively. The detailed indication list is presented in Appendix A. Tables 3.1 through 3.4 show the number of indications in each voltage range detected at EOC-11, and the number of indications removed from service due to tube repairs for any reason. The number of indications that remain in service for Cycle 12 is the difference between the number detected and the ones removed from service. No tubes were unplugged with the intent to return them to service after inspection. The number of indications confirmed by RPC or not inspected is also given in Tables 3.1 through 3.4. Appendix A shows for each indication if it was confirmed or not tested.

The summary of all four-steam generators shows the following:

- A total of 830 bobbin signals were identified as ODSCC TSP indications during the inspection.
- Of the 830 indications, none were above 2 volts.
- No indications were plugged due to ODSCC TSP indications
- 38 indications were removed from service for reasons other than ODSCC at the support plates.

Table 3.1
Inspection Results for SG 1

Voltage Bin	CY 11 Inservice	Confirmed or not tested	Indications Repaired	Returned to Service CY 12
0.1	1	1		1
0.2	20	20		20
0.3	38	36	1	37
0.4	42	40		42
0.5	43	40		43
0.6	15	14	2	13
0.7	13	12		13
0.8	13	12		13
0.9	7	7	1	6
1	11	11	1	10
1.1	9	8	1	8
1.2	7	7		7
1.3	5	4		5
1.4	2	2		2
1.5	4	4		4
1.6	3	3		3
1.7	2	2		2
1.8	1	1		1
1.9				
2				
2.1				
2.2				
2.3				
2.4				
2.5				
TOTAL	236	224	6	230

Figure 3.1

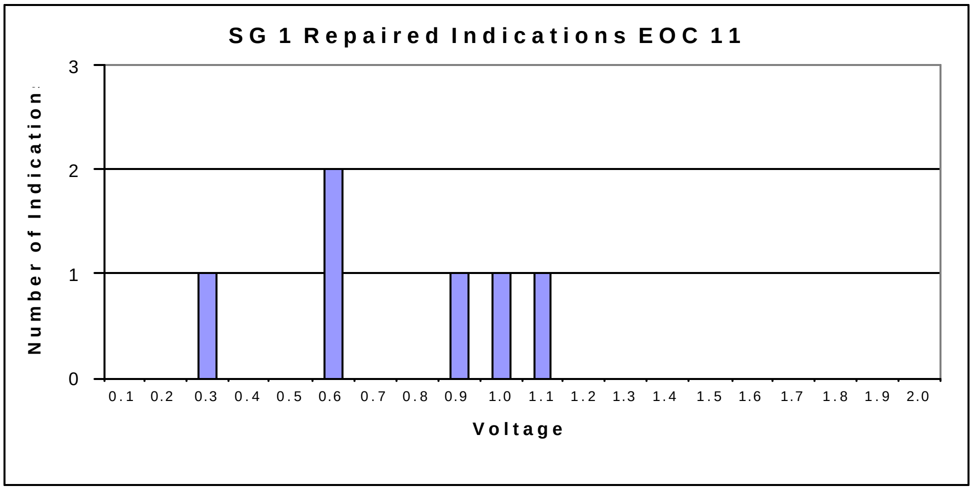


Table 3.2
Inspection Results for SG 2

Voltage Bin	CY 11 Inservice	Confirmed or not tested	Indications Repaired	Returned to Service CY 12
0.1	0	0		0
0.2	16	16		16
0.3	32	31		32
0.4	66	66	1	65
0.5	36	35	2	34
0.6	20	19	1	19
0.7	24	24	1	23
0.8	8	8	1	7
0.9	9	9	1	8
1	8	8		8
1.1	12	12	2	10
1.2	4	4		4
1.3	0	0		0
1.4	1	0		1
1.5	2	2		2
1.6	2	2	1	1
1.7	1	1		1
1.8	1	1		1
1.9	1	1		1
2	0	0		0
2.1	0	0		0
2.2	0	0		0
2.3	0	0		0
2.4	0	0		0
2.5	0	0		0
TOTAL	243	239	10	233

Figure 3.2

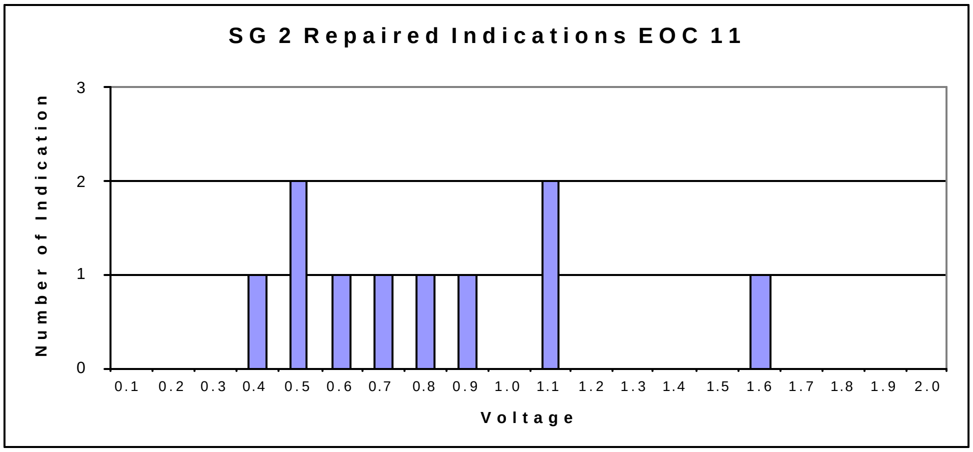


Table 3.3
Inspection Results for SG 3

Voltage Bin	CY 11 Inservice	Confirmed or not tested	Indications Repaired	Returned to Service CY 12
0.1	0	0		0
0.2	9	9		9
0.3	15	14	1	14
0.4	20	20		20
0.5	22	21	2	20
0.6	32	31		32
0.7	31	31	3	28
0.8	19	19	1	18
0.9	17	17	2	15
1	12	12		12
1.1	10	10	3	7
1.2	5	5		5
1.3	3	3		3
1.4	4	3	1	3
1.5	4	4	1	3
1.6	5	5	2	3
1.7	2	2		2
1.8	0	0		0
1.9	0	0		0
2	2	2		2
2.1	0	0		0
2.2	0	0		0
2.3	0	0		0
2.4	0	0		0

2.5	0	0		0
2.6	0	0		0
2.7	0	0		0
TOTAL	212	208	16	196

Figure 3.3

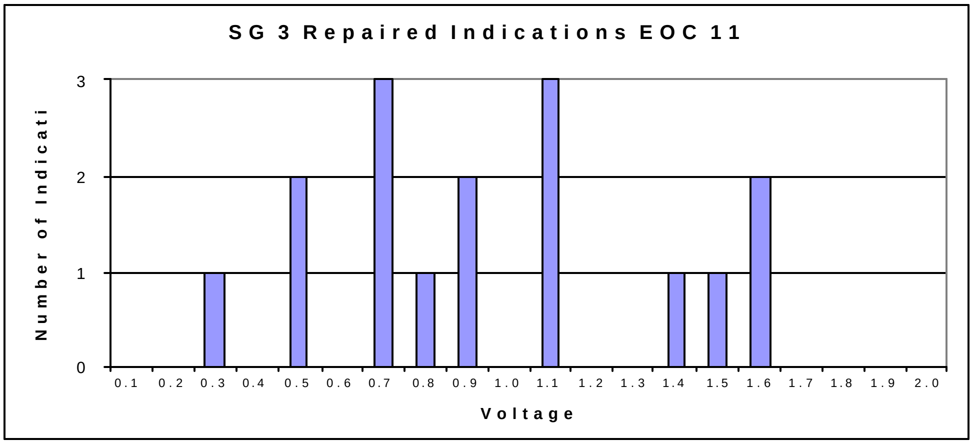
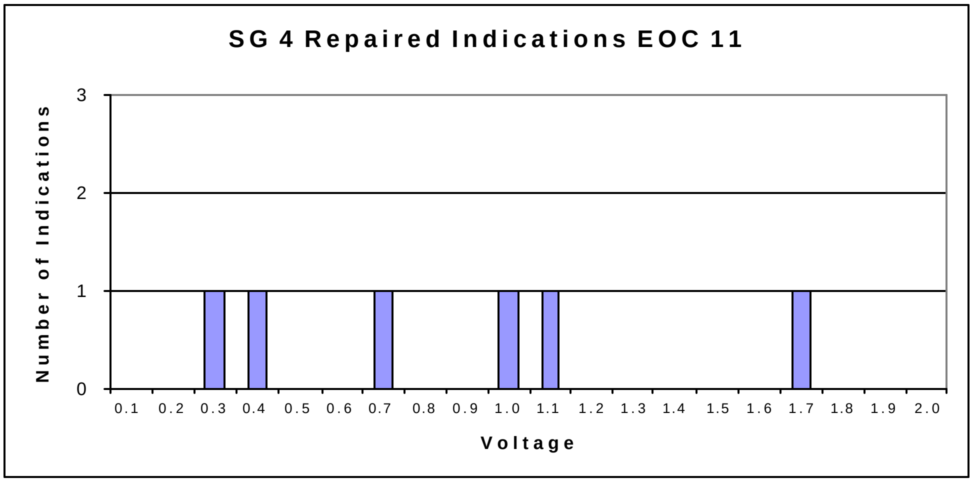


Table 3.4
Inspection Results for SG 4

Voltage Bin	CY 11 Inservice	Confirmed or not tested	Indications Repaired	Returned to Service CY 12
0.1	0	0		0
0.2	10	9		10
0.3	15	15	1	14
0.4	19	17	1	18
0.5	14	12		14
0.6	13	12		13
0.7	18	17	1	17
0.8	7	7		7
0.9	10	10		10
1	8	7	1	7
1.1	5	4	1	4
1.2	1	0		1
1.3	7	6		7
1.4	2	1		2
1.5	2	2		2
1.6	2	2		2
1.7	5	5	1	4
1.8	0	0		0
1.9	1	1		1
2	0	0		0
2.1	0	0		0
2.2	0	0		0
2.3	0	0		0

2.4	0	0		0
2.5	0	0		0
TOTAL	139	127	6	133

Figure 3.4



3.2 Voltage Growth Rates for Cycle 11

The voltage growth for each indication detected at EOC-11 was determined by identifying the corresponding voltage at the previous inspection, EOC-10. The following process was used to determine the EOC-10 voltage:

- If the indication was reported in Reference 6 at EOC-10, then the reported voltage is used.
- If the indication was not reported in Reference 6 at EOC-10, then a re-evaluation of the historical data of the corresponding EOC-10 inspection result was made.

The voltage at EOC-10 is provided for each indication detected at EOC-11 in Appendix A. The procedure for computing the voltage change and binning the values is described in Reference 11. The distribution of voltage differences over the entire cycle is shown in Table 3.5 for all four steam generators. A comparison of the growth rates for each steam generator on an EFPY basis is determined by dividing by the EFPY of Cycle 11. This comparison is shown in Figure 3.5

Table 3.5
Voltage Changes from EOC-10 to EOC-11

	Number of Indications			
Voltage Bin	SG 1	SG 2	SG 3	SG 4
-1.2		2		
-1.1	1	0		
-1.0	0	1		1
-0.9	0	0		0
-0.8	0	0	1	0
-0.7	0	1	0	1
-0.6	1	0	1	2
-0.5	3	0	2	0
-0.4	2	1	0	2
-0.3	3	8	2	5
-0.2	7	4	5	7
-0.1	18	16	21	9
0	66	55	46	29
0.1	76	85	65	37
0.2	32	46	34	21
0.3	13	14	22	12
0.4	11	5	5	5
0.5	0	3	1	6
0.6	1	0	2	1
0.7	0	1	2	1
0.8	1	0	1	
0.9	1	0	1	
1		0	0	

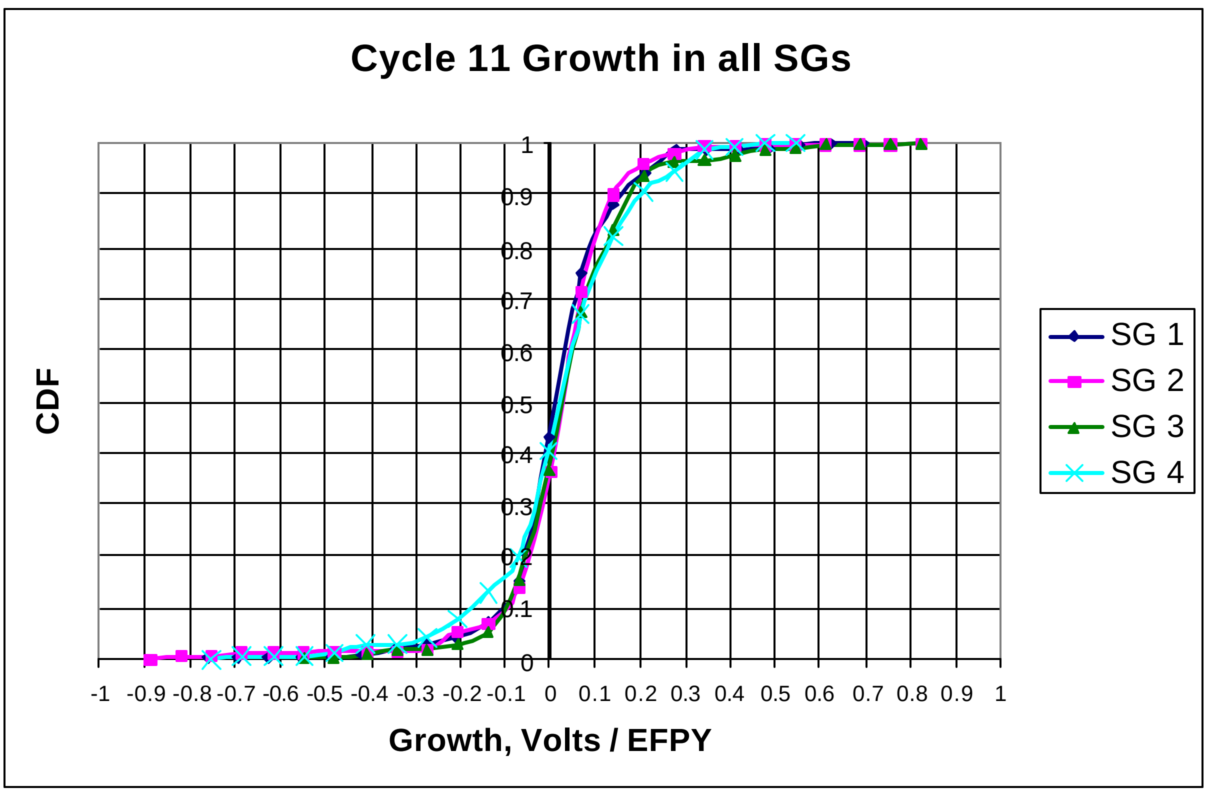
1.1	0	0
1.2	1	1

Table 3.6

Cumulative Voltage Growth per EFPY from EOC-10 to EOC-11

Cumulative Volts / EFPY	Number of Indications SG 1	SG 2	SG 3	SG 4
0. or less	101	88	78	56
0.0693	76	85	65	37
0.1385	32	46	34	21
0.2078	13	14	22	12
0.2771	11	5	5	5
0.3464	0	3	1	6
0.4157	1	0	2	1
0.4850	0	1	2	1
0.5543	1	0	1	
0.6236	1	0	1	
0.6927		0		
0.7620		0		
0.8312		1	1	

Figure 3.5



The voltage growth rates in volts per EFPY for all of the steam generators is shown in Table 3.6 and Table 3.7.

Table 3.7
Average and 95th Percentile Cycle 11 Growth Rates per EFPY

Steam Generator	Average Voltage Growth per EFPY in Cycle 11	95th Percentile Growth per EFPY in Cycle 11
1	.016	0.229
2	.020	0.180
3	.042	0.264
4	.020	0.291

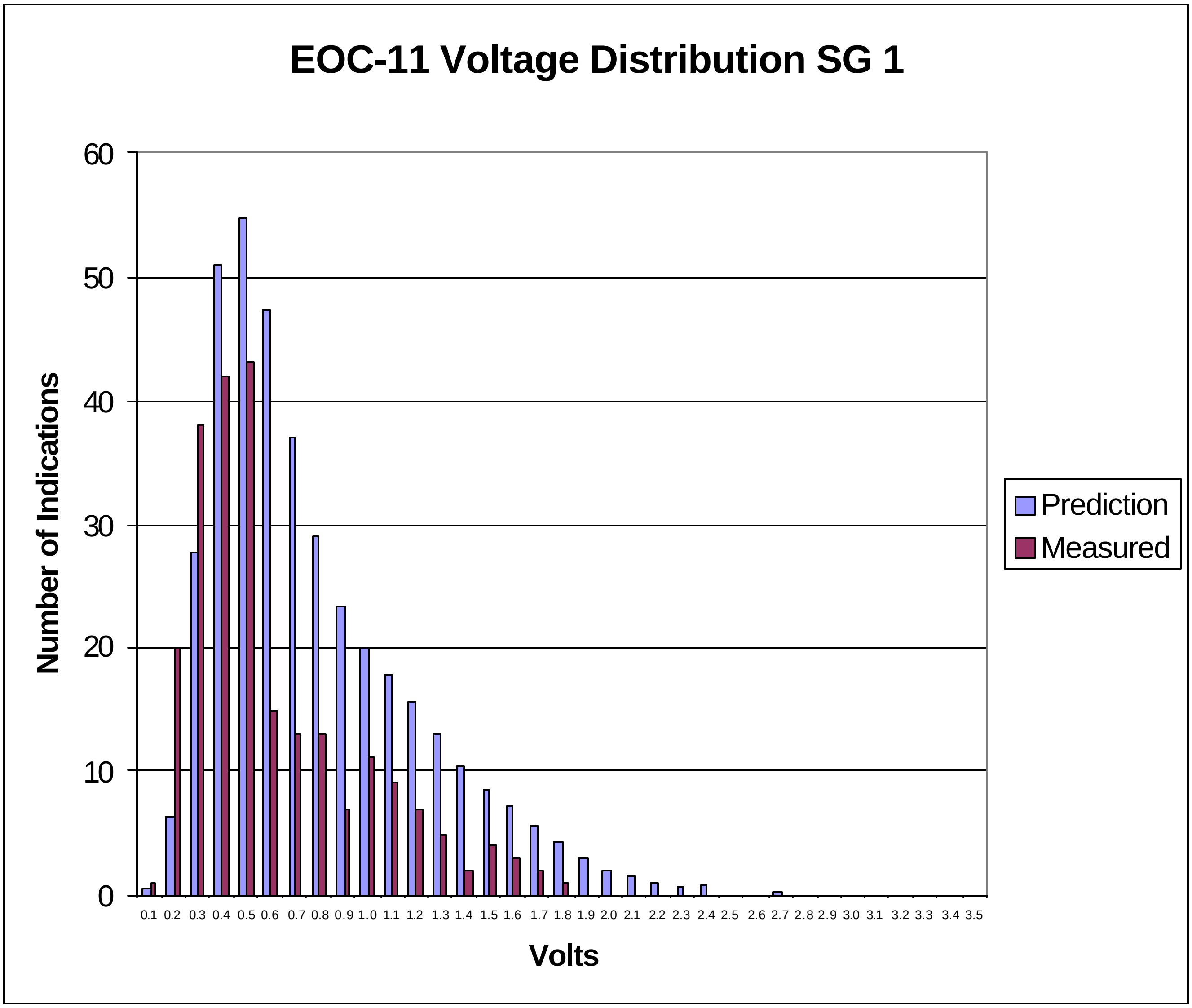
The cycle 11 growth rate for each steam generator is essentially the same and is very small. The very low average growth and the symmetry about the median volts on Figure 3.5 indicates that the apparent growth measured is predominately NDE uncertainty.

4.0 Comparison of Predicted and Measured Voltage Distributions at EOC-11

4.1 Comparison of Voltage Distributions

The voltage distribution measured at EOC-11 is compared to the voltage distribution predicted in Reference 4 for each steam generator in Figures 4.1 through 4.4. In all steam generators there are fewer indications than predicted, and the indications have lower voltage. This is at least partially due to the constant POD for all voltages assumed in the predictive analysis, and the very small voltage growth measured.

Figure 4.1



EOC-11 Voltage Distribution SG 1
Number of Indications
60
50
40
30
20
10
0
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4 3.5
Volts
Prediction
Measured

Figure 4.2

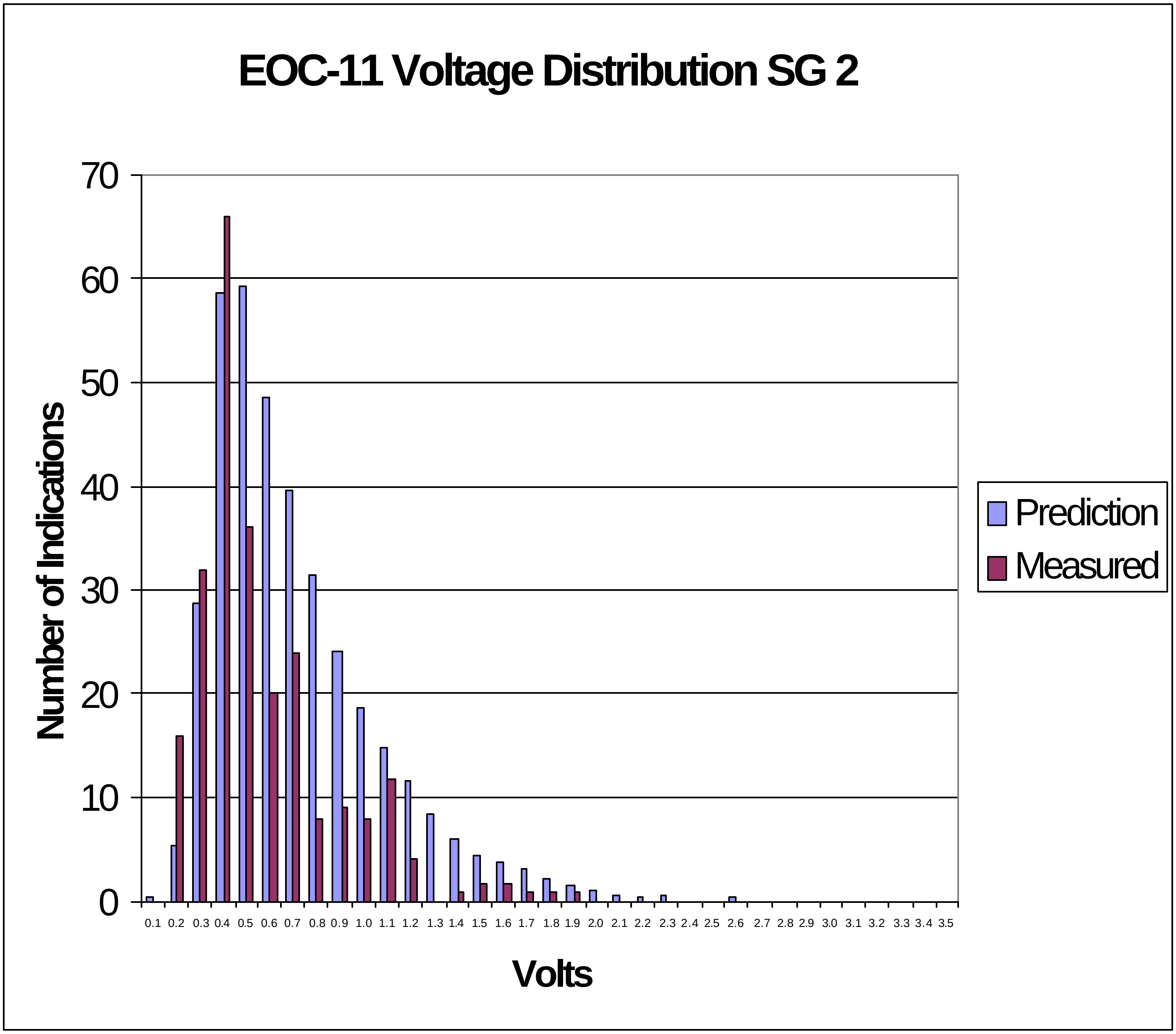

EOC-11 Voltage Distribution SG 2
Number of Indications
70
60
50
40
30
20
10
0
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4 3.5
Volts
Prediction
Measured

Figure 4.3

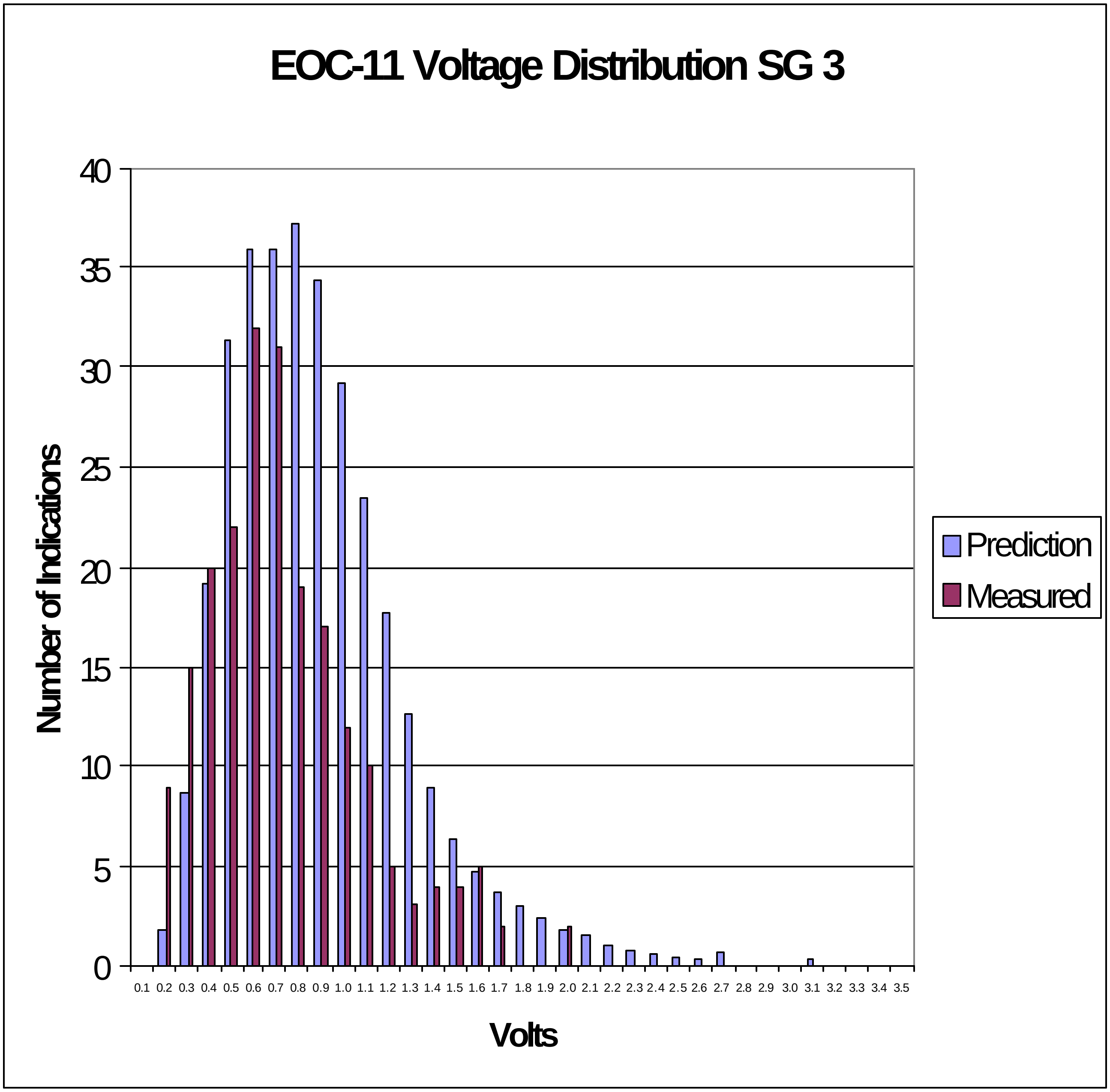
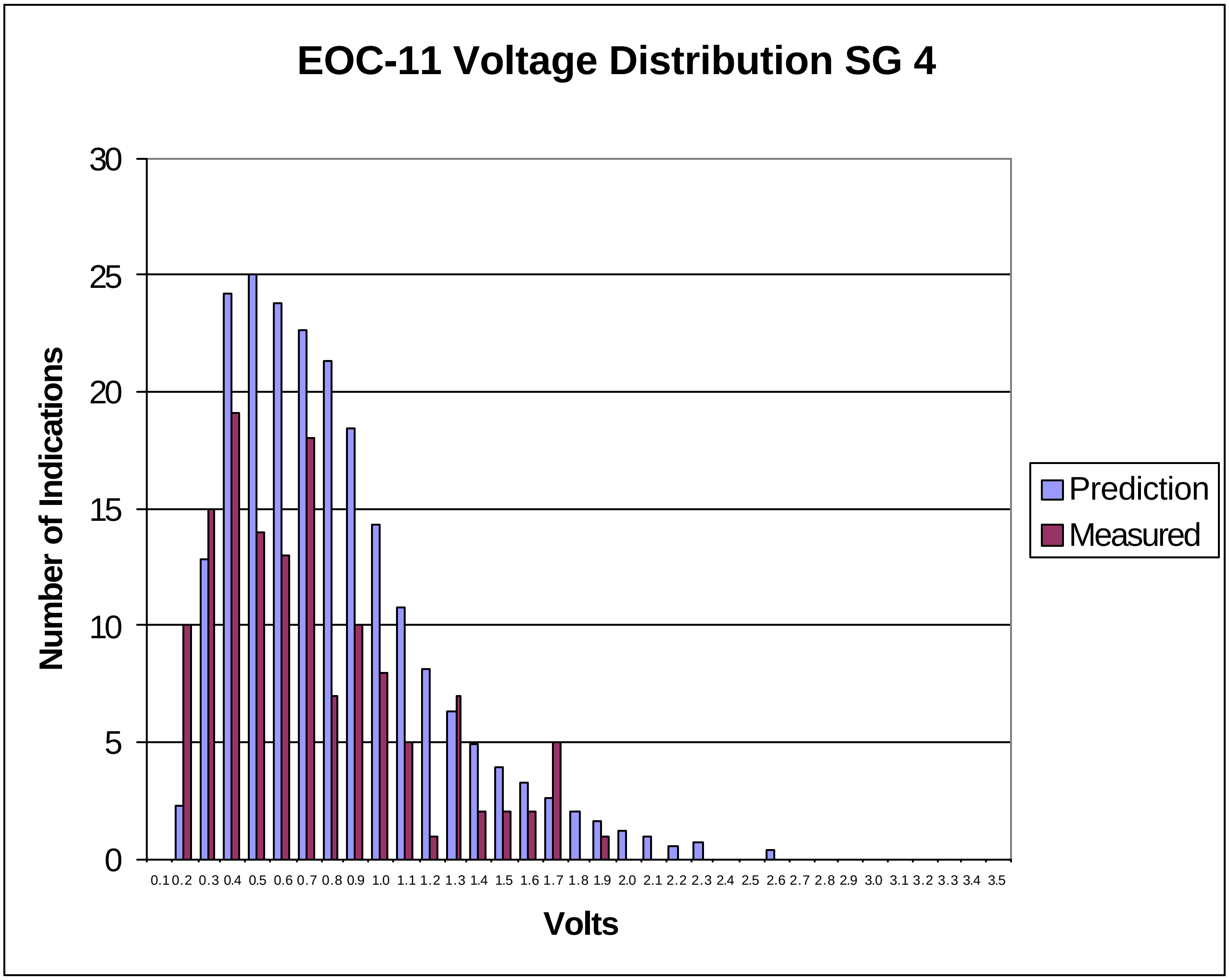


Figure 4.4



EOC-11 Voltage Distribution SG 4
30
25
20
15
10
5
0
Number of Indications
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4 3.5
Volts
Prediction
Measured

4.2 Comparison of Voltage Growth Distributions

The voltage growth distributions developed in Section 3.2 for Cycle 11, are compared with the corresponding growth distribution of Cycle 10 and Cycle 9. Figures 4.5 through 4.8 show the comparisons for SG1 through SG4, respectively.

Figure 4.5

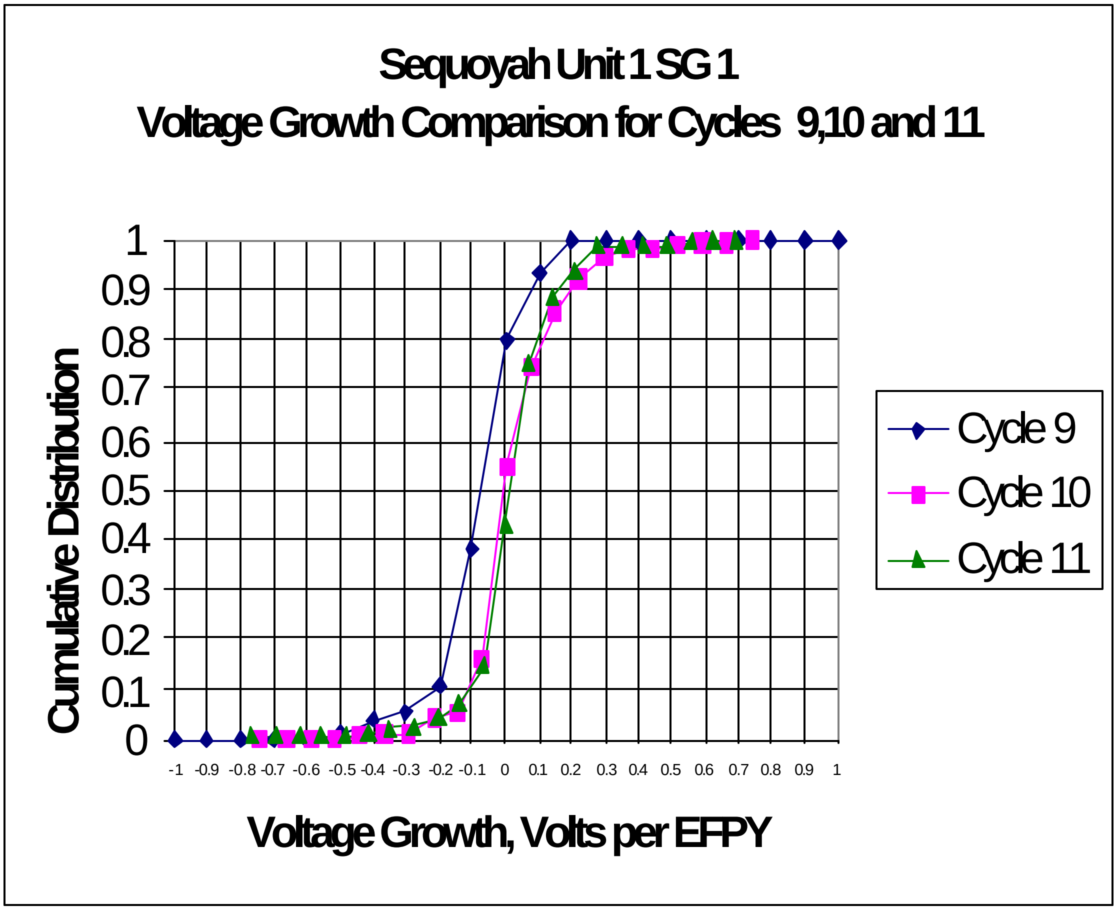
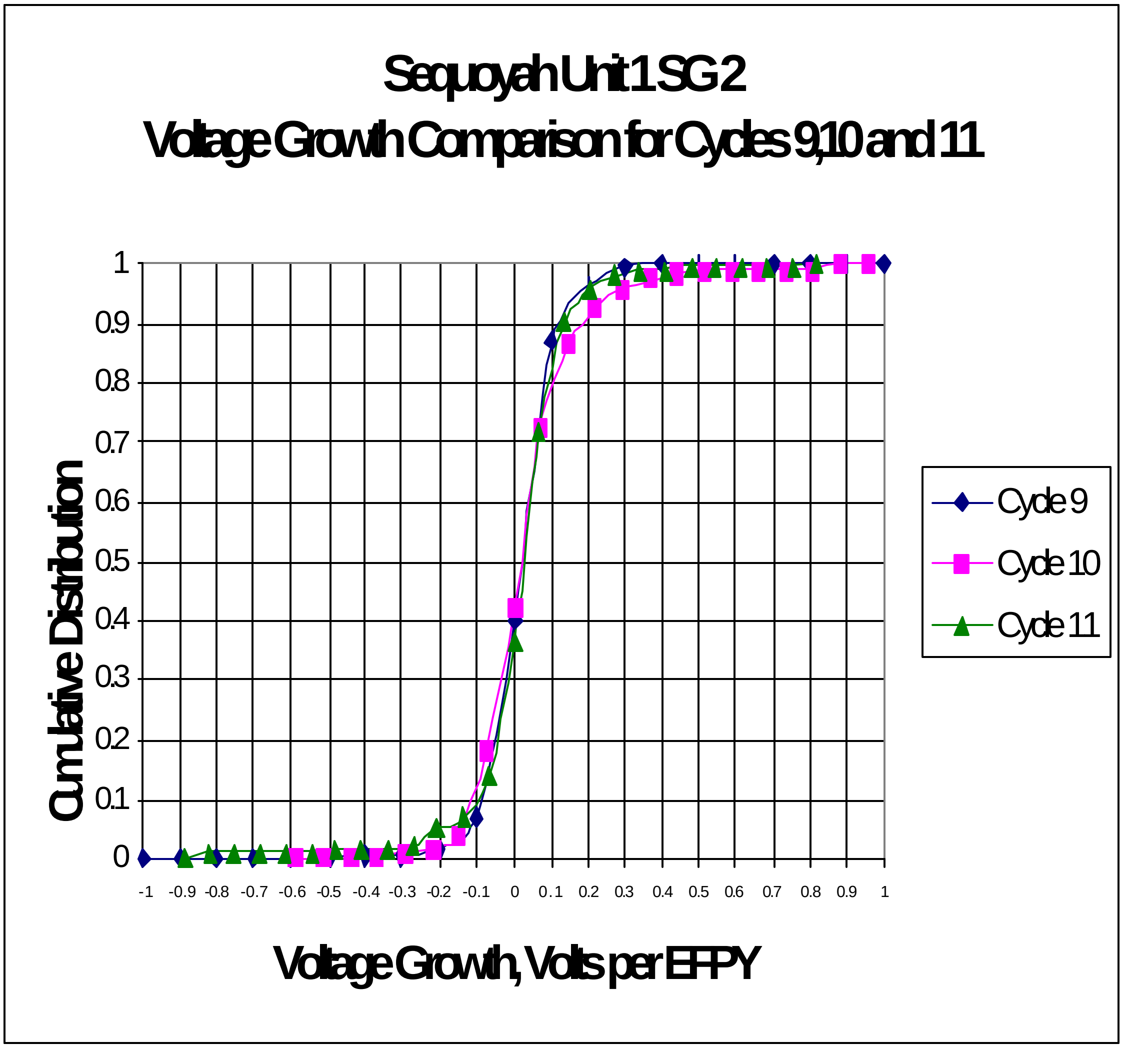
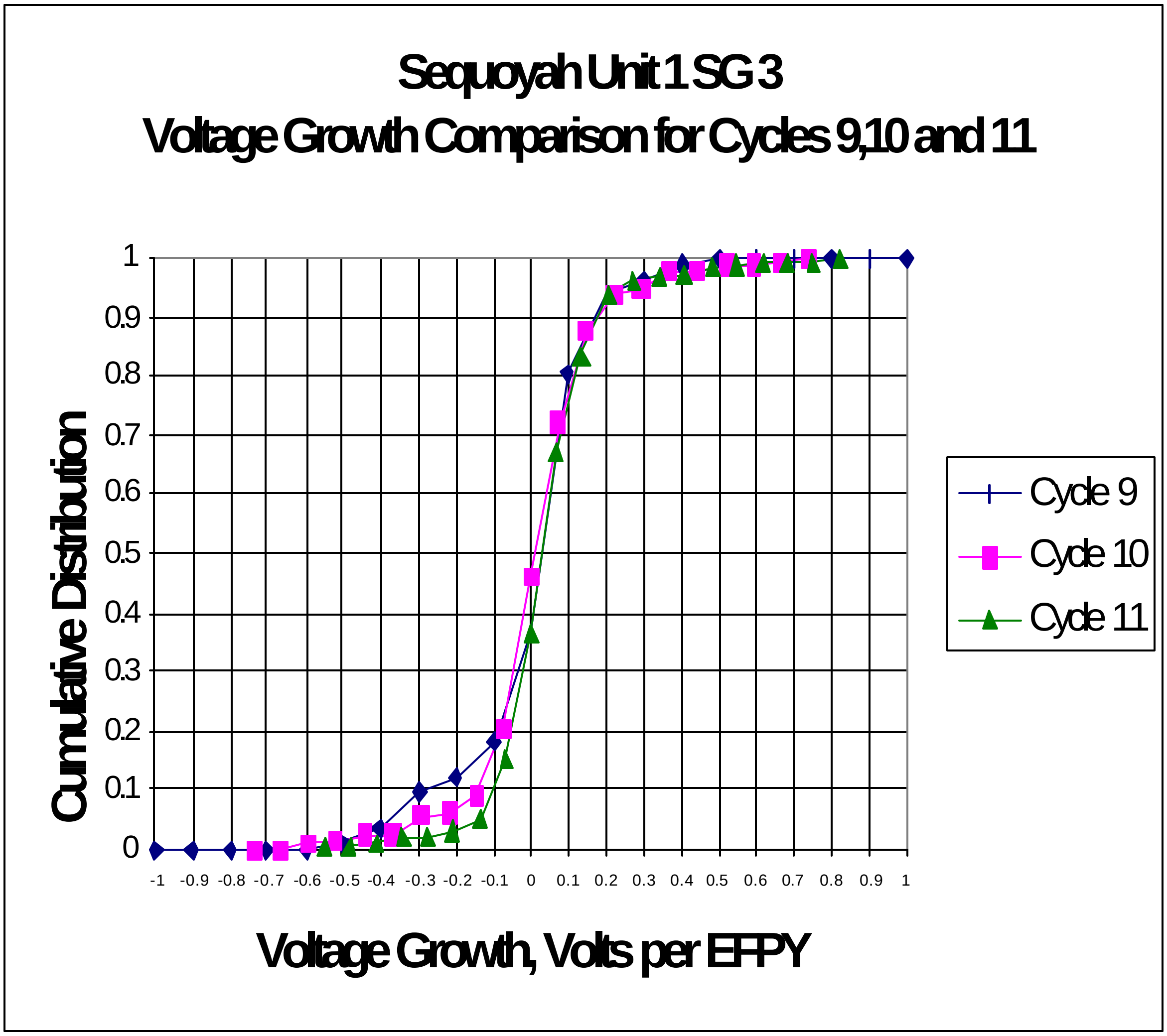


Figure 4.6



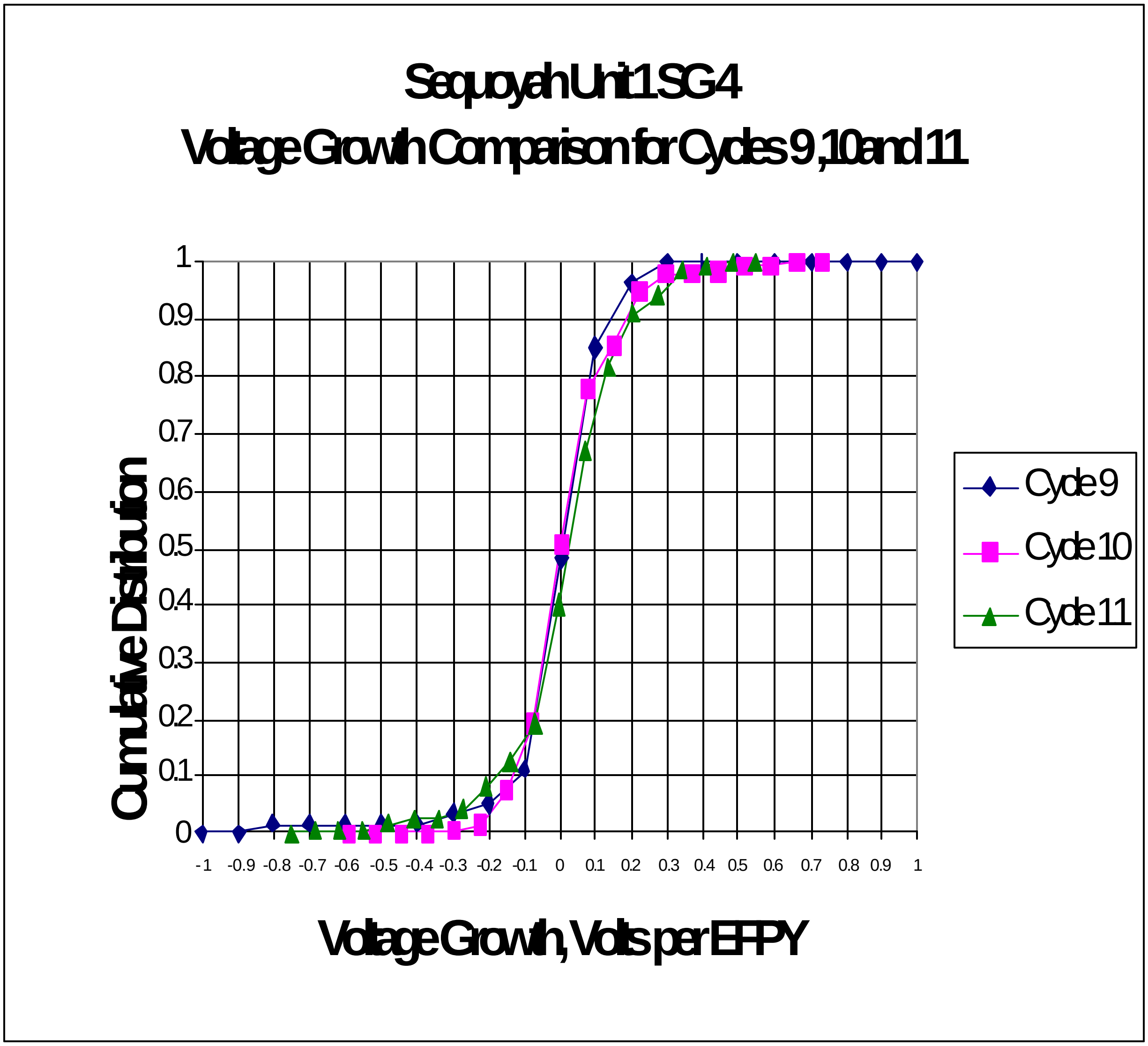
Sequoyah Unit 1 SG 2
Voltage Growth Comparison for Cycles 9,10 and 11
Cumulative Distribution
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Voltage Growth, Volts per EFPY
Cycle 9
Cycle 10
Cycle 11

Figure 4.7



Sequoyah Unit 1 SG 3
Voltage Growth Comparison for Cycles 9,10 and 11
Cumulative Distribution
Voltage Growth, Volts per EFPY
Cycle 9
Cycle 10
Cycle 11
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
-1
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Figure 4.8



The growth rates of cycle 11 are slightly greater than the corresponding rates of cycle 10. Therefore it is appropriate to use a bound to the cycle 11 growth rates in the prediction for the end of cycle 12.

5.0 Analysis Methods and Data Base for ARC Correlations

Westinghouse has developed a Monte Carlo based computer program to perform the calculations prescribed in GL 95-05 (Reference 1). The methodology for predicting the EOC voltage distribution and computing the probability of burst and leakage at accident conditions is based on the Westinghouse Topical Report, WCAP-14277, Revision 1 (Reference 7). The specific computer program employed is described and verified in Reference 8.

The predictions for EOC-11 recorded in Reference 5 used the tube burst and leakage correlations of Addendum 3 to EPRI Report NP-7480-L (Reference 9). Recently, additional data has been added to the database that slightly affects the burst correlation. The new data is included in Addendum 4 to EPRI Report NP-7480-L (Reference 10). The new Addendum 4 database results in a slightly lower best fit burst correlation, and a slightly lower standard error. This results in a lower probability of burst for cases where the probability of burst is very low because of the reduced uncertainty in the correlation. The probability of leak correlation is slightly affected.

In order to maintain continuity in the analysis results, the condition monitoring assessment will be performed using the Addendum 3 database to be consistent with the basis for the EOC-11 prediction. The Operational Assessment of the predicted EOC-12 voltage distribution will be performed using the Addendum 4 database. The specific parameters used in the correlations are provided in Sections 5.1 through 5.4.

5.1 Tube Material Properties

The tube material properties are provided in Reference 7 for 7/8 inch diameter tubes at 650F. The parameters used in the analysis are the flow stress mean of 68.78 Ksi and the flow stress standard deviation of 3.1725 Ksi.

5.2 Burst Correlation

The burst pressure, Pb, is normalized to a material with a flow stress of 68.78 ksi that is the mean of the 7/8 inch tube data appropriate for Sequoyah Unit 1.

$$Pb = a0 + a1 \, Log(Volts)$$

Parameter	Addendum 3 Database	Addendum 4 Database
a0	7.57661 Ksi	7.55943 Ksi
a1	-2.39816	-2.37763
Standard error	0.823889	0.81919
Number of data points	91	93
Reference Flow Stress	68.78 Ksi	68.78 Ksi
Covariance Coefficient V11	.0087443	.00830788
Covariance Coefficient V12	-.00422648	-.00381259
Covariance Coefficient V22	.0139006	.0133098

5.3 Leak Rate Correlation

The leak rate criterion is given in terms of gallons per minute condensed at room temperature. The correlation formula provides leak rate in liter per hour at a pressure of 2560psi. In order to obtain gallons per minute condensed at room temperature, the leak rate Q in the correlation equation must be multiplied by the conversion factor 0.004403. Addendum 4 did not change the leak rate correlation.

$$Log(Q) = b3 + b4\ Log(Volts)$$

Parameter	Addendum 2, 3 & 4 Database
b3	-0.526882
b4	0.987179
Standard error	0.808109
Number of data points	29
Covariance Coefficient V11	0.385504
Covariance Coefficient V12	-0.314445
Covariance Coefficient V22	0.272396

5.4 Probability of Leak Correlation

The probability of leak as a function of indication voltage is revised in Reference 10. In the Monte Carlo analysis leakage is quantified only if the indication is computed be a leaker, based on the probability of leak correlation.

$$Pr(Leak) = 1/\{1+ e^{\wedge}[b1 + b2 \, Log(Volts)]\}$$

Parameter	Addendum 3 Database	Addendum 4 Database
b1	-4.31326	-4.31823
b2	4.21125	4.21652
Number of data points	137	139
Covariance Coefficient V11	.67152	.66934
Covariance Coefficient V12	-.59145	-.58947
Covariance Coefficient V22	.59172	.58997

5.5 NDE Uncertainties

The NDE uncertainties applied for the EOC-11 and EOC-12 voltage projections are the same as given in the prior Sequoyah Unit 1 90 Day reports, References 2 through 5. The probe wear uncertainty has a standard deviation of 7% 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 used in the Monte Carlo analysis to predict the burst probabilities and accident leak rates at EOC-11, and EOC-12. The voltages reported were adjusted to account for differences between the laboratory standard and the standard used in the field.

6.0 Condition Monitoring:

Tube Leak Rate and Burst Probabilities at EOC-11

6.1 Analysis Approach

The measured EOC-11 voltage distributions of Table 3.1 through 3.4 for each steam generator are used as the basis for the leak rate and burst probability predictions for EOC-11. The voltage distributions developed for the computation of POB and leakage consider NDE uncertainty on the measured values, but consider no voltage growth. For a direct comparison with the previous predictions for EOC-11 (Reference 5), the burst and leak correlations used (Reference 9) were the same as those used in Reference 5.

6.2 EOC-11 Burst Probabilities and Leak Rates

The predicted results from Reference 5 for each of the steam generators at EOC-11 are shown in Table 6.1. The leakage rate is the 95^{th} percentile evaluated at 95% confidence. The burst probability is 95% confidence based on the number of trials.

Table 6.1
EOC-11 Predicted Results, Reference 5

SG	Number of Monte Carlo Trials	Number of Indications	Number of Bursts in 1,000,000 Trials	Max Volts*	Burst Probability 95% conf.	95/95 SLB Leak Rate, gpm
1	1,000,000	388.67	17	2.7	2.6 x 10^-5	0.5112
2	1,000,000	376.00	13	2.6	2.1 x 10^-5	0.3923
3	1,000,000	324.00	21	3.1	2 x 10^-5	0.5055
4	1,000,000	212.67	10	2.6	1.7 x 10^-5	0.2617

Note. The maximum voltage is defined as the voltage where the integration of the voltage distribution from the tail reaches 0.3 of an indication

The Monte Carlo analysis results for each of the steam generators based on the measured voltage distribution at EOC-11 are shown in Table 6.2. The analysis program inputs and outputs are detailed in Reference 11. One Million Monte Carlo trials were performed for each steam generator. The leakage rate is the 95th percentile evaluated at 95% confidence. The burst probability is 95% confidence based on the number of trials.

Table 6.2
Analysis Results for Measured EOC-11 Voltage Distributions

SG	Number of Monte Carlo Trials	Number of Indications	Number of Bursts in 1,000,000 Trials	Max Volts, Measured	Burst Probability 95% conf.	95/95 SLB Leak Rate, gpm
1	1,000,000	236	5	1.75	1.1 x 10^-5	0.1982
2	1,000,000	243	7	1.88	1.3 x 10^-5	0.1739
3	1,000,000	212	12	1.96	2.8 x 10^-5	0.2475
4	1,000,000	139	7	1.90	1.3 x 10^-5	0.1494

6.3 Comparison with Acceptance Criteria

The results indicate that the previous predictions for EOC-11 were conservative for POB and leakage for all four steam generators. All steam generators are well below the burst acceptance criterion of 1.0 x 10^-2, and the Sequoyah Unit 1 leakage criterion of 8.2 gpm. The acceptance criteria on POB and leakage are satisfied with significant margin.

7.0 Operational Assessment: Tube Leak Rate and Burst Probabilities at EOC-12

7.1 Analysis Approach

The BOC-12 voltage distribution is developed from the measured distribution by considering the POD and the indications that are removed from service. The EOC-12 voltage distribution is developed considering the NDE uncertainties and voltage growth during the cycle. The latest burst and leakage correlations, Reference 10, will be used for the EOC-12 predictions. The burst probabilities and leak rates are computed using the computed EOC-12 voltage predictions to address the acceptance criteria at the end of the cycle.

7.2 BOC Voltage Distribution

The BOC-12 voltage distribution for each steam generator is determined from the measured EOC-11 voltage distribution. First, the number of indications potentially missed during the inspection and the number of new indications initiating during the Cycle 12, is considered by dividing the measured number of indications in each voltage range by the assumed POD. From this number of indications in each voltage range is subtracted the number of indications removed from service for any reason. This then gives the BOC-12 voltage distribution.

7.2.1 POD

The POD used is the NRC accepted value of 0.6 for all voltages (Reference 1).

7.2.2 Tube Repairs

Considering the repaired tubes and the POD, the BOC-12 voltage distribution for each SG is given in Table 7.1

Table 7.1
BOC-12 Voltage Distributions for all SGs

Voltage Bin	SG 1	SG 2	SG 3	SG 4
0.1	1.67	0	0	0
0.2	33.33	26.67	15.00	16.67
0.3	62.33	53.33	24.00	24.00
0.4	70.00	109.00	33.33	30.67
0.5	71.67	58.00	34.67	23.33
0.6	23.00	32.33	53.33	21.67
0.7	21.67	39.00	48.67	29.00
0.8	21.67	12.33	30.67	11.67
0.9	10.67	14.00	26.33	16.67
1	17.33	13.33	20.00	12.33
1.1	14.00	18.00	13.67	7.33
1.2	11.67	6.67	8.33	1.67
1.3	8.33	0	5.00	11.67
1.4	3.33	1.67	5.67	3.33
1.5	6.67	3.33	5.67	3.33
1.6	5.00	2.33	6.33	3.33
1.7	3.33	1.67	3.33	7.33
1.8	1.67	1.67	0	0
1.9	0	1.67	0	1.67
2	0	0	3.33	0
2.1	0	0	0	0
2.2	0	0	0	0
2.3	0	0	0	0
2.4	0	0	0	0
2.5	0	0	0	0
2.6	0	0	0	0
2.7	0	0		0
TOTAL	387.33	395.00	337.33	225.67

7.3 Voltage Growth Rates for Cycle 12

The voltage growth rates for cycles 9, 10 and 11 were compared in Section 4. The growth rates of cycle 11 are slightly greater than the corresponding rates of cycle 10. Therefore, it is appropriate to use a bound to the cycle 11 growth rates in the prediction for the end of cycle 12. Because the growth rate cumulative distribution is essentially the same for all four steam generators, a distribution which bounds the cumulative distribution of all of the steam generators was used. This results in a conservative, but not excessively conservative growth rate for use in the EOC-12 prediction for all SGs. The bounding growth distribution in terms of volt change per EFPY is shown in Figure 7.1, and listed in Table 7.2.

Figure 7.1

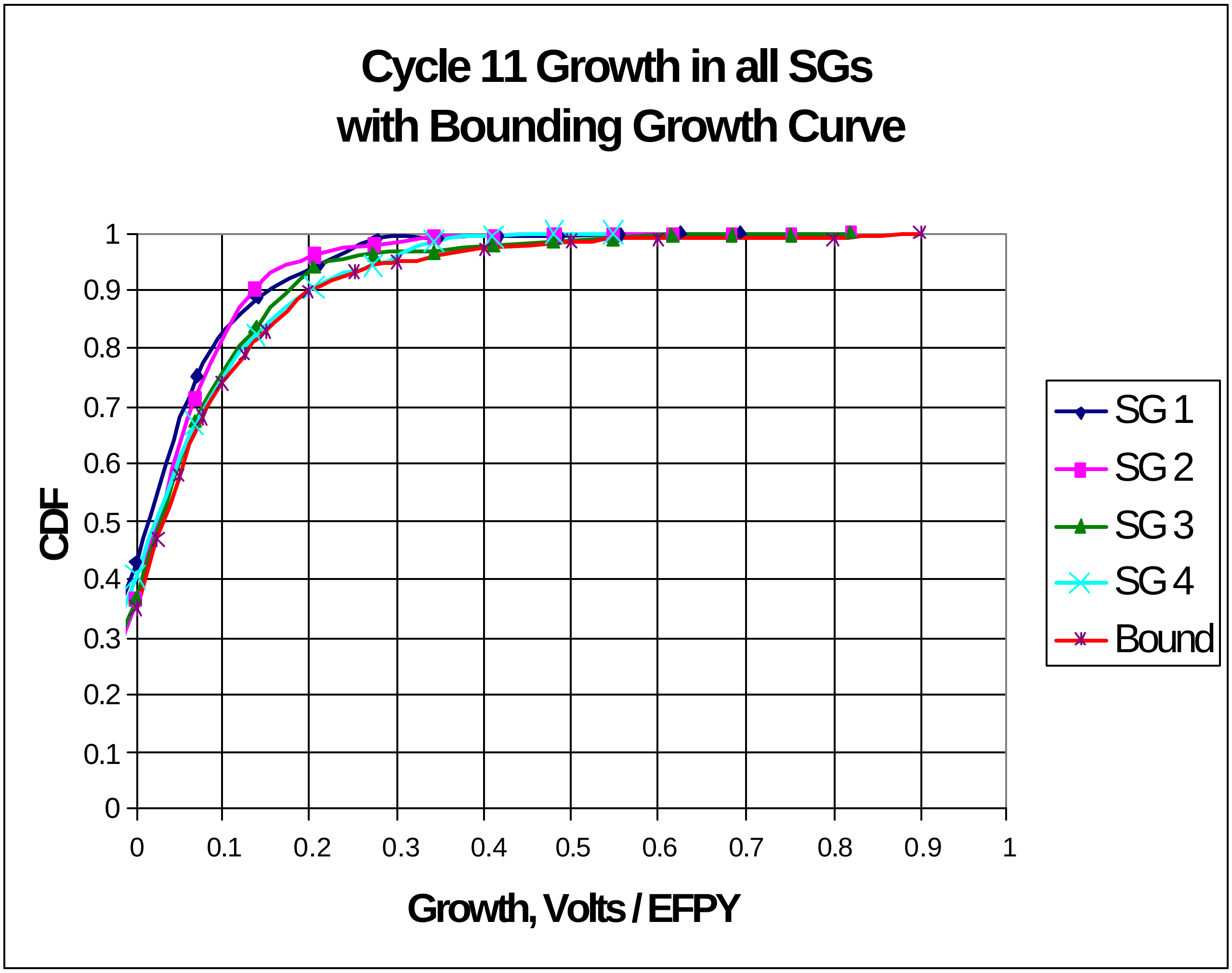


Table 7.2
Cumulative Distribution of Bounding Voltage Growth per EFPY for EOC-12 Predictions

Voltage Growth per EFPY	Cumulation
0	0.35
0.025	0.47
0.050	0.58
0.075	0.68
0.10	0.74
0.125	0.79
0.15	0.83
0.20	0.90

0.25	0.93
0.30	0.95
0.40	0.97
0.50	0.987
0.60	0.99
0.80	0.99
0.90	1

7.4 Prediction of Voltage Distributions at EOC-11

Using the number of BOC indications from Table 7.1 and the growth distribution from Table 7.2, the prediction of the EOC-12 voltage distribution is made for each steam generator. These distributions are shown for each steam generator in Figures 7.2 through 7.5. The analysis inputs and outputs are detailed in Reference 11.

Figure 7.2

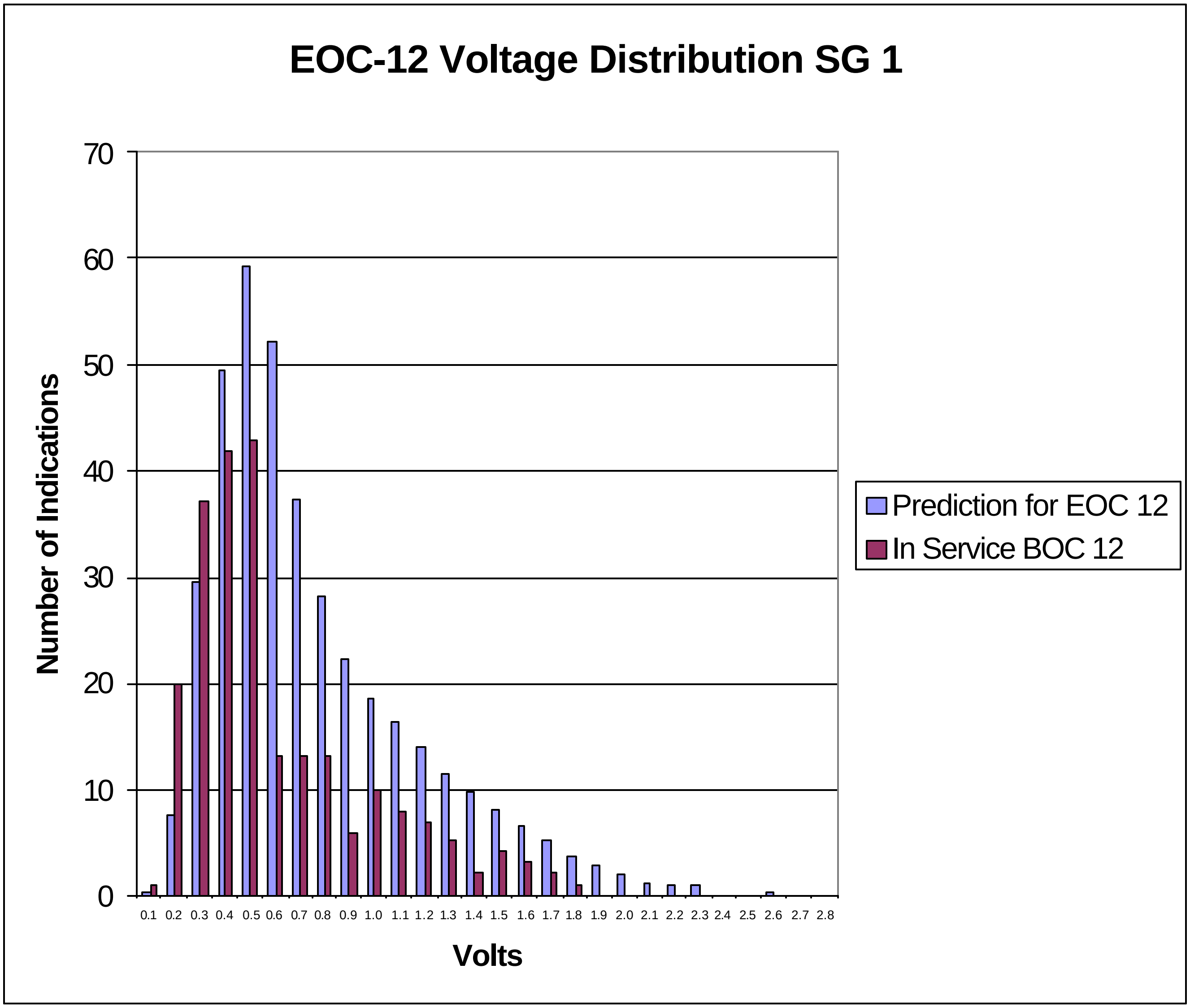
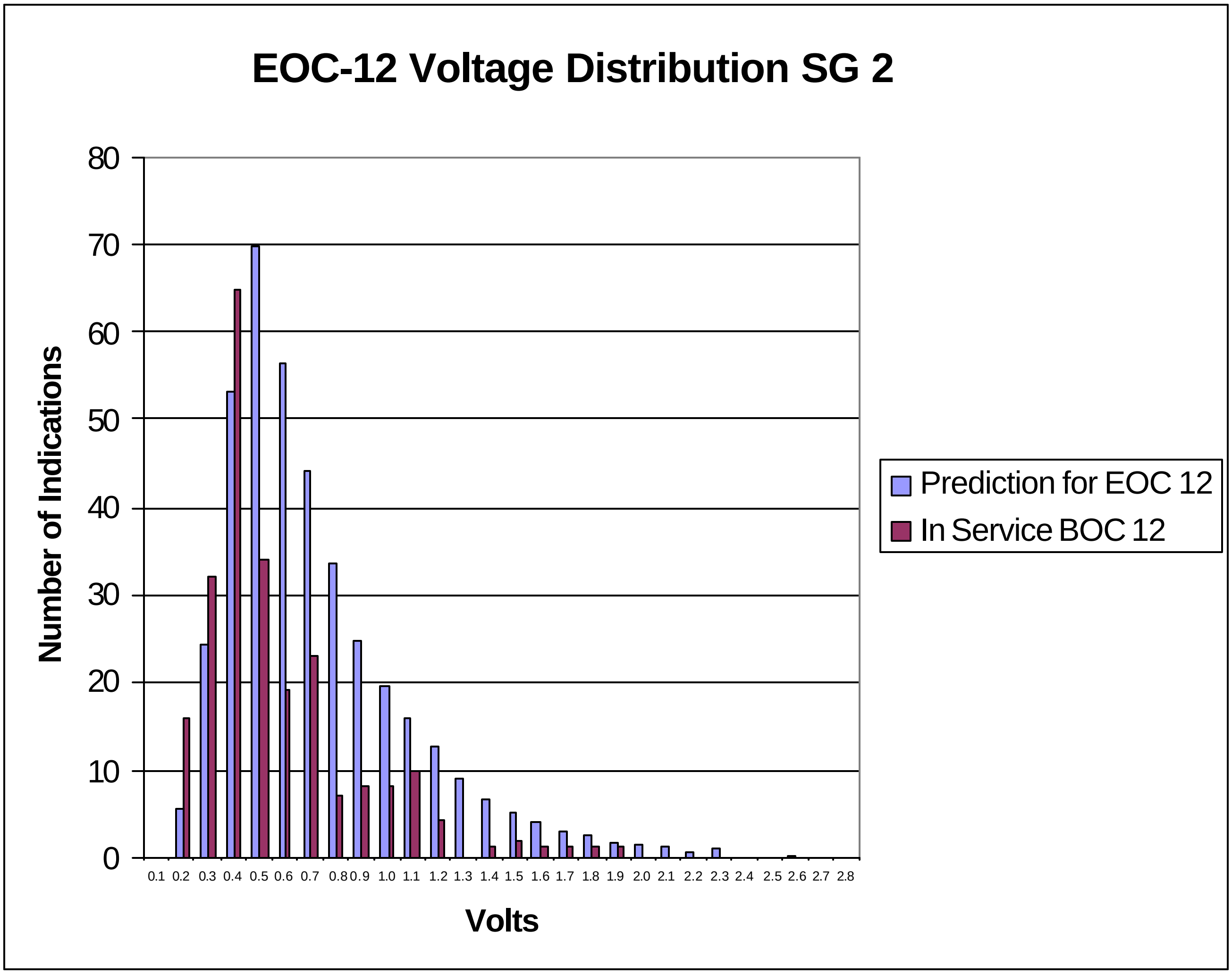

EOC-12 Voltage Distribution SG 1
70
60
50
40
30
20
10
0
Number of Indications
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8
Volts
Prediction for EOC 12
In Service BOC 12

Figure 7.3



EOC-12 Voltage Distribution SG 2
Number of Indications
0
10
20
30
40
50
60
70
80
Volts
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8
Prediction for EOC 12
In Service BOC 12

Figure 7.4

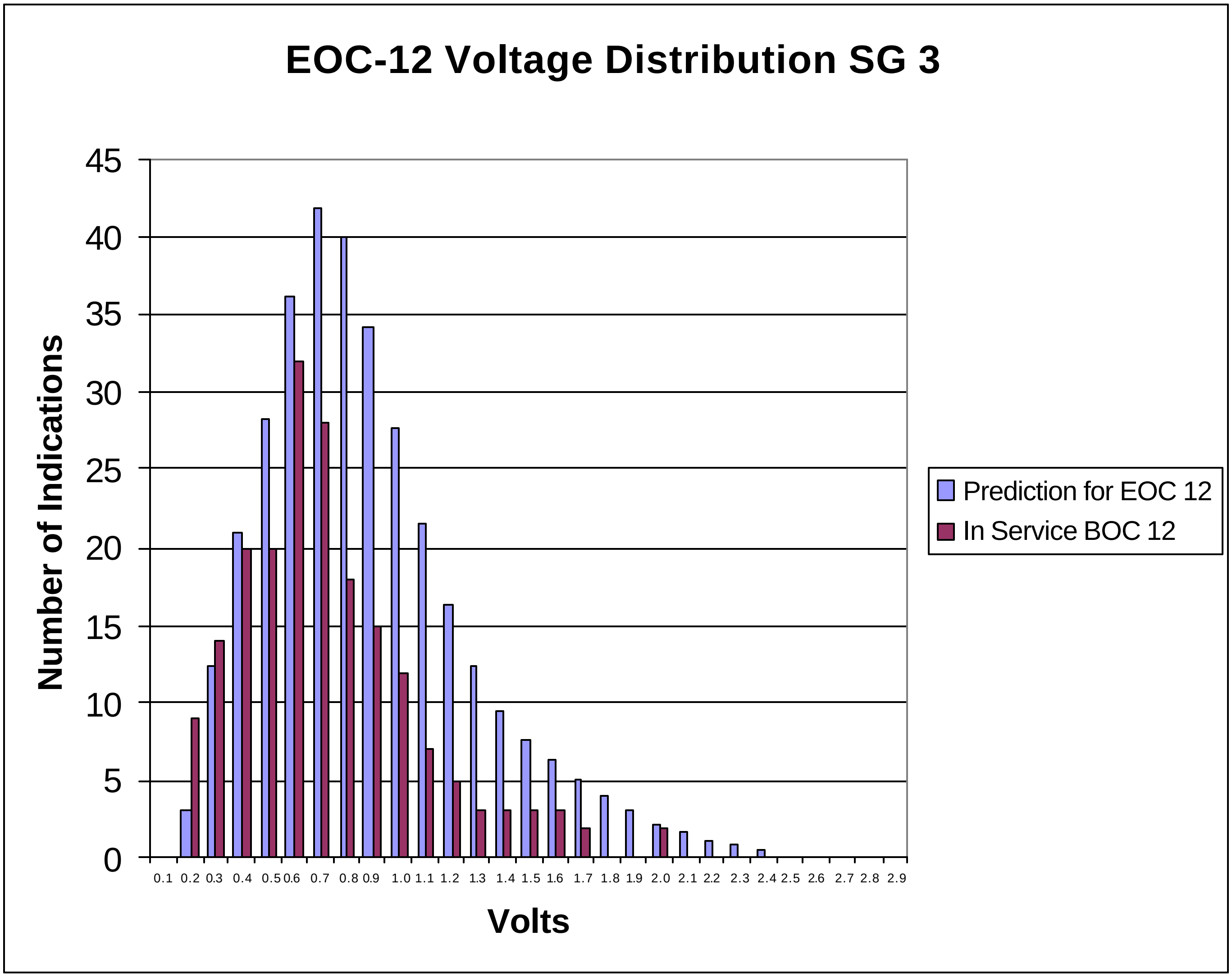
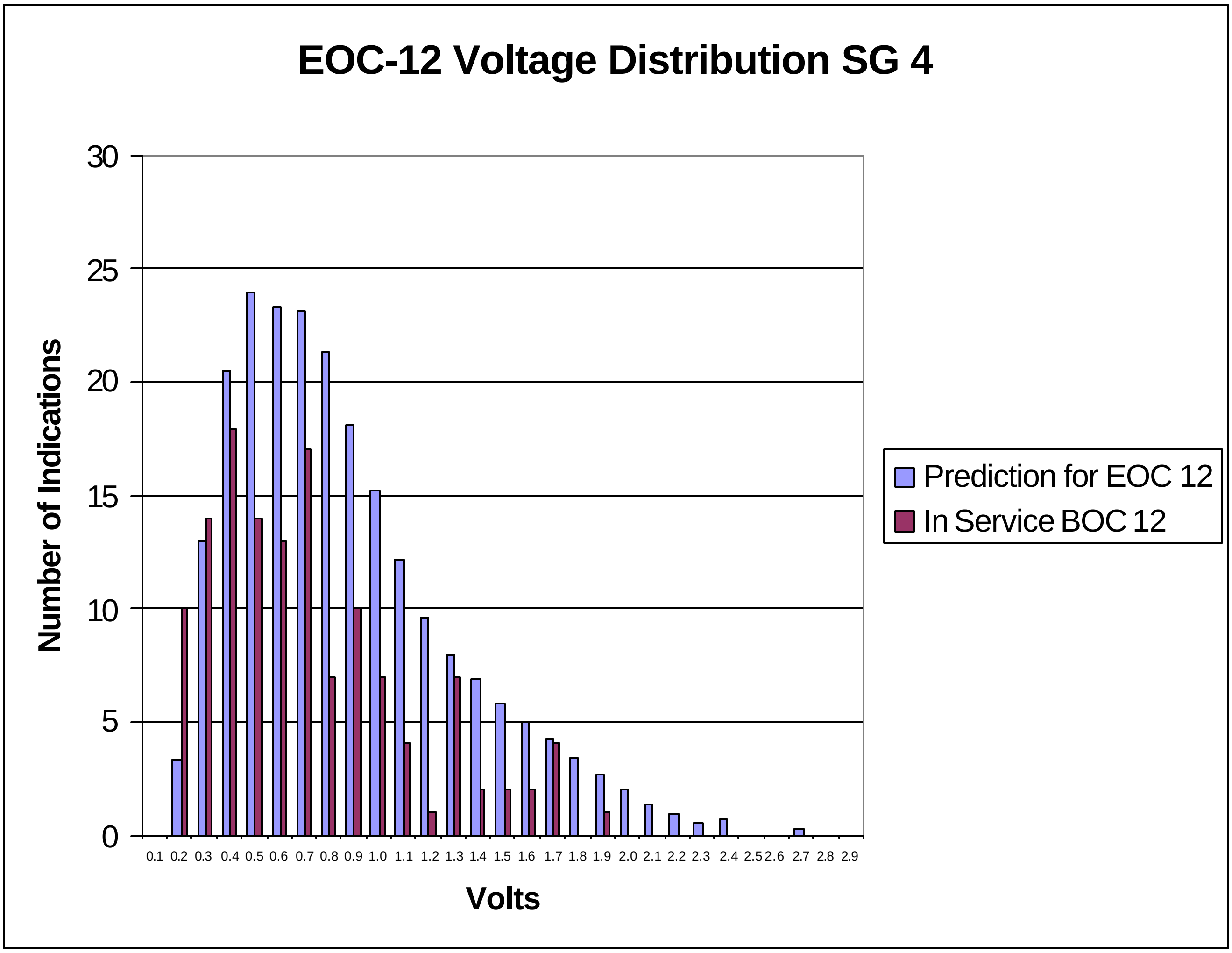

EOC-12 Voltage Distribution SG 3
Number of Indications
45
40
35
30
25
20
15
10
5
0
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9
Volts
Prediction for EOC 12
In Service BOC 12

Figure 7.5



7.5 Prediction of Tube Leak Rates and Burst Probabilities at EOC-12

The Monte Carlo analysis results for predicted EOC-12 voltage distributions are shown in Table 7.3. One million Monte Carlo trials were performed for each steam generator in this operational assessment. The leakage rate is the 95th percentile evaluated at 95% confidence. The burst probability is 95% confidence based on the number of trials.

Table 7.3
EOC-12 Predicted Results, One Million Trials

SG	Number of Monte Carlo Trials	Number of Indications	Number of Bursts in 1,000,000 Trials	Max Volts *	Burst Probability 95% conf.	95/95 SLB Leak Rate, gpm
1	1,000,000	387.33	21	2.6	3.0 x 10^-5	0.4661
2	1,000,000	395.00	17	2.6	2.6 x 10^-5	0.4108
3	1,000,000	337.33	19	2.8	2.8 X 10^-5	0.5166
4	1,000,000	225.67	16	2.7	2.4 x 10^-5	0.3319

Note. The maximum voltage is defined as the voltage where the integration of the voltage distribution from the tail reaches 0.3 of an indication.

7.6 Comparison with Acceptance Criteria

All steam generators are well below the burst acceptance criterion of 1.0 x 10^-2, and the Sequoyah Unit 1 leakage criterion of 8.2 gpm.

8.0 References

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

2. SG-96-01-007, Revision 1, "Sequoyah Unit-1 Cycle 8 Alternate Plugging Criteria 90-Day Report," Westinghouse Nuclear Services Division, February 1996.

3. SG-97-07-006, "Sequoyah Unit-1 Cycle 9 Alternate Plugging Criteria 90-Day Report," Westinghouse Nuclear Services Division, July 1997.

4. SG-98-12-001, "Sequoyah Unit-1 Cycle 10 Voltage-Based Repair Criteria 90-Day Report," Westinghouse Nuclear Services Division, December 1998.

5. 00-TR-FSW-016, Rev 00, "Condition Monitoring and Operational Assessment: GL-95-05 Alternate Repair Criterion 90 Day Report, End of Cycle 10 for Sequoyah Unit 1", Westinghouse Electric Company, May 10, 2000.

6. 00-TR-FSW-018, Rev 00, "Indication Tables for the Condition Monitoring and Operational Assessment: GL-95-05 Alternate Repair Criterion 90 Day Report, End of Cycle 10 for Sequoyah Unit 1", Westinghouse Electric Company, May 10, 2000.

7. 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. ABB CENP Report, 00-TR-FSW-006, Rev. 0, " GL 95-05 Analysis Methods for Sequoyah Unit 1", February 22, 2000.

9. EPRI Report NP-7480-L, Addendum 3, 1999 Database Update , "Steam Generator Outside Diameter Stress Corrosion Cracking at Tube Support Plates – Database for Alternate Repair Criteria," May 1999.

10. EPRI Report NP-7480-L, Addendum 4, 2001 Database Update , "Steam Generator Outside Diameter Stress Corrosion Cracking at Tube Support Plates – Database for Alternate Repair Criteria," March 2001.

11. Westinghouse Calculation CN-SGDA-01-144, Rev. 0, " Calculation Details for GL 95-05 Analyses for Sequoyah Unit 1 End of Cycle 11, December 2001.

Appendix A

Indication List
Sequoyah Unit 1 GL-95-05
End of Cycle 11

Steam Generator 1			Cycle 11	Cycle 10	Cycle 11		Cycle 10	Confirmed, C or not tested, N	
Row	Col	Supt	Volts	Volts	Ref.		Ref.		Plug?
1	94	H01	0.58	0.36	1	H	11H010Z	N	Yes
2	41	H03	0.28	0.78	1	H	11H008Z	N	
2	45	H05	0.15	0.22	1	H	11H008Z	N	
2	46	H01	0.8	0.67	2	H	11H008Z	N	
2	47	H03	0.41	0.28	1	H	11H008Z	N	
2	85	H01	0.33	0.31	1	H	11H009Z	N	
2	85	H02	1.58	1.19	1	H	11H009Z	C	
2	87	H01	0.26	0.31	1	H	11H009Z	N	
2	89	H02	0.22	0.35	1	H	11H009Z	N	
2	91	H01	0.95	0.96	1	H	11H009Z	C	
3	23	H02	0.28	0.36	3	H	11H062Z	N	
3	43	H01	0.13	0.01	1	H	LOOKB	N	
3	58	C03	0.44	0.4	64	C	10C065Z	N	
3	89	H01	0.47	0.54	2	H	11H010Z		
4	39	H01	0.35	0.26	1	H	11H008Z	N	
4	47	H04	0.28	0.25	1	H	11H008Z	N	
4	56	H02	0.54	0.47	95	H	11C086Z	N	
4	60	H07	0.32	0.3	95	H	11C086Z	N	
4	70	H06	0.29	0.27	4	H	11H011Z	N	
4	86	H02	1.07	1.02	1	H	11H009Z	N	
4	87	H01	0.45	0.33	1	H	11H009Z	N	
5	1	C07	0.25	0.21	63	C	10C063Z	N	
5	51	C06	0.27	0.28	63	C	10C065Z	N	
5	55	H01	1.44	1.19	94	H	11C087Z	N	
5	55	H04	0.31	1.46	94	H	11C087Z	N	
5	57	H01	0.58	0.74	94	H	11C087Z	N	
5	67	H03	0.44	0.3	3	H	LOOKB	N	
5	84	H01	0.42	0.31	2	H	11H010Z	N	
6	1	H02	0.48	0.44	95	H	11C086Z	N	
6	19	H05	0.2	0.21	3	H	LOOKB	N	
6	27	H01	0.95	0.95	3	H	11H063Z	N	
6	31	H02	0.74	0.66	3	H	11H008Z	N	
6	41	C01	0.23	0.11	13	C	10C001Z	N	
6	46	H01	0.47	0.41	2	H	11H008Z	N	
6	50	H02	0.48	0.34	95	H	LOOKB	N	

6	55	C04	0.38	0.44	62	C	10C072Z	N
6	57	H01	0.72	0.63	95	H	11C086Z	
6	84	H01	0.9	0.56	1	H	11H009Z	N
6	86	H02	0.2	0.24	1	H	11H009Z	N
6	86	H04	0.27	0.27	1	H	11H009Z	N
7	16	H01	0.57	0.45	4	H	11H012Z	N
7	16	H02	0.45	0.36	4	H	11H012Z	N
7	27	C03	0.16	0.23	14	C	10C010Z	N
7	29	H01	1.45	1.5	3	H	LOOKB	C
7	43	H01	0.26	0.26	1	H	LOOKB	C
7	54	H01	0.58	0.44	94	H	11C087Z	C
7	65	H01	0.83	1.47	3	H	11C087Z	N
7	65	H02	1.2	1.24	3	H	11C087Z	N
7	66	H02	1.27	1.29	4	H	LOOKB	
7	92	H02	1.56	1.48	2	H	11H010Z	C
7	92	H03	0.32	0.33	2	H	11H010Z	N
7	94	H01	0.66	0.55	1	H	11H010Z	N
7	94	H02	1.18	0.35	1	H	11H010Z	C
8	26	H01	1.09	1.28	4	H	11H063Z	C
8	46	H07	0.78	0.78	2	H	11H008Z	N
8	63	H01	1.15	0.91	95	H	11C086Z	N
8	65	H01	1.53	1.26	3	H	11C086Z	N
8	65	H02	1.24	1.13	3	H	11C086Z	N
8	66	H01	0.59	0.76	4	H	11H011Z	N
8	66	H02	0.96	0.91	4	H	11H011Z	N
9	11	H02	0.32	0.53	56	C	10C051Z	N
9	26	H07	0.23	0.4	44	C	10C043Z	N
9	39	C07	0.19	0.26	17	C	10C012Z	N
9	44	H03	0.33	0.18	44	C	LOOKB	N
9	61	H07	0.23	0.31	59	C	10C060Z	N
9	66	H01	1.46	1.54	40	C	10C018Z	N
9	66	H02	0.96	0.86	40	C	10C018Z	N
9	69	C07	0.17	0.23	40	C	10C017Z	N
9	70	C07	0.24	0.27	40	C	LOOKB	N
10	24	H07	0.65	0.64	21	C	10C042Z	N
10	48	H01	0.31	0.23	56	C	LOOKB	N
10	49	H01	0.3	0.19	56	C	10C060Z	N
10	51	H01	0.7	0.58	58	C	10C060Z	N
10	53	H01	1.63	1.63	69	C	10C060Z	N
10	66	H01	0.94	0.82	41	C	10C017Z	C
10	66	H05	0.25	0.3	41	C	LOOKB	
10	76	H06	0.19	0.24	41	C	LOOKB	N
10	78	C01	0.21	0.17	41	C	LOOKB	
10	87	H04	1.3	0.95	15	C	10C013Z	N
10	91	H01	0.55	0.64	15	C	10C013Z	

10	91	H02	0.47	0.16	15	C	LOOKB		
10	91	H03	0.86	0.49	15	C	10C013Z	C	
10	92	H01	0.84	0.67	15	C	10C013Z	C	
11	20	H01	0.36	0.62	20	C	10C043Z	N	
11	34	H01	1.75	1.68	44	C	LOOKB	C	
11	77	H03	0.49	0.26	40	C	LOOKB	N	
11	77	H04	0.49	0.22	40	C	LOOKB	N	
11	84	H01	0.56	0.63	15	C	10C014Z	N	
11	91	H02	1.36	1.67	47	C	10C014Z	N	
11	91	H03	0.39	0.35	47	C	10C014Z	N	
11	91	H04	0.36	0.29	47	C	10C014Z	N	
11	93	H01	0.69	0.93	15	C	10C014Z	C	
11	93	H02	0.75	0.95	15	C	10C014Z	N	
12	65	H01	0.75	0.82	41	C	LOOKB	C	
13	73	H07	0.61	0.9	40	C	10C018Z		
15	61	H03	0.87	0.89	58	C	10C060Z	N	Yes
15	79	H01	0.58	0.5	43	C	10C018Z	N	
15	84	H01	0.73	0.97	15	C	10C014Z	C	
16	24	H02	0.43	0.28	21	C	LOOKB	N	
16	74	H02	0.4	0.19	41	C	LOOKB	N	
16	78	C05	0.32	0.4	43	C	10C017Z	N	
16	89	H04	0.45	0.25	15	C	10C013Z	N	
17	10	H07	0.3	0.27	57	C	LOOKB	N	
17	26	C06	0.43	0.4	27	C	10C041Z	N	
17	59	H01	0.34	0.41	36	C	10C027Z	C	
17	78	H01	0.5	0.93	34	C	10C020Z	N	
17	80	H01	0.82	0.74	32	C	10C016Z	C	
17	81	H01	0.32	0.32	32	C	LOOKB	N	
17	85	H01	1.48	1.47	16	C	10C016Z	C	
17	90	H01	0.33	0.3	15	C	10C016Z	N	
18	10	H04	0.39	0.4	56	C	10C050Z	N	
18	11	H01	1.23	0.9	57	C	10C050Z	N	
18	59	H01	1.02	0.63	36	C	10C026Z		Yes
18	66	H01	1.19	0.82	39	C	10C019Z	C	
18	71	H06	0.12	0.12	35	C	10C019Z	N	
19	9	H03	0.25	0.21	57	C	10C050Z	N	
19	38	H01	0.46	0.35	25	C	LOOKB	C	
19	46	H01	0.23	0.16	21	C	LOOKB	N	
19	67	H01	1.01	1.03	38	C	10C020Z	C	
19	79	H01	0.95	0.9	34	C	LOOKB	C	
19	82	H01	0.62	0.56	33	C	10C016Z	N	
20	6	H03	0.33	0.29	56	C	LOOKB	N	
20	28	H05	0.33	0.28	26	C	10C039Z	N	
20	29	C05	0.27	0.27	26	C	10C039Z	N	
20	34	H01	0.3	0.34	26	C	10C028Z	N	

20	37	H01	0.35	0.34	24	C	10C030Z	N
20	68	H01	1.64	1.28	39	C	10C019Z	C
20	70	H01	1.16	1.17	35	C	10C019Z	N
21	29	H07	0.59	0.55	27	C	10C041Z	N
21	50	H01	0.43	0.43	39	C	10C027Z	N
21	54	H01	1.2	1.14	32	C	10C027Z	N
21	76	H01	0.93	0.96	35	C	10C020Z	N
21	81	H01	0.72	0.71	34	C	10C015Z	N
21	86	H01	0.79	0.61	15	C	10C016Z	N
21	87	H01	0.89	0.71	16	C	LOOKB	N
21	87	H02	0.38	0.26	16	C	10C015Z	N
21	88	H01	0.49	0.44	15	C	10C016Z	N
21	88	H03	0.34	0.25	15	C	LOOKB	N
21	89	H01	1.01	0.74	16	C	10C015Z	N
22	7	H03	0.3	0.23	57	C	10C050Z	N
22	7	H04	0.3	0.28	57	C	10C050Z	N
22	15	H01	0.37	0.48	31	C	10C050Z	N
22	26	C06	0.25	0.3	28	C	10C039Z	N
22	29	C05	0.32	0.33	26	C	10C039Z	N
22	40	H05	0.17	0.21	24	C	10C030Z	N
22	61	H03	0.41	0.61	36	C	10C026Z	N
22	65	H01	1.01	1.19	38	C	10C028Z	N
22	86	H02	0.65	0.38	16	C	10C015Z	N
22	88	H02	0.95	0.7	16	C	LOOKB	C
24	60	H01	0.48	0.47	36	C	LOOKB	N
24	67	H01	0.47	0.24	39	C	LOOKB	N
24	67	H04	0.24	0.22	39	C	LOOKB	N
24	82	H01	0.42	0.3	32	C	10C015Z	N
24	85	H01	0.42	0.25	15	C	10C015Z	N
24	86	H01	0.53	0.53	16	C	LOOKB	N
25	14	H07	0.31	0.38	31	C	10C050Z	
25	43	H01	0.51	0.48	23	C	10C031Z	N
25	52	H01	0.41	0.31	30	C	LOOKB	N
25	52	H02	0.38	0.36	30	C	LOOKB	N
25	67	H01	0.67	1.1	38	C	10C020Z	N
25	74	H01	1.16	1.35	34	C	10C020Z	N
26	45	H01	0.45	0.37	21	C	10C030Z	N
26	86	H04	0.23	0.14	16	C	10C015Z	N
27	16	H04	0.62	0.23	31	C	10C039Z	N
27	39	H01	1.05	0.89	25	C	LOOKB	C
28	46	H01	0.32	0.48	22	C	10C030Z	N
29	11	H01	0.46	0.48	56	C	10C050Z	N
29	11	H05	0.34	0.32	56	C	LOOKB	N
29	13	H01	0.45	0.44	31	C	10C050Z	N
29	13	H06	0.63	0.57	31	C	10C050Z	N

29	46	H01	0.53	0.29	21	C	LOOKB	C	
29	52	H01	0.3	0.31	30	C	10C027Z	N	
29	61	H06	0.35	0.31	37	C	10C027Z	N	
29	66	H01	0.47	1.01	38	C	10C020Z		
29	75	H03	0.42	0.61	34	C	10C020Z	N	
29	77	H02	0.92	1.07	34	C	10C020Z	N	
29	78	H01	0.94	0.99	34	C	10C020Z	N	
29	81	H01	1.09	1.06	34	C	10C015Z	C	
30	14	H06	0.2	0.19	30	C	10C050Z	N	
30	77	H02	0.35	0.35	35	C	10C019Z	N	
30	81	H01	0.31	0.46	35	C	10C016Z		
30	81	H03	0.39	0.55	35	C	10C016Z	N	
31	14	H06	0.23	0.39	31	C	10C050Z	N	Yes
31	40	H02	0.3	0.3	25	C	LOOKB	N	
32	17	H05	0.5	0.42	31	C	LOOKB	N	
32	38	H02	0.47	0.37	24	C	10C030Z	N	
32	62	H01	0.5	0.41	37	C	LOOKB	N	
32	74	C07	0.2	0.15	35	C	10C019Z	N	
32	75	H01	0.62	0.43	35	C	10C019Z	N	
32	77	H02	1	0.49	35	C	LOOKB	N	Yes
33	17	H05	1.27	0.48	30	C	10C032Z	N	
33	17	H06	0.42	0.45	30	C	10C032Z	N	
33	18	H03	0.55	0.35	29	C	LOOKB	C	
33	19	H02	0.75	0.88	28	C	10C032Z	N	
33	19	H06	0.17	0.51	28	C	10C032Z	N	
33	20	H02	0.2	0.12	44	C	LOOKB	N	
33	23	H02	0.32	0.33	28	C	10C032Z	N	
33	29	H01	0.24	0.29	27	C	10C034Z	N	
33	65	H01	0.33	0.15	39	C	10C021Z	N	
33	65	H07	0.14	0.18	39	C	LOOKB	N	
33	74	H01	0.19	0.24	34	C	10C022Z	N	
34	16	H04	0.6	0.54	31	C	10C032Z	N	Yes
34	72	H01	0.43	0.44	34	C	10C021Z	N	
34	74	H01	0.24	0.17	35	C	10C021Z	N	
35	64	H01	0.12	0.21	36	C	LOOKB	N	
35	78	H02	0.33	0.4	35	C	10C021Z	N	
36	47	H03	0.3	0.29	21	C	10C032Z	N	
36	68	H02	0.48	0.48	39	C	LOOKB	N	
36	69	H03	0.38	0.48	36	C	10C022Z	N	
36	70	H01	0.67	0.58	34	C	LOOKB	C	
36	73	H02	0.37	0.47	34	C	10C022Z	N	
37	69	H02	0.28	0.32	37	C	10C021Z	N	
37	69	H06	0.18	0.06	37	C	LOOKB	N	
38	30	H01	0.36	0.34	27	C	10C030Z	N	
38	69	H01	0.68	0.59	36	C	10C022Z	N	

38	74	C04	0.09	0.1	35	C	10C021Z	N
39	62	H02	0.38	0.35	36	C	LOOKB	N
39	64	H02	0.23	0.26	36	C	LOOKB	N
39	72	H03	0.45	0.42	35	C	10C022Z	N
40	69	H01	0.8	1.16	36	C	10C022Z	C
42	40	H02	0.24	0.2	25	C	10C030Z	N
42	48	H02	0.78	0.44	38	C	LOOKB	C
42	60	H02	0.45	0.52	36	C	10C021Z	N
42	66	H01	0.43	0.39	39	C	10C021Z	N
43	48	H02	0.26	0.14	39	C	LOOKB	N
43	49	H04	0.2	0.16	39	C	10C024Z	N
43	59	H01	0.5	0.57	37	C	10C021Z	N
43	59	H03	0.15	0.31	37	C	10C021Z	N
43	61	H02	1.02	1.56	36	C	10C022Z	C
43	62	H01	0.37	0.24	36	C	LOOKB	N
43	63	H02	1.33	1.08	37	C	10C021Z	N
44	61	H05	0.47	0.48	37	C	10C021Z	N
45	37	H02	0.47	0.44	24	C	LOOKB	N
45	49	H01	0.76	0.73	39	C	10C024Z	N
45	50	H03	0.39	0.29	30	C	10C052Z	N
46	48	H03	0.25	0.24	38	C	10C023Z	N

Steam Generator 2			Cycle 11	Cycle 10	Cycle11		Cycle 10	Confirmed, C or not tested, N	
Row	Col	Supt	Volts	Volts	Ref.		Ref.		Plug?
1	80	H06	0.26	0.31	6	H	21H004Z	N	
2	31	H02	0.46	0.43	3	H	21H001Z	N	
2	43	H01	0.31	0.3	3	H	21H001Z	N	
2	49	H01	0.7	0.53	83	H	21H070Z	N	
2	88	H04	0.38	0.33	2	H	21H003Z	N	
3	1	C06	0.4	0.39	70	C	20C058Z	N	
3	13	H01	0.6	0.5	4	H	21H071Z	N	
3	13	H03	0.39	0.33	4	H	LOOKB	N	
3	28	H01	1.02	1.01	4	H	LOOKB	C	
3	41	H01	1.2	1.12	2	H	21H002Z	N	
3	81	H06	0.63	0.45	6	H	21H004Z	N	
4	2	H05	0.58	0.45	83	H	21H070Z	N	
4	6	H01	1.1	0.89	83	H	21H070Z	N	
4	9	H01	0.73	0.59	83	H	LOOKB	N	
4	13	H01	0.41	0.35	3	H	21H070Z	N	
4	17	H01	0.48	0.49	3	H	21H005Z	N	Yes
4	29	H01	0.21	0.14	3	H	LOOKB	N	
4	30	H01	0.67	0.76	3	H	21H001Z	C	
4	37	H01	0.36	0.32	1	H	21H001Z	N	
4	47	H01	0.33	0.27	3	H	21H001Z	N	
4	83	C03	0.2	0.17	8	C	20C005Z	N	
5	39	H01	0.4	0.33	2	H	21H002Z	N	
5	52	H01	0.31	0.23	84	H	21H071Z	N	
6	34	H01	0.54	0.51	2	H	21H001Z	N	
6	34	H04	0.34	0.31	2	H	21H001Z	N	
6	43	H01	0.92	0.74	3	H	21H001Z	N	
6	47	H01	0.26	0.33	3	H	21H001Z	N	
6	63	H05	0.42	0.31	83	H	21H069Z	N	
6	65	H01	0.2	0.22	5	H	LOOKB	N	
7	24	H01	0.84	1	4	H	21H006Z		Yes
7	53	H01	0.57	0.27	94	H	21H071Z	N	
7	66	H01	0.61	0.44	6	H	21H006Z	N	
7	70	H01	1.52	1.05	6	H	21H006Z	C	
7	87	H04	0.24	0.14	1	H	LOOKB	N	
7	94	H01	0.39	0.33	1	H	21H004Z	N	
8	36	H01	0.75	0.88	2	H	21H001Z	N	
9	15	H01	0.35	0.29	20	C	20C047Z	N	
9	21	H01	0.39	0.36	20	C	LOOKB	C	
9	30	H04	0.57	0.39	22	C	20C011Z	N	Yes
9	47	H01	0.35	0.24	20	C	20C011Z	N	
9	55	H01	0.85	0.49	63	C	20C055Z	N	

9	59	H03	0.47	0.68	63	C	20C055Z	N	
9	66	H01	0.64	0.7	16	C	20C015Z	N	
10	4	H01	0.74	0.66	65	C	20C047Z	N	Yes
10	15	H02	0.89	0.77	47	C	20C047Z	C	
10	30	H01	1	0.68	25	C	20C009Z	C	
10	49	H01	0.55	0.6	62	C	20C055Z	C	
10	65	H01	0.19	0.13	15	C	LOOKB	C	
11	34	H01	1.88	0.75	17	C	20C011Z	C	
11	60	H01	0.86	1.16	63	C	LOOKB	C	
12	6	H01	0.65	0.78	65	C	20C047Z	C	
12	10	H01	0.4	0.38	64	C	20C047Z	N	
12	90	C05	0.32	0.32	13	C	20C012Z	N	
13	4	C06	0.65	0.68	64	C	20C047Z	N	
13	4	H02	1.37	1.17	64	C	20C047Z	C	
13	4	H03	0.32	0.35	64	C	20C047Z	N	
13	4	H05	0.47	0.57	64	C	20C047Z	N	
13	5	H01	0.92	0.79	65	C	20C047Z	N	
13	5	H03	0.53	0.44	65	C	20C047Z	N	
13	7	H01	0.3	0.22	65	C	20C047Z	N	
13	60	H01	0.58	0.43	63	C	20C055Z	N	
13	62	H01	0.35	0.35	62	C	LOOKB	C	
13	82	C03	0.2	0.18	16	C	20C013Z	N	
14	6	H01	0.5	0.43	65	C	20C047Z	N	
14	6	H05	0.22	0.26	65	C	20C047Z	N	
14	9	H01	0.67	0.36	65	C	20C047Z	N	
14	14	H01	0.31	0.34	47	C	20C047Z	N	
14	37	H01	1.53	1.64	19	C	20C009Z	N	Yes
15	3	H03	0.29	0.21	65	C	20C047Z	N	
15	6	H02	0.46	0.55	64	C	20C047Z	N	
15	11	H01	1.04	0.95	65	C	20C047Z	N	
15	12	H01	1.08	1.12	47	C	20C047Z	C	
15	21	H01	0.62	0.01	20	C	LOOKB	N	
15	37	H01	0.47	0.4	17	C	20C011Z	N	
15	40	H01	0.83	0.76	19	C	20C011Z	C	
15	82	H07	0.63	0.71	16	C	20C013Z	N	
15	89	C05	0.35	0.37	13	C	20C013Z	N	
16	10	H01	0.63	0.59	64	C	20C047Z	C	
16	10	H03	0.51	0.54	64	C	20C047Z	N	
16	17	H01	0.78	0.84	47	C	20C037Z	C	
16	24	H01	0.53	0.42	25	C	20C037Z	N	
16	24	H07	0.35	0.37	25	C	20C037Z	N	
16	31	H01	0.36	0.33	25	C	20C009Z	N	
16	44	H01	1.08	0.98	19	C	20C009Z	N	Yes
16	83	H07	0.25	0.21	15	C	20C012Z	N	
17	15	H01	0.74	0.53	25	C	20C046Z	C	

17	18	H01	0.9	0.86	26	C	LOOKB	C	
17	25	H05	0.34	0.3	26	C	LOOKB	C	
17	35	H01	1.14	1.12	30	C	LOOKB	C	
17	35	H02	1.2	1.06	30	C	20C028Z	C	
17	36	H01	0.59	0.33	30	C	20C028Z	N	
17	50	H01	0.34	0.25	36	C	20C049Z	N	
17	60	H01	0.69	0.74	39	C	20C026Z	N	
17	60	H02	0.21	0.18	39	C	20C026Z	N	
17	64	H01	1.06	0.56	41	C	20C028Z	N	Yes
17	70	H01	0.33	0.23	43	C	LOOKB	N	
17	87	C05	0.34	0.25	13	C	LOOKB	N	
18	11	H01	0.46	0.31	64	C	20C046Z	N	
18	79	C06	0.19	0.09	44	C	LOOKB	N	
18	85	H02	0.33	0.37	13	C	20C012Z	N	
19	38	H01	0.33	0.28	30	C	LOOKB	N	
19	75	H06	0.44	0.25	44	C	20C020Z	N	
19	78	H02	0.47	0.46	46	C	20C020Z	N	
19	88	C05	0.4	0.4	14	C	20C013Z	N	
20	17	H03	0.99	0.98	26	C	LOOKB	C	
20	31	H01	0.44	0.45	47	C	LOOKB	C	
20	31	H05	0.7	1.09	47	C	LOOKB	N	
20	53	H01	0.4	0.29	38	C	20C025Z	N	
20	54	H01	1.03	1.16	38	C	20C025Z	N	
20	54	H03	0.31	0.36	38	C	LOOKB	N	
20	55	H01	1.76	1.54	39	C	20C025Z	N	
21	25	H01	0.55	0.37	26	C	20C036Z	C	
21	44	H01	0.49	0.47	32	C	20C030Z	N	
21	49	H01	0.6	0.53	36	C	20C049Z	N	
21	76	H02	0.32	1.58	46	C	20C020Z	N	
21	80	H06	0.64	0.57	46	C	20C013Z	N	
22	12	H01	0.38	0.26	25	C	20C046Z	N	
22	48	H01	0.43	0.58	37	C	20C049Z		
22	57	H01	1.12	0.99	39	C	20C025Z	N	
22	65	H01	0.36	0.17	41	C	LOOKB	C	
22	76	H06	0.23	0.07	44	C	LOOKB	N	
22	80	H05	0.21	0.19	44	C	LOOKB	N	
22	80	H06	0.37	0.28	44	C	20C012Z	N	
22	86	C06	0.41	0.4	13	C	20C012Z	N	
22	86	H07	0.28	0.35	13	C	20C012Z	N	
23	34	H01	0.45	0.25	30	C	LOOKB	C	
24	12	H01	0.65	0.39	25	C	20C046Z	N	
24	44	H04	0.3	0.32	33	C	20C029Z	N	
25	28	H01	0.42	0.31	47	C	20C036Z	N	
25	35	H01	0.32	0.37	30	C	20C028Z	N	Yes
25	35	H02	0.64	0.27	30	C	LOOKB	N	Yes

25	83	H07	0.33	0.33	46	C	20C013Z	N	
25	87	H01	0.2	0.01	13	C	LOOKB	N	
26	9	H01	0.54	0.92	65	C	20C046Z	N	
26	51	H01	1.03	0.96	36	C	20C049Z	N	
26	53	H01	0.63	0.64	36	C	20C025Z	N	
26	59	H01	0.99	0.75	39	C	20C025Z	N	
26	78	H01	0.45	1.15	44	C	LOOKB	C	
27	16	H07	0.39	0.33	22	C	20C036Z	N	
27	23	H01	0.27	0.25	27	C	20C036Z	N	
27	34	H01	0.21	0.16	30	C	20C028Z	N	
27	37	H01	0.47	0.31	31	C	LOOKB	C	
27	60	H01	0.48	0.3	39	C	20C028Z	N	
27	63	H01	0.41	0.24	40	C	20C028Z	N	
27	73	H02	0.39	0.13	44	C	LOOKB	N	
27	76	H02	0.17	1.43	46	C	20C020Z	N	
27	76	H04	0.17	0.18	46	C	LOOKB	N	
27	76	H05	0.32	0.17	46	C	20C020Z	N	
28	11	H01	0.89	1.01	64	C	20C046Z	N	
28	19	H01	1.05	1.09	26	C	20C035Z	N	
28	70	H01	0.4	0.84	42	C	20C019Z	N	
29	13	H01	1.09	1.03	25	C	20C046Z	C	
29	17	H01	0.36	0.27	27	C	20C036Z	N	
29	28	H01	0.98	0.76	47	C	20C036Z	C	
29	30	H01	1.01	0.54	47	C	20C028Z	N	
29	45	H01	0.6	0.58	32	C	20C030Z	N	
30	23	H02	1.65	1.63	26	C	20C035Z	C	
30	27	H01	0.21	0.13	47	C	LOOKB	N	
30	34	H01	0.66	0.7	31	C	20C027Z	C	
30	69	C06	0.4	0.43	43	C	20C019Z	N	
30	77	H02	0.2	0.1	44	C	LOOKB	N	
31	14	H01	1.01	1.19	25	C	LOOKB	C	
31	14	H02	0.3	0.34	25	C	20C046Z	N	
31	22	H01	0.46	0.25	26	C	20C036Z	N	
31	35	H01	0.58	0.56	30	C	LOOKB	C	
31	45	C05	0.25	0.29	32	C	20C030Z	N	
31	52	H01	0.36	0.37	36	C	LOOKB	N	
31	57	H01	0.42	0.29	38	C	20C026Z	N	
31	67	H07	0.19	0.39	41	C	20C020Z	N	
32	52	H05	0.49	0.33	36	C	20C025Z	N	
32	54	H02	0.36	0.69	38	C	20C025Z	N	
33	38	H01	0.38	0.36	30	C	LOOKB	N	
33	40	H06	0.22	0.16	30	C	20C032Z	N	
33	47	H01	0.4	0.4	32	C	LOOKB	N	
33	49	H01	0.47	0.44	36	C	20C024Z	N	Yes
33	77	H03	0.18	0.19	46	C	20C022Z	N	

34	44	H01	0.58	0.7	33	C	20C033Z	N
34	44	H02	0.32	0.16	33	C	20C033Z	N
34	44	H03	0.43	0.58	33	C	20C033Z	N
34	46	H01	0.61	0.87	33	C	20C034Z	N
34	47	H01	0.34	0.25	33	C	20C034Z	C
34	48	H01	0.28	1.34	37	C	20C023Z	N
34	51	H01	0.22	0.28	74	C	LOOKB	N
34	64	H01	0.75	0.64	40	C	20C023Z	N
34	76	H01	0.42	0.35	44	C	20C021Z	N
34	77	C05	0.18	0.16	44	C	LOOKB	N
34	78	H04	0.41	0.24	44	C	20C021Z	N
34	79	H01	0.8	1.06	44	C	20C021Z	N
34	79	H04	0.37	0.75	44	C	20C021Z	N
35	18	H01	1.44	1.2	26	C	20C034Z	C
35	18	H02	0.22	0.18	26	C	20C034Z	N
35	20	C06	0.13	0.21	26	C	20C034Z	N
35	20	H01	0.23	0.22	26	C	20C034Z	N
35	37	H01	0.99	0.84	31	C	20C031Z	N
35	72	H07	0.57	0.41	43	C	20C022Z	N
35	78	H03	0.46	0.54	44	C	20C021Z	N
35	78	H04	0.35	0.46	44	C	20C021Z	N
36	19	H01	1.42	1.1	26	C	20C034Z	C
36	25	H02	0.64	0.58	27	C	LOOKB	N
36	32	C06	0.35	0.33	29	C	20C031Z	N
36	44	H01	0.69	0.51	33	C	20C033Z	N
36	46	H01	0.55	0.43	33	C	20C034Z	N
36	61	H04	0.17	0.49	40	C	20C023Z	N
36	67	H03	0.38	0.23	40	C	20C021Z	N
36	73	H07	0.39	0.27	43	C	20C022Z	N
37	26	C06	0.3	0.27	47	C	20C034Z	N
37	26	H06	0.38	0.39	47	C	LOOKB	N
37	40	H01	0.4	0.43	30	C	LOOKB	N
37	41	H02	0.87	0.73	32	C	20C032Z	N
37	74	H03	0.19	0.24	46	C	20C022Z	N
38	24	H01	0.44	0.39	27	C	LOOKB	N
38	34	H01	0.99	1.1	31	C	20C031Z	N
38	34	H03	0.35	0.3	31	C	20C031Z	N
38	72	H05	0.23	0.57	42	C	20C021Z	N
39	22	H01	0.37	0.3	27	C	20C033Z	N
39	38	H01	0.68	0.43	30	C	LOOKB	C
39	65	H02	0.25	0.25	40	C	20C023Z	N
39	69	H02	0.32	0.24	42	C	LOOKB	N
39	69	H03	0.34	0.23	42	C	LOOKB	N
39	72	H01	0.45	0.31	43	C	20C021Z	N
40	39	H01	0.71	0.53	30	C	20C032Z	N

41	47	H01	0.41	0.43	32	C	20C033Z	N
41	52	H03	0.24	0.2	37	C	20C024Z	N
43	30	H04	0.68	0.67	29	C	20C031Z	N
43	30	H05	0.46	0.37	29	C	20C031Z	N
43	30	H06	0.39	0.39	29	C	20C031Z	N
43	52	H03	0.42	0.37	37	C	20C024Z	N
43	57	H05	0.29	0.3	38	C	20C023Z	N
44	33	H03	0.27	0.28	29	C	20C031Z	N
44	34	H03	0.66	0.71	31	C	20C031Z	N
44	34	H04	0.35	0.35	31	C	20C031Z	N
44	34	H05	0.33	0.47	31	C	20C031Z	N
44	36	H01	0.6	0.54	31	C	LOOKB	C
44	36	H02	0.85	0.63	31	C	20C031Z	N
44	36	H05	0.14	0.23	31	C	20C031Z	N
44	43	H07	0.32	0.33	33	C	20C033Z	N
44	54	H02	0.33	0.2	38	C	LOOKB	N
44	54	H06	0.4	0.51	38	C	20C023Z	N
45	41	H06	0.22	0.31	32	C	20C031Z	N
45	53	H04	0.37	0.31	36	C	LOOKB	N
45	54	H04	0.48	0.25	39	C	20C024Z	N
45	55	H04	0.23	0.6	38	C	LOOKB	N
46	49	H06	0.25	0.35	37	C	20C024Z	N

Steam Generator 3			Cycle 11	Cycle 10	Cycle11		Cycle 10	Confirmed, C or not tested, N	
Row	Col	Supt	Volts	Volts	Ref.		Ref.		Plug?
1	34	H02	1.7	0.51	1	H	31H002Z	N	
1	70	H01	0.6	0.51	5	H	LOOKB	N	
2	65	H01	0.71	0.72	5	H	31H130Z	N	Yes
2	67	H02	0.65	0.7	5	H	30C007Z	N	
2	73	H01	0.36	0.28	5	H	LOOKB	N	
2	76	H01	0.56	0.47	6	H	LOOKB	C	
2	80	H01	0.32	0.43	6	H	31H005Z	N	
2	80	H02	0.64	0.55	6	H	31H005Z	N	
2	86	H01	0.17	0.2	2	H	31H005Z	N	
2	92	H02	0.76	0.6	2	H	31H005Z	N	
3	21	H05	0.3	0.33	3	H	LOOKB	C	
3	60	H01	0.2	0.15	127	H	31H133Z	N	
3	66	H01	0.85	0.83	5	H	LOOKB	N	Yes
4	28	H02	0.87	0.88	4	H	30C007Z	N	Yes
4	42	H04	1.03	1.15	2	H	31H001Z	N	Yes
4	83	H01	0.66	0.63	5	H	LOOKB	C	
4	84	H03	0.43	0.46	1	H	LOOKB		Yes
4	87	H01	0.48	0.42	1	H	31H005Z	N	
4	88	H01	0.6	0.61	1	H	LOOKB	C	
4	88	H02	0.51	0.43	1	H	31H005Z	C	
4	88	H05	0.65	0.64	1	H	LOOKB	C	
5	3	H03	0.35	0.23	126	H	LOOKB	N	
5	6	H02	1.35	1.06	126	H	31H133Z	N	
5	29	H01	1.05	0.79	3	H	31H008Z	N	
5	34	H01	1.92	1.53	1	H	31H002Z	C	
5	44	H01	0.58	0.35	2	H	31H002Z	N	
5	50	H02	0.99	0.77	127	H	31H133Z	N	
5	51	H01	0.64	0.63	127	H	31H133Z	C	
5	51	H05	0.53	0.48	127	H	LOOKB	C	
5	60	H01	0.19	0.44	127	H	LOOKB	N	
5	72	H03	0.98	1.09	5	H	31H008Z	C	
5	86	H01	1.56	0.95	1	H	31H006Z	N	Yes
5	87	H01	1.35	1.88	2	H	31H006Z		Yes
6	21	H01	1.01	0.97	4	H	30C007Z	N	
6	26	H01	1.14	1.16	4	H	30C007Z	N	
6	27	H01	0.73	0.63	4	H	30C007Z	N	
6	41	H01	0.97	0.99	2	H	31H001Z	C	
6	62	H01	1.43	1.26	126	H	31H130Z	C	
6	62	H04	0.66	0.4	126	H	LOOKB	C	
6	83	H01	0.27	0.13	5	H	31H005Z	N	

7	42	H01	1.67	0.97	1	H	31H002Z	C	
7	47	H02	0.23	0.42	1	H	31H002Z	N	
7	65	H01	0.49	0.47	6	H	31H133Z	N	
7	86	H01	0.46	0.48	1	H	LOOKB	C	
7	88	H01	0.25	0.29	2	H	LOOKB	C	
7	89	H01	0.77	0.68	2	H	31H006Z	C	
7	89	H04	0.77	0.72	2	H	31H006Z	C	
7	91	H02	0.9	1.08	1	H	31H006Z	N	
8	9	H01	0.48	0.42	127	H	31H130Z	N	
8	30	H01	1.55	1.41	3	H	31H001Z	N	Yes
8	30	H04	0.26	0.26	3	H	LOOKB	N	Yes
8	37	H01	1.16	1.08	2	H	31H001Z	C	
8	40	H01	0.86	0.75	1	H	31H001Z	N	
8	53	H01	0.32	0.14	126	H	LOOKB	N	
8	56	H02	0.96	1.34	126	H	LOOKB	C	
8	77	H01	0.8	0.65	5	H	30C007Z	N	
8	90	H06	0.63	0.64	2	H	31H005Z	N	
9	31	H01	0.47	0.34	14	C	30C014Z	N	
9	51	H01	0.85	0.69	52	C	30C058Z	N	
9	55	H01	0.69	0.76	52	C	LOOKB	N	
9	62	H06	0.61	0.7	52	C	LOOKB	N	
9	64	H03	0.49	0.43	13	C	LOOKB	N	Yes
9	72	H03	0.64	0.67	13	C	LOOKB	N	
9	93	H01	0.58	0.7	9	C	30C019Z	N	
10	27	H01	1.56	1.61	13	C	30C040Z	N	
10	27	H03	0.58	0.78	13	C	LOOKB	N	
10	42	H01	1.39	0.56	11	C	30C015Z	N	
10	87	H01	0.79	0.77	9	C	30C018Z	C	
10	93	H01	1.46	1.09	10	C	30C018Z	N	Yes
11	7	H04	0.92	0.69	49	C	LOOKB	C	
11	12	H01	0.37	0.52	13	C	LOOKB	C	
11	12	H02	0.8	0.72	13	C	30C060Z	N	
11	12	H06	0.91	1.05	13	C	LOOKB	C	
11	20	H01	0.37	0.36	14	C	30C041Z	C	
11	24	H01	0.71	0.74	13	C	30C041Z	C	
11	33	H03	0.73	0.54	10	C	LOOKB	C	
11	35	H04	0.29	0.23	12	C	LOOKB	C	
11	52	H03	0.4	0.26	52	C	30C058Z	N	
11	53	H01	0.88	0.92	52	C	LOOKB	N	
11	86	H01	0.32	0.3	10	C	LOOKB	C	
11	91	H01	0.66	0.79	10	C	30C019Z	C	
11	91	H04	0.59	0.52	10	C	LOOKB	N	
12	4	H02	0.64	0.65	49	C	30C059Z	C	
12	7	H03	0.61	0.46	50	C	LOOKB	C	
12	10	H01	0.22	0.15	50	C	LOOKB	C	

12	19	H02	0.92	0.75	13	C	30C040Z	N
12	28	H01	1.02	0.93	13	C	30C040Z	C
12	31	H02	0.55	0.68	13	C	LOOKB	C
12	35	H04	0.21	0.2	11	C	LOOKB	N
12	37	H01	0.58	0.54	11	C	30C015Z	N
12	53	C07	0.56	0.51	51	C	LOOKB	N
12	62	H01	1.11	0.97	51	C	LOOKB	C
12	75	H01	0.32	0.28	16	C	30C020Z	N
12	92	H02	1.2	0.93	10	C	30C018Z	C
13	14	H04	0.46	0.62	14	C	30C060Z	N
13	15	C04	0.18	0.34	14	C	30C060Z	N
13	22	H01	0.39	0.43	14	C	30C041Z	N
13	28	H01	0.6	0.41	14	C	30C041Z	N
13	31	H01	0.47	0.6	14	C	30C014Z	N
13	32	H04	0.65	0.75	9	C	LOOKB	C
13	35	H07	0.11	0.07	12	C	LOOKB	N
13	49	H01	0.79	0.77	50	C	30C058Z	C
13	50	H03	0.61	0.36	49	C	30C058Z	N
13	52	H01	0.73	0.64	52	C	30C058Z	C
13	54	H06	0.39	0.44	51	C	30C058Z	N
13	55	H01	0.56	0.45	52	C	30C058Z	N
13	57	H03	0.54	0.49	52	C	30C058Z	N
13	57	H04	0.62	0.75	52	C	30C058Z	N
13	71	H03	0.67	0.4	13	C	30C021Z	N
14	10	H02	0.87	0.97	50	C	30C059Z	C
14	13	H04	1.37	1.29	13	C	LOOKB	N
14	35	H01	0.48	0.46	11	C	LOOKB	C
14	36	H02	0.7	0.74	11	C	30C015Z	C
14	38	H03	0.48	0.44	11	C	LOOKB	C
14	44	H01	1.1	1.14	11	C	30C015Z	N
14	54	H01	0.87	0.75	52	C	30C057Z	C
14	69	H01	0.94	0.7	14	C	LOOKB	C
14	92	H02	0.34	0.17	10	C	LOOKB	C
15	18	H03	0.52	0.5	13	C	LOOKB	C
15	29	H03	0.64	0.63	14	C	30C041Z	N
15	34	H01	0.91	0.96	11	C	LOOKB	C
15	54	H02	0.61	0.46	51	C	30C058Z	N
15	54	H05	0.52	0.54	51	C	30C058Z	N
15	87	H01	1.07	1.02	10	C	30C019Z	N
16	21	H03	0.71	0.62	13	C	LOOKB	N
16	30	H02	0.69	0.43	14	C	LOOKB	N
16	57	H01	0.69	0.75	51	C	30C057Z	C
16	57	H07	0.98	1.86	51	C	LOOKB	C
16	61	H01	0.57	0.51	51	C	30C057Z	N
16	71	H02	0.41	0.33	14	C	30C020Z	N

16	77	H01	0.2	0.08	16	C	LOOKB	N	
17	23	H01	0.28	0.23	26	C	30C039Z		
17	28	H01	0.67	0.5	29	C	30C041Z	C	
17	44	H01	0.64	0.62	32	C	30C033Z	C	
17	65	H01	0.67	0.52	21	C	LOOKB	N	Yes
18	12	H02	0.26	0.38	24	C	30C059Z	N	
18	21	H02	0.2	0.31	26	C	30C038Z	N	
18	29	H03	0.31	0.23	28	C	LOOKB	C	
18	30	H01	0.42	0.37	28	C	LOOKB	C	
18	53	H04	0.67	0.64	18	C	LOOKB	N	Yes
18	73	H01	0.5	0.44	22	C	LOOKB	C	
19	29	H01	0.79	0.58	29	C	LOOKB	N	
19	29	H02	0.18	0.26	29	C	30C041Z	C	
19	31	H01	0.52	0.38	28	C	30C054Z		
19	38	H03	1.42	1.17	31	C	30C033Z	C	
19	73	H01	0.87	0.91	23	C	30C023Z	N	
19	85	H01	0.5	0.4	9	C	30C019Z	N	
19	85	H06	0.5	0.59	9	C	30C019Z	N	
19	89	H01	0.86	0.7	10	C	LOOKB	C	
20	28	H06	0.32	0.33	28	C	LOOKB	C	
20	48	H01	0.32	0.4	15	C	LOOKB	C	
20	51	H01	0.6	0.66	15	C	30C029Z	N	
20	52	H02	1.16	1.66	16	C	LOOKB	C	
20	85	H01	0.81	0.41	10	C	30C018Z	N	
20	85	H03	0.58	0.52	10	C	LOOKB	C	
20	88	H01	1.29	1.01	9	C	30C018Z	N	
21	26	H01	0.54	0.32	29	C	30C041Z	N	
21	26	H04	1.04	0.54	29	C	30C041Z	C	
21	31	H04	0.92	0.79	28	C	30C030Z	C	
21	35	H01	0.92	0.78	31	C	30C033Z	C	
21	41	H01	0.65	0.53	33	C	30C033Z	N	
21	48	H05	0.85	0.75	16	C	LOOKB	N	
21	52	H01	0.79	0.81	15	C	30C028Z	N	
21	70	H03	1.05	1.14	20	C	LOOKB	N	Yes
21	78	H01	0.24	0.88	22	C	30C023Z	N	
21	84	H01	0.47	0.55	9	C	30C019Z	N	
21	88	H01	1.52	0.95	10	C	30C019Z	C	
21	89	H01	0.87	0.47	10	C	LOOKB	C	
22	26	H01	0.83	0.68	28	C	LOOKB	C	
22	35	H01	0.67	0.59	30	C	LOOKB	C	
22	44	H01	0.77	0.61	32	C	LOOKB	C	
23	83	H02	0.55	0.45	22	C	30C019Z	N	
24	66	H04	0.85	0.89	21	C	30C022Z	N	
24	72	H04	0.45	0.47	23	C	LOOKB	N	
26	66	H02	1.58	1.24	21	C	30C022Z	C	

27	64	H02	1.21	0.94	20	C	LOOKB	C	
27	84	H01	0.26	0.41	9	C	LOOKB	C	
28	24	C05	0.21	0.21	26	C	30C040Z	N	
28	65	H01	0.57	0.37	20	C	30C029Z	C	
29	24	H07	0.16	0.29	27	C	30C041Z	N	
29	60	H01	0.62	0.57	20	C	LOOKB	N	Yes
29	75	H01	0.37	0.38	23	C	LOOKB	C	
30	80	H01	0.57	0.77	23	C	30C018Z	C	
30	82	H02	0.43	0.76	23	C	LOOKB	C	
31	35	C06	0.3	0.25	31	C	30C033Z	N	
31	65	H01	1.05	0.76	21	C	30C028Z	N	
32	66	H02	0.4	0.44	21	C	30C022Z	N	
33	19	H04	0.27	0.25	24	C	LOOKB	N	
33	66	H01	0.6	0.3	20	C	30C024Z	C	
34	35	H02	0.73	0.46	30	C	30C035Z	N	
36	62	H01	0.55	0.6	21	C	30C026Z	C	
36	69	H01	0.49	0.27	20	C	LOOKB	N	
36	70	H01	0.89	0.88	21	C	30C024Z	N	
36	70	H02	1.44	0.73	21	C	30C024Z	C	
36	73	H02	1.96	1.74	67	C	30C025Z	C	
37	21	H06	0.31	0.48	27	C	30C036Z	N	
37	34	H02	0.9	0.98	31	C	30C034Z	N	
37	48	H01	0.35	0.29	16	C	LOOKB	N	
37	53	H04	0.79	0.58	19	C	LOOKB	C	
37	75	H01	0.48	0.41	23	C	30C024Z	N	
38	41	H01	0.42	0.63	32	C	LOOKB	N	
38	52	H02	0.6	0.5	16	C	30C024Z	C	
38	56	H01	1.02	0.46	18	C	LOOKB	N	Yes
39	48	H02	0.68	0.62	16	C	30C025Z	N	
39	63	H01	1.25	1.11	21	C	LOOKB	C	
41	50	H07	0.55	0.43	16	C	30C025Z	N	
42	58	H01	0.69	0.78	18	C	30C027Z	N	
43	65	H06	0.52	0.43	21	C	LOOKB	N	
44	41	H01	0.58	0.78	32	C	LOOKB	C	
44	59	H01	0.79	0.63	19	C	30C027Z	N	
44	59	H02	0.31	0.32	19	C	30C027Z	N	
45	59	C01	0.55	0.58	18	C	30C026Z	N	

Steam Generator 4 Row	Col	Supt	Cycle 11 Volts	Cycle 10 Volts	Cycle11 Ref.		Cycle 10 Ref.	Confirmed, C or not tested, N	Plug?
1	83	H05	0.14	0.44	5	H	41H004Z	N	
2	12	H01	0.73	0.75	3	H	41H132Z	N	
2	16	H02	1.65	1.16	3	H	LOOKB	C	
3	5	H01	0.43	0.01	142	H	LOOKB	C	
3	11	H01	0.93	1.23	141	H	41H133Z	N	
3	70	H07	0.33	0.8	6	H	41H008Z	N	
4	9	H01	1.24	1.25	141	H	41H132Z	N	
4	69	H01	0.91	0.76	5	H	41H007Z		Yes
4	92	H01	0.95	0.45	1	H	LOOKB	C	
4	92	H03	0.47	0.44	1	H	LOOKB	N	
5	2	H01	1.9	1.74	153	H	41H133Z	C	
5	4	H01	0.31	0.2	141	H	LOOKB	N	
5	5	H01	0.78	0.48	142	H	41H133Z	C	
5	24	H01	0.93	0.75	3	H	41H008Z	C	
5	31	H01	1.67	1.81	3	H	LOOKB	C	
5	31	H02	0.28	0.23	3	H	41H002Z	N	
5	32	H01	1.28	1.45	2	H	41H002Z		
5	32	H04	1.19	0.83	2	H	LOOKB		
5	71	H01	0.87	0.55	6	H	41H006Z	C	
5	71	H02	0.86	0.98	6	H	41H006Z	C	
5	90	H02	0.31	0.33	2	H	41H004Z	N	
6	23	H01	1.3	1.49	3	H	LOOKB	C	
6	72	H01	0.38	0.4	5	H	41H005Z	N	
6	73	H01	1.06	1.67	5	H	LOOKB	C	Yes
6	90	H02	0.67	0.68	1	H	LOOKB	C	
7	41	H02	0.96	0.86	2	H	LOOKB	N	
7	57	H01	0.71	0.52	141	H	41H133Z	C	
7	69	H02	0.3	0.23	6	H	41H008Z	N	
8	4	H01	0.55	0.61	141	H	41H132Z	N	
8	7	H05	0.39	0.24	141	H	LOOKB	N	
8	72	H01	0.8	0.69	5	H	41H005Z	N	
8	77	H01	0.87	0.67	5	H	LOOKB	C	
9	5	H01	0.58	0.52	58	C	40C042Z	N	
9	49	H01	1.3	1.04	57	C	LOOKB	C	
9	53	H01	0.46	0.73	59	C	LOOKB	C	
9	64	H05	0.32	0.6	14	C	40C051Z		
9	84	H03	1.09	0.69	12	C	40C012Z		
10	5	H01	0.48	0.43	58	C	40C042Z	N	
10	15	H05	0.86	0.78	14	C	LOOKB	C	
10	16	H02	0.23	0.15	14	C	40C032Z	N	
10	34	H01	1.59	1.27	12	C	40C007Z	C	

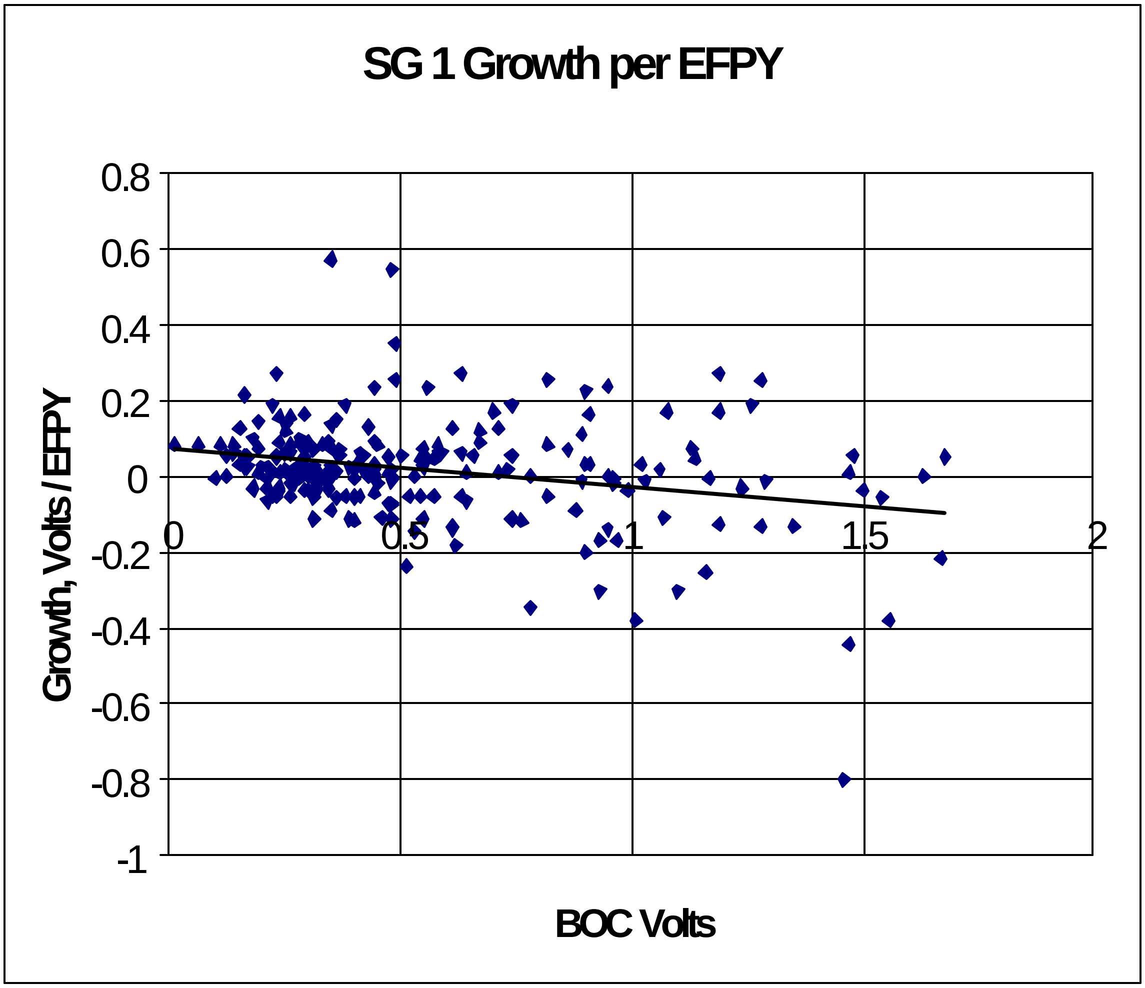
10	34	H02	0.45	0.35	12	C	LOOKB		
10	37	H05	0.49	0.28	11	C	LOOKB	C	
10	51	H06	0.17	0.17	57	C	40C051Z	N	
10	68	H01	0.56	1.3	13	C	LOOKB	C	
10	69	H01	0.5	0.78	13	C	40C015Z	C	
10	70	H01	0.47	0.49	13	C	40C015Z	C	
10	92	H03	0.35	0.27	11	C	LOOKB	N	
11	53	H03	0.28	0.37	59	C	LOOKB	C	
11	58	H01	1.25	0.98	60	C	40C051Z	C	
11	59	H02	0.16	0.19	59	C	40C051Z	N	
11	62	H01	1.7	1.63	60	C	41H0163Z	C	
12	9	H01	1.25	1.24	57	C	40C042Z	N	
12	25	H05	0.39	0.29	13	C	LOOKB	C	Yes
13	6	H01	0.77	0.79	58	C	40C042Z	N	
13	34	H05	0.61	1.7	12	C	LOOKB	C	Yes
14	4	H01	0.67	0.65	58	C	40C042Z		
14	59	H03	1.45	1.35	59	C	LOOKB	N	
15	19	H01	0.28	0.37	13	C	LOOKB	C	
15	69	H01	0.41	0.55	14	C	40C017Z	N	
15	76	H01	0.28	0.3	16	C	40C017Z	N	
15	88	H02	1.04	1.03	12	C	LOOKB	C	
16	9	H02	0.48	0.44	57	C	LOOKB	C	
16	60	H02	0.31	0.39	59	C	LOOKB	N	
16	65	H01	0.98	1.35	13	C	LOOKB	C	
16	66	H01	0.49	0.35	13	C	LOOKB	N	
16	67	H01	0.89	0.91	13	C	40C015Z	N	
17	26	H02	0.56	0.53	30	C	40C033Z	N	
17	48	H03	1.59	1.39	153	H	40C023Z	C	
18	9	H01	0.53	0.3	57	C	40C038Z	C	
18	11	H01	0.71	0.9	58	C	40C038Z	N	
18	57	H02	0.63	0.58	22	C	40C024Z	N	
18	57	H03	0.84	1.13	22	C	LOOKB	C	
19	7	H01	0.69	0.67	57	C	40C041Z	C	
19	12	H01	0.68	0.82	28	C	40C038Z	N	
19	15	C01	0.23	0.24	29	C	40C038Z	N	
19	86	H01	0.85	0.78	11	C	40C014Z	N	
20	58	H01	0.72	0.55	22	C	40C024Z	N	
20	59	H01	0.98	0.9	23	C	40C024Z	C	
20	59	H02	0.61	0.62	23	C	40C024Z	N	
20	64	H01	0.33	0.39	22	C	LOOKB	N	
20	85	H03	1.01	0.83	11	C	LOOKB	C	
21	47	H01	0.82	0.57	34	C	40C027Z	N	
21	63	H01	0.56	0.45	22	C	40C025Z	N	
22	16	H03	0.66	0.6	29	C	LOOKB	N	
22	18	H04	0.11	0.12	29	C	LOOKB		

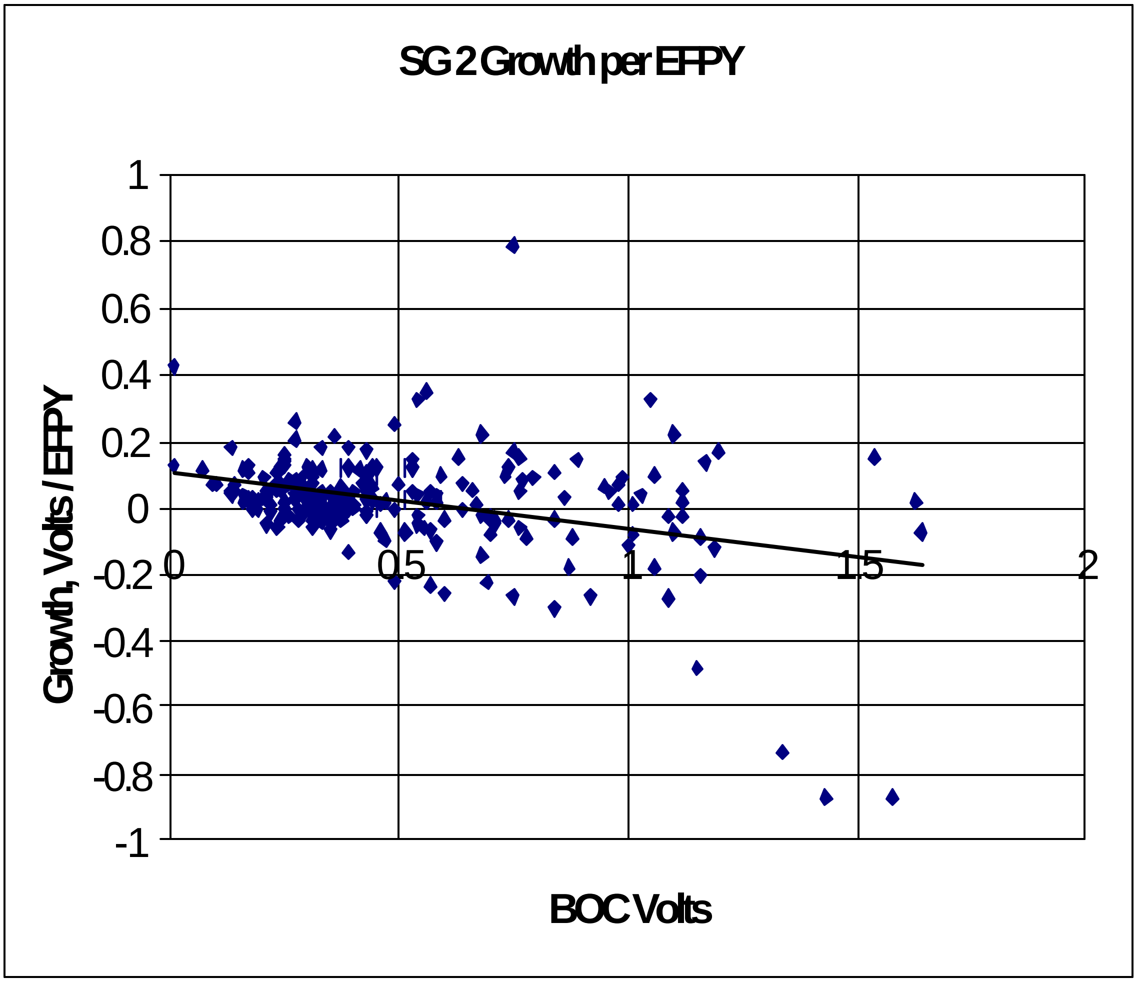
22	25	H05	0.3	0.33	31	C	40C032Z		
22	34	H05	0.52	0.36	33	C	40C026Z		
22	56	H01	0.59	0.46	22	C	40C024Z	C	
22	79	H02	0.64	0.52	26	C	40C018Z	N	
22	86	H02	0.57	0.47	12	C	40C013Z	N	
23	11	H01	1.44	1.05	57	C	40C038Z	C	
23	24	H01	0.82	1.1	30	C	40C033Z	C	
23	84	H03	0.66	0.21	12	C	LOOKB	N	
24	10	H02	1.3	1.02	57	C	40C038Z		
24	13	H02	0.41	0.4	29	C	LOOKB	N	
24	46	H02	0.69	0.41	34	C	40C026Z	N	
24	47	H02	0.64	0.22	35	C	40C026Z	N	
25	61	H01	1.39	0.72	23	C	40C025Z	C	
25	70	H06	0.19	0.18	24	C	40C017Z	N	
25	86	H01	0.65	0.47	11	C	40C014Z	N	
29	75	H01	0.39	0.37	26	C	40C019Z	N	
29	80	H03	0.19	0.13	27	C	LOOKB	N	
29	84	H01	1.34	1.12	11	C	LOOKB	N	
29	84	H02	0.69	0.7	11	C	40C013Z	N	
29	84	H07	0.28	0.24	11	C	40C013Z	N	
30	44	H01	0.57	0.35	34	C	40C026Z	N	
30	51	H01	0.44	0.38	15	C	LOOKB	N	
30	54	H03	0.96	1.22	17	C	LOOKB	C	
30	72	C05	0.4	0.31	24	C	40C018Z	N	
31	16	H03	0.38	0.35	29	C	40C031Z	N	
31	19	H01	0.65	0.73	29	C	40C031Z	N	
31	20	H01	1.65	1.44	29	C	40C031Z	C	Yes
31	37	H03	0.29	0.37	33	C	40C027Z	N	
31	39	H02	1.65	1.1	32	C	40C027Z	N	
31	39	H03	0.58	0.91	32	C	40C027Z	N	
31	62	H06	0.34	0.43	22	C	40C025Z	N	
32	34	H02	0.47	1.14	33	C	LOOKB		
32	45	H02	0.7	0.55	35	C	40C026Z	N	
33	37	H02	0.52	0.53	33	C	40C028Z	N	
33	55	H07	0.21	0.23	19	C	40C022Z	N	
33	69	H02	0.7	0.22	25	C	LOOKB	C	
34	21	H04	0.38	0.49	28	C	40C030Z	C	
34	75	H03	0.39	0.1	27	C	LOOKB	N	
35	51	H06	0.17	0.26	16	C	40C023Z	C	
35	61	H02	0.35	0.34	23	C	LOOKB	N	
36	56	H02	0.66	0.52	22	C	LOOKB	N	
36	68	H02	0.87	0.78	24	C	40C020Z	C	
36	77	H05	0.28	0.59	26	C	40C020Z	N	Yes
37	22	H02	0.22	0.13	29	C	LOOKB	N	
37	30	H03	0.19	0.25	30	C	40C029Z	N	

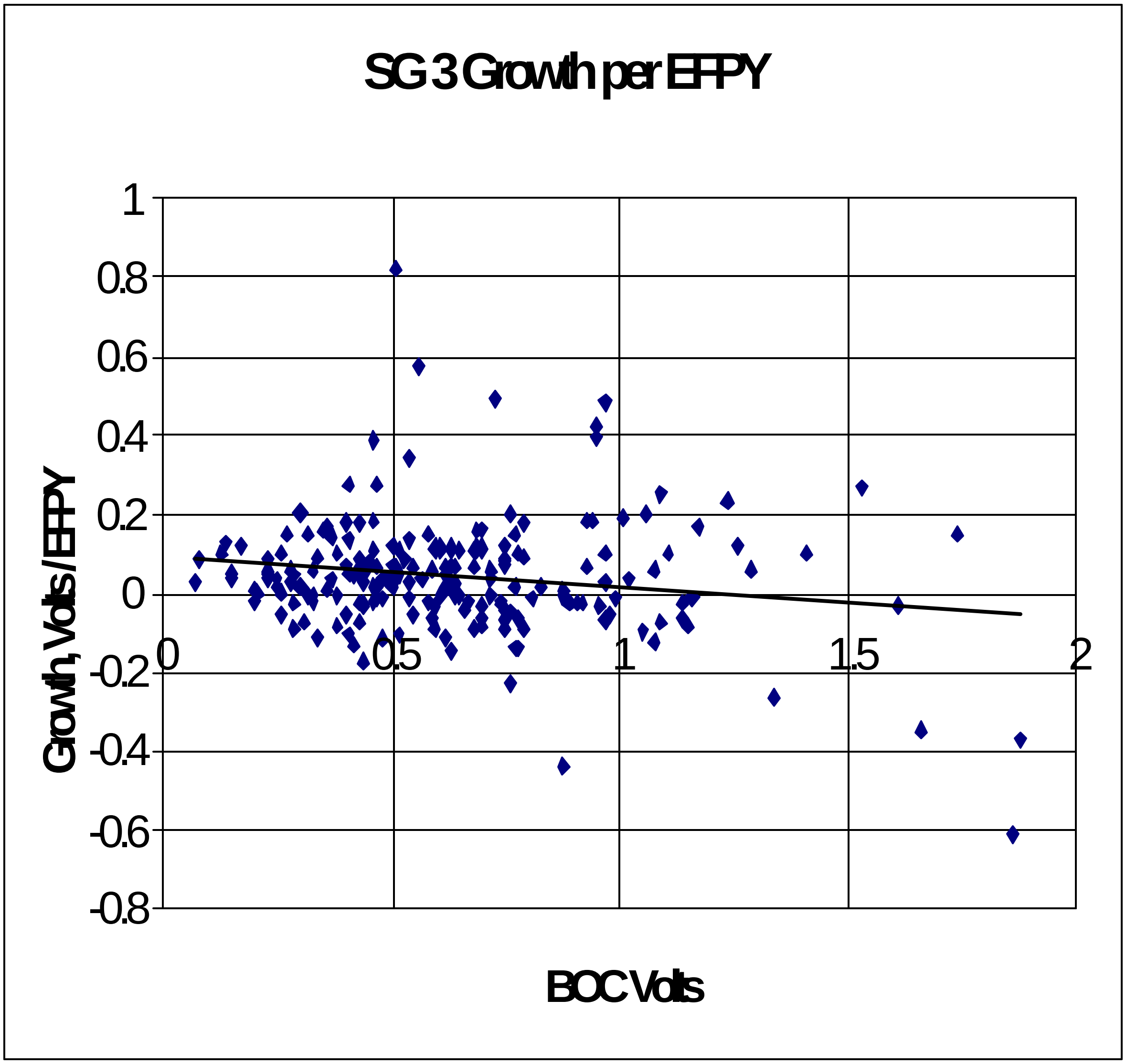
37	61	H02	0.56	0.66	23	C	LOOKB	C
38	63	H03	0.37	0.24	23	C	LOOKB	N
39	23	H01	0.2	0.15	28	C	40C030Z	N
39	67	H03	0.28	0.72	25	C	40C021Z	C
41	42	H04	0.21	0.18	34	C	40C029Z	N
42	55	H01	1.03	1.05	21	C	LOOKB	C
42	55	H02	0.36	0.23	21	C	LOOKB	N
45	52	H06	0.18	0.47	16	C	40C023Z	N

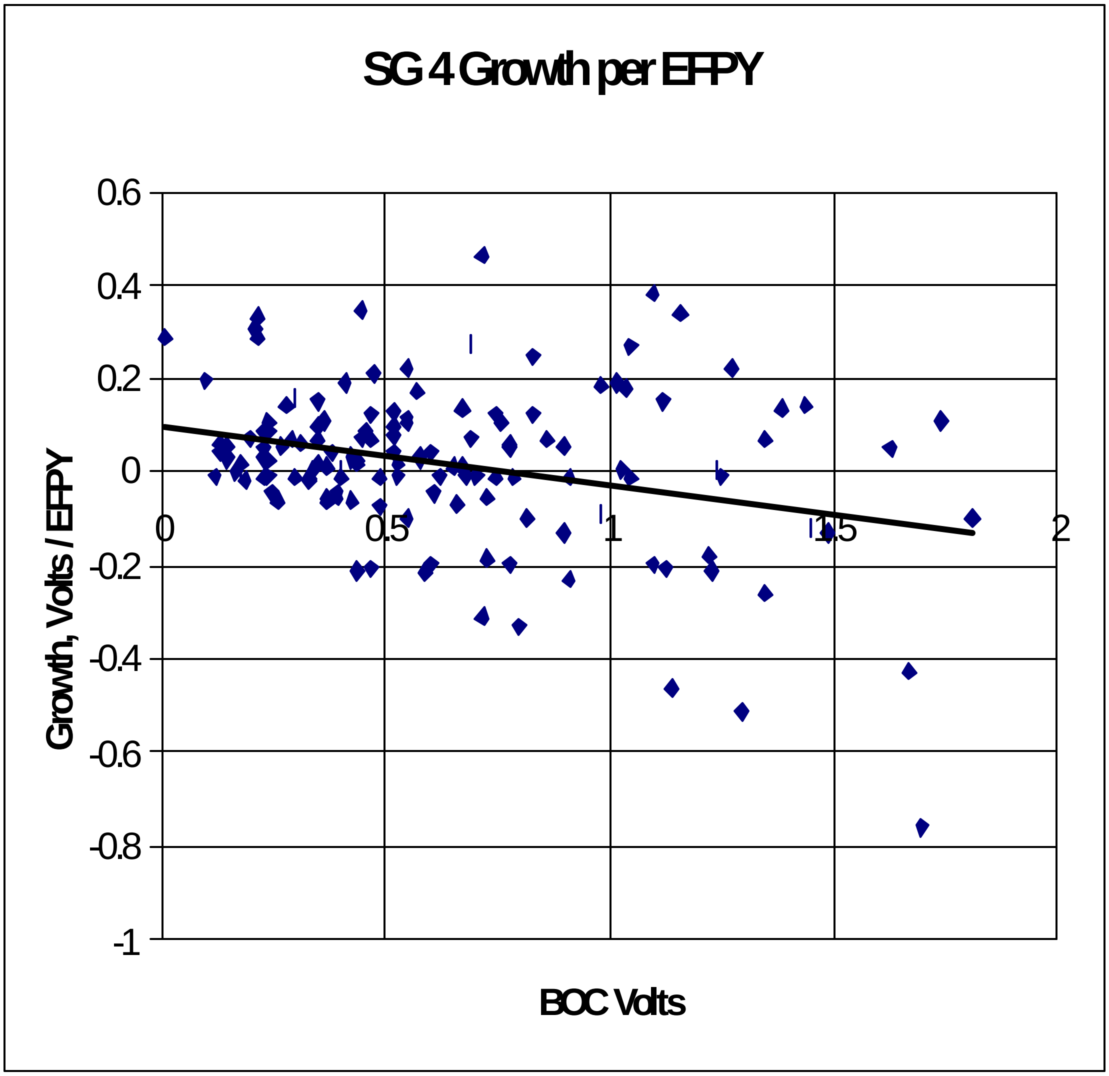
Appendix B

Voltage Growth vs BOC Voltage
Sequoyah Unit 1 GL-95-05
End of Cycle 11




SG 2 Growth per EFPY
Growth, Volts / EFPY
BOC Volts
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
0.5
1
1.5
2


SG 3 Growth per EFPY
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
0.5
1
1.5
2
Growth, Volts/EFPY
BOC Volts



SG 4 Growth per EFPY
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
0.5
1
1.5
2
Growth, Volts / EFPY
BOC Volts