



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001
April 20, 2001

LICENSEE: Tennessee Valley Authority

FACILITY: Sequoyah Nuclear Plant, Unit 1

SUBJECT: SUMMARY - APRIL 11, 2001, MEETING REGARDING SEQUOYAH UNIT 1
STEAM GENERATOR INSPECTION PLAN FOR CYCLE 11 REFUELING
OUTAGE

On April 11, 2001 representatives of the Tennessee Valley Authority (TVA), the licensee for the Sequoyah Nuclear Plant, met in a public meeting with members of the U.S. Nuclear Regulatory Commission (NRC) staff at NRC Headquarters in Rockville, Maryland. TVA requested this meeting to brief the staff regarding the methods and criteria to be used during the Sequoyah (SQN) Unit 1 fall 2001 refueling outage for inspection of the steam generator (SG) tubes. This meeting was a followup to a meeting on the same issues on May 15, 2000.

Background

The NRC issued Amendment No. 252 to SQN Unit 1 on March 8, 2000, to provide alternate repair criteria (ARC) for primary water stress corrosion cracking (PWSCC). During the month of March 2000, TVA conducted a total of 36,294 nondestructive examinations on the tubes in the four SQN Unit 1 SGs. These exams included a 100% bobbin-coil inspection of all tubes and 100% "Plus Point" (+Point) inspections of hot leg dented tube support plate intersections having eddy current instrument indications greater than or equal to (\geq) 2 volts. The +Point probe was also used as a diagnostic tool for 1647 bobbin coil indications in less-than (<) 2-volt dented intersections detected by bobbin coil inspections. Three circumferential stress corrosion cracks (two inner diameter, one outer diameter) were identified during these < 2-volt inspections and the tubes were removed from service by plugging. Approximately 200 other tubes were plugged for other reasons during the March 2000 outage.

At the meeting on May 15, 2001, the NRC staff stated that it believes that more extensive +Point inspections should have been conducted during the March 2000 inspections at the < 2-volt dented intersections. The staff believes that TVA had clearly committed to do so in a letter to the NRC dated March 12, 1997, that was provided by TVA to support approval of an April 9, 1997 amendment for voltage-based ARC for outside diameter stress corrosion cracking (ODSCC). TVA discussed their commitment in the letter to sample all dents < 5 volts with a rotating pancake coil probe (RPC), such as +Point. This was not done during the March 2000 inspections. At the May 15, 2000, meeting, the NRC staff suggested that both Pacific Gas and Electric Company and TVA should develop appropriate sampling strategies for dented intersections < 2 volts. It is more likely that circumferential cracks will be detected in the 1 - 2-volt range than in the < 1-volt range, so a future sampling strategy may consider splitting the range into sections where detection would be most likely.

Meeting Summary

TVA stated that the commitment in the March 12 1997, letter was never intended to apply to dented intersections in the < 2-volt range. Because two different license amendments for two

NRC-001

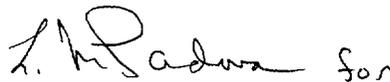
different types of SG degradation mechanisms (ODSCC and PWSCC) had been issued during the past several years that treated dents in the < 2-volt range slightly differently, TVA stated that there had been some confusion regarding the extent of inspection of these tubes and this issue was entered into the SQN Corrective Action Program for resolution. TVA then defined a population of dents below 2 volts.

During the meeting, a number of Lissajous scans with voltage amplitudes ranging from 0.37 volts to 3.74 volts from the most recent SQN Unit 1 SG tube inspections were displayed and discussed by TVA. These scans demonstrated that Lissajous patterns < 1.0 volts are very hard to interpret as to whether an actual SG tube dent is indicated, because they were inconclusive and subjective. Therefore, TVA has proposed a threshold of ≥ 1.0 volts for +point inspections. This will increase the number of +point inspections from 8,360 after Cycle 10 to 15,774 during the Fall 2001 inspections. Bobbin calls will continue to be inspected with +point (1,647 were inspected after Cycle 10).

TVA also stated that approximately 5,000 additional intersections will be inspected to validate the Cycle 10 operational assessment methodology, assumptions, and conclusions. TVA concluded that no indications are predicted to have "percent degraded areas" large enough to challenge structural integrity. If the operational assessment is invalidated by structural or leakage concerns, the scope of this inspection will be expanded and the NRC will be informed.

TVA plans to submit a license amendment request by June 29, 2001, to revise SQN Unit 1 License Condition 2.C.(9)(d) to reflect the new 1.0-volt threshold and to document the Cycle 11 inspection plan. The submittal will supersede the commitment to inspect all dents less than 5 volts with an RPC.

The NRC staff concluded that the SQN Unit 1 planned inspection program, including the revised threshold, was reasonable. The staff stated that there are a number of potential complications, however. One is the need to expand the validation inspection sample size if necessary, as stated above. The staff also stated that TVA should pursue sizing capability of outside-diameter cracks and should consider in situ pressure testing in certain cases.



Ronald W. Hernan, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-327

Enclosures: 1. Attendance List
2. TVA Handout

cc w/enclosures: See next page

different types of SG degradation mechanisms (ODSCC and PWSCC) had been issued during the past several years that treated dents in the < 2-volt range slightly differently, TVA stated that there had been some confusion regarding the extent of inspection of these tubes and this issue was entered into the SQN Corrective Action Program for resolution. TVA then defined a population of dents below 2 volts.

During the meeting, a number of Lissajous scans with voltage amplitudes ranging from 0.37 volts to 3.74 volts from the most recent SQN Unit 1 SG tube inspections were displayed and discussed by TVA. These scans demonstrated that Lissajous patterns < 1.0 volts are very hard to interpret as to whether an actual SG tube dent is indicated, because they were inconclusive and subjective. Therefore, TVA has proposed a threshold of ≥ 1.0 volts for +point inspections. This will increase the number of +point inspections from 8,360 after Cycle 10 to 15,774 during the Fall 2001 inspections. Bobbin coils will continue to be inspected with +point (1,647 were inspected after Cycle 10).

TVA also stated that approximately 5,000 additional intersections will be inspected to validate the Cycle 10 operational assessment methodology, assumptions, and conclusions. TVA concluded that no indications are predicted to have "percent degraded areas" large enough to challenge structural integrity. If the operational assessment is invalidated by structural or leakage concerns, the scope of this inspection will be expanded and the NRC will be informed.

TVA plans to submit a license amendment request by June 29, 2001, to revise SQN Unit 1 License Condition 2.C.(9)(d) to reflect the new 1.0-volt threshold and to document the Cycle 11 inspection plan. The submittal will supersede the commitment to inspect all dents less than 5 volts with an RPC.

The NRC staff concluded that the SQN Unit 1 planned inspection program, including the revised threshold, was reasonable. The staff stated that there are a number of potential complications, however. One is the need to expand the validation inspection sample size if necessary, as stated above. The staff also stated that TVA should pursue sizing capability of outside-diameter cracks and should consider in situ pressure testing in certain cases.

/RA by M.Padovan Acting for/

Ronald W. Hernan, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-327

Enclosures: 1. Attendance List
2. TVA Handout

cc w/enclosures: See next page

DOCUMENT NAME: G:\PDII-2\Sequoyah\Meeting Summary - April 22, 2001.wpd

OFFICE	PDII-2/PM	PDII-2/LA	PDII-2/PD
NAME	RHernan <i>RP for</i>	BClayton <i>BC</i>	RCorreia <i>RCorreia</i>
DATE	4/19/01	4/19/01	4/19/01

OFFICIAL RECORD COPY

DISTRIBUTION:

PUBLIC

Sequoyah R/F

R. Hernan (Hard Copy)

B. Clayton (Hard Copy)

B. Sheron

J. Zwolinski/S. Black

H. Berkow

R. Correia

P. Frederickson, RII

OGC

ACRS

K. Clark (e-Mail)

SRosenberg (e-Mail)

T. Sullivan

L. Lund

E. Murphy

C. Kahn

U. Bhachu

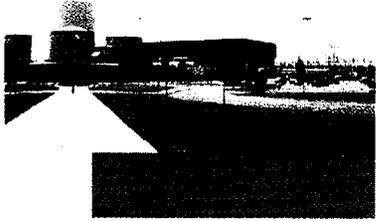
Region II - P. Fredrickson

NRC/TVA MEETING ON SEQUOYAH UNIT 1 STEAM GENERATOR TUBE INSPECTIONS
WEDNESDAY, APRIL 11, 2001

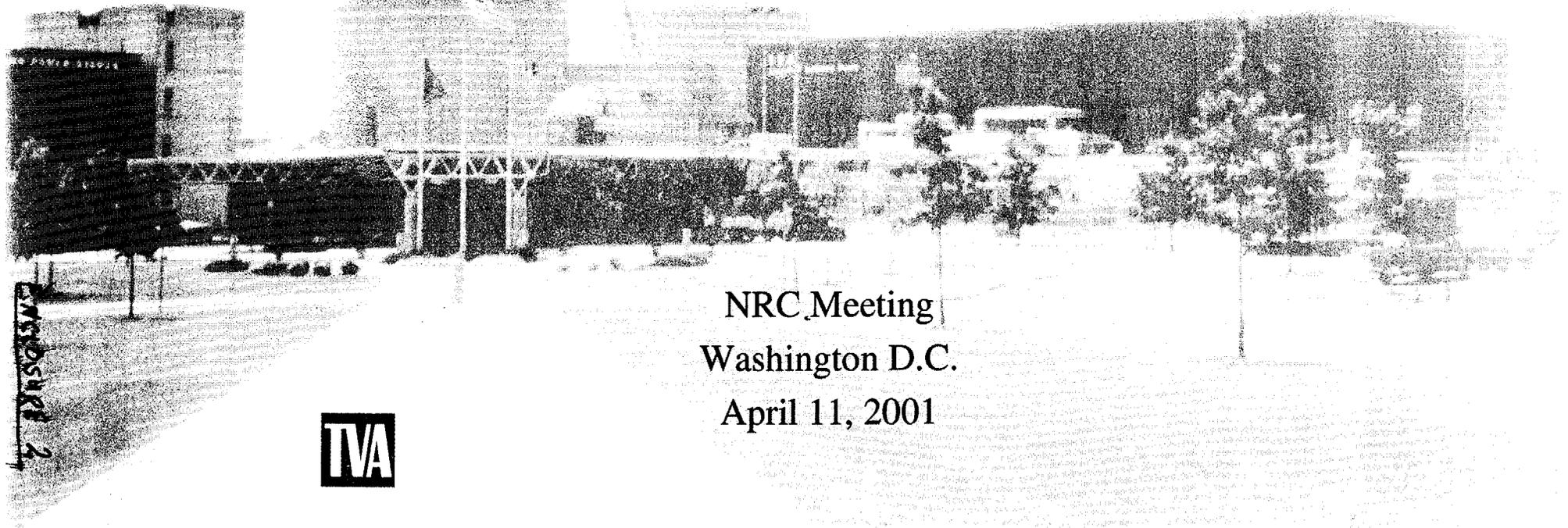
ATTENDEES

<u>Name</u>	<u>Affiliation</u>
Ronald Hernan	NRC
Herb Berkow	NRC
Richard P. Correia	NRC
Ted Sullivan	NRC
Louise Lund	NRC
Emmett Murphy	NRC
Cheryl Kahn	NRC
U. Bhachu	NRC
Pedro Salas	TVA
Joe Valente	TVA
David Goetcheus	TVA
Helen Cothron	TVA
Dan Salter	HGP, Inc.

Sequoyah Nuclear Plant



Steam Generator Inspection
Unit 1 End of Cycle 11
Less Than 2 Volt Dents



NRC Meeting
Washington D.C.
April 11, 2001



Agenda

- **Opening Remarks** **Joe Valente**
- **Introduction** **David Goetcheus**
- **Licensing Basis** **David Goetcheus**
- **Unit 1 Cycle 11 Dent Inspection Plan** **Helen Cothron**
- **Conclusions** **Helen Cothron**

Introduction

- **During the Sequoyah Unit 1 end of Cycle 10 steam generator inspection, 3 circumferential cracks were identified in less than 2-volt dented intersections**
 - Operational assessment was successfully performed without a dent inspection expansion
 - On May 15, 2000, TVA and NRC met to discuss the condition monitoring and operational assessment
 - *No safety concerns were identified during the meeting*
 - *At that meeting, TVA agreed to meet again with the NRC to present the end of Cycle 11 inspection plan for less than 2-volt dented intersections*

Licensing Basis

- **In a March 12, 1997 RAI response on dent inspections, TVA committed to test all dented intersections less than 5 volts**
 - TVA's intent was dents less than 5 volts, but greater than or equal to the dent calling threshold
 - ✦ *Dent thresholds were and still are standard in the industry*
 - It was not intended to apply to the range of 0 - 2.0 volts

Licensing Basis

- **WCAP 15128, Revision 2 approved for use by SQN's Technical Specification Change on March 8, 2000, defines the dent inspection plan for SQN on page 2-3**
 - 100% bobbin coil inspection of all TSP intersections
 - Plus point coil inspection of all bobbin coil indications at dented TSP intersections
 - Plus point coil inspection of all prior PWSCC indications left in service
 - On a SG basis, Plus point coil inspection of all TSP intersections having greater than 2.0-volt dents up to the highest TSP for which PWSCC has been detected in the prior and current inspections and 20% of dents greater than 2.0 volts at the next highest TSP

Licensing Basis

- **TVA realizes that the two statements seem contradictory and need clarification**
 - This issue was entered into Sequoyah's Corrective Action Program
 - *TVA will develop a new inspection strategy for less than 2-volt dented intersections for the Unit 1 Cycle 11 inspection. The new strategy will be documented in a future submittal*
 - This meeting serves to define Sequoyah Unit 1 inspection for dented intersections less than 2 volts for end of Cycle 11 and a new dent calling threshold
 - *Sequoyah will submit the inspection plan and change procedures accordingly*
 - *The inspection plan will be contained in a License Amendment change request to Unit 1 License Condition 2.C.(9)(d)*
 - *Amendment request expected to be submitted by June 29 in support of NRC approval for the Unit 1 Cycle 11 refueling outage*

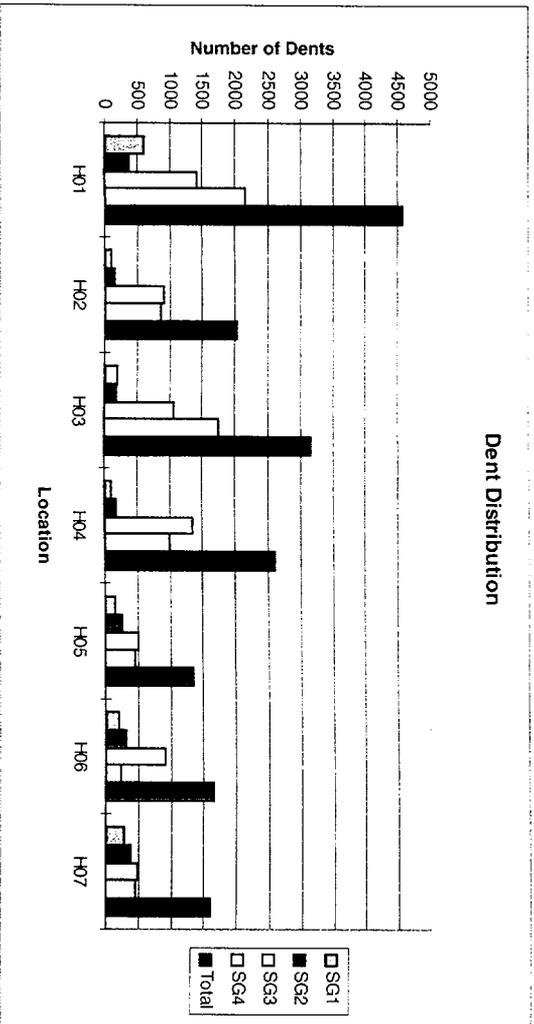
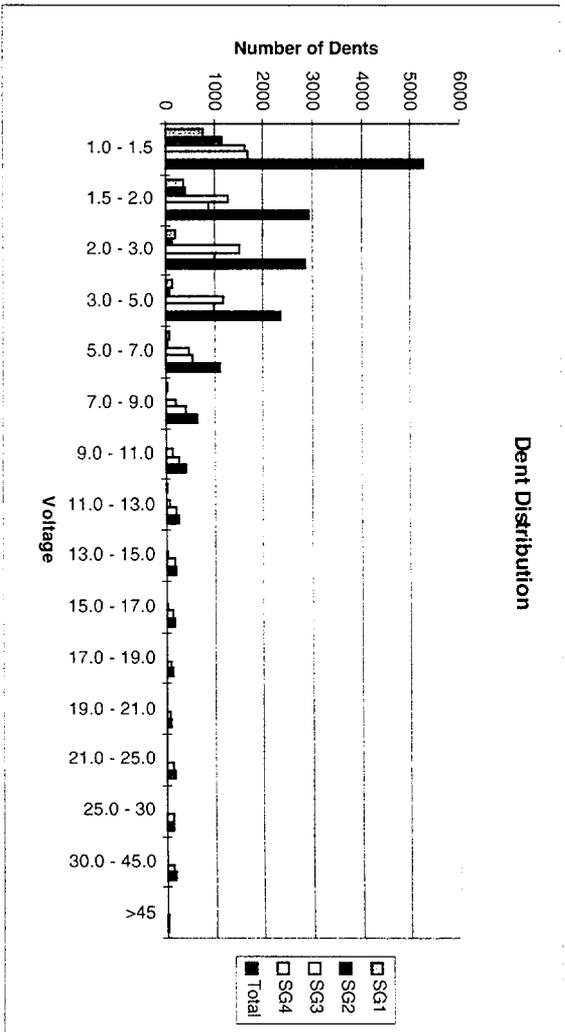
Dented Intersection Calling Threshold

- **After the U1C10 inspection, the population of dents below 2 volts were evaluated**
 - Due to NRC's concerns, a population of dents below 2 volts was defined
 - The population below 1 volt is inconclusive and subjective as to whether a dent exists or not

Dented Intersection Calling Threshold

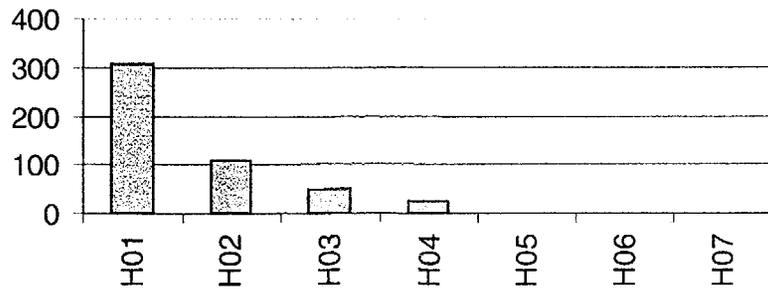
- **The new threshold for Sequoyah Unit 1 will be 1 volt**
 - Dented intersections greater than or equal to 1 volt will be inspected in all 4 steam generators
 - ✦ *15,774 dent inspections with plus point compared to base scope of 8,360 at end of Cycle 10*
 - No circumferential crack has been identified in a dent less than 1.5 volt
- **Bobbin calls will continue to be plus point inspected regardless of dent voltage**
 - 1,647 additional plus point exams were performed end of Cycle 10

Population of Dented Intersections

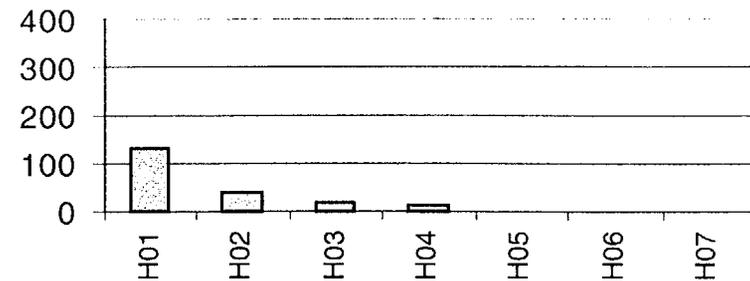


Cracking at Dented Intersections

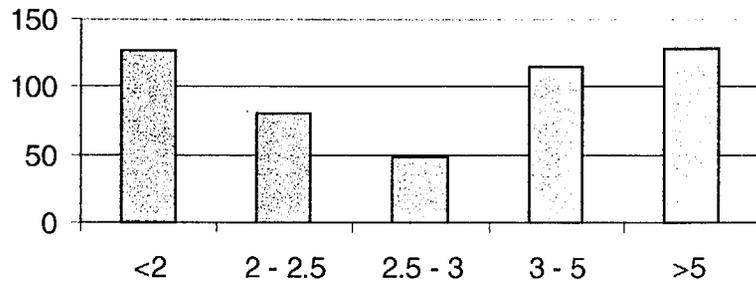
Cycle 7 - Cycle 10 ID Axial Indications vs Location



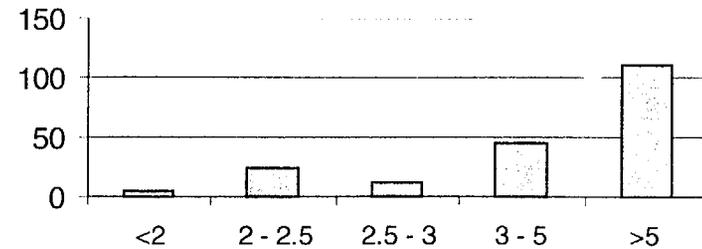
Cycle 7 - Cycle 10 Circ Indications vs Location



Cycle 7 - Cycle 10 ID Axial Indications vs Dent Voltage

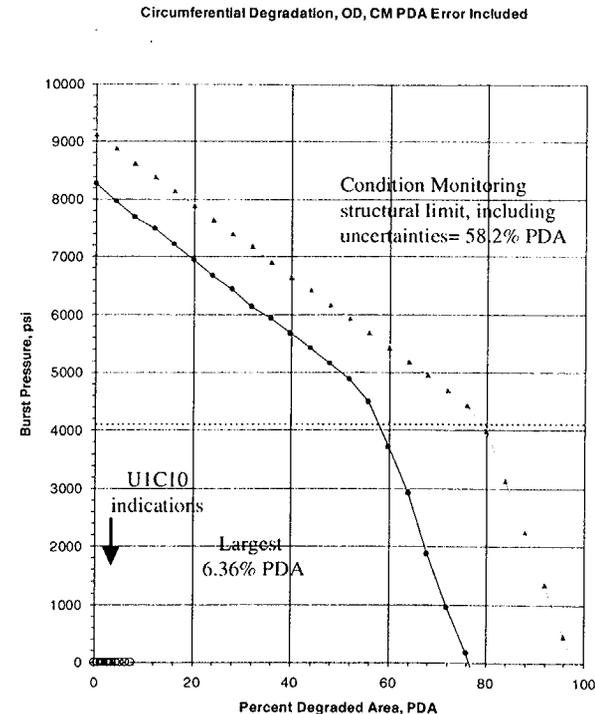
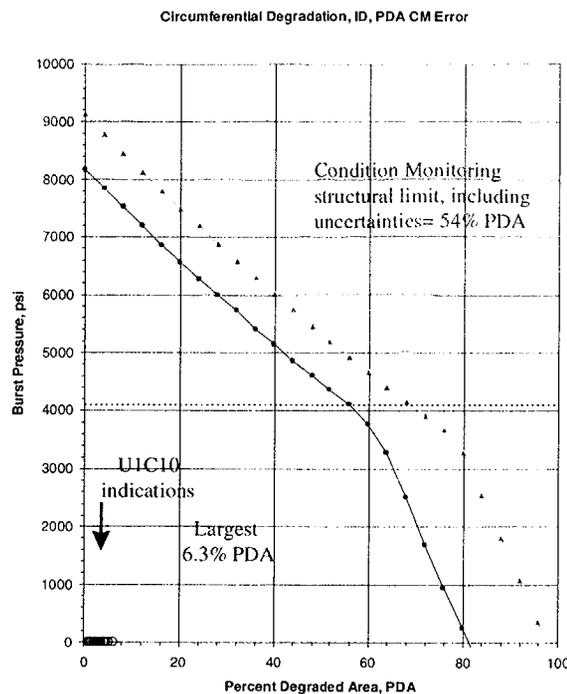


Cycle 7 - Cycle 10 Circ Indications vs Dent Voltage



Objective of Larger Inspection

- Approximately 5,000 additional intersections will be inspected to validate end of Cycle 10 operational assessment methodology, assumptions, and conclusions
 - No indications are predicted to have PDAs large enough to challenge structural integrity



Objective of Larger Inspection

- **Approximately 5,000 additional intersections will be inspected to validate end of Cycle 10 operational assessment methodology, assumptions, and conclusions**
 - Between 100 and 150 indications were assumed unidentified during the end of Cycle 10 inspection
 - ☛ *Calculated accident-induced leakage remained well below allowable 1 gpm*
- **Expansion will be necessary if operational assessment is invalidated by structural or leakage concerns**
 - Plan will be developed when data is compiled
 - NRR will be informed of the expansion decision

Conclusions

- **Sequoyah Unit 1 dent calling threshold will be established at 1 volt**
- **Dented intersections greater than or equal to 1 volt will be inspected end of Cycle 11 with plus point**
- **If end of Cycle 10 operational assessment conclusions are validated, no expansion will be necessary**
 - The same operational assessment methodology will be applied end of Cycle 11 to determine cycle length for Cycle 12
 - NRR will be informed of expansion plans
- **This strategy will be submitted to the NRC and procedures will be changed accordingly**
- **Unit 1 SG replacement is on schedule for the next outage, Spring 2003**

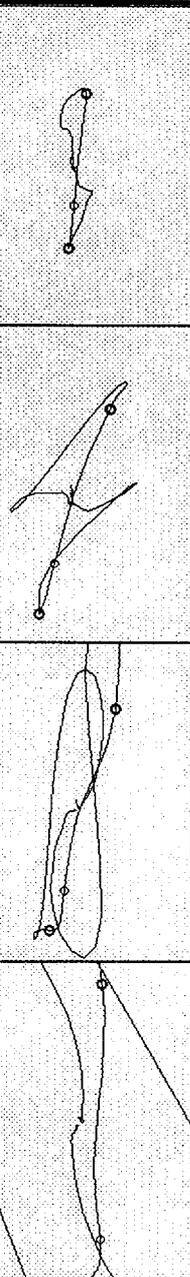
File Layout

Help

↑ ↓ Call Order < Freq >

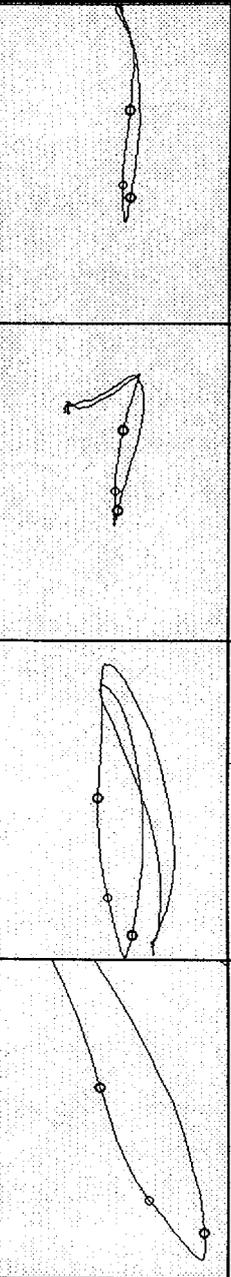
P1	400	G2	C1	Diff	1	400	G2	C1	Diff	3	200	G2	C1	Diff	5	100	G2	C1	Diff
0.57 v/d	span 41	rot 21			0.43 v/d	span 30	rot 23			0.59 v/d	span 42	rot 154			0.39 v/d	span 27	rot 248		

02H + 0.11

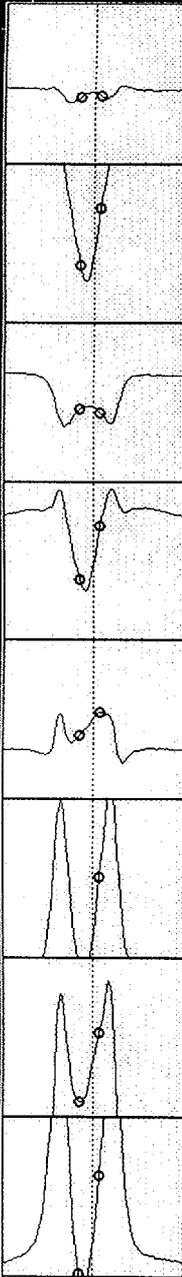


Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180
3.74 volts	186 deg	0			3.96 volts	199 deg	0(P1:Vpp)			5.82 volts	197 deg	0(P1:Vpp)			5.16 volts	187 deg	0(P1:Vpp)		

P2	400	G2	C5	Hs1	2	400	G2	C5	Hs1	4	200	G2	C5	Hs1	5	100	G2	C5	Hs1
0.42 v/d	span 30	rot 18			0.50 v/d	span 35	rot 8			0.55 v/d	span 40	rot 137			0.43 v/d	span 31	rot 215		



Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180
1.54 volts	359 deg	46(P1:Vpp)			1.74 volts	4 deg	4(P1:Vpp)			3.32 volts	345 deg	4(P1:Vpp)			3.29 volts	325 deg	4(P1:Vpp)		



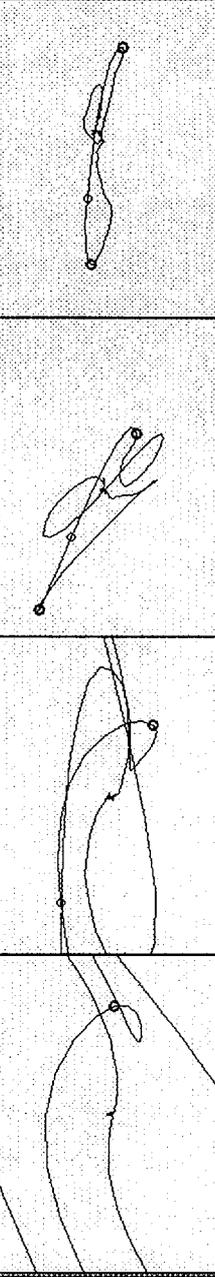
3 7 0 0 1 1 1

File Layout

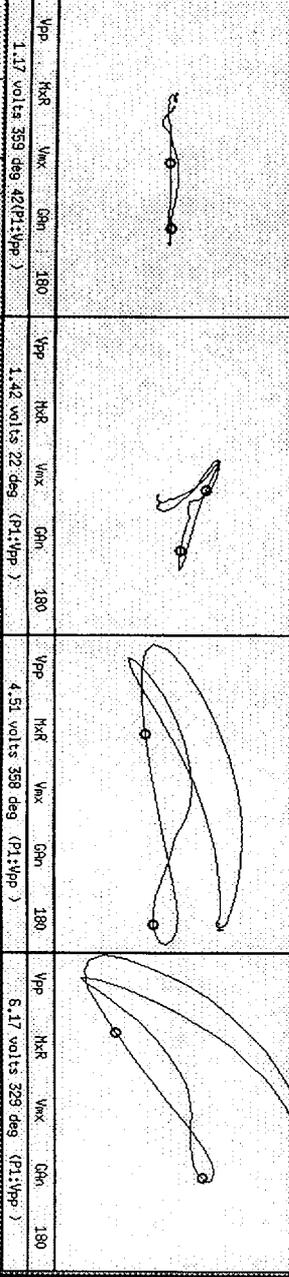
Help

Call Order < Freq >

Pl	400	G2	G1	Diff	1	400	G2	G1	Diff	3	200	G2	G1	Diff	5	100	G2	G1	Diff	
	0.22																			
	0.28 v/d span 20 rot 21																			
	0.43 v/d span 30 rot 23																			
	0.53 v/d span 42 rot 164																			
	0.39 v/d span 27 rot 248																			



Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	
2.56 volts 188 deg 0																				
3.64 volts 209 deg 0(P1:Vpp)																				
7.62 volts 195 deg 0(P1:Vpp)																				
8.07 volts 172 deg 0(P1:Vpp)																				
	0.42 v/d span 30 rot 18																			
	2 400 G2 C5 Hbs1 0.50 v/d span 35 rot 8																			
	4 200 G2 C5 Hbs1 0.55 v/d span 40 rot 137																			
	5 100 G2 C5 Hbs1 0.56 v/d span 62 rot 215																			



Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180	Vpp	HkR	Vpk	Gn	180
1.17 volts 359 deg 42(P1:Vpp)																			
1.42 volts 22 deg (P1:Vpp)																			
4.51 volts 358 deg (P1:Vpp)																			
5.17 volts 329 deg (P1:Vpp)																			

Phase

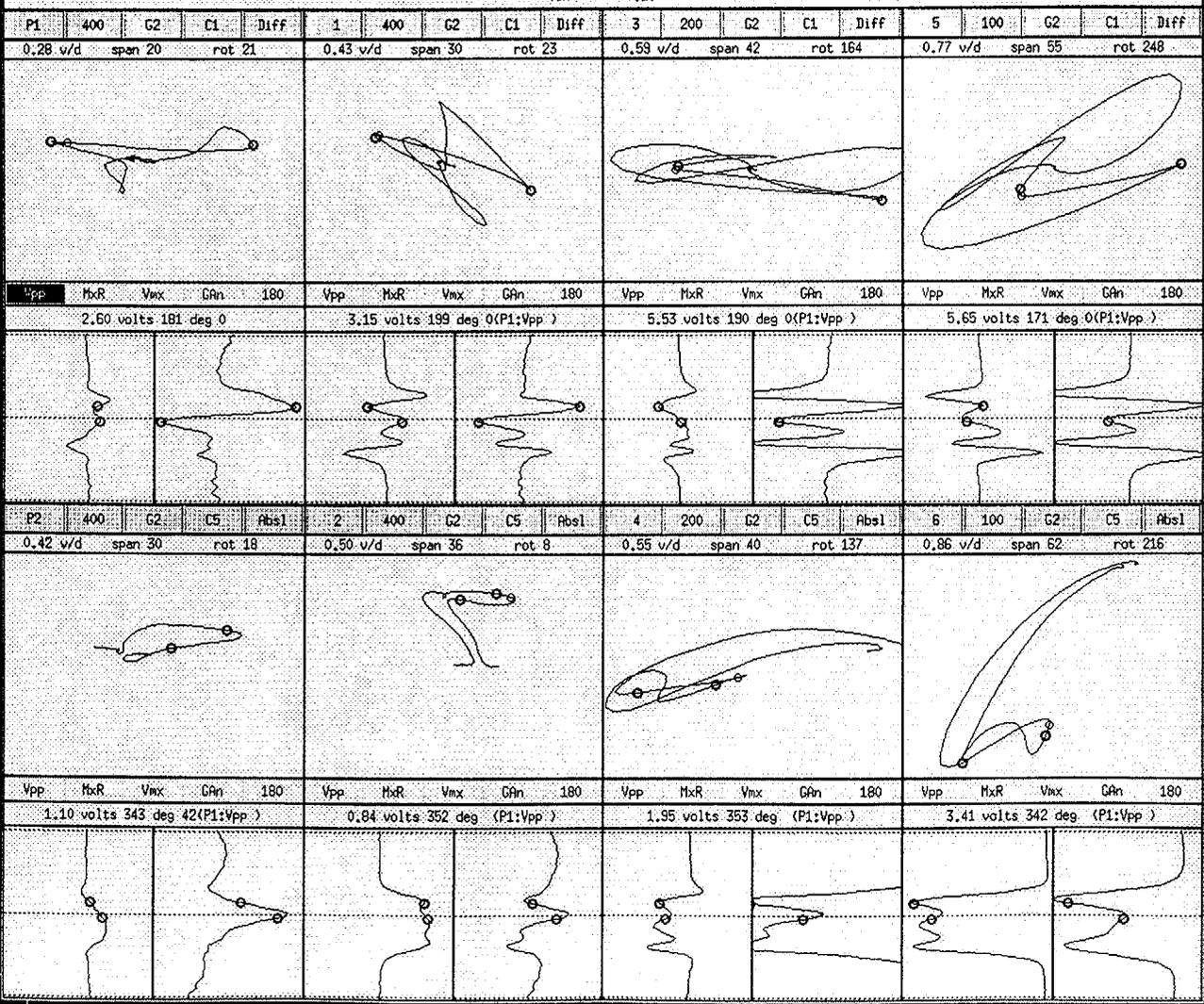
200 200 1.1

File Layout

Help

Coil Order < Freq >

03H + 0.13



2.60 volts

Confirmation

9/1/01
11:00

SG40CCAL000 12THU 20:51:11 MAR-02-2000 SG 40 R 9 C 80 I005

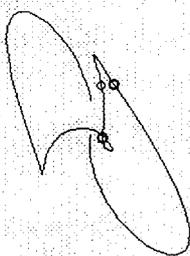
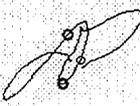
File Layout

Help

← EBI Coil Order < Freq >

P1	400	G2	C1	Diff	1	400	G2	C1	Diff	3	200	G2	C1	Diff	5	100	G2	C1	Diff
0.28 v/d	span 20	rot 21			0.43 v/d	span 30	rot 23			1.13 v/d	span 55	rot 164			0.98 v/d	span 70	rot 248		

04H - 0.15



Vpp	HxR	Vmx	Gph	180	Vpp	HxR	Vmx	Gph	180	Vpp	HxR	Vmx	Gph	180	Vpp	HxR	Vmx	Gph	180
1.06 volts	173 deg 0				0.89 volts	185 deg 0 (P1:Vpp)				1.54 volts	203 deg 0 (P1:Vpp)				2.23 volts	193 deg 0 (P1:Vpp)			

P2	400	G2	C5	Phs1	2	400	G2	C5	Phs1	4	200	G2	C5	Phs1	5	100	G2	C5	Phs1
0.10 v/d	span 7	rot 18			0.13 v/d	span 3	rot 8			0.28 v/d	span 20	rot 157			0.86 v/d	span 52	rot 215		

Vpp	HxR	Vmx	Gph	180	Vpp	HxR	Vmx	Gph	180	Vpp	HxR	Vmx	Gph	180	Vpp	HxR	Vmx	Gph	180
0.12 volts	46 deg 10 (P1:Vpp)				0.40 volts	344 deg (P1:Vpp)				0.52 volts	257 deg (P1:Vpp)				1.75 volts	191 deg (P1:Vpp)			

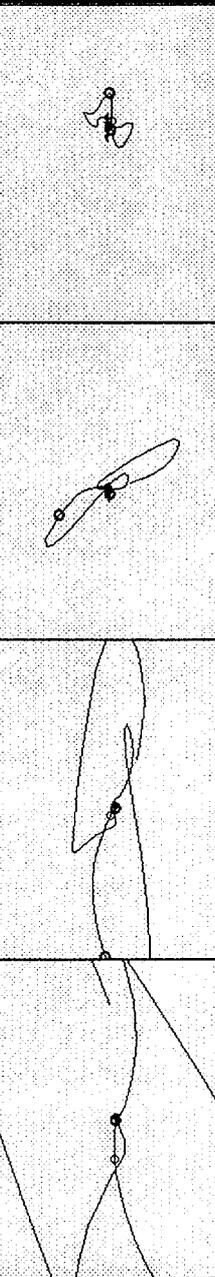
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00

File Layout

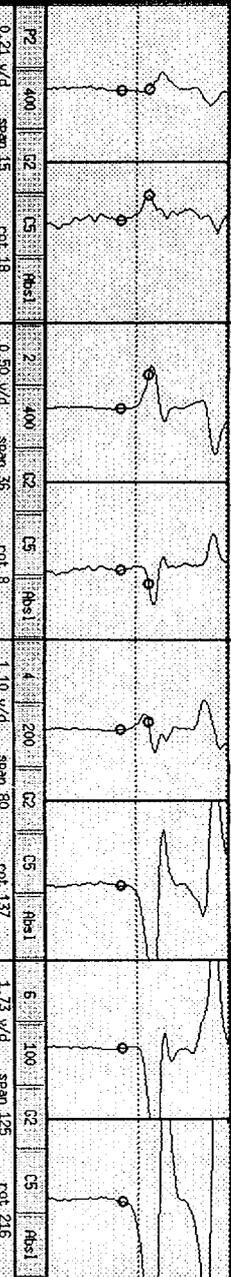
Help

Ctrl Order < Prev >

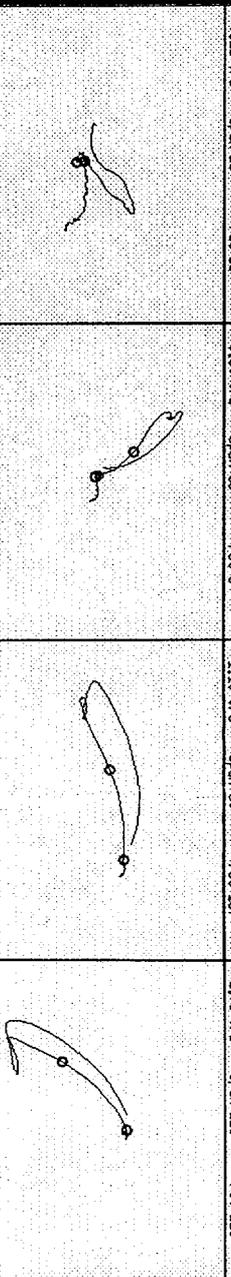
P1	400	G2	C1	Diff	1	400	G2	C1	Diff	3	200	G2	C1	Diff	5	100	G2	C1	Diff
0.28 v/d span 20 rot 21																			



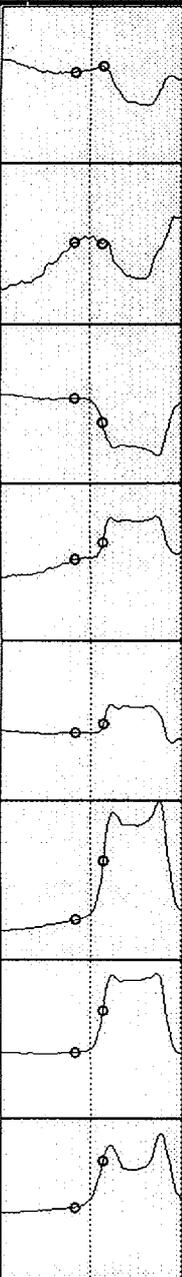
P2	400	G2	C5	Abs1	2	400	G2	C5	Abs1	4	200	G2	C5	Abs1	6	100	G2	C5	Abs1
0.47 v/d span 15 rot 18																			



P3	400	G2	C5	Abs1	2	400	G2	C5	Abs1	4	200	G2	C5	Abs1	6	100	G2	C5	Abs1
0.50 v/d span 36 rot 8																			



P4	400	G2	C5	Abs1	2	400	G2	C5	Abs1	4	200	G2	C5	Abs1	6	100	G2	C5	Abs1
0.97 v/d span 15 rot 18																			



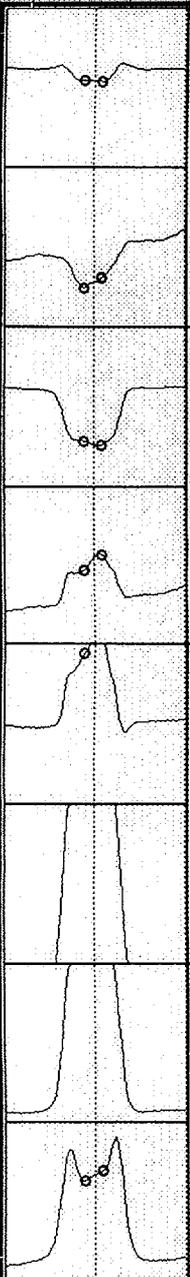
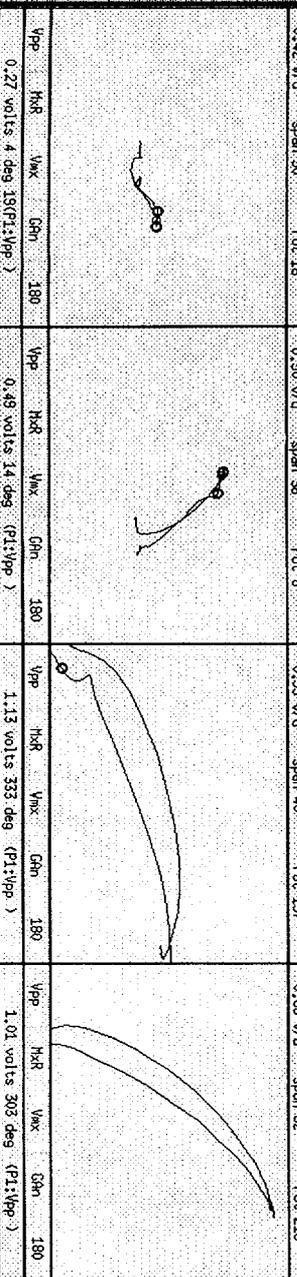
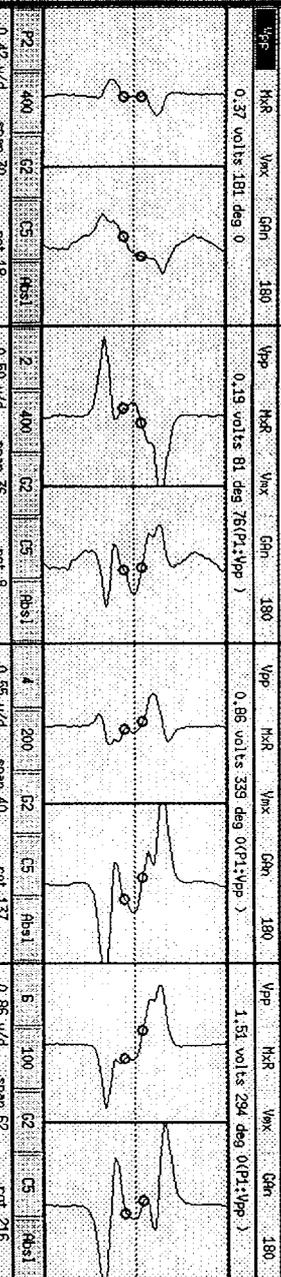
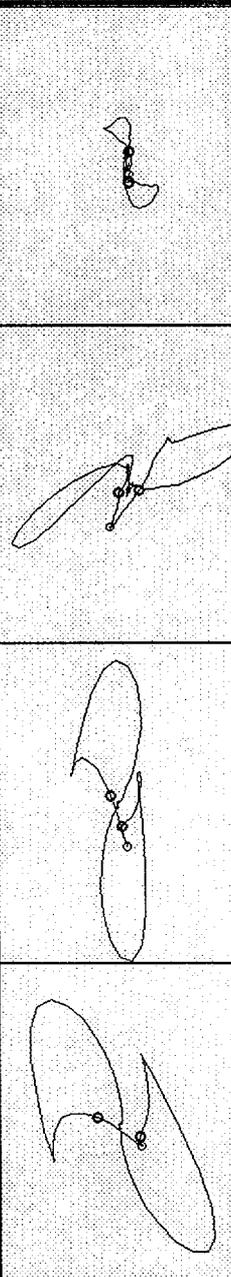
0.47 volt burst
 occurs roughly
 below 1000 Hz

File Layout

Help

Call Order < Frag >

P1	400	G2	C1	Diff	1	400	G2	C1	Diff	3	200	G2	C1	Diff	5	100	G2	C1	Diff
0.28 V/d	span 20	rot 21			0.21 V/d	span 15	rot 23			0.59 V/d	span 42	rot 164			0.77 V/d	span 55	rot 248		



0.37 volt

Tennessee Valley Authority

SEQUOYAH NUCLEAR PLANT

cc:

Mr. J. A. Scalice
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Mr. Karl W. Singer, Senior Vice President
Nuclear Operations
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Jack A. Bailey
Vice President
Engineering & Technical Services
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Richard T. Purcell
Site Vice President
Sequoyah Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Soddy Daisy, TN 37379

General Counsel
Tennessee Valley Authority
ET 10H
400 West Summit Hill Drive
Knoxville, TN 37902

Mr. Robert J. Adney, General Manager
Nuclear Assurance
Tennessee Valley Authority
5M Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Mark J. Burzynski, Manager
Nuclear Licensing
Tennessee Valley Authority
4X Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Pedro Salas, Manager
Licensing and Industry Affairs
Sequoyah Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Soddy Daisy, TN 37379

Mr. D. L. Koehl, Plant Manager
Sequoyah Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Soddy Daisy, TN 37379

Mr. Russell A. Gibbs
Senior Resident Inspector
Sequoyah Nuclear Plant
U.S. Nuclear Regulatory Commission
2600 Igou Ferry Road
Soddy Daisy, TN 37379

Mr. Lawrence E. Nanney, Director
Division of Radiological Health
Dept. of Environment & Conservation
Third Floor, L and C Annex
401 Church Street
Nashville, TN 37243-1532

County Executive
Hamilton County Courthouse
Chattanooga, TN 37402-2801

Ms. Ann Harris
305 Pickel Road
Ten Mile, TN 37880