



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

May 10, 2001

LICENSEE: Tennessee Valley Authority

FACILITY: Sequoyah Nuclear Plant, Unit 1

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

This is a revised summary to replace the one issued on April 20, 2001.

On April 11, 2001, representatives of the Tennessee Valley Authority (TVA), the licensee for the Sequoyah Nuclear Plant, held 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 last SG tube examination in 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, 2000, the NRC staff stated that it believed 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 to sample all dents $<$ 5 volts with a rotating pancake coil (RPC) probe, such as +Point. This was not done during the March 2000 inspections. TVA stated that the commitment in the March 12, 1997, letter was never intended to apply to dented intersections in the $<$ 2-volt range.

The NRC staff disagreed with TVA's position, and suggested that TVA develop appropriate sampling strategies for dented intersections $<$ 2 volts. A Pacific Gas and Electric Company (PG&E) representative was present at the meeting because PG&E had submitted a license amendment request for the same ARC that had been approved for TVA. The NRC staff suggested that it might be helpful for TVA and PG&E to work together on a strategy for

inspecting < 2-volt dented intersections. The staff believes that it is more likely that circumferential cracks will be detected in the 1-volt to 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

The focus of the April 11, 2001, meeting was to present TVA's inspection strategy for the < 2-volt dented intersections. TVA made a presentation that first explained the intent of the prior inspection strategy that had been submitted to the NRC in support of their ARC for ODSCC and PWSCC at dented tube support plate intersections. 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 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. Due to NRC's concerns, TVA then defined a population of dents below 2 volts.

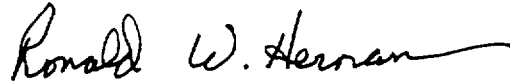
TVA also stated that they did not apply the inspection criteria to dented intersections in the range of 0 - 2.0 volts, because TVA assumes a dent threshold of 2 volts. TVA believes such a threshold is standard for the industry. The NRC staff stated that they are not aware of any such threshold. To support this argument, TVA presented 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. TVA believes that Lissajous patterns < 1.0 volts are very hard to interpret as to whether an actual SG tube dent is indicated, because interpretations of the patterns could be inconclusive and subjective. Therefore, TVA proposed a threshold of ≥ 1.0 volts for +point inspections.

TVA stated that this new strategy will increase the number of +point inspections from 8,360 after Cycle 10 to 15,774 during the fall 2001 inspections. Indications found with the bobbin coil probe will continue to be inspected with +point (1,647 were inspected after Cycle 10), regardless of dent voltage. 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 replace the commitment to inspect all dents less than 5 volts with an RPC probe.

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 discussed its concerns with appropriate selection of in situ test candidates due to weaknesses in the ability to assign eddy current uncertainties.

The staff stated that TVA should pursue sizing capability of outside-diameter cracks and should consider in situ pressure testing in certain cases, such as detecting circumferential cracking and mixed mode cracking in dents .

A handwritten signature in black ink, reading "Ronald W. Hernan". The signature is fluid and cursive, with a long horizontal stroke at the end.

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

May 10, 2001

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/RA/

Ronald W. Hernan, Senior Project Manager, Section 2
Project Directorate II
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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. rev1.wpd

OFFICE	PDII-2/PM	PDII-2/LA	EMCB	PDII-2/PD
NAME	RHernan <i>RH</i>	BClayton <i>BC</i>	TSullivan <i>ES</i>	PMadden <i>PM</i>
DATE	5/ 8 /01	5/ 8 /01	5/ 9 /01	5/ 10 /01

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

ATTENDEES

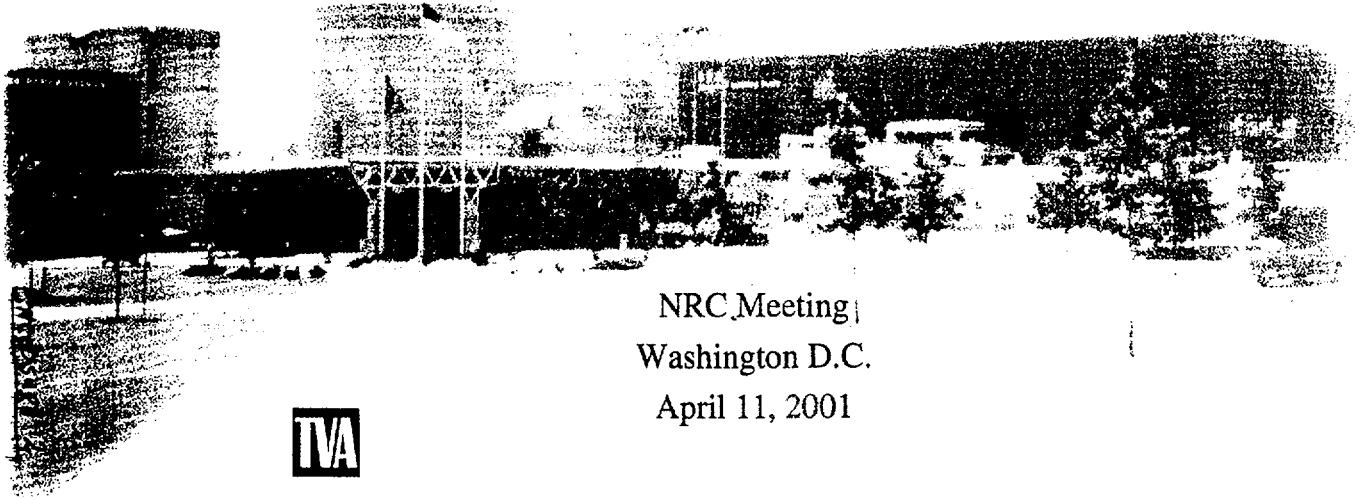
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Herb Berkow	NRC
Richard P. Correia	NRC
Ted Sullivan	NRC
Louise Lund	NRC
Emmett Murphy	NRC
Cheryl Khan	NRC
U. Bhachu	NRC
Pedro Salas	TVA
Joe Valente	TVA
David Goetcheus	TVA
Helen Cothron	TVA
Dan Salter	HGP, Inc.

ENCLOSURE 1

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*

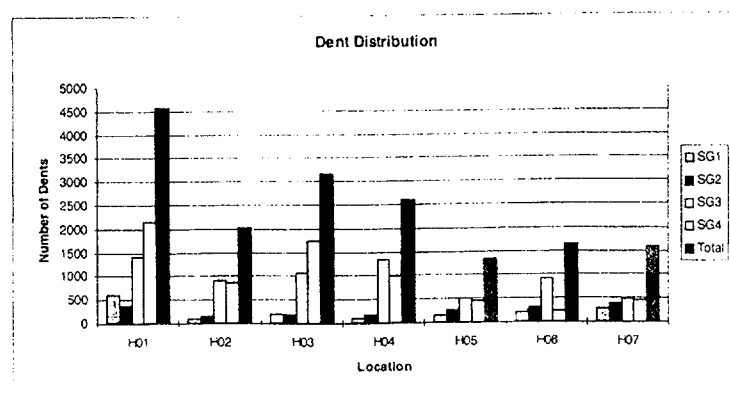
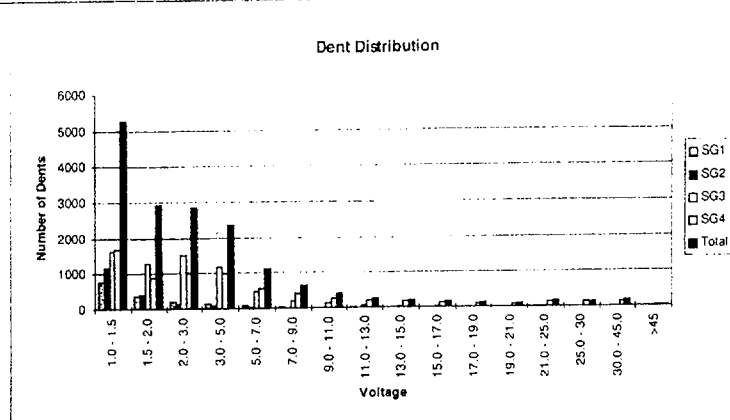
Dented Intersection Calling Threshold

- **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

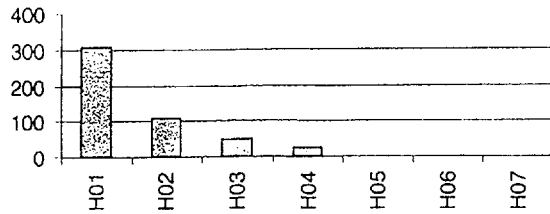
- **The new threshold for Sequoyah Unit 1 will be 1 volt**
 - Dented intersections greater than or equal to 1 volt will be inspected in all 4 steam generators
 - *15,774 dent inspections with plus point compared to base scope of 8,360 at end of Cycle 10*
 - No circumferential crack has been identified 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

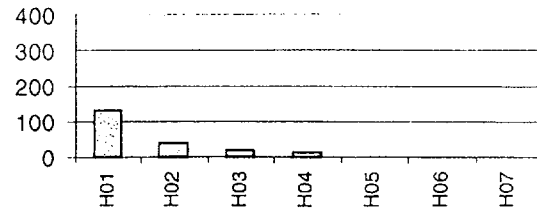


Cracking at Dented Intersections

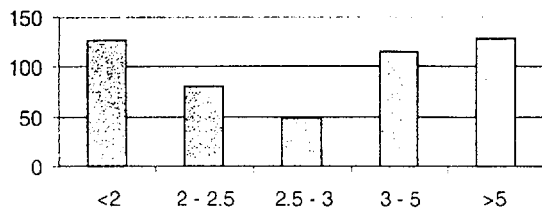
Cycle 7 - Cycle 10 ID Axial Indications vs Location



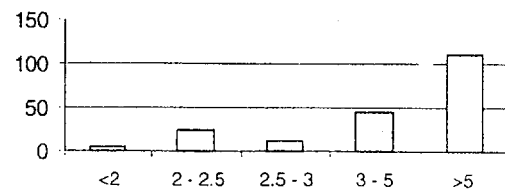
Cycle 7 - Cycle 10 Circ Indications vs Location



Cycle 7 - Cycle 10 ID Axial Indications vs Dent Voltage

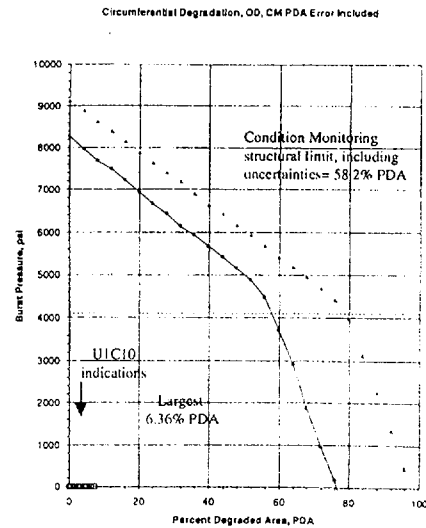
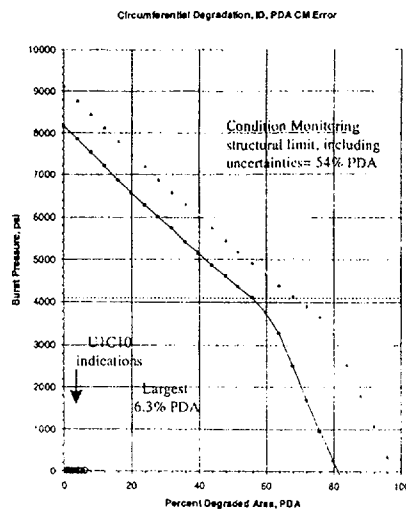


Cycle 7 - Cycle 10 Circ Indications vs Dent Voltage



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**

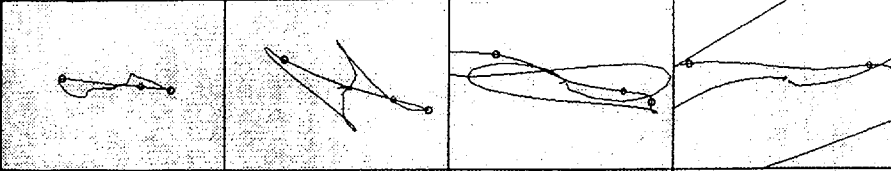
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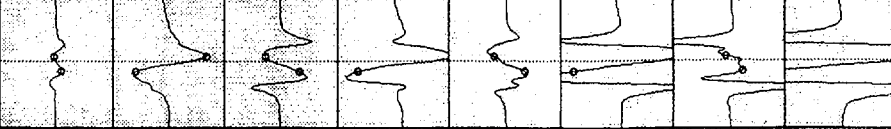
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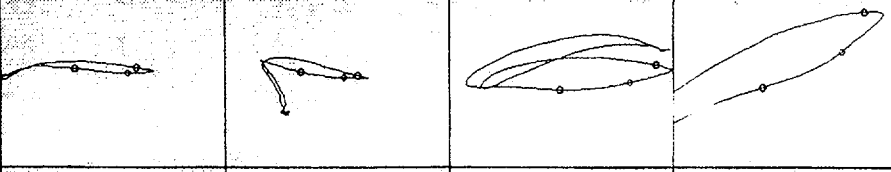
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0.57	w/d	span 41	rot 21	0.43	w/d	span 30	rot 23	0.59	w/d	span 42	rot 164	0.39	w/d	span 27	rot 248



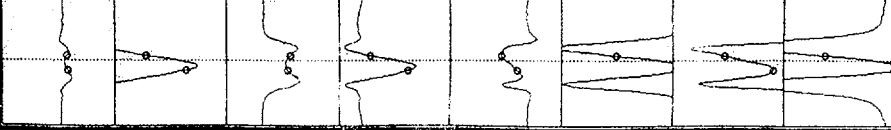
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3.74	volts	196	deg	0	3.96	volts	198	deg	0(P1:Vpp)	5.82	volts	197	deg	0(P1:Vpp)	5.16	volts	187	deg	0(P1:Vpp)	



P1	W/d	span	rot	P2	W/d	span	rot	P3	W/d	span	rot	P4	W/d	span	rot
0.42	w/d	span 30	rot 18	0.50	w/d	span 36	rot 8	0.55	w/d	span 40	rot 137	0.43	w/d	span 31	rot 216



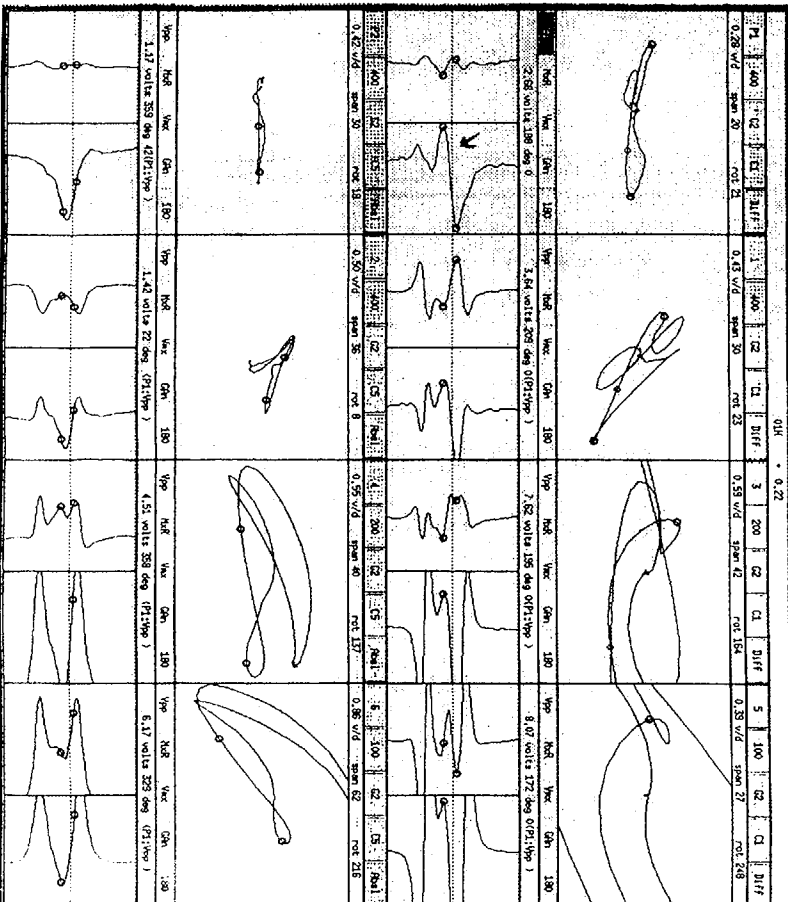
Vpp	H/R	Vux	G/n	180	Vpp	H/R	Vux	G/n	180	Vpp	H/R	Vux	G/n	180	Vpp	H/R	Vux	G/n	180	
1.54	volts	359	deg	46(P1:Vpp)	1.74	volts	4	deg	(P1:Vpp)	3.32	volts	346	deg	(P1:Vpp)	1.29	volts	325	deg	(P1:Vpp)	

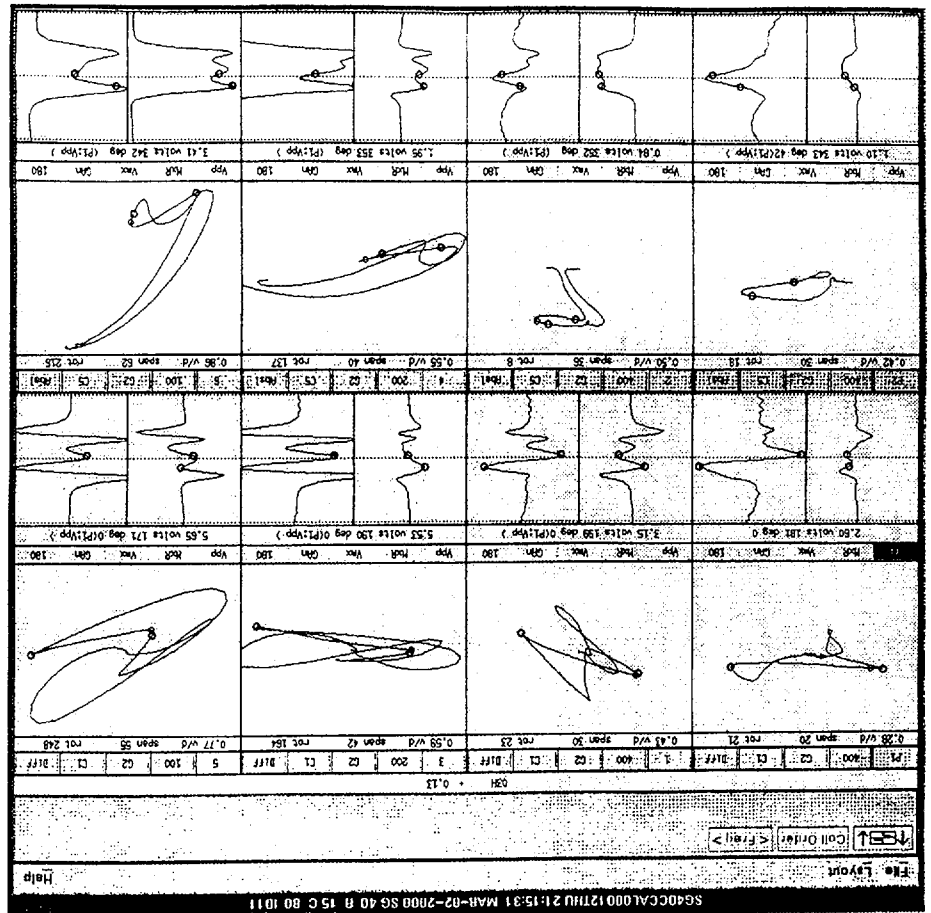


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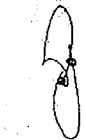


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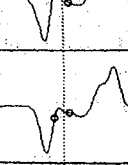
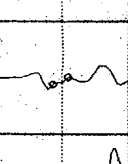
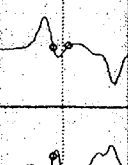
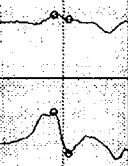
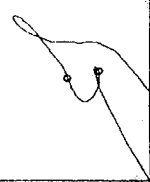
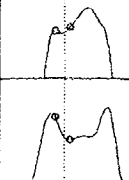
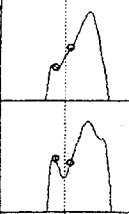
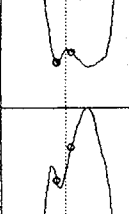
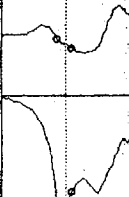
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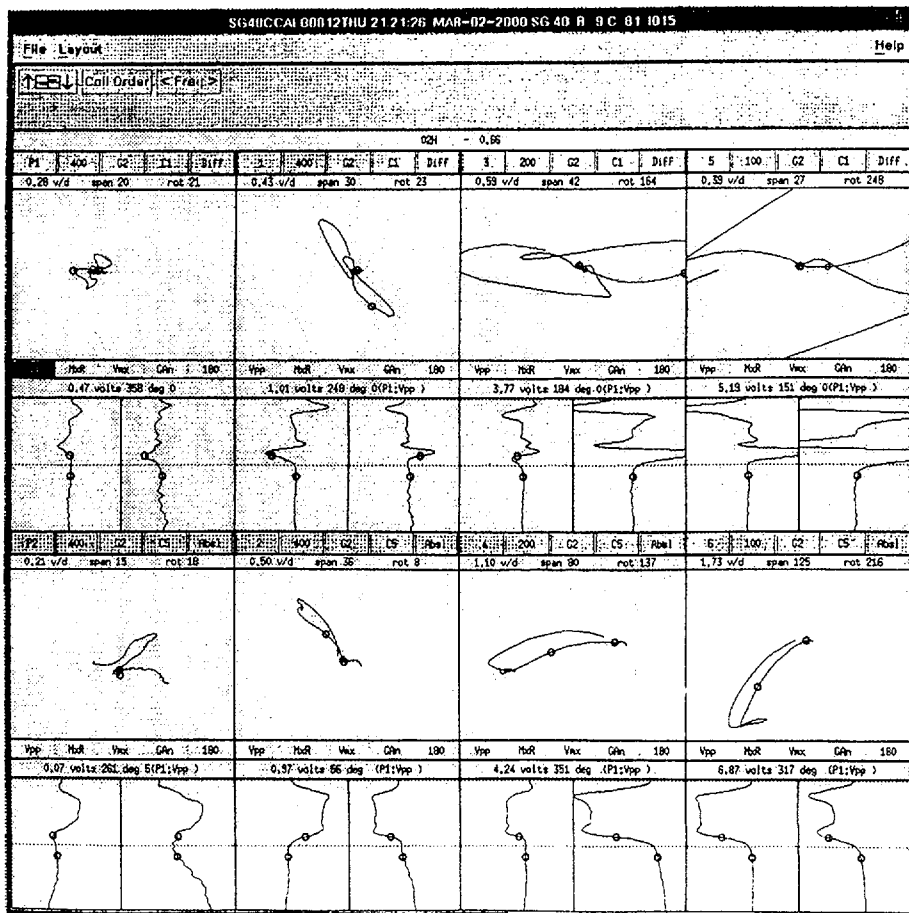
OK - 0.15

0.28 v/d					0.43 v/d					1.19 v/d					0.98 v/d				
run	20	ret	21	diff	run	30	ret	33	diff	run	85	ret	184	diff	run	70	ret	248	
1	22	13	9	30.17	1	400	62	61	diff	3	200	62	61	diff	5	150	62	61	diff



1.06 volts 175 deg 0	0.89 volts 185 deg 0 (P1:Vpp)	1.54 volts 209 deg 0 (P1:Vpp)	2.23 volts 193 deg 0 (P1:Vpp)
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0.47 volt
phase shift
180 deg

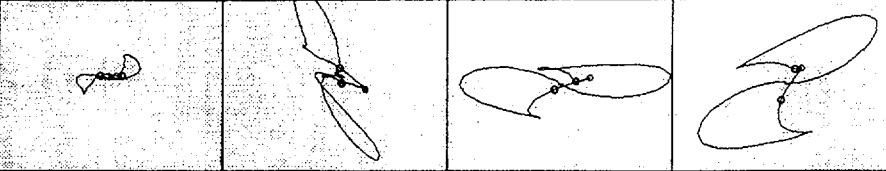
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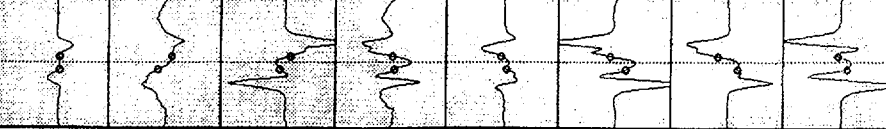
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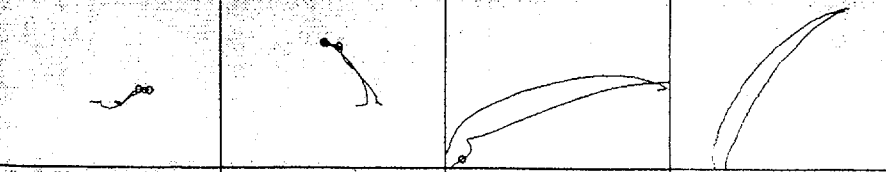
P1	400	G2	CL	Diff	1	400	G2	CL	Diff	3	200	G2	CL	Diff	5	100	G2	CL	Diff
0.28 w/d	span 20	rot 21			0.21 w/d	span 15	rot 23			0.55 w/d	span 42	rot 154			0.77 w/d	span 55	rot 248		



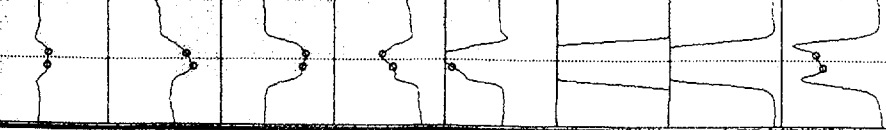
Vpp	Hdr	Vux	Gdn	180	Vpp	Hdr	Vux	Gdn	180	Vpp	Hdr	Vux	Gdn	180	Vpp	Hdr	Vux	Gdn	180
0.37 volts	181 deg	0			0.19 volts	81 deg	75 (P1:Vpp)			0.86 volts	339 deg	0 (P1:Vpp)			1.51 volts	294 deg	0 (P1:Vpp)		



P1	400	G2	CL	Diff	1	400	G2	CL	Diff	3	200	G2	CL	Diff	5	100	G2	CL	Diff
0.42 w/d	span 20	rot 18			0.50 w/d	span 36	rot 8			0.55 w/d	span 40	rot 137			0.86 w/d	span 62	rot 215		



Vpp	Hdr	Vux	Gdn	180	Vpp	Hdr	Vux	Gdn	180	Vpp	Hdr	Vux	Gdn	180	Vpp	Hdr	Vux	Gdn	180
0.27 volts	4 deg	19 (P1:Vpp)			0.48 volts	14 deg	(P1:Vpp)			1.13 volts	333 deg	(P1:Vpp)			1.01 volts	303 deg	(P1:Vpp)		



1.37 1.15
1.1 1.1

Tennessee Valley Authority

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