

# ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9006130257 DOC. DATE: 90/06/05 NOTARIZED: NO DOCKET #  
 FACIL: 50-315 Donald C. Cook Nuclear Power Plant, Unit 1, Indiana & 05000315  
 50-316 Donald C. Cook Nuclear Power Plant, Unit 2, Indiana & 05000316

AUTH. NAME AUTHOR AFFILIATION  
 ALEXICH, M.P. Indiana Michigan Power Co. (formerly Indiana & Michigan Ele  
 RECIP. NAME RECIPIENT AFFILIATION  
 Document Control Branch (Document Control Desk)

SUBJECT: Forwards addl info re util 900126 revised response to NRC  
 Bulletin 88-002, per NRC 900509 request.

DISTRIBUTION CODE: IE13D COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 49  
 TITLE: Bulletin Response, 88-02 Rapidly Propagating Fatigue Cracks in Steam

### NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR ENCL
	PD3-1 LA	1 0	PD3-1 PD	1 1
	GIITTER, J.	1 1		
INTERNAL:	AEOD/DSP/TPAB	1 1	NRR MURPHY, E	1 1
	NRR NEIGHBORS, D	1 1	NRR/DOEA/OGCB11	1 1
	NRR/DREP/PEPB9D	1 1	NRR/DST 8E2	1 1
	NRR/PMAS/ILRB12	1 1	<u>REG-FILE</u> 02	1 1
	RES/DSIR/EIB	1 1	RGN3 FILE 01	1 1
EXTERNAL:	LPDR	1 1	NRC PDR	1 1
	NSIC	1 1		

### NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK,  
 ROOM P1-37 (EXT. 20079) TO ELIMINATE YOUR NAME FROM DISTRIBUTION  
 LISTS FOR DOCUMENTS YOU DON'T NEED!

TOTAL NUMBER OF COPIES REQUIRED: LTTR 16 ENCL 15



INDIANA  
MICHIGAN  
POWER

AEP:NRC:1056B

Donald C. Cook Nuclear Plant Units 1 and 2  
Docket Nos. 50-315 and 50-316  
License Nos. DPR-58 and DPR-74  
NRC BULLETIN 88-02; REQUEST FOR ADDITIONAL INFORMATION

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

Attn: T. E. Murley

June 5, 1990

References:

- 1) Letter AEP:NRC:1056A, M. P. Alexich (Indiana Michigan Power Company) to T. E. Murley (NRC), "NRC Bulletin 88-02; Request for Additional Information," dated January 26, 1990
- 2) Letter J. G. Gitter (NRC) to M. P. Alexich (Indiana Michigan Power Company), "Request for Additional Information (RAI)-Donald C. Cook Nuclear Power Plant Unit 1- Response to NRC Bulletin 88-02," dated May 9, 1990

Dear Dr. Murley:

Our letter of January 26 1990 (Reference 1) revised our response to NRC Bulletin 88-02, "Rapidly Propagating Fatigue Cracks in Steam Generator Tubes." Our revised response concluded that there were no indications of service-induced tube denting in the Cook Nuclear Plant Unit 1 steam generators. Following the submittal of the revised response, members of your staff requested additional information regarding our basis for arriving at this conclusion (Reference 2). The attachment to this letter, which describes the evaluation conducted by our consultant, Conam Nuclear, Inc., is provided in response to this request.

TE13  
11


Dr. T. E. Murley

-2-

AEP:NRG:1056B

This document has been prepared following Corporate procedures that incorporate a reasonable set of controls to ensure its accuracy and completeness prior to signature by the undersigned.

Sincerely,



M. P. Alexich  
Vice President

MPA/eh

Attachment

cc: D. H. Williams, Jr.  
A. A. Blind - Bridgman  
J. P. Padgett  
G. Charnoff  
NFEM Section Chief  
A. B. Davis - Region III  
NRC Resident Inspector - Bridgman

ATTACHMENT TO AEP:NRC:1056B

BULLETIN 88-02: REQUEST FOR ADDITIONAL INFORMATION

The following provides the additional information requested in regards to NRC Bulletin 88-02, "Rapidly Propagating Fatigue Cracks in Steam Generator Tubes."

Request No. 1

Describe the data analysis guidelines and criteria for the detection of support plate corrosion and the presence of magnetite in the support plate crevices.

Response

In November 1988, a review of eddy current data was performed on selected tubes from the 1985 and 1987 inspections of the Cook Nuclear Plant Unit 1 steam generators. The contractor selected for the review, Conam Inspection (now known as Conam Nuclear, Inc.), was asked to evaluate the data with regard to service-induced denting, evidence of upper support plate corrosion, and the presence of magnetite in the tube-to-support plate crevices. Rather than establishing specific guidelines or reporting criteria prior to the review, I&M relied on Conam's expertise and experience to perform an appropriate review.

The following is an outline of the method used by Conam's analyst to evaluate the bobbin coil eddy current data:

1. Establish a 400/100 kHz differential mix.
  - a. Suppress simulated support ring on ASME standard.
  - b. Set probe motion horizontal with the 100 percent through-wall artificial flaw going down and to the right first.
2. Using 400 kHz, set volts using the simulated support ring on the ASME standard to six volts and store to all channels.
3. Evaluate the seventh support plate on both the hot and cold legs for denting and evidence of corrosion or magnetite.
  - a. Denting
    - 1) Signal in the 400/100 kHz differential mix is horizontal, moving to the left first (see Figure 1).

- 2) Dent signal is confirmed using 400 kHz differential or 400 kHz absolute.

b. Corrosion or magnetite

- 1) Toggle through all channels for distorted signals (i.e., anything other than normal support plate signals as shown in Figure 2).
- 2) When distorted signal is observed in the support plate crevice, report distortion as magnetite if the 100 kHz differential signal moves in an upward direction first and the 400 kHz differential signal moves down first (see Figure 3).
- 3) Observe 10 kHz differential for evidence of support plate ligament damage which would be indicative of severe corrosion.

The above described method was again used during the April 1989 Cook Nuclear Plant Unit 1 inspection. The results of the evaluation indicated that magnetite at the upper support plate was not detected, and that signals reported as dents were actually located at the upper or lower edge of the support plate and were very small in volume. (As noted in the previous submittal, these signals remain unchanged and are believed to represent manufacturing "dings" as opposed to service-induced denting.)

Request No. 2

Describe the bases for these guidelines and criteria, including a description of mockups and calibration standards employed.

Response

The method used to evaluate the Cook Nuclear Plant Unit 1 eddy current data for the detection of support plate corrosion and the presence of magnetite in support plate crevices is considered skill-of-the-trade by Conam, and is included in the analysts' training program. This formal training program includes the "Conam Data Analysis Manual" and the EPRI NDE Center's "Manual of ISI Training."

Training instructions relative to magnetite detection are based in part on an EPRI study which was reported by S. D. Brown at the Third Annual Steam Generator NDE Workshop in June 1984, entitled "Array Coil Detection/Characterization of Magnetite Within the

Support Plate Crevice Gap." While the study was performed using array coil technology to evaluate the degree of magnetite packing present at a tube-to-support plate intersection, the results can be extended to bobbin coil data for detection of magnetite. Conam has augmented the training by familiarizing analysts with actual field data from plants with denting and magnetite formation (see Figures 4 and 5).

Request No. 3

Describe how the data analysts' comprehension of the data analysis guidelines and criteria was assured.

Response

All of Conam's data analysts are trained and qualified using all sections of the training course. The evaluation of the Cook Nuclear Plant Unit 1 data was performed by D. Michael Chambers, Level III Eddy Current. Copies of Mr. Chambers' resume and certification of qualification are attached for reference.

In addition to having been the lead analyst for second party review of all eddy current inspections conducted at Cook Nuclear Plant Units 1 and 2 since late 1985, Mr. Chambers has extensive experience at PWR plants throughout the world. As such, he is in an excellent position to critique the Cook Nuclear Plant Unit 1 data relative to other plants with known magnetite denting.

Request No. 4

Pages 1 and 2 of the attachment to the licensee's January 29, 1990, letter refer to "45 dents" or "signal anomalies previously reported as dents" which were subsequently "determined to be insignificant." Please provide a copy of the field eddy current data for a representative sample of these signal anomalies.

Response

Figures 6 through 34 provide the requested data. An example of a "normal" support plate is included, as well as examples of signals classified as "dents" and "small distorted signals."

# CONAM INSPECTION

January 8, 1986

## RESUME

### D. MICHAEL CHAMBERS

Social Security Number: 559-74-5542

Birth Date: April 14, 1948

Level III Eddy Current

Level IIA - Eddy Current Data Analyst

Level II - UT

## EDUCATION

### General

Amador High School Pleasanton, California  
Diploma 1966

### NDE Oriented

<u>Date</u>	<u>Length</u>	<u>Subject</u>	<u>Given By</u>
1971	12 Weeks	NDE Training	Chanute Air Force Base U.S. Air Force School Rantoul, Illinois
3/1979	20 Hours	Eddy Current Data Analysis	
5/1984	8 Hours	Eddy Current MIZ 18	Conam Inspection

## EMPLOYMENT

CONAM INSPECTION  
Richmond, California

March 3 1982 to Present

NDE Technician

Level III - Eddy Current

Level IIA Eddy Current Data Analyst

Level II - UT

CONAM INSPECTION  
Richmond, California

March 1976 to October 1979

NDE Technician

Level I - Eddy Current Operator

Level IIB - Eddy Current Operator

Level IIA - Eddy Current Data Analyst

Level II - UT

U. S. AIR FORCE  
Rantoul, Illinois

August 1966 to March 1975

NDE Instructor





# CONAM INSPECTION

## CERTIFICATION OF PERSONNEL QUALIFICATION

SSN: 559-74-5542

NAME CHAMBERS, D. MICHAEL

CERTIFICATIONS				EXAM SCORES				TNG. HRS.	RECERTIFICATION/RESTRICTIONS
METHOD	LEVEL	DATE	EXAMINER	GEN	SPEC	PRAC	COMP.		
EC	IIA	3-18-85	R. Marlow <i>[Signature]</i>	80.0	100	92.0	90.8	20	
			WT FACTOR:	.3	.3	.4			
EC	III	1-8-86	R. J. Slack <i>[Signature]</i>	88.0	93.9	95.0	100	93.57	O. Gamble 12-8-86 <i>[Signature]</i> O. Gamble 12-87 <i>[Signature]</i>
EC	III	1-10-89	R. J. SLACK <i>[Signature]</i>	88.0	94.62	80.0	100	90.78	R. Marlow 12-89 <i>[Signature]</i>

EXPERIENCE

WT FACTOR: .3 .3 .2 .2

FROM	TO	COMPANY	NDT METHODS & HIGHEST LEVEL ATTAINED
8/1971	3/1976	U.S. Air Force	NDT Specialist (Instructor Rating)
3/1976	10/1979	Conam Inspection, Richmond, California	Level II, UT, MT, RT, PT, EC
3/1982	Present	Conam Inspection, Richmond, California	Eddy Current Level IIA, 7-19-82; Level III, 1-08-86
		(over)	

### EYE EXAMINATIONS

DATE	EXAMINED BY	DATE	EXAMINED BY
6-87	O. Campbell		
6-88	O. Campbell		
7-89	L. Nye		

### EDUCATION AND TRAINING (HIGHEST PUBLIC, ADVANCED AND NDT)

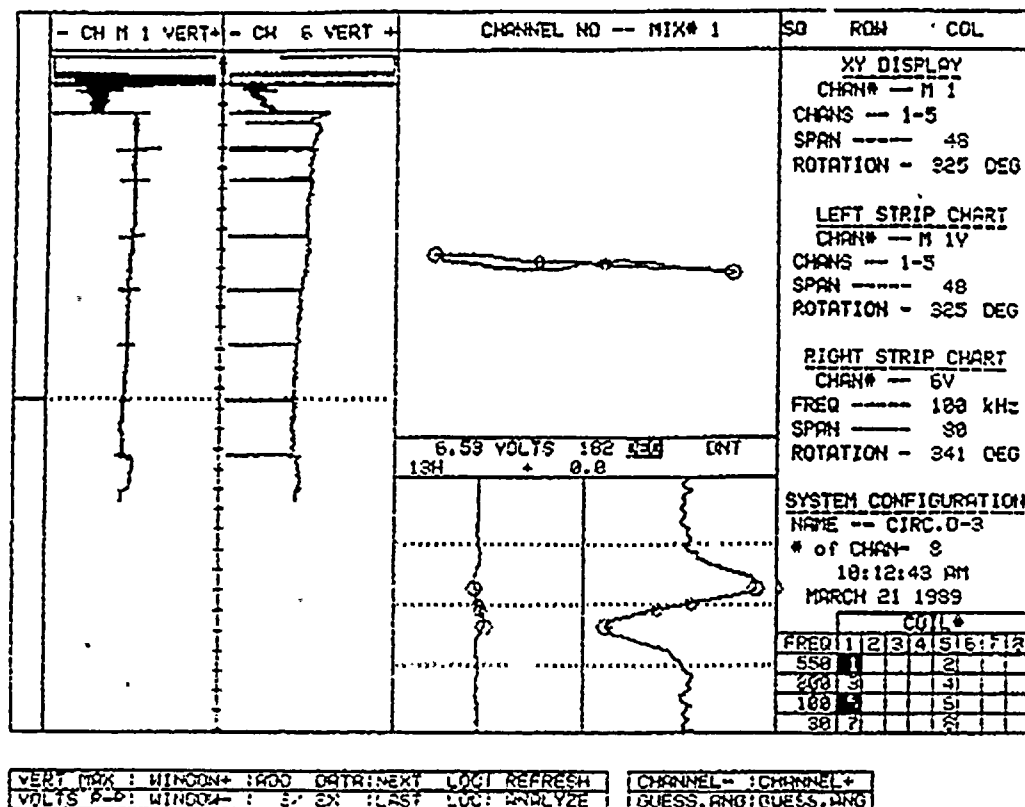
SCHOOL	LOCATION	DATE	LENGTH	SUBJECT
Amador High School	Pleasanton, Ca	6-66	4 Yrs	General/Graduated
U.S. Air Force	Chanute AFB, IL.	11-71	12Wks	NDT/20 Hrs Min. E.C.
Conam Inspection	Richmond, Ca	3-79	20Hrs	E.C. Data Analysis
Conam Inspection	Richmond, Ca	5-84	8 Hrs	E.C. MIZ-18

### COMMENTS

In accordance with the Conam Division  
Procedure 99-CNTP-003  
and the 1984 Edition of SNT-TC-1A.

"All historical information supplied by me to  
compile this certification is true and correct  
to the best of my knowledge."

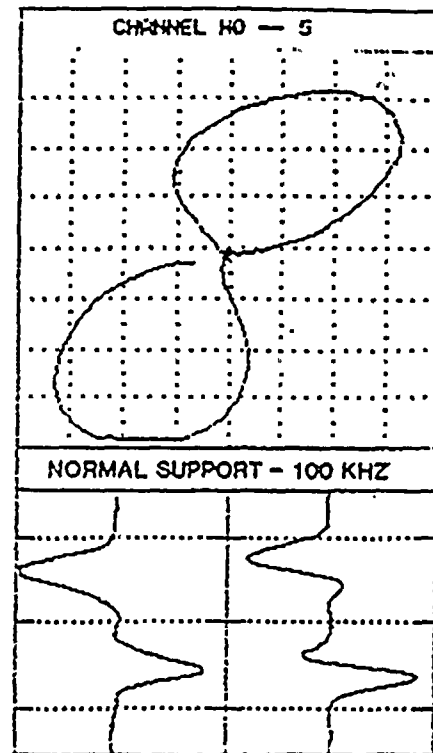
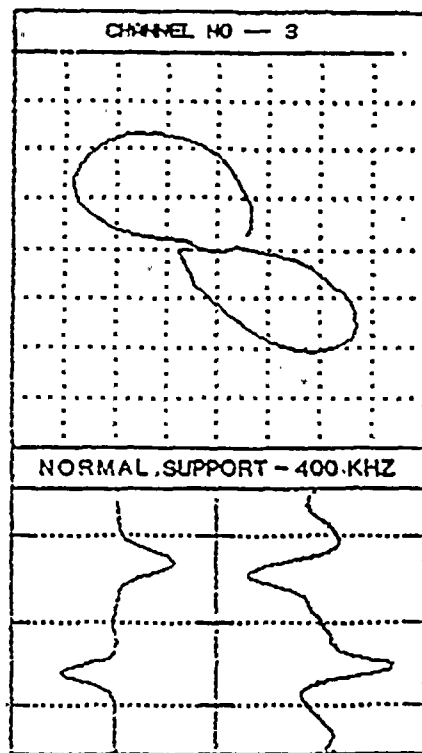
*[Signature]* 9-22-87  
Examinee Date



# Westinghouse Steam Generator - Foreign PWR Plant

Typical service-induced dent; note - 550/100 kHz differential mix for the particular tube wall thickness in this plant is comparable to 400/100 kHz differential mix for Cook Unit 1 tubing.

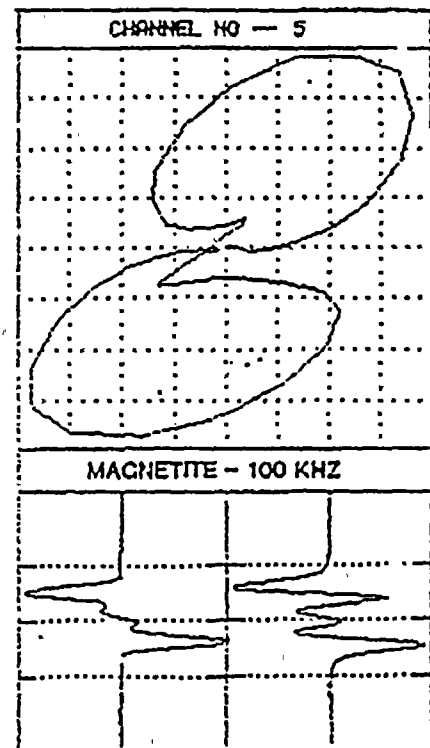
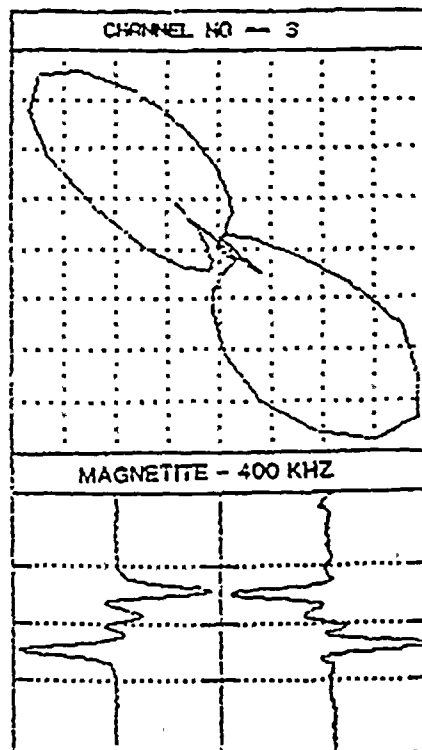
Figure 1



Conam Training Material  
Westinghouse Steam Generator

"Normal" Support Plate Signal

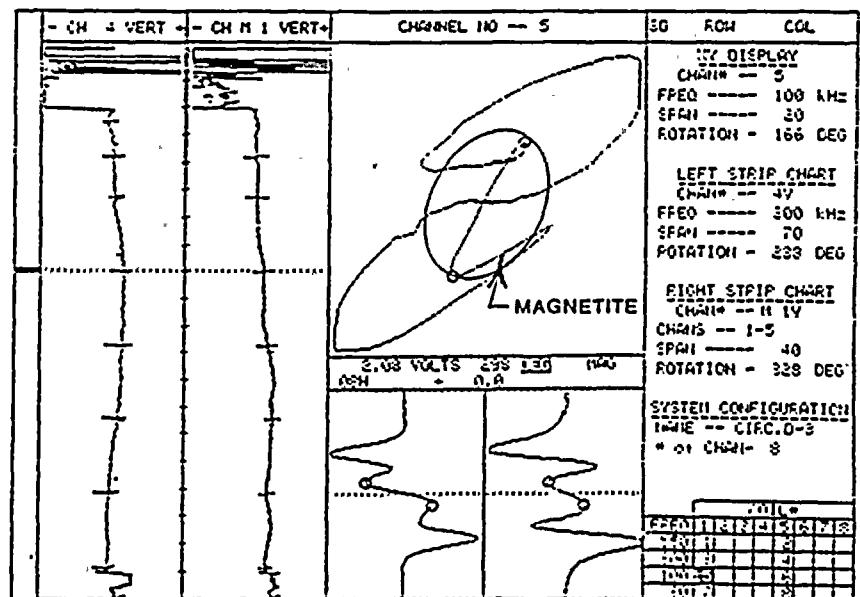
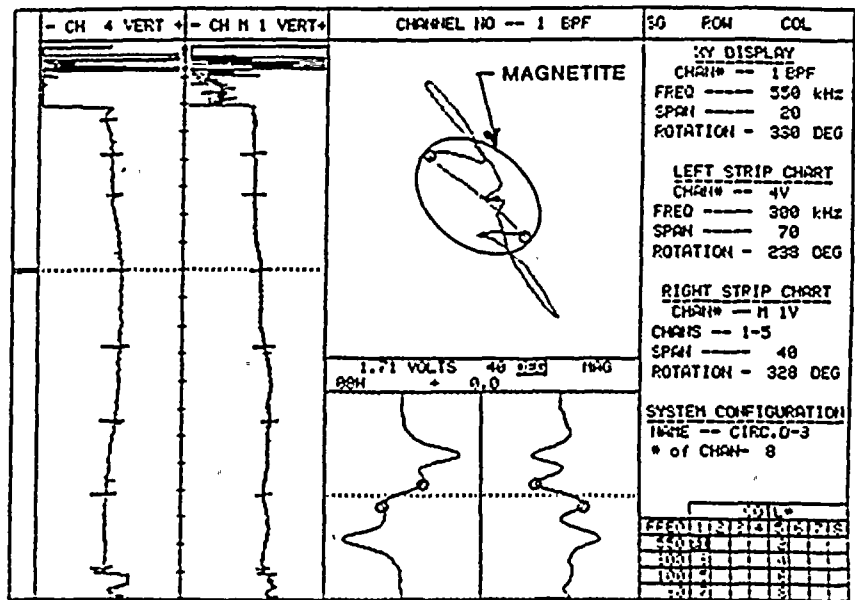
Figure 2



Conam Training Material  
Westinghouse Steam Generator

Distorted Signal at Support Plate  
Reported as Magnetite

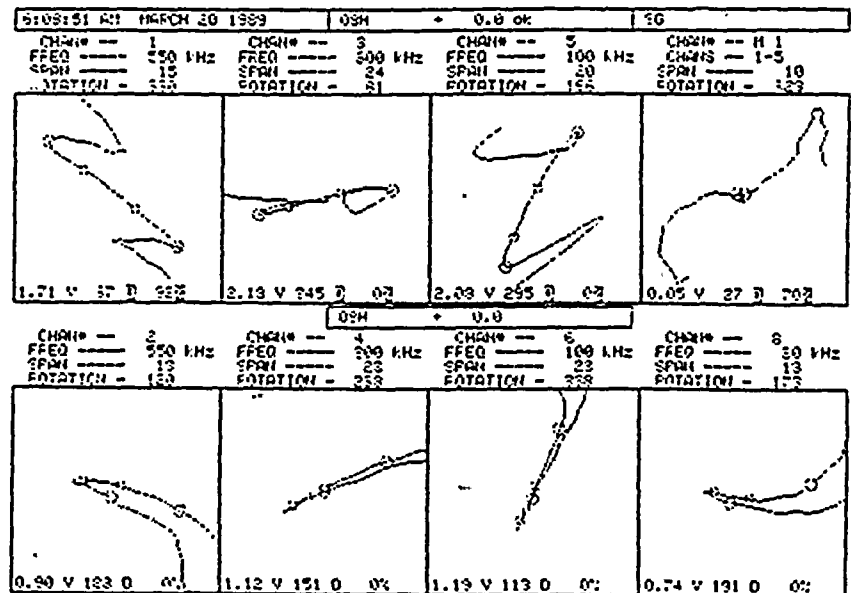
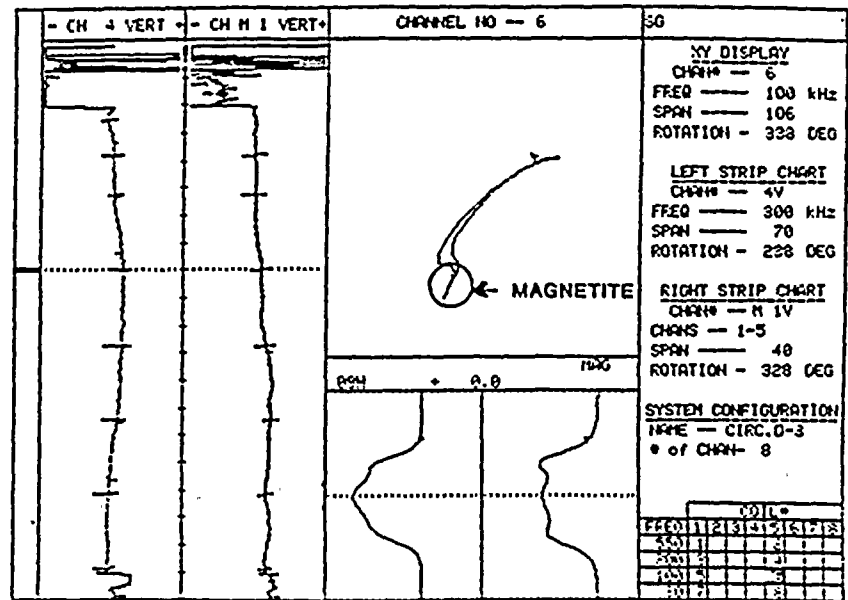
Figure 3



Westinghouse Steam Generator - Foreign PWR Plant

Example of magnetite signal; see Figure 5 for additional channels on same tube.

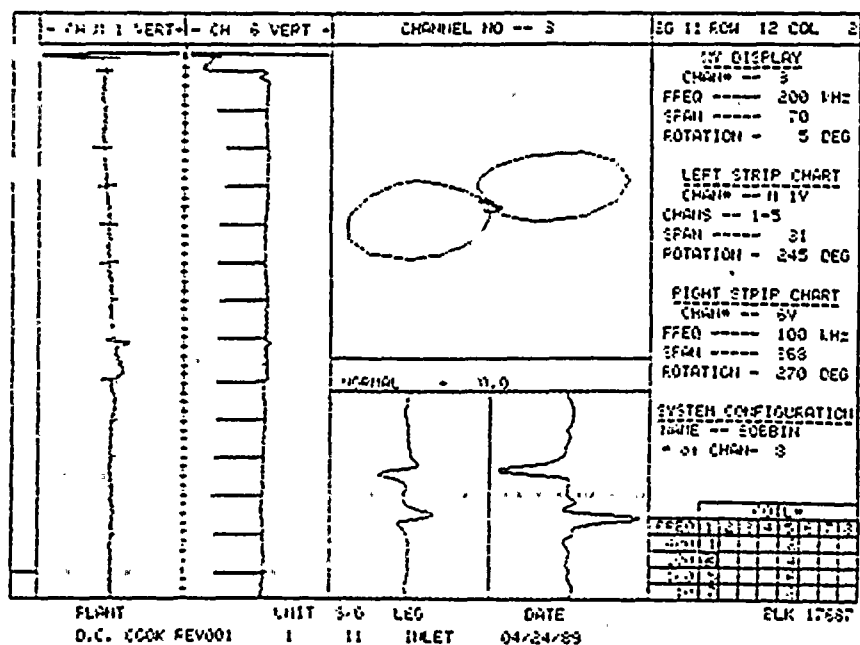
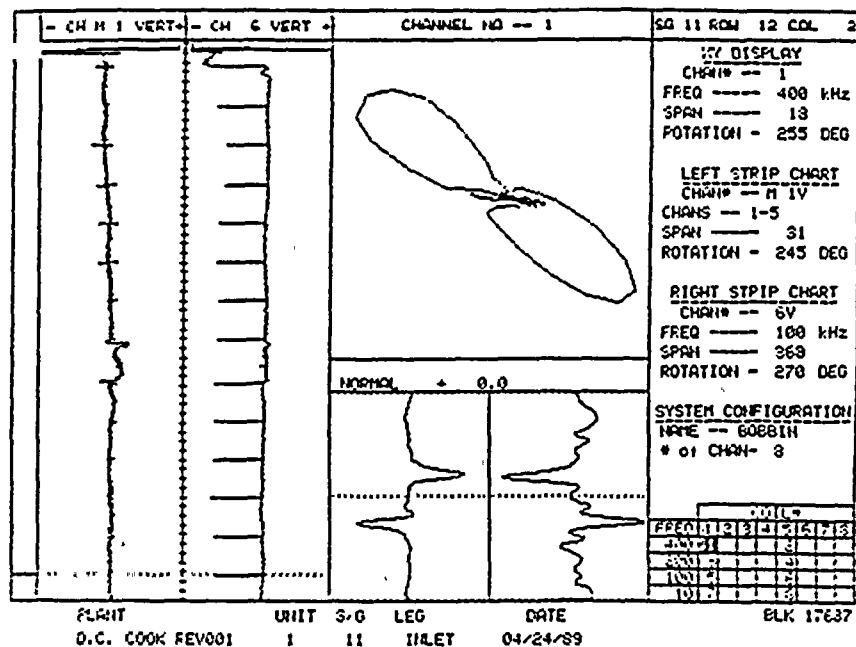
Figure 4



Westinghouse Steam Generator - Foreign PWR Plant

Example of magnetite signal; see Figure 4 for additional channels on same tube.

Figure 5



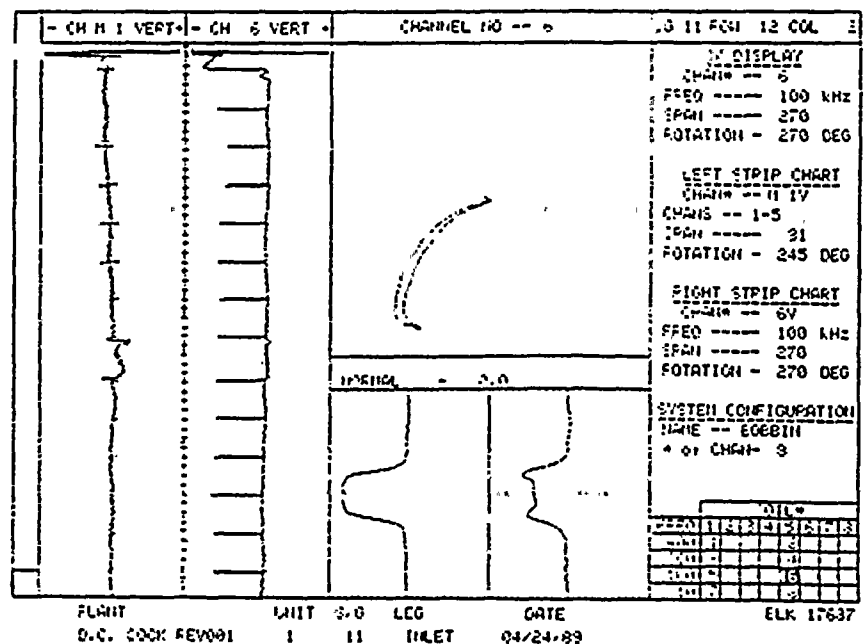
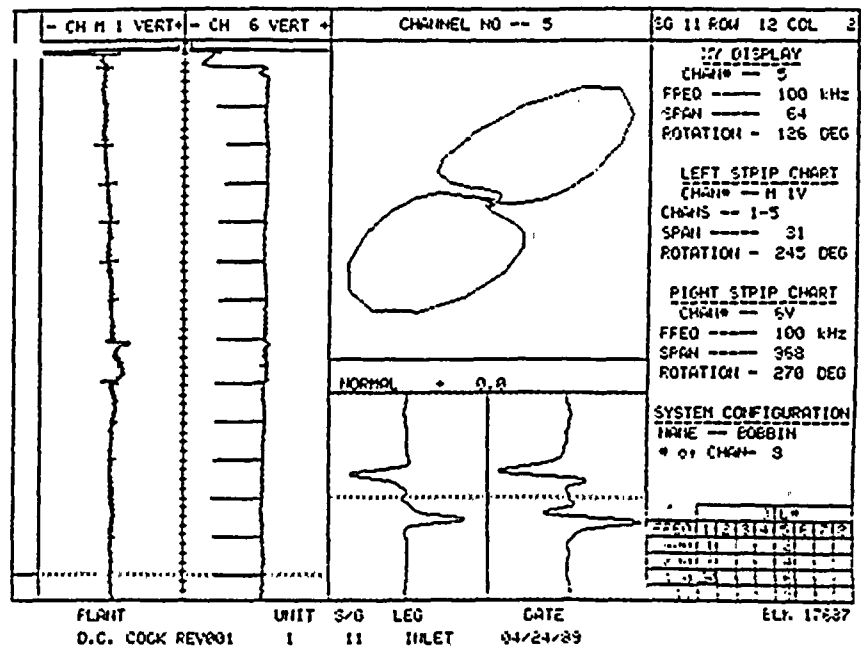
Cook Unit 1

SG No. 11, Tube R12C2, 2nd cold leg support

Typical of "normal" support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figure 7 for additional channels).

Figure 6



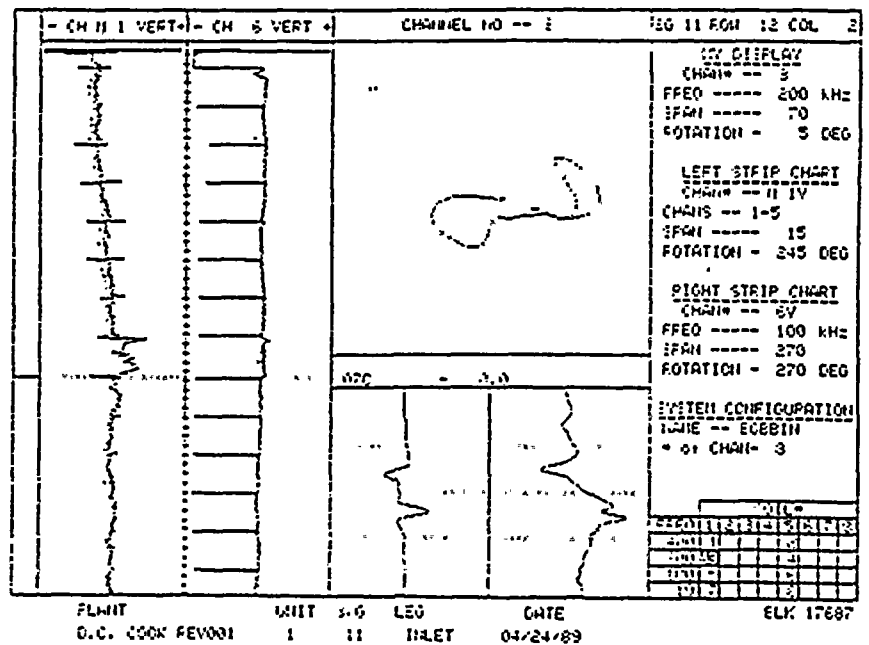
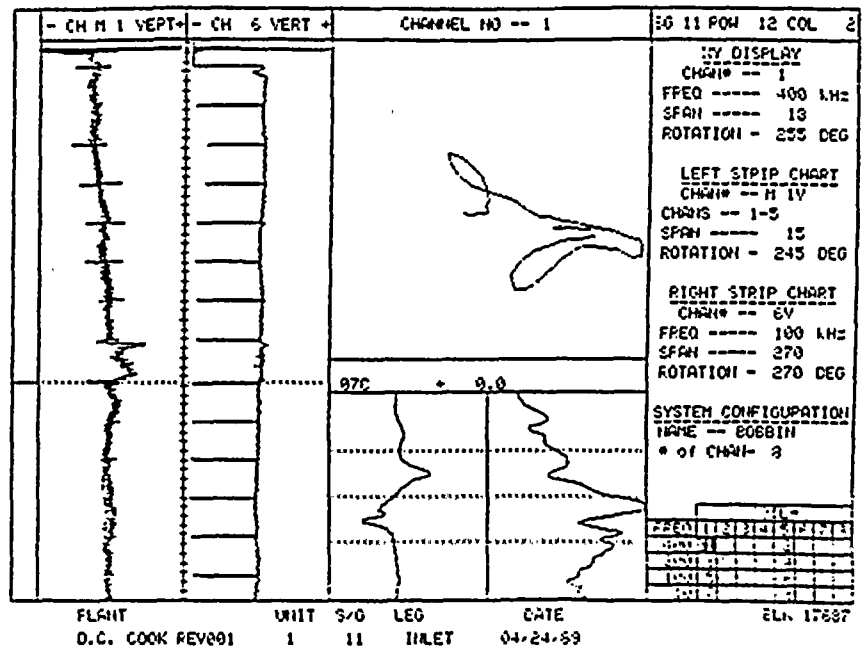


Cook Unit 1

SG No. 11, Tube R12C2, 2nd cold leg support

Typical of "normal" support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figure 6 for additional channels).

Figure 7

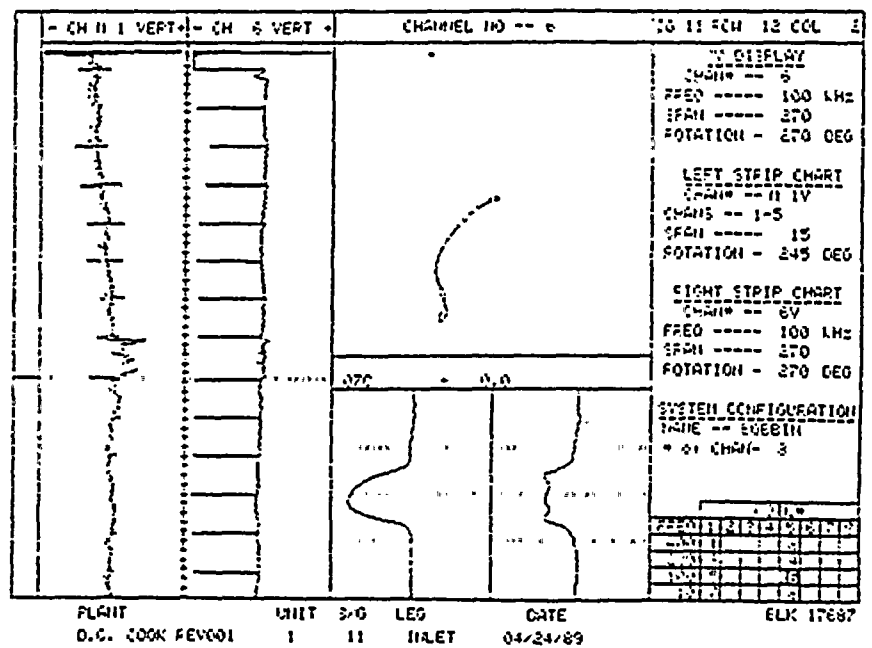
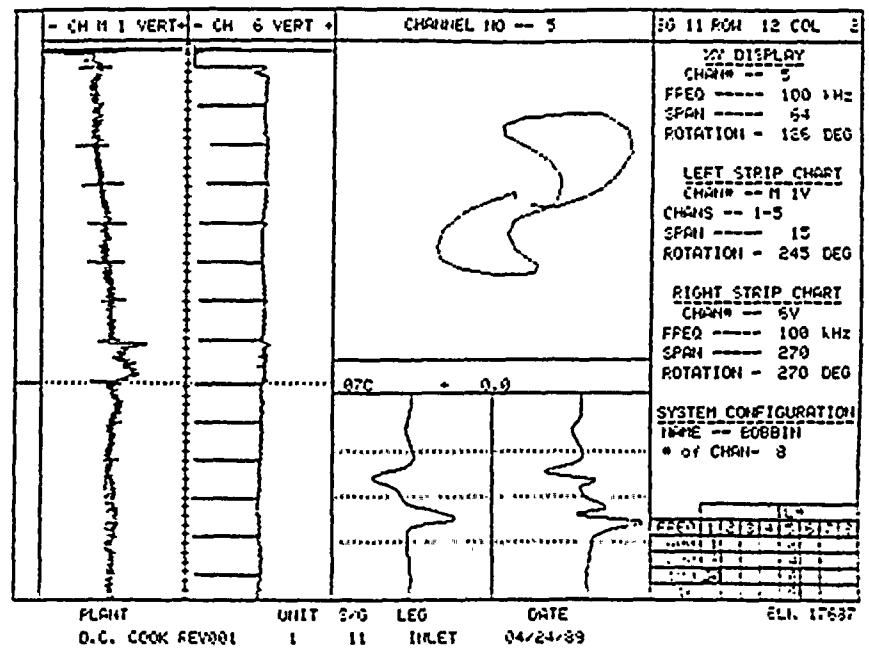


Cook Unit 1

SG No. 11, Tube R12C2, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figures 9 and 10 for additional channels).

Figure 8

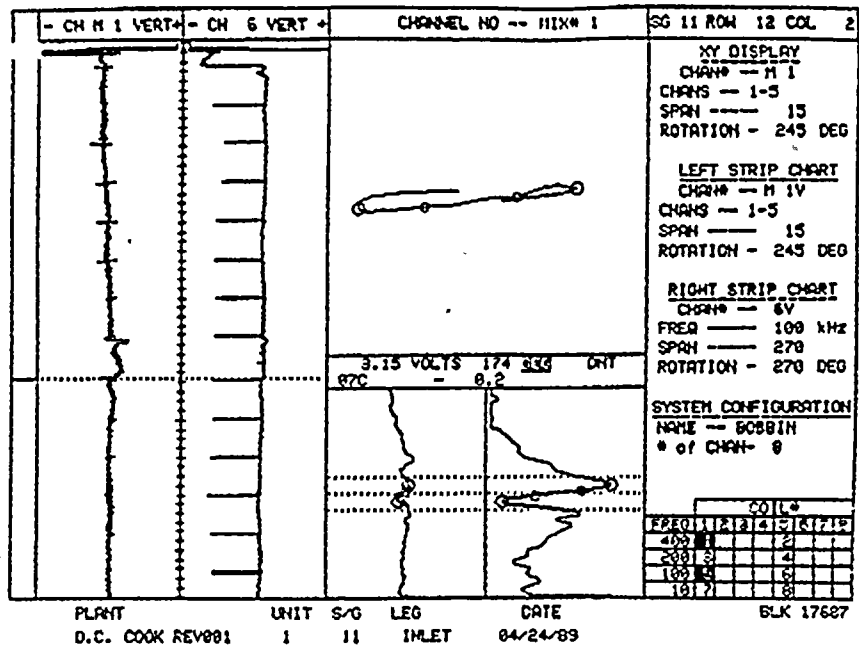


Cook Unit 1

SG No. 11, Tube R12C2, 7th cold leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figures 8 and 10 for additional channels).

Figure 9

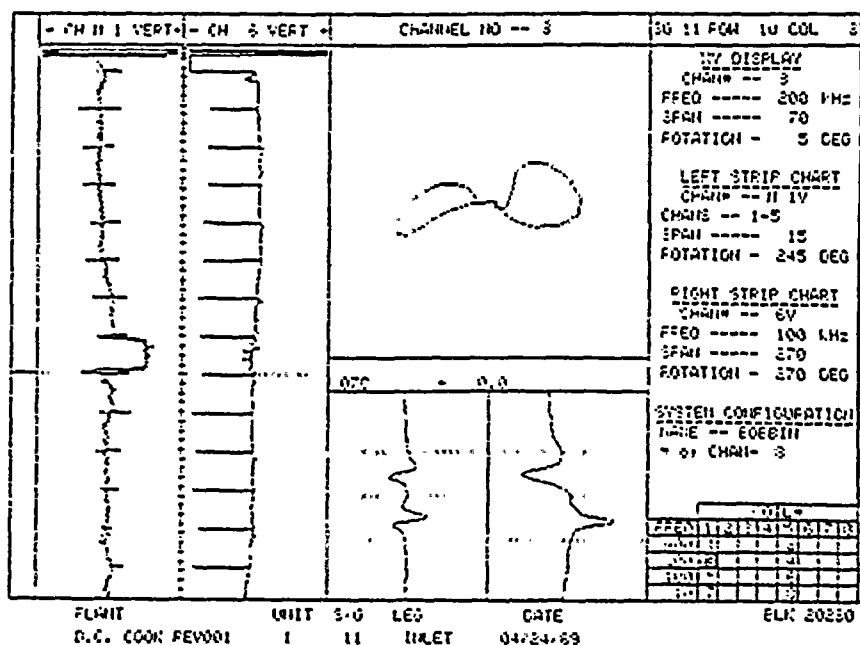
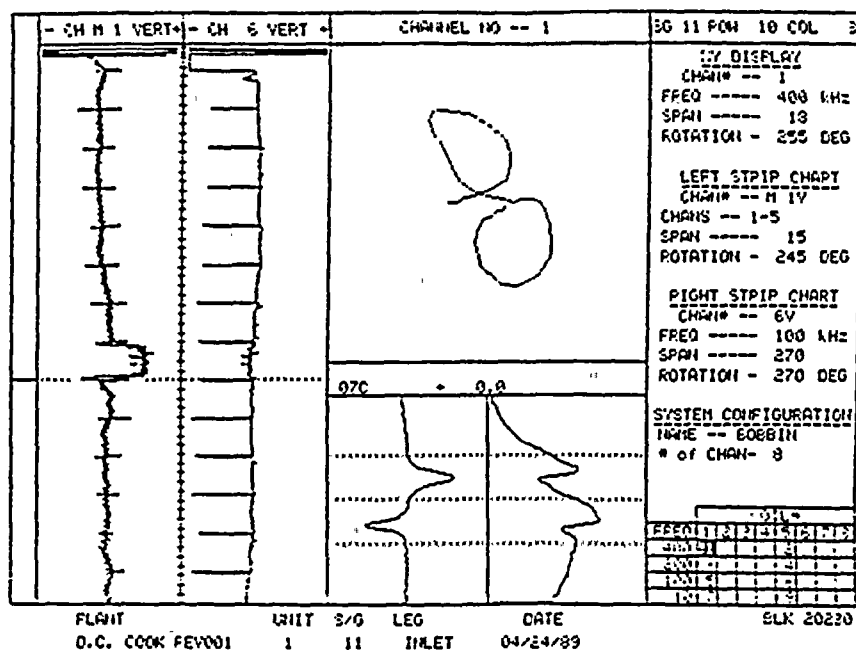


Cook Unit 1

SG No. 11, Tube R12C2, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400/100 kHz differential mix at -0.2 inches shown in display; see Figures 8 and 9 for additional channels).

Figure 10

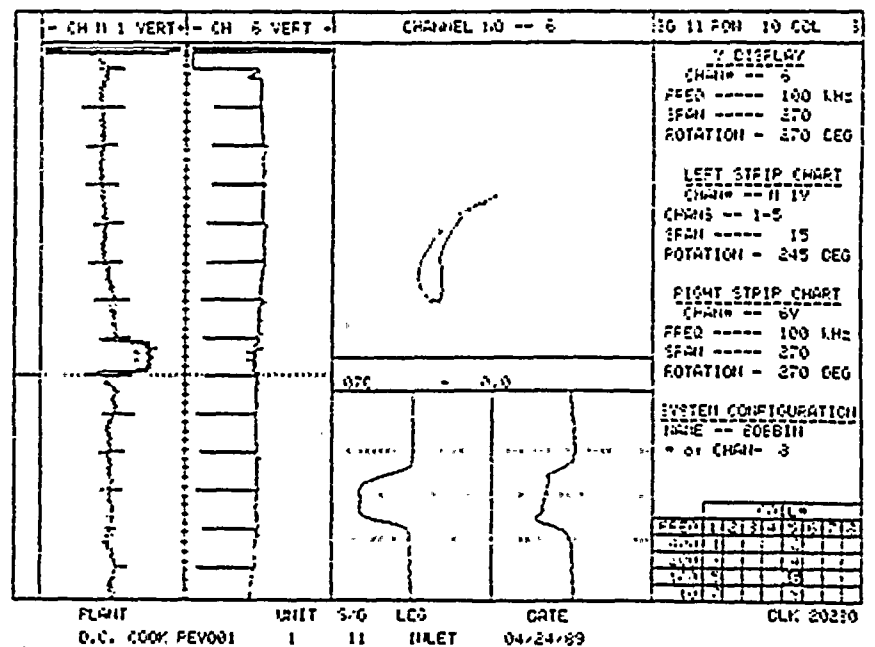
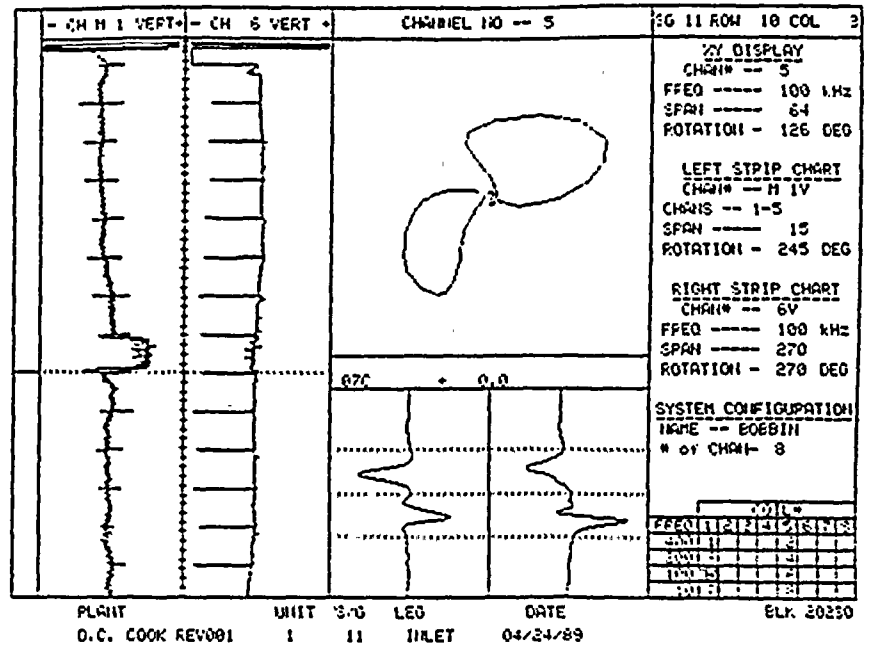


Cook Unit 1

SG No. 11, Tube R10C3, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figure 12 for additional channels).

Figure 11

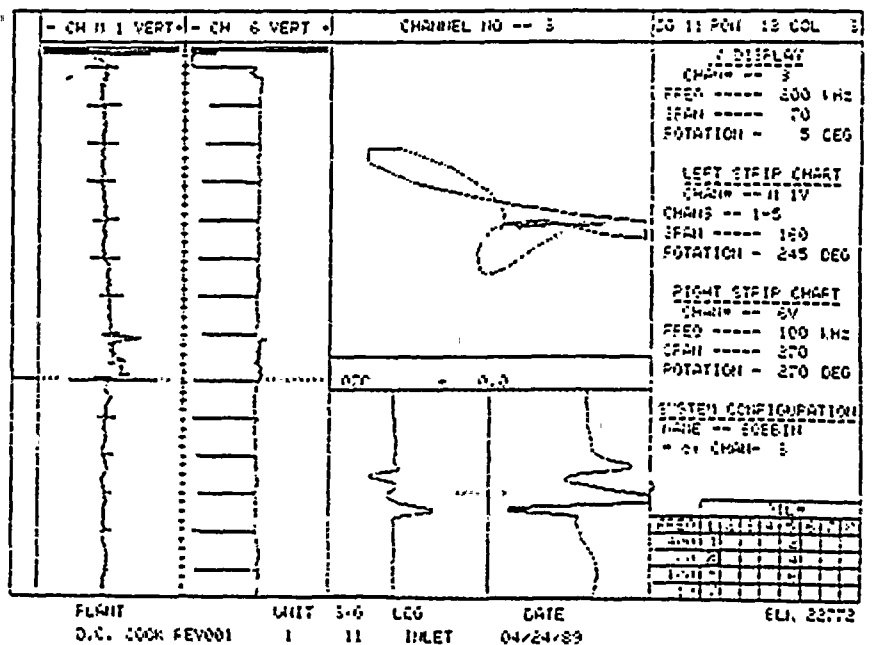
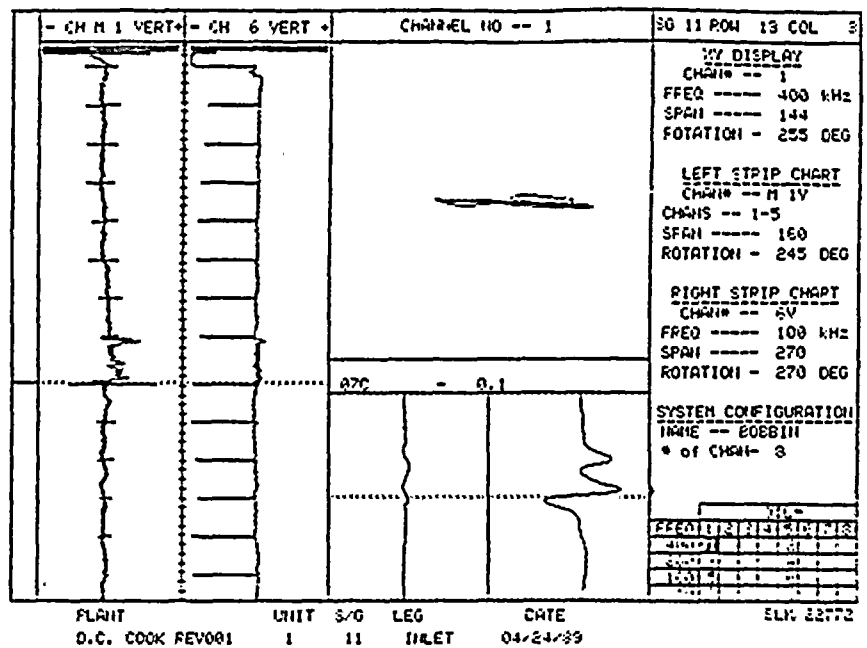


Cook Unit 1

SG No. 11, Tube R10C3, 7th cold leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figure 11 for additional channels).

Figure 12



Cook Unit 1

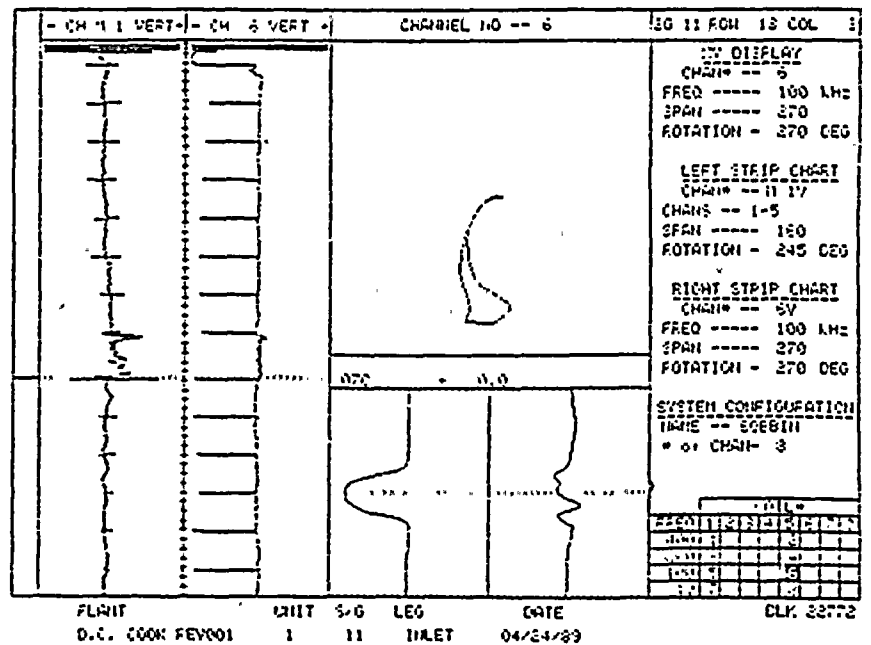
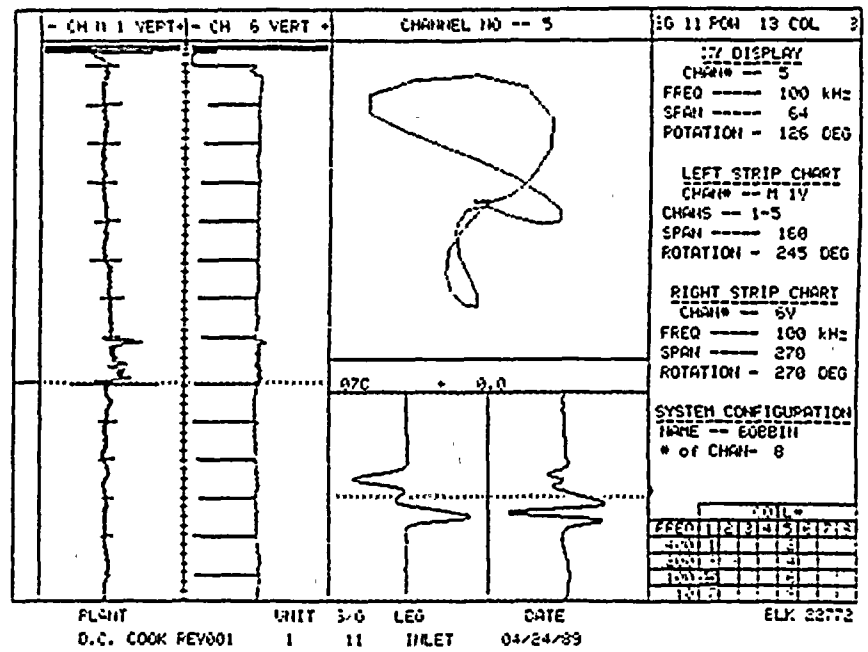
SG No. 11, Tube R13C3, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figure 14 and 15 for additional channels).

Figure 13





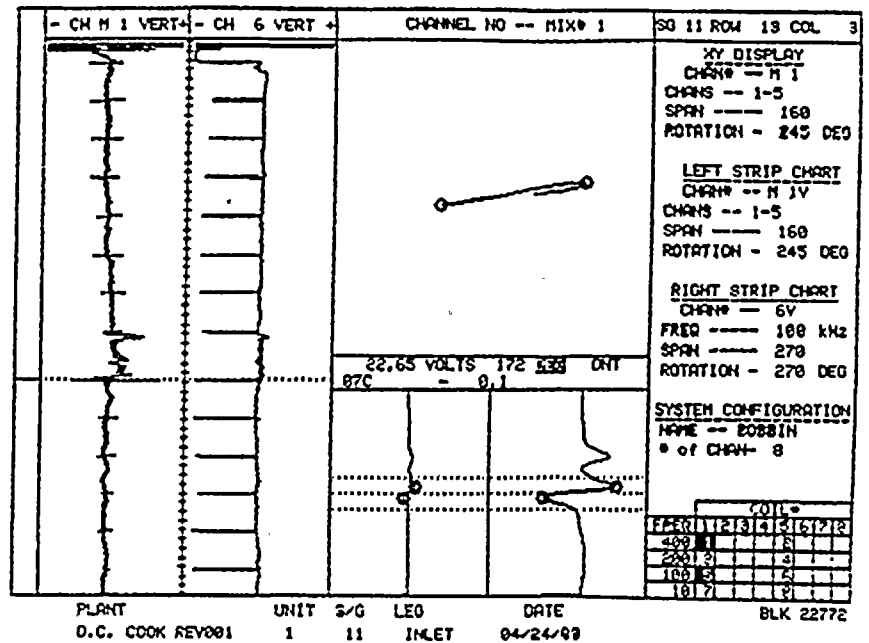


Cook Unit 1

SG No. 11, Tube R13C3, 7th cold leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figures 13 and 15 for additional channels).

Figure 14

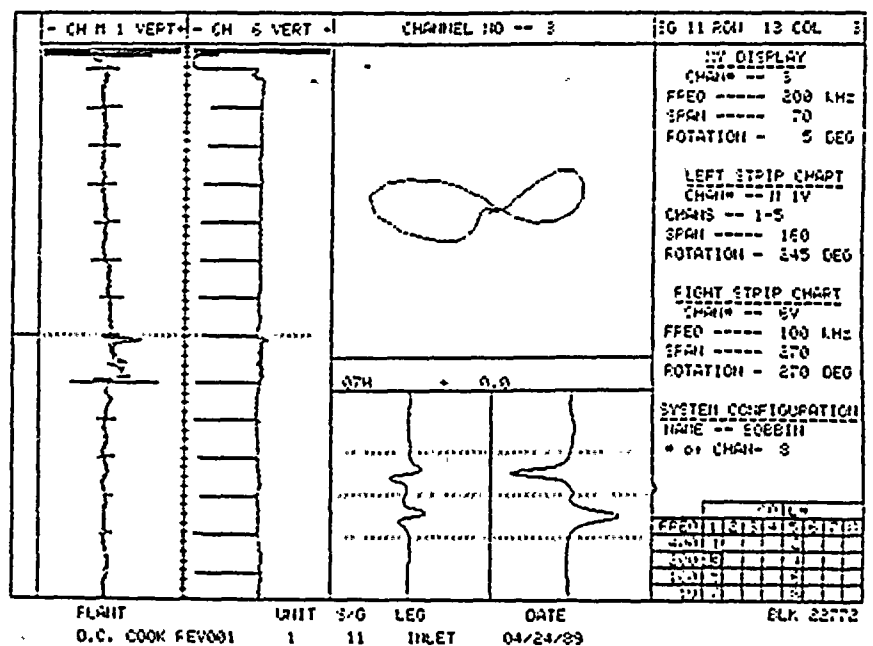
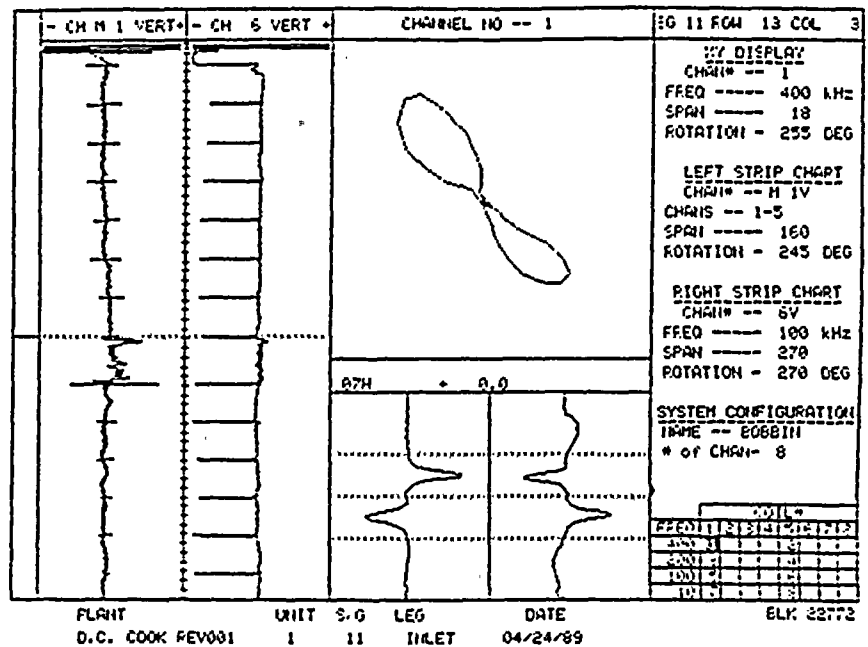


Cook Unit 1

SG No. 11, Tube R13C3, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential mix at -0.1 inches shown in display; see Figures 13 and 14 for additional channels).

Figure 15

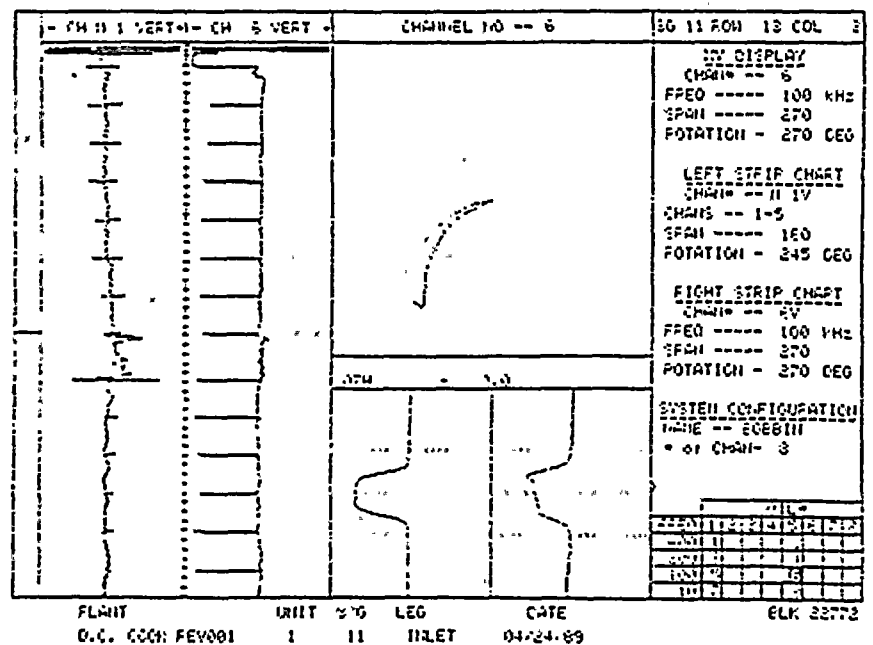
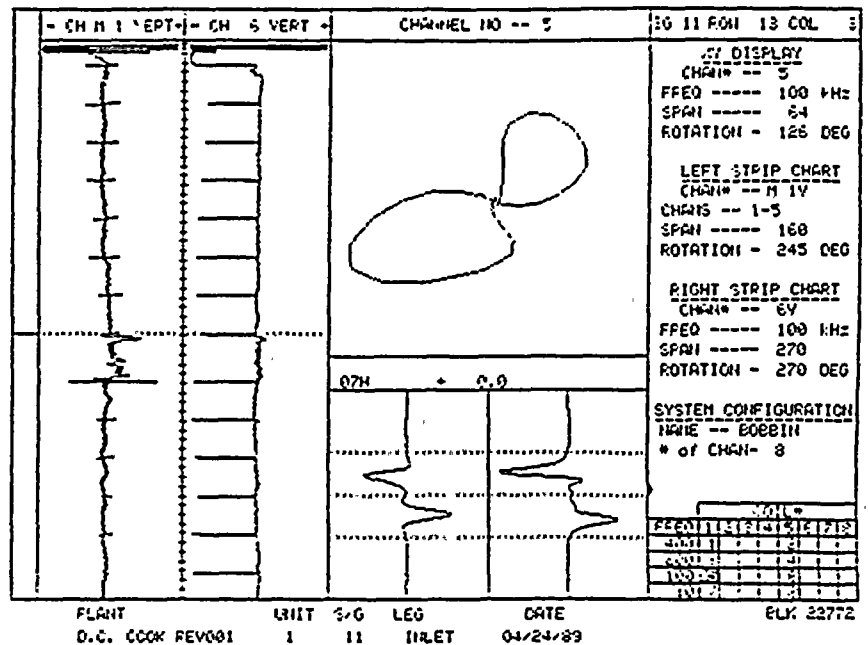


Cook Unit 1

SG No. 11, Tube R13C3, 7th hot leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figure 17 for additional channels).

Figure 16

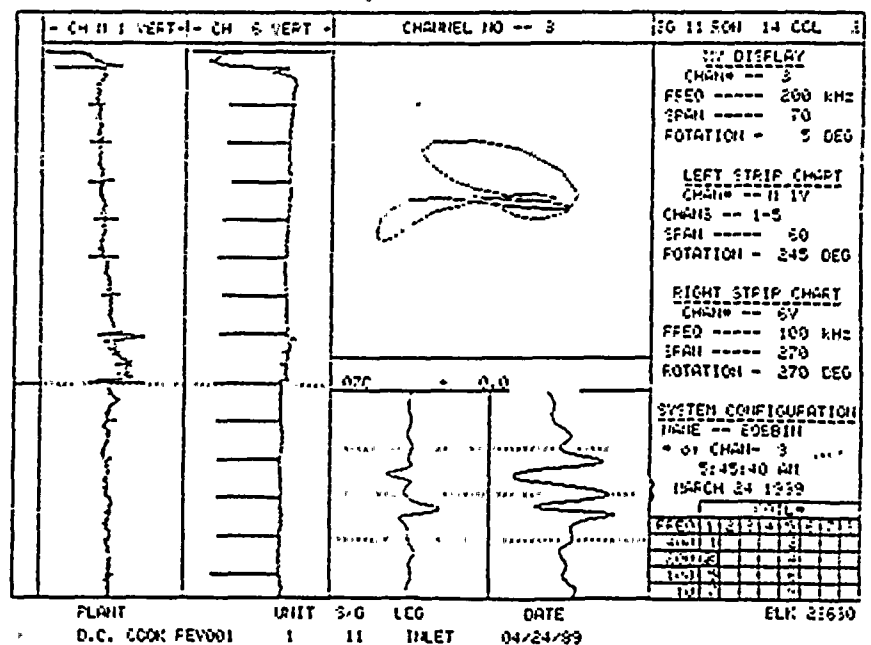
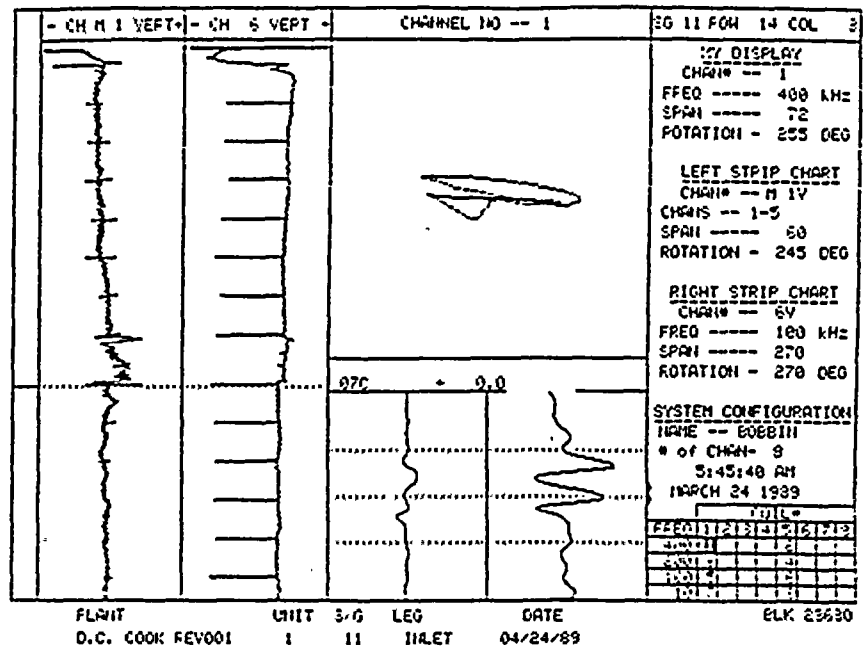


Cook Unit 1

SG No. 11, Tube R13C3, 7th hot leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figure 16 for additional channels).

Figure 17

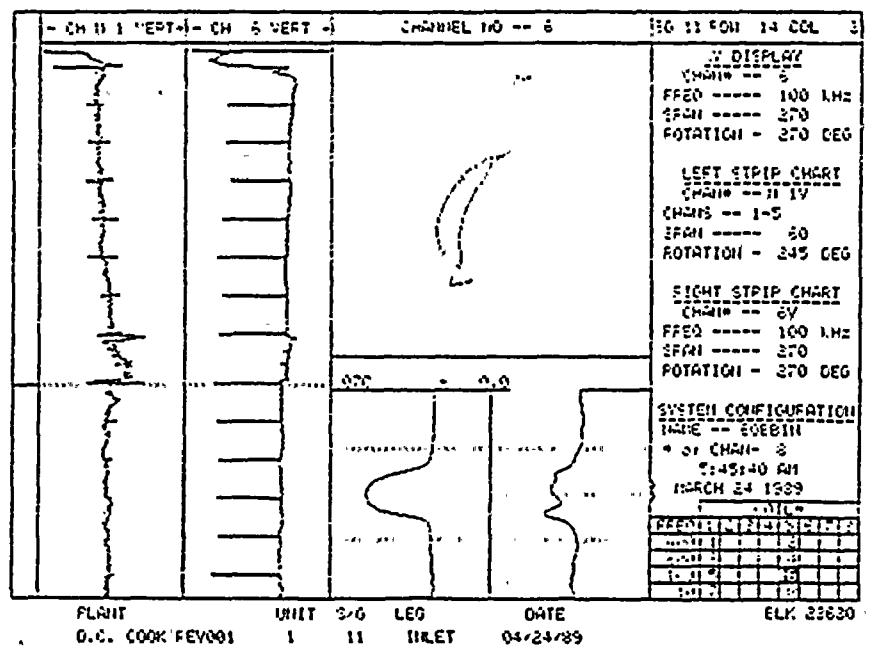
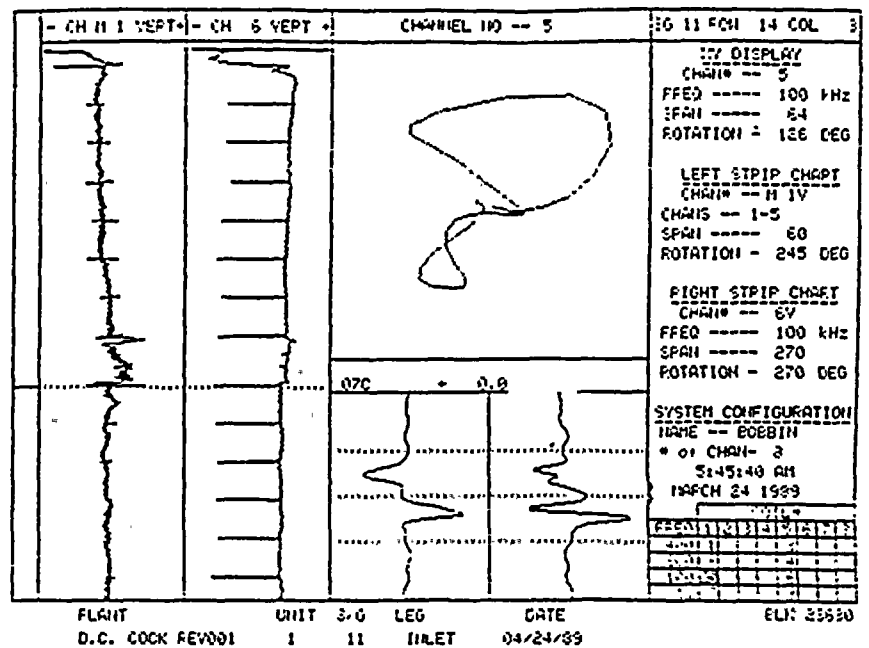


Cook Unit 1

SG No. 11, Tube R14C3, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figures 19 and 20 for additional channels).

Figure 18

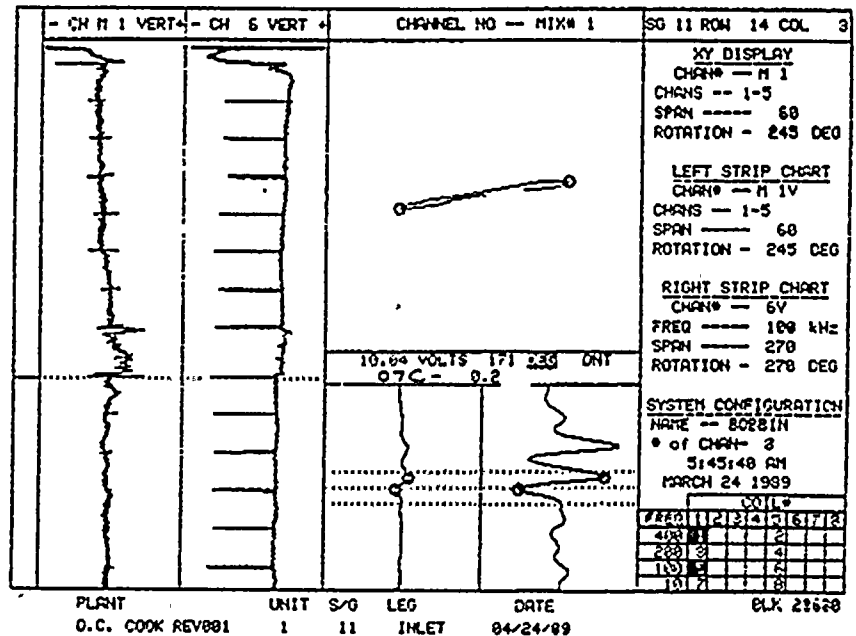
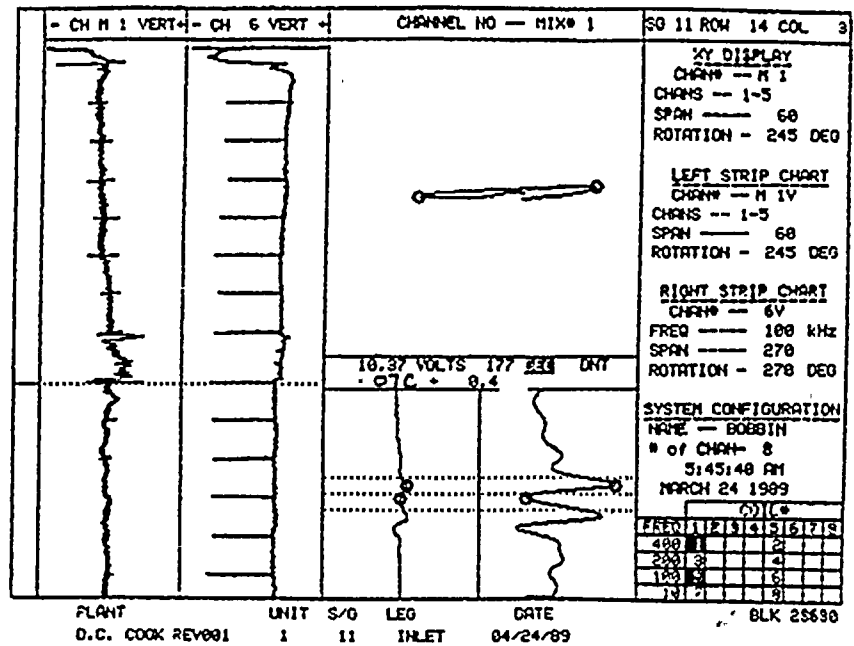


Cook Unit 1

SG No. 11, Tube R14C3, 7th cold leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figures 18 and 20 for additional channels).

Figure 19

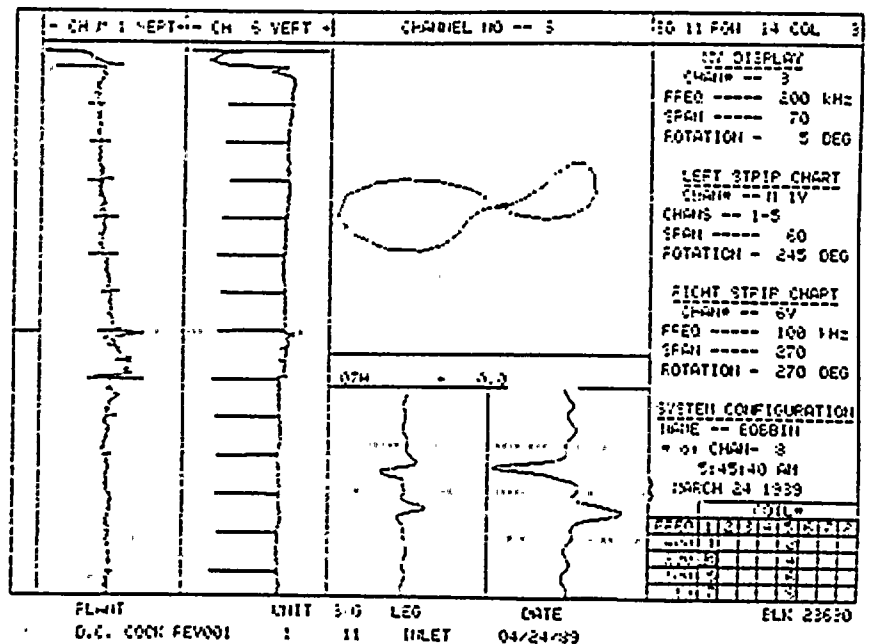
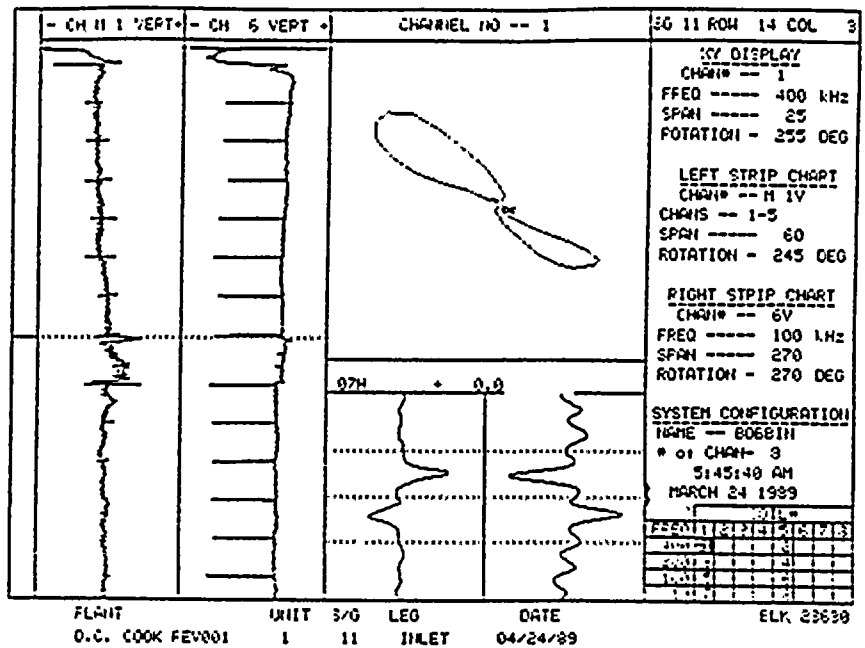


Cook Unit 1

SG No. 11, Tube R14C3, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential mix at +0.4 inches and -0.2 inches shown in top and bottom displays; see Figures 18 and 19 for additional channels).

Figure 20



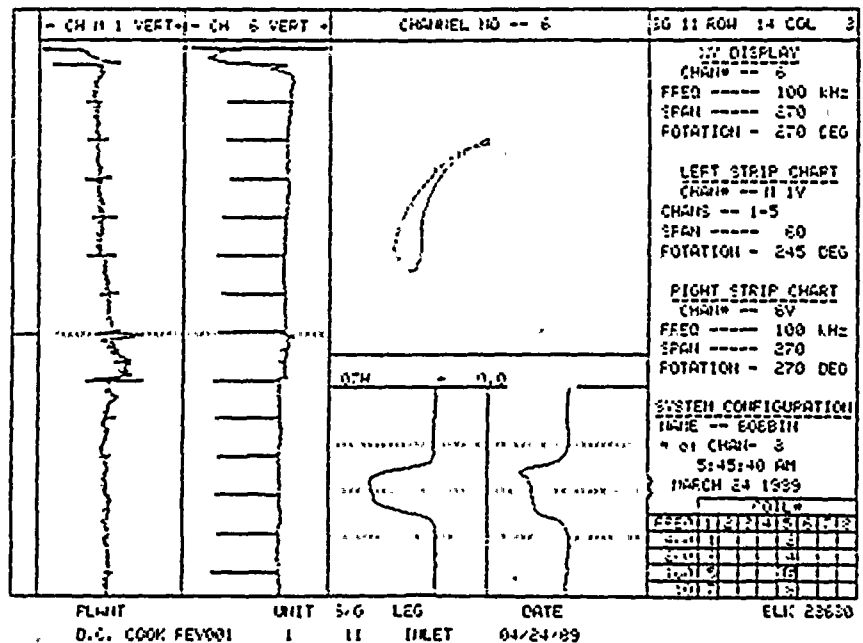
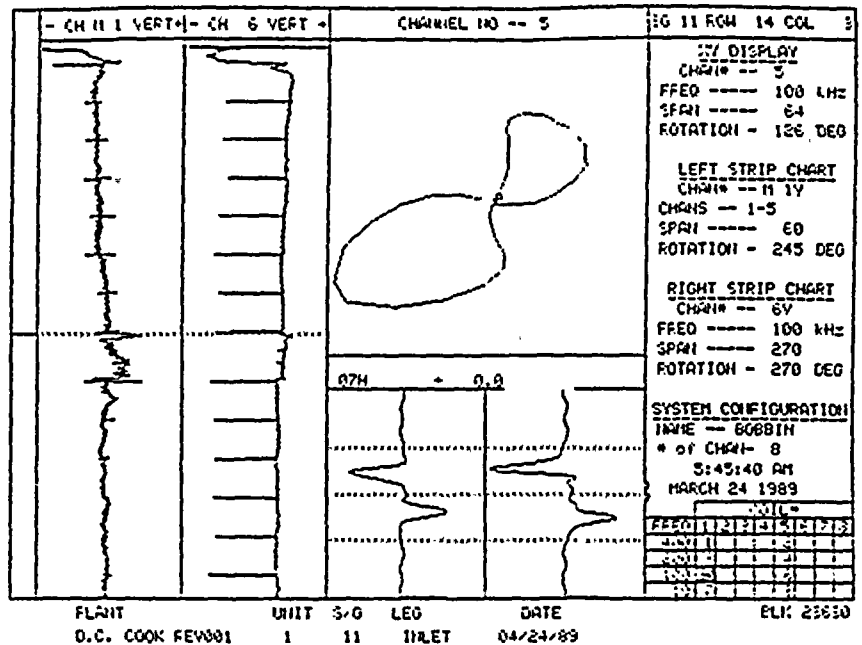
Cook Unit 1

SG No. 11, Tube R14C3, 7th hot leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figure 22 for additional channels).

Figure 21



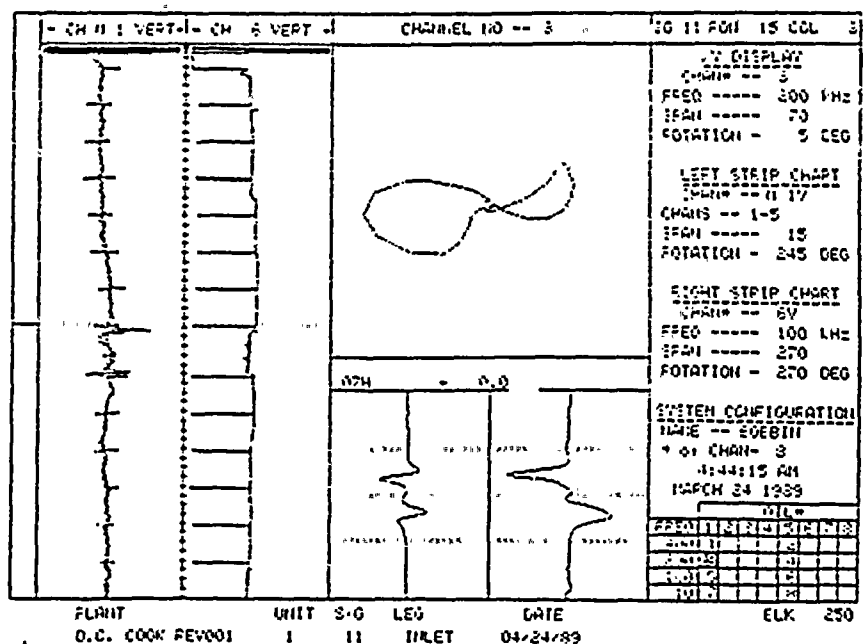
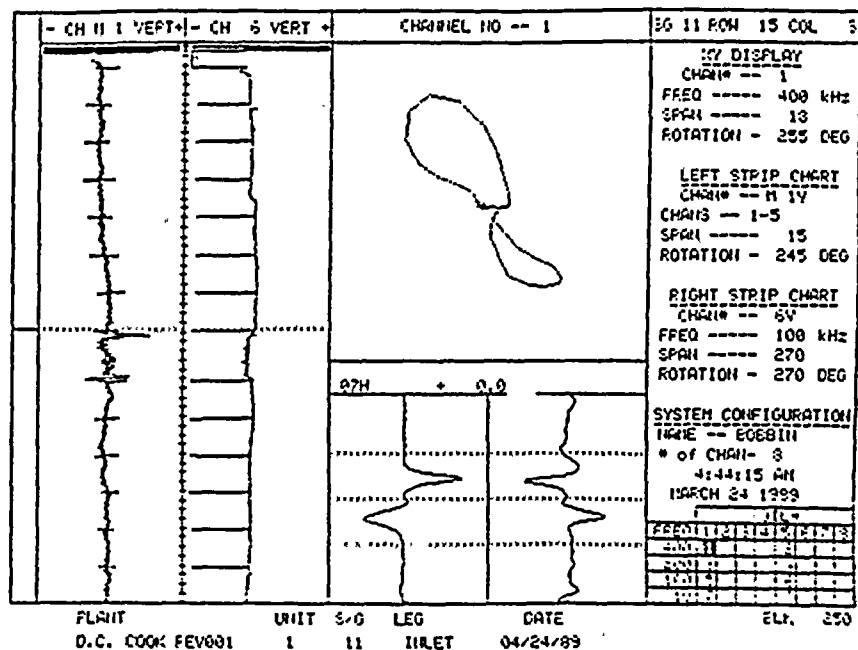


Cook Unit 1

SG No. 11, Tube R14C3, 7th hot leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figure 21 for additional channels).

Figure 22



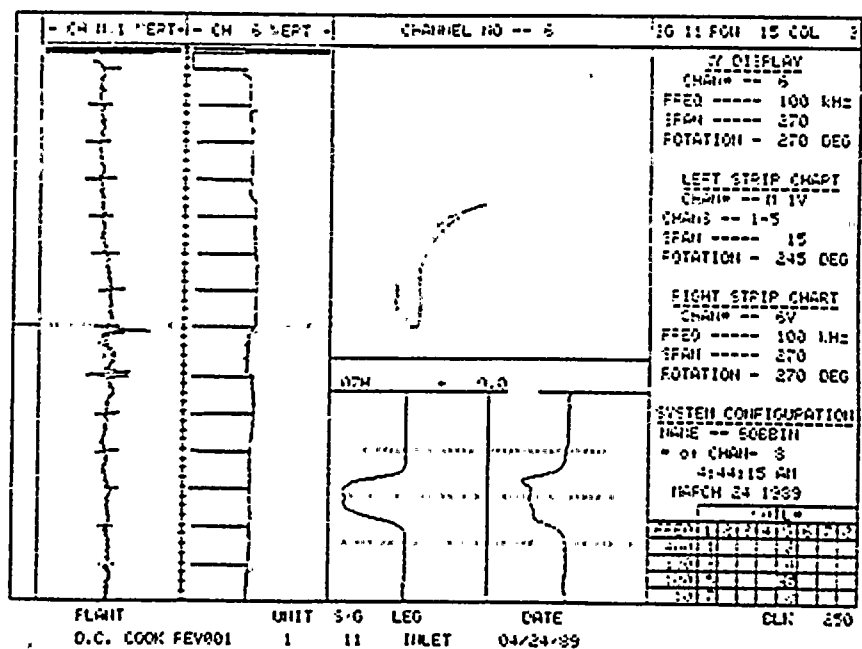
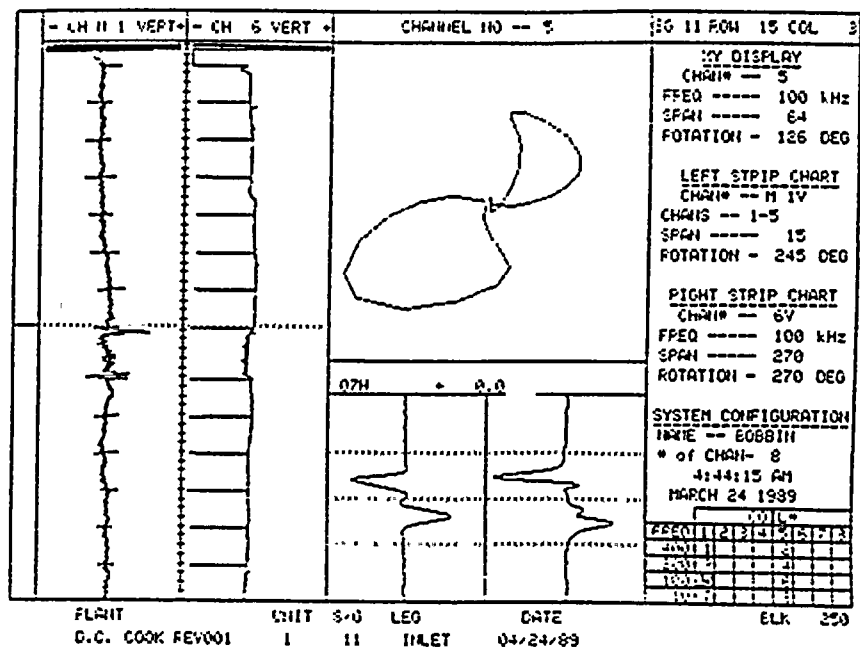
Cook Unit 1

SG No. 11, Tube R15C3, 7th hot leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figure 24 for additional channels).

Figure 23



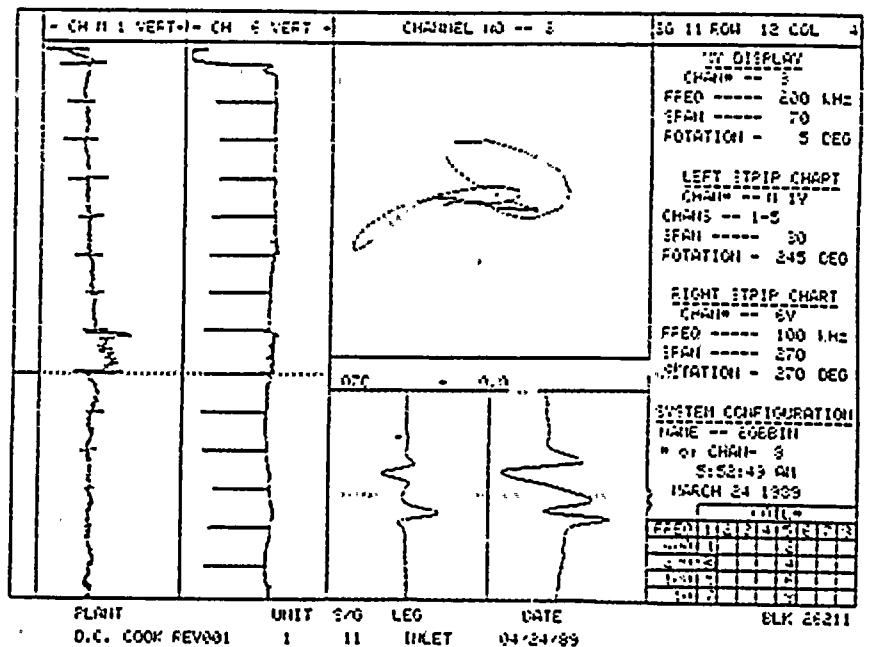
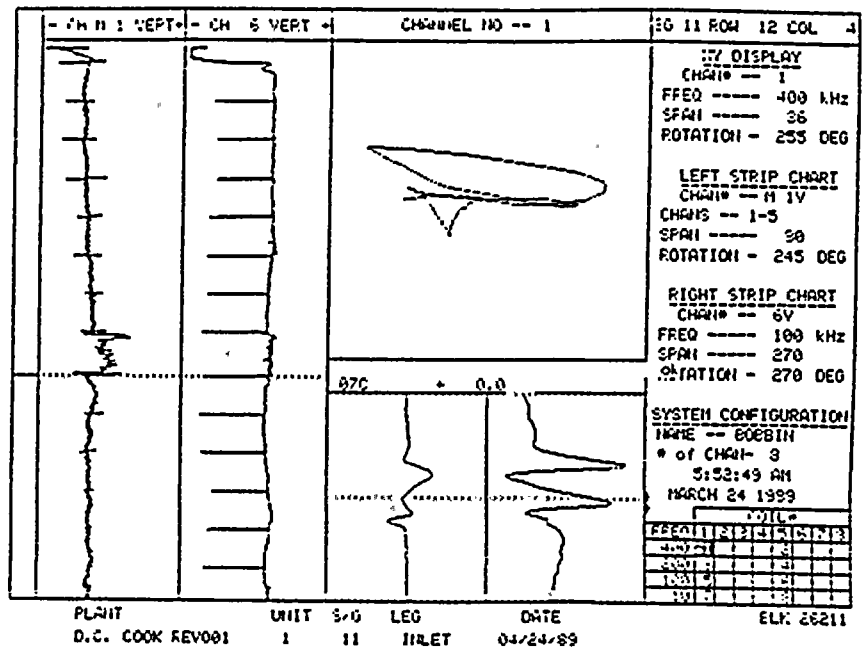


Cook Unit 1

SG No. 11, Tube R15C3, 7th hot leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figure 23 for additional channels).

Figure 24



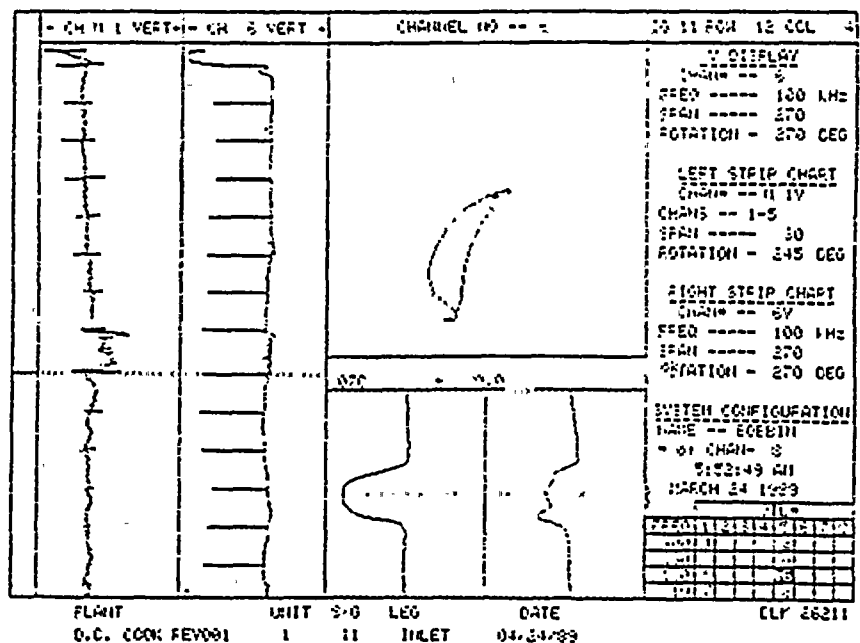
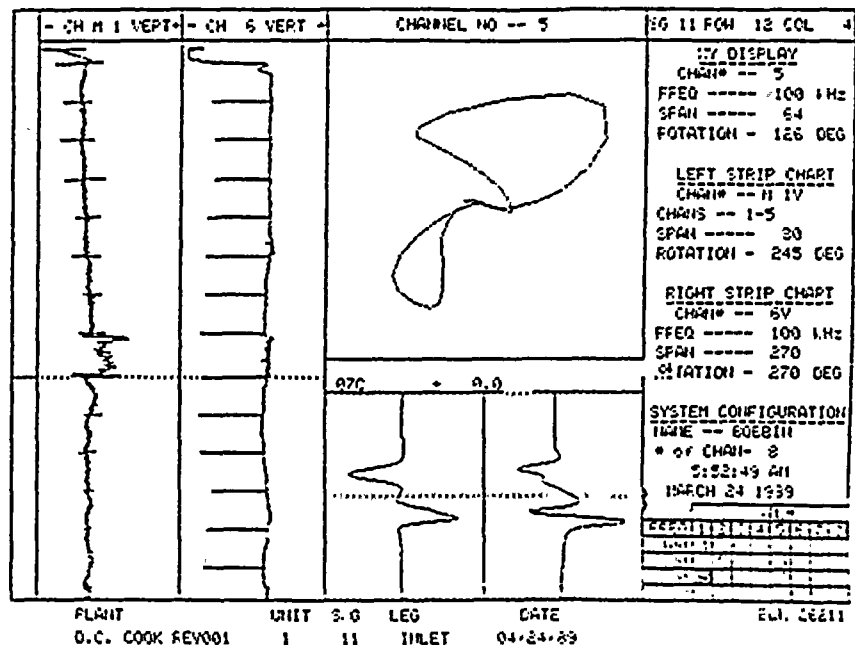
Cook Unit 1

SG No. 11, Tube R12C4, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figures 26 and 27 for additional channels).

Figure 25



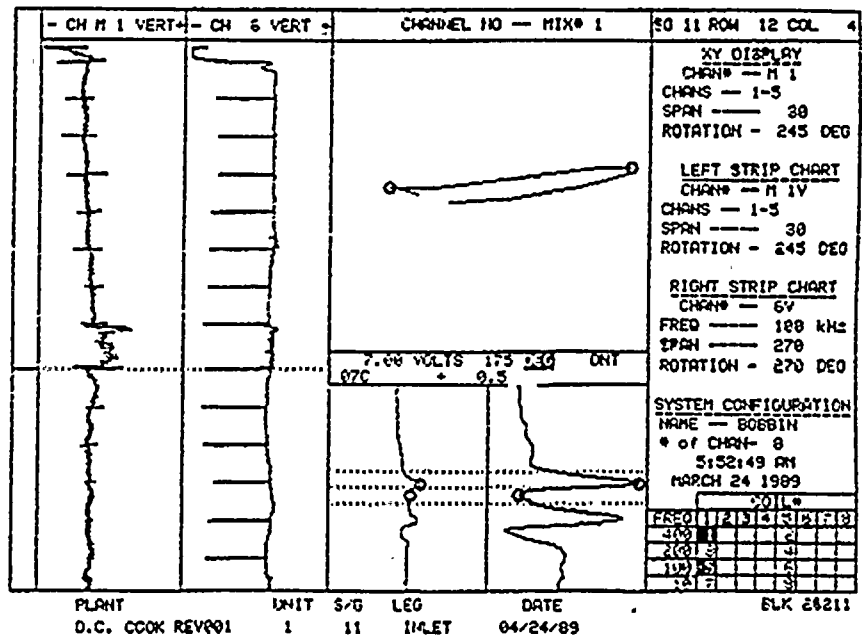
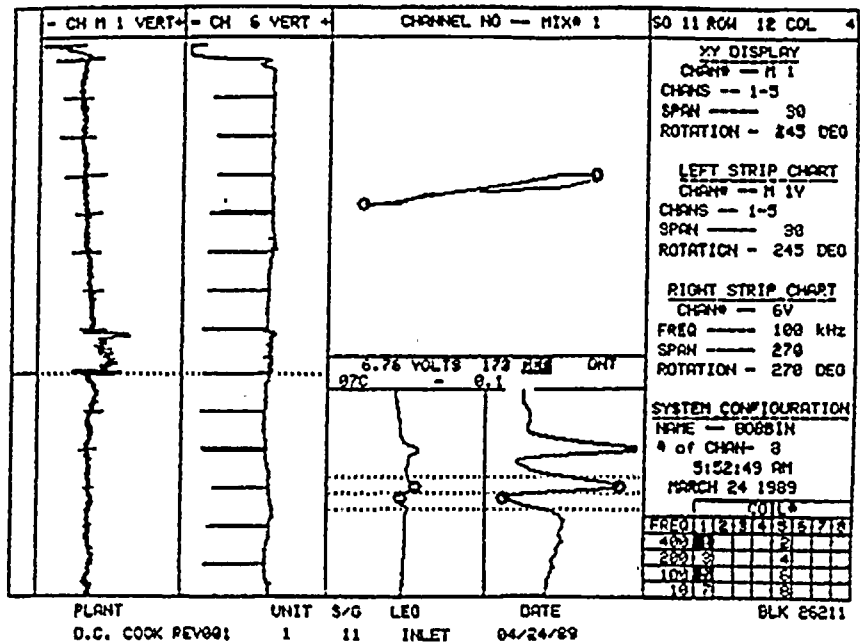


Cook Unit 1

SG No. 11, Tube R12C4, 7th cold leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figure 25 and 27 for additional channels).

Figure 26



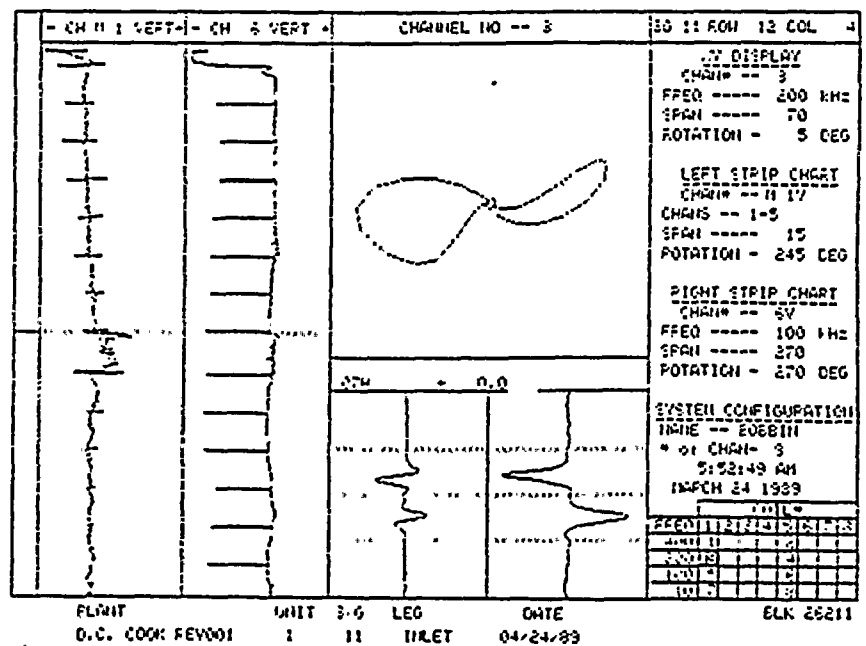
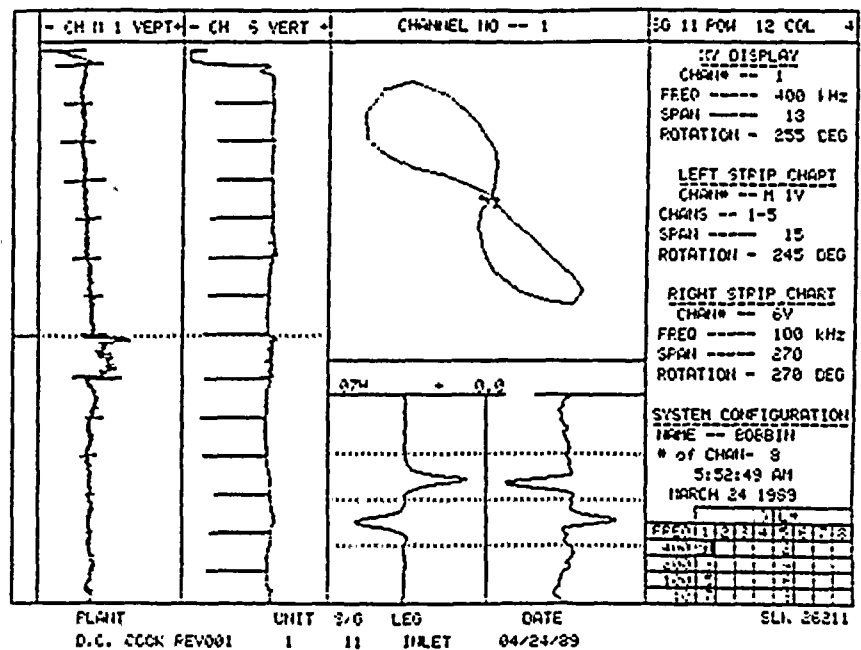
Cook Unit 1

SG No. 11, Tube R12C4, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential mix at -0.1 inches and +0.5 inches shown in top and bottom displays; see Figures 25 and 26 for additional channels).

Figure 27



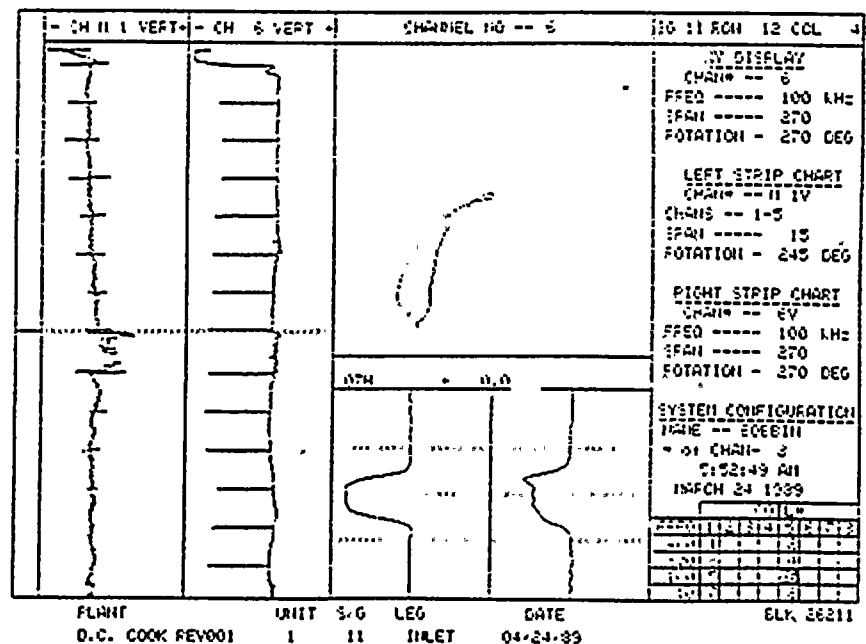
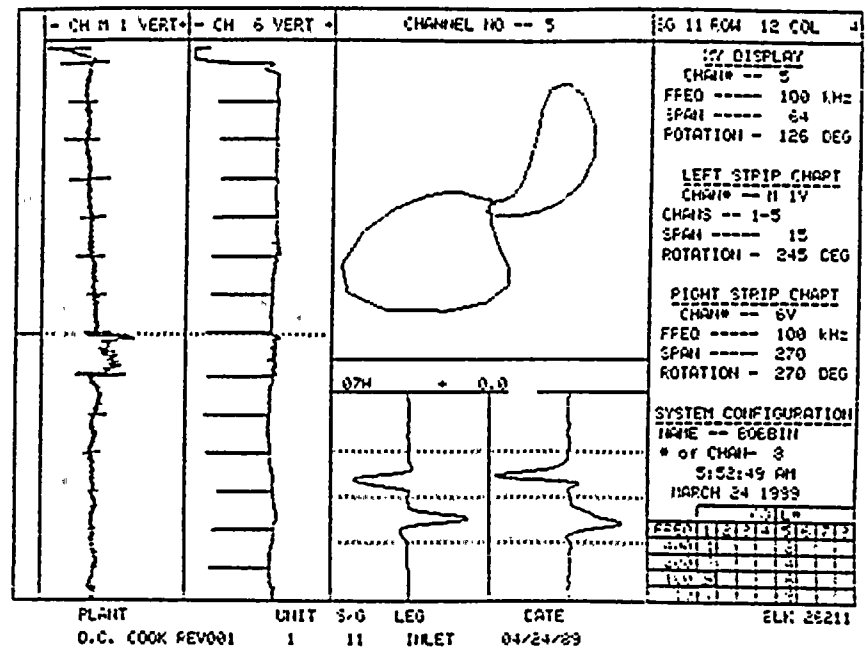


Cook Unit 1

SG No. 11, Tube R12C4, 7th hot leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figure 29 for additional channels).

Figure 28

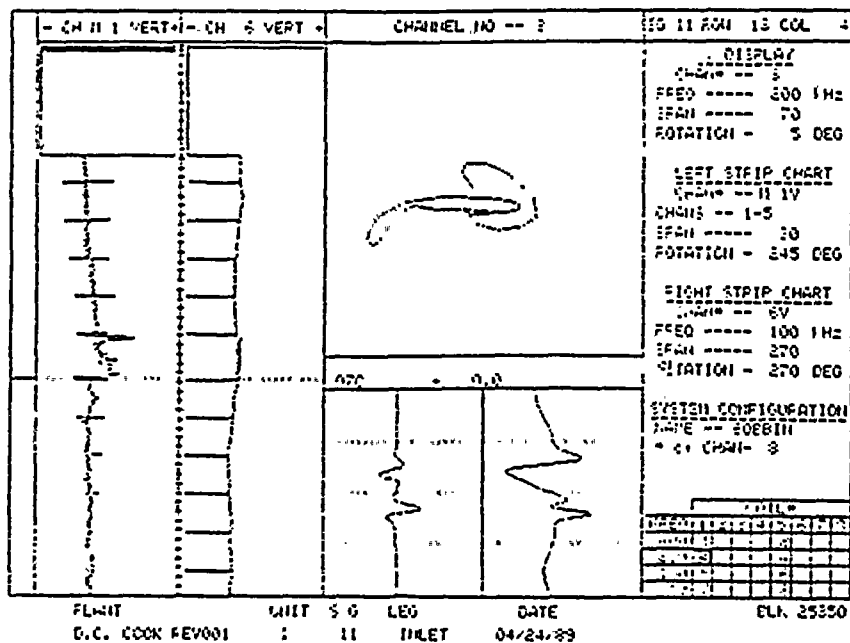
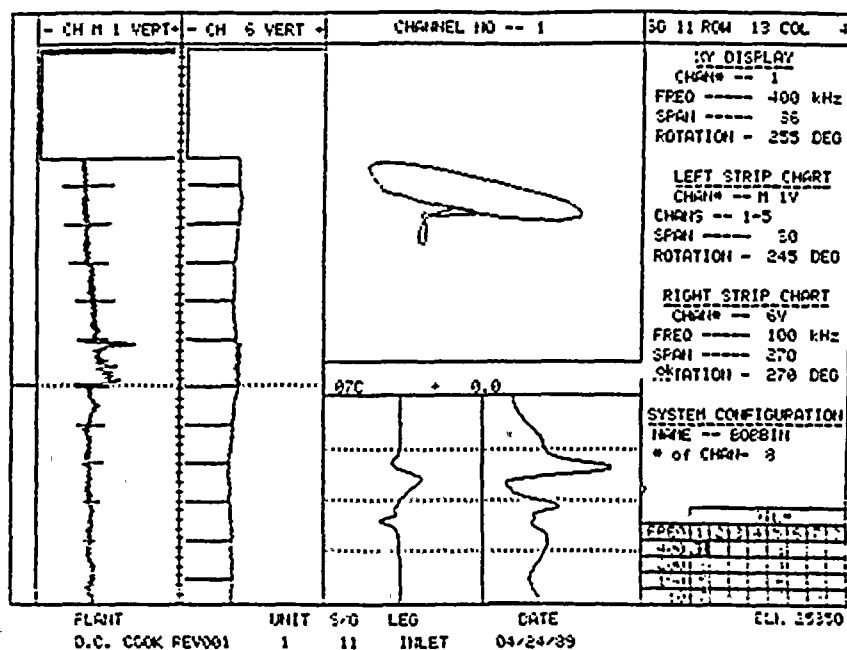


Cook Unit 1

SG No. 11, Tube R12C4, 7th hot leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figure 28 for additional channels).

Figure 29

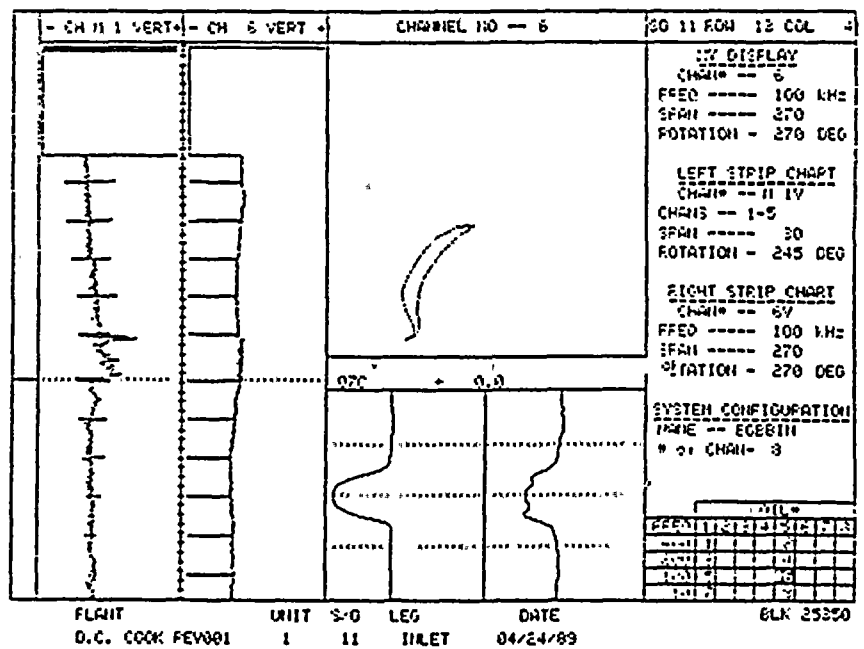
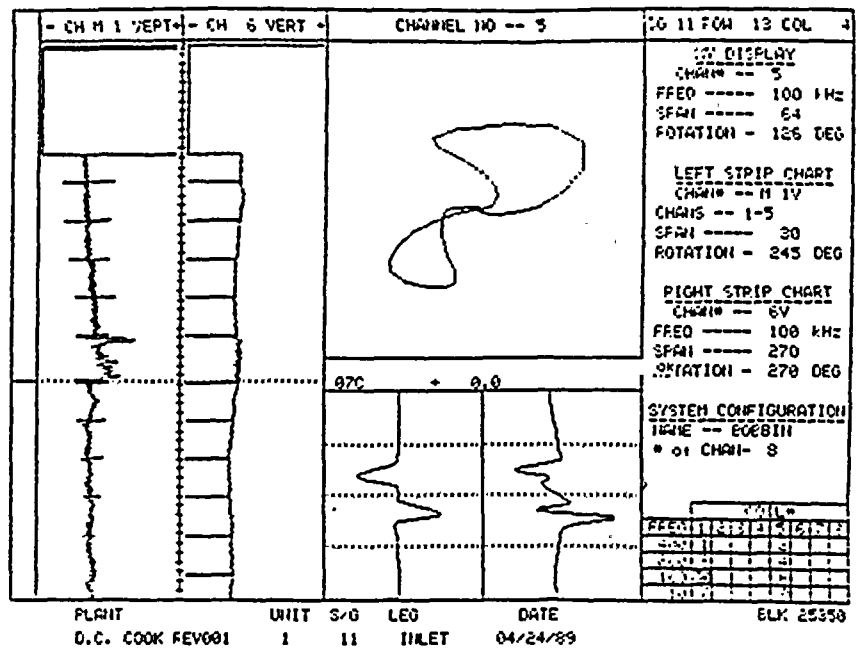


Cook Unit 1

SG No. 11, Tube R13C4, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figures 31 and 32 for additional channels).

Figure 30

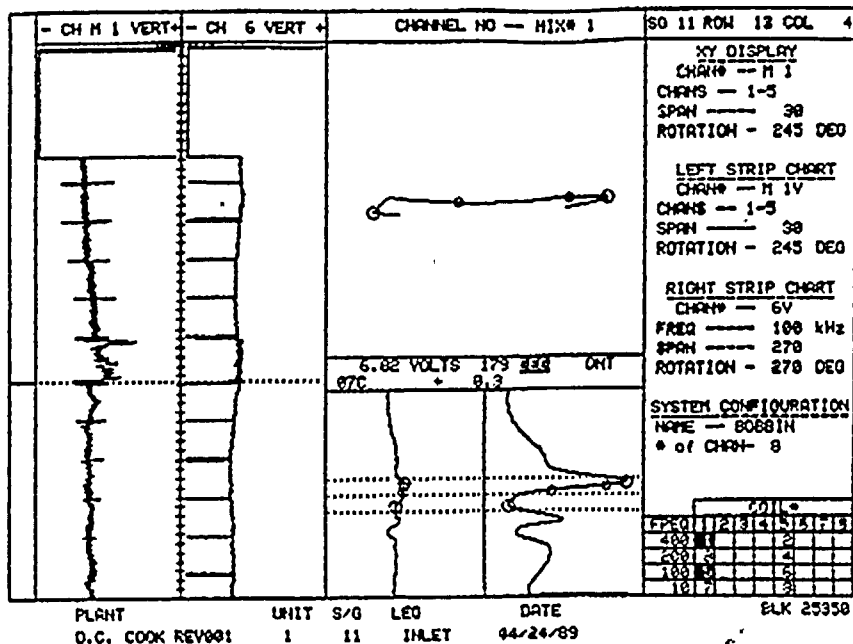


Cook Unit 1

SG No. 11, Tube R13C4, 7th cold leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figures 30 and 32 for additional channels).

Figure 31

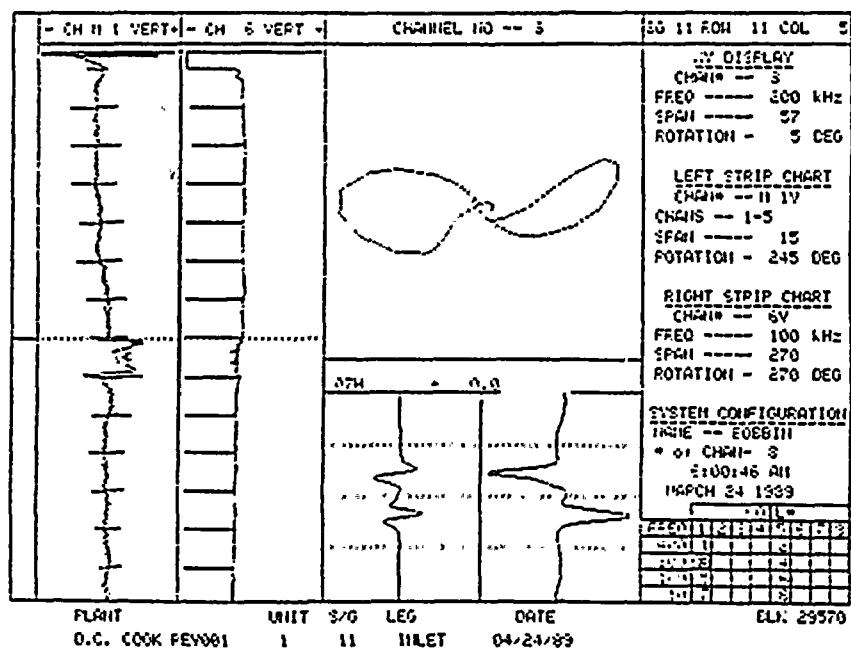
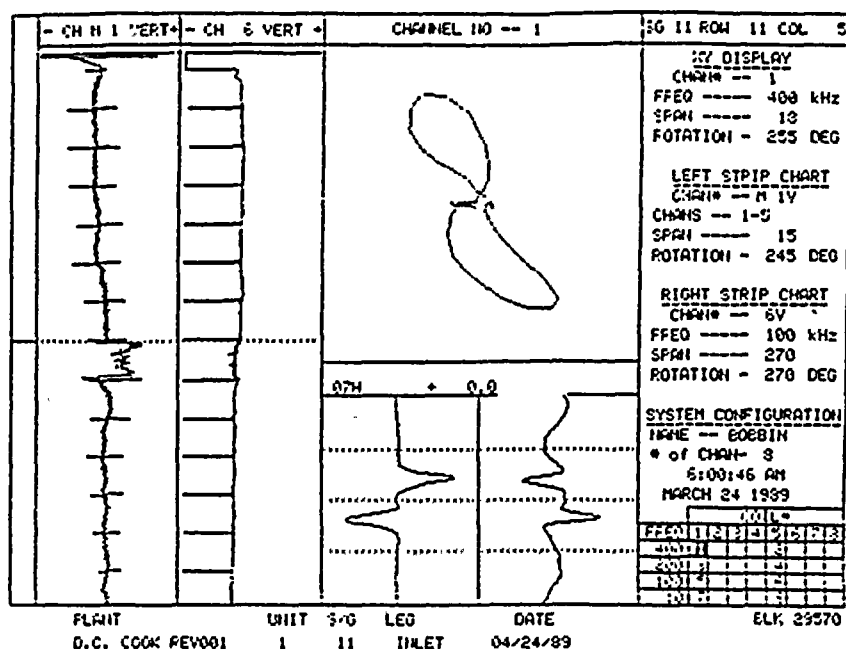


Cook Unit 1

SG No. 11, Tube R13C4, 7th cold leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential mix at +0.3 inches shown in display; see Figures 30 and 31 for additional channels).

Figure 32

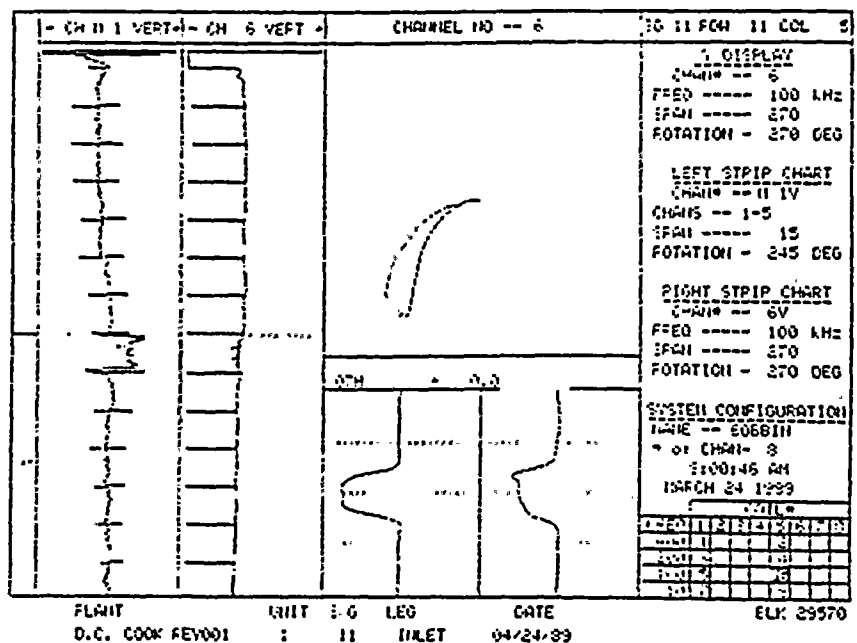
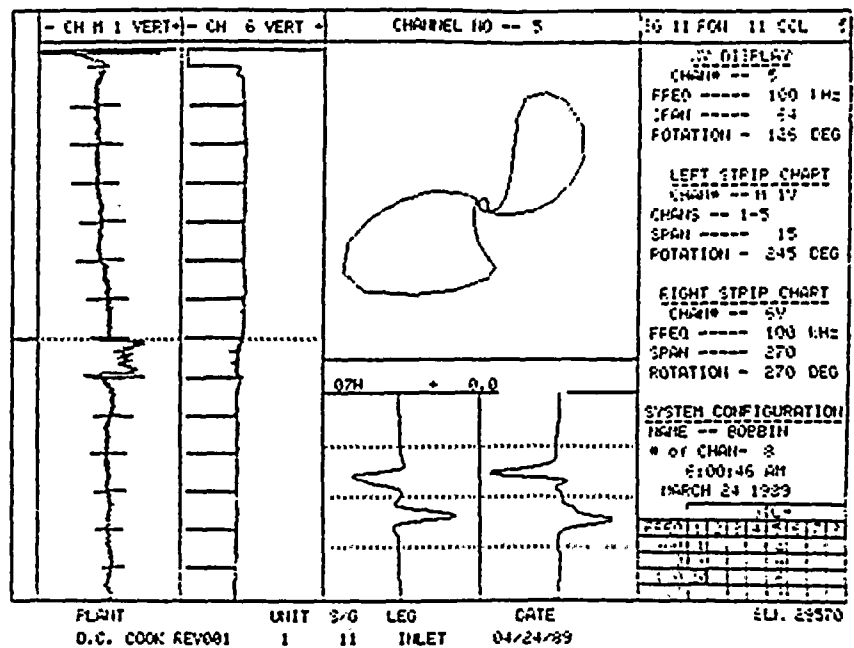


Cook Unit 1

SG No. 11, Tube R11C5, 7th hot leg support

Representative "anomalous" signal at support plate intersection (400 kHz differential and 200 kHz differential shown in top and bottom displays; see Figure 34 for additional channels).

Figure 33



Cook Unit 1

SG No. 11, Tube R11C5, 7th hot leg support

Representative "anomalous" signal at support plate intersection (100 kHz differential and 100 kHz absolute shown in top and bottom displays; see Figure 33 for additional channels).

Figure 34