5"

Schlumberger

COMPENSATED NEUTRON-FORMATION DENSITY

COUNTY MORROW
FIELD WILDCAT
LOCATION 1766'S AND 1414'W
WELL "ARCO HANNA" 1
COMPANY ARCO OIL AND GAS

COMPANY	ARCO OIL AND GAS			
WELL	"ARCO HANNA" 1			
FIELD	WILDCAT			
COUNTY	MORROW	STATE	OREGON	
LOCATION	1766'S AND 1414'W FROM NE CORNER			Other Services: DIL BHC GR FDC CNL GR SHOT
API SERIAL NO.	SECT. 23	TWP. 2S	RANGE 27E	

Permanent Datum	GL	Elev.	3199.6 F	Elev.: K.B 3225.6 F
Log Measured From	KB	26.0 F	above Perm. Datum	D.F 3224.6 F
Drilling Measured From	KB			G.L. 3199.6 F

Date	03-AUG-88			
Run No.	1			
Depth Driller	7331.0 F			
Depth Logger (Schl.)	7244.0 F			
Btm. Log Interval	7241.0 F			
Top Log Interval	1898.0 F			
Casing-Driller	16 @1898.0 F	@	@	
Casing-Logger	1898.0 F			
Bit Size	13 3/8			
Type Fluid in Hole	DRISPAC			
Dens. | Visc.	9.40 LB/G	48.0 S		
pH | Fld. Loss	10.0	6.1 C3		
Source of Sample	CIRCULATED			
Rm @ Meas. Temp.	7.480 OHMM @ 79.0 DEGF		@	
Rmf @ Meas. Temp.	4.010 OHMM @ 73.0 DEGF		@	
Rmc @ Meas. Temp.	3.030 OHMM @ 72.0 DEGF		@	
Source: Rmf | Rmc	MEASURED	MEASURED		
Rm @ BHT	3.723 OHMM @ 166. DEGF		@	
TIME Circulation Ended	07:00 4 AUG			
TIME Logger on Bottom	19:34 4 AUG			
Max. Rec. Temp.	166. DEGF			
Equip. | Location	8804	SACRAMENTO		
Recorded By	DAVID ROTHERS			
Witnessed By	FRANK MARTIN JR.			

The well name, location and borehole reference data were furnished by the customer

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretations made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

Schlumberger

COMPENSATE FORMATION

COUNTY MORROW
FIELD WILDCAT
LOCATION 1766'S AND 1414'W
WELL "ARCO HANNA" #1
COMPANY ARCO OIL AND GAS

COMPANY	ARCO OIL AND GAS		
WELL	"ARCO HANNA" #1		
FIELD	WILDCAT		
COUNTY	MORROW	STA	
LOCATION	1766'S AND 1414'W FROM NE CORNER		
API SERIAL NO.	049-00002	SECT. 23	TWP. 2S

Permanent Datum	GL	Elev.	3199.6 F	
Log Measured From	KB	26.0 F	above Pe	
Drilling Measured From	KB			

Date	24-AUG-88		
Run No.	2		
Depth Driller	9211.0 F		
Depth Logger (Schl.)	9213.0 F		
Btm. Log Interval	9210.0 F		
Top Log Interval	7276.0 F		
Casing-Driller	13 3/8" @7285.0 F	@	
Casing-Logger	7276.0 F		
Bit Size	12 1/4"		
Type Fluid in Hole	POLYACRYLAMIDE		
Dens. | Visc.	8.70 LB/G	42.0 S	
pH | Fld. Loss	10.7	8.2 C3	
Source of Sample	FLOWLINE		
Rm @ Meas. Temp.	2.180 OHMM @ 83.0 DEGF		
Rmf @ Meas. Temp.	2.610 OHMM @ 73.0 DEGF		
Rmc @ Meas. Temp.	1.830 OHMM @ 73.0 DEGF		
Source: Rmf | Rmc	MEASURED	MEASURED	
Rm @ BHT	1.084 OHMM @ 180. DEGF		
TIME Circulation Ended	08:50 8-24		
TIME Logger on Bottom	18:26 8-24		
Max. Rec. Temp.	180. DEGF		
Equip. | Location	8804	SACRAMENTO	
Recorded By	SCOTT PILCH		
Witnessed By	MARC KAMERLING		

D NEUTRON-
DENSITY

TE OREGON

Other Services:
DIL-BHC-GR

RANGE
27E

m. Datum

Elev.: K.B.3326.8 F
D.F.3324.6 F
G.L.3106.6 F

The well name, location and borehole reference data were furnished by the customer.

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Run No.	1		
Service Order No.	527488		
Drilling Fluid Level	0.0 F		
Salinity	50.0 PPM		
Rmf @ BHT	1.864 OHMM	● 166. DEGF	●
Rmc @ BHT	1.384 OHMM	● 166. DEGF	●
Logging Speed	1800.0 F/HR		
EQUIPMENT DATA			
Tool Number 1	PGS 86		
Tool Number 2	CNC 2359		
Tool Number 3	SGC 581		
Tool Number 4	NLM 418		
Tool Number 5			
Tool Number 6			
Tool Number 7			
Tool Number 8			
Tool Number 9			
Tool Number 10			
Tool Number 11			
Tool Number 12			

REMARKS:

Run No.	2		
Service Order No.	527575		
Drilling Fluid Level	0.0 F		
Salinity	3000.0 PPM		
Rmf @ BHT	1.77 OHMM	● 180 DEGF	●
Rmc @ BHT	.826 OHMM	● 180 DEGF	●
Logging Speed	1800.0 F/HR		
EQUIPMENT DATA			
Tool Number 1	PGS-HB 86		
Tool Number 2	CNC-A 2359		
Tool Number 3	SGC-JC 581		
Tool Number 4	PGC-JA 433		
Tool Number 5	NLM-BC 418		
Tool Number 6			
Tool Number 7			
Tool Number 8			
Tool Number 9			
Tool Number 10			
Tool Number 11			
Tool Number 12			

REMARKS:

MAXIMUM RECORDING THERMOMETERS: T1=180, T2=180

CNL BOWSPRING USED

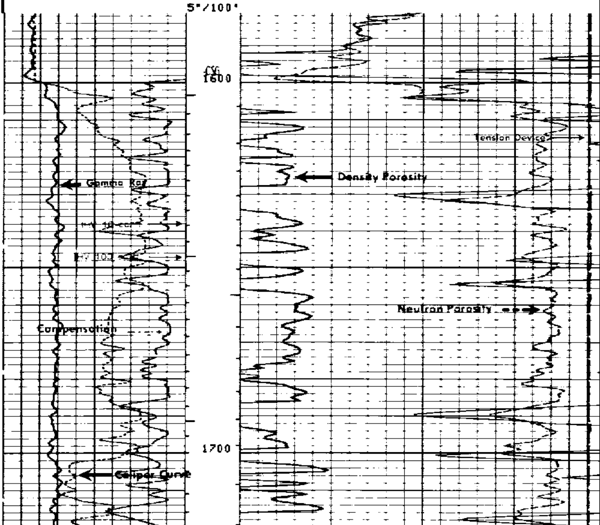
```
EVENT MARK SUMMARY:

OUTPUT  INTERVAL        DEPTH TRACK
        BETWEEN PIPS    EDGE
```

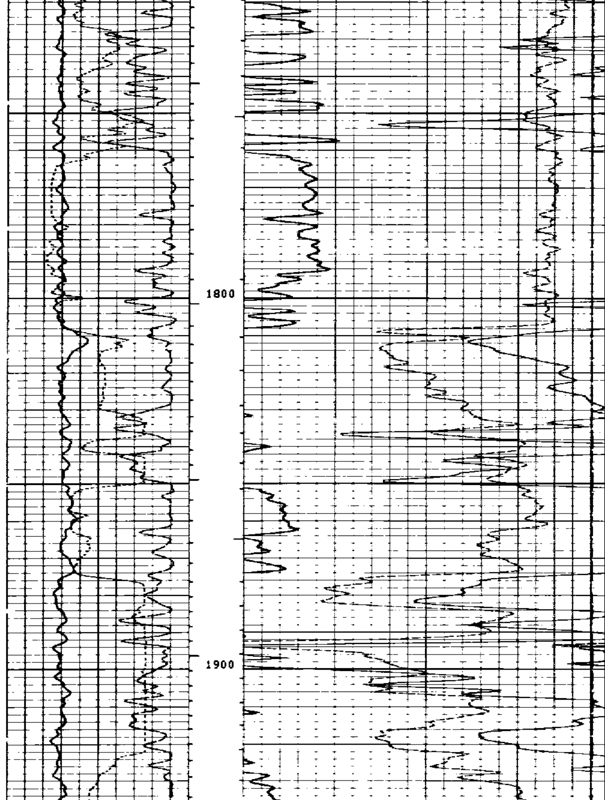
```
IHV     10.0000 F3     LEFT EDGE
ICV     10.0000 F3     RIGHT EDGE
```

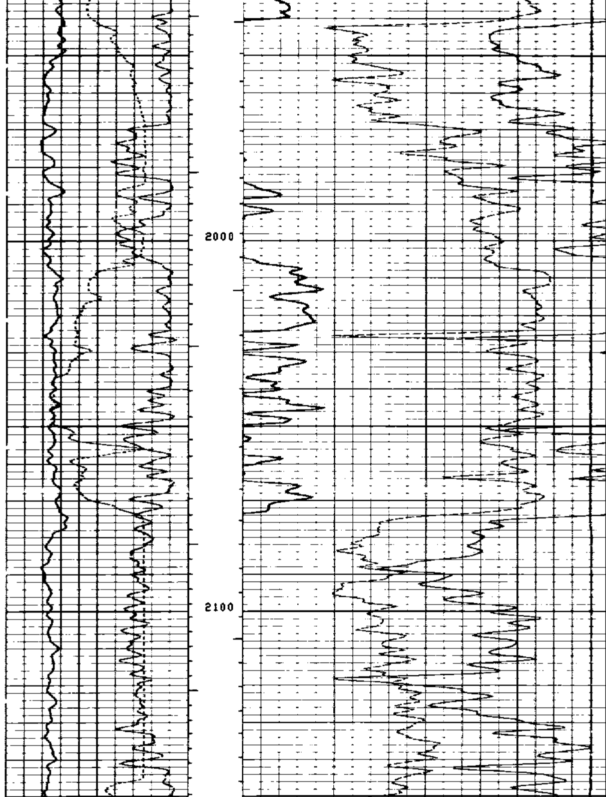
```
CEMENT VOLUME = 4076.59 F3
HOLE VOLUME =    9608.92 F3
FROM  7270.5 TO   1598.0 FEET
```

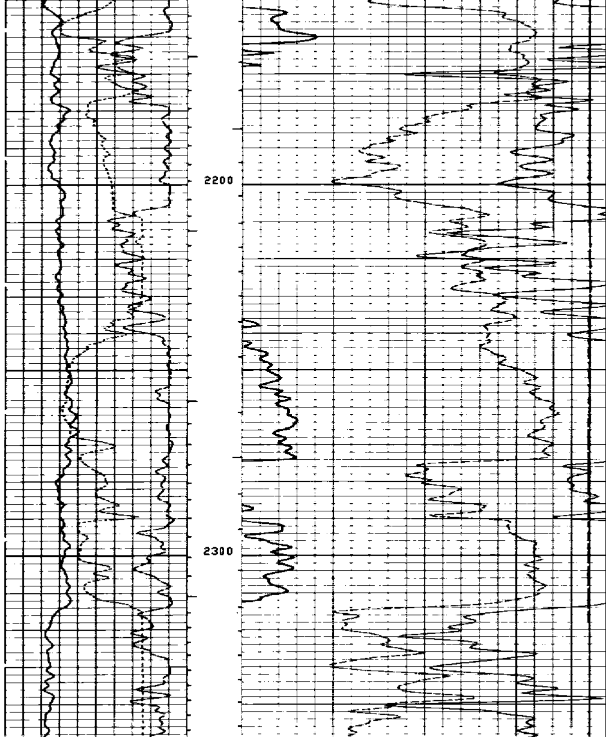
DRHO(G/C3)			TENS(LB)
.90000 -.1000			10000. 0.
CALI(IN)		NPOR	
14.000 24.000		.60000	0.
GR (GAPI)		DPHI	
0.0 150.00		.60000	0.

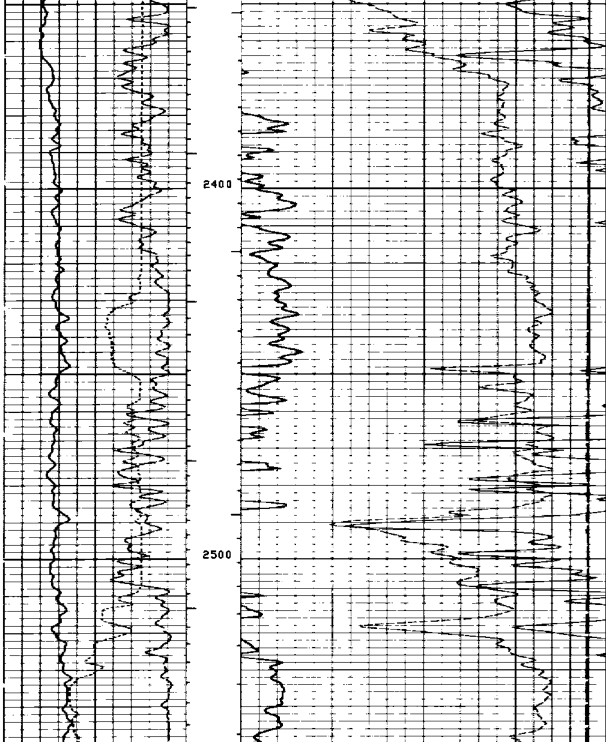
```
CP 30.4            FILE    3       04-AUG-88 22:28
```

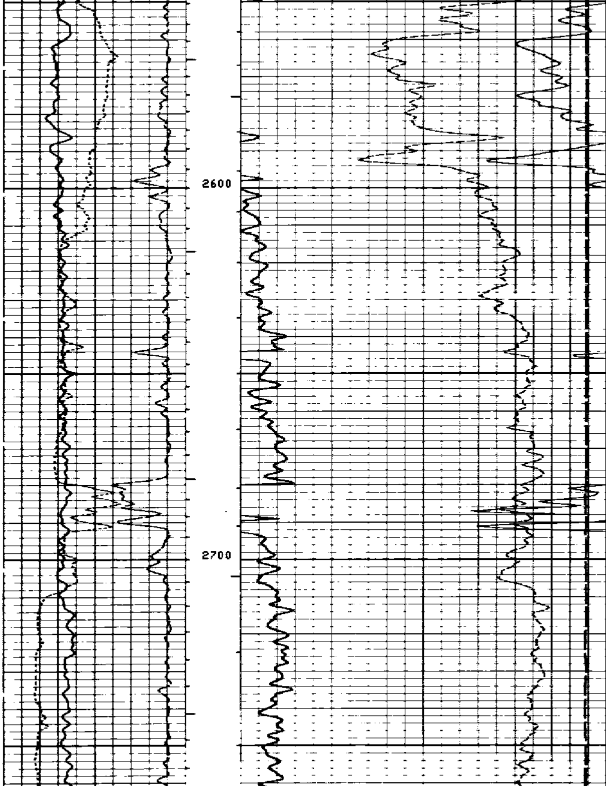


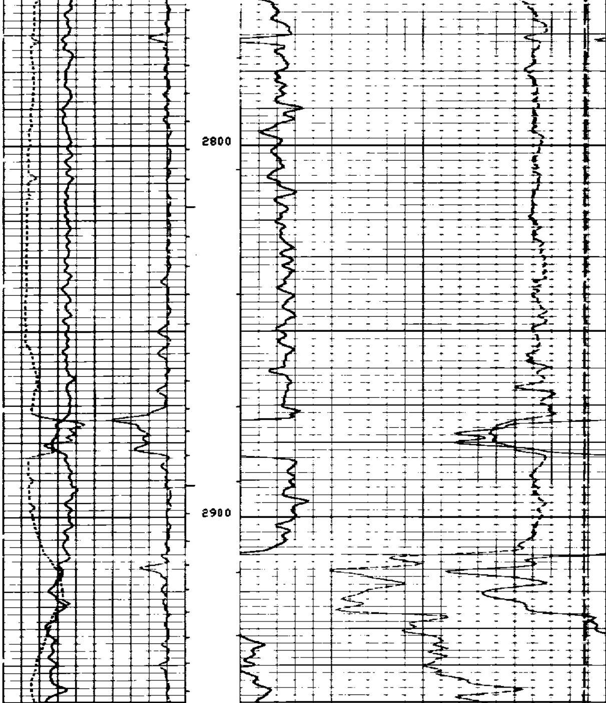


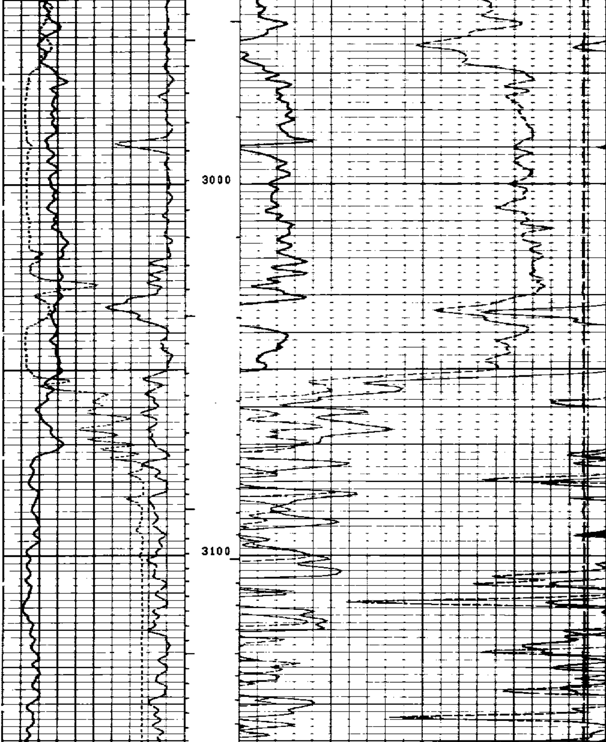


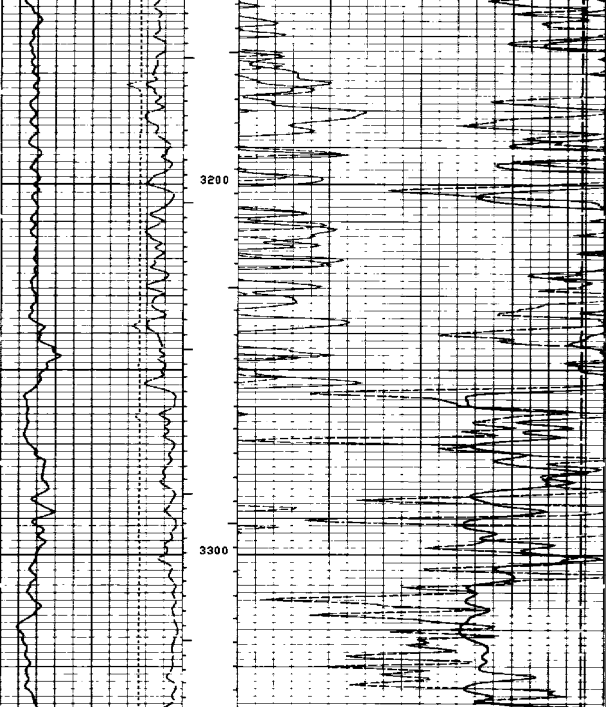


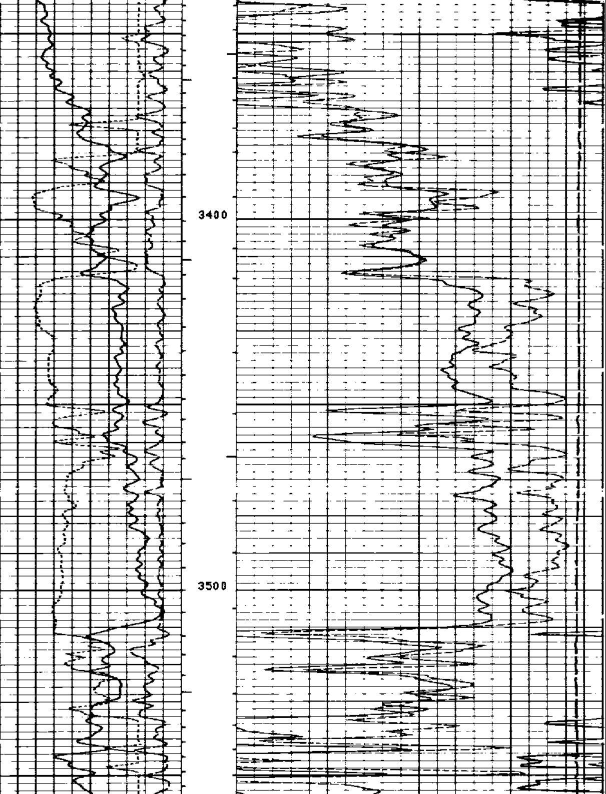


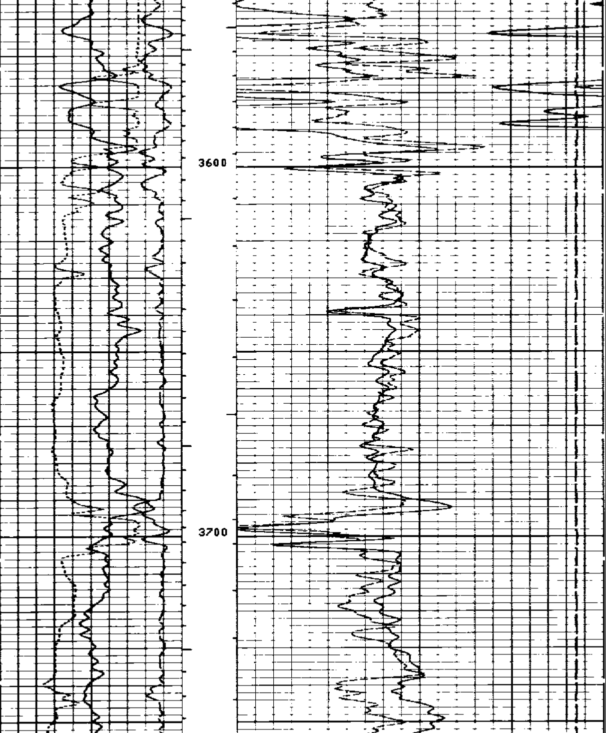


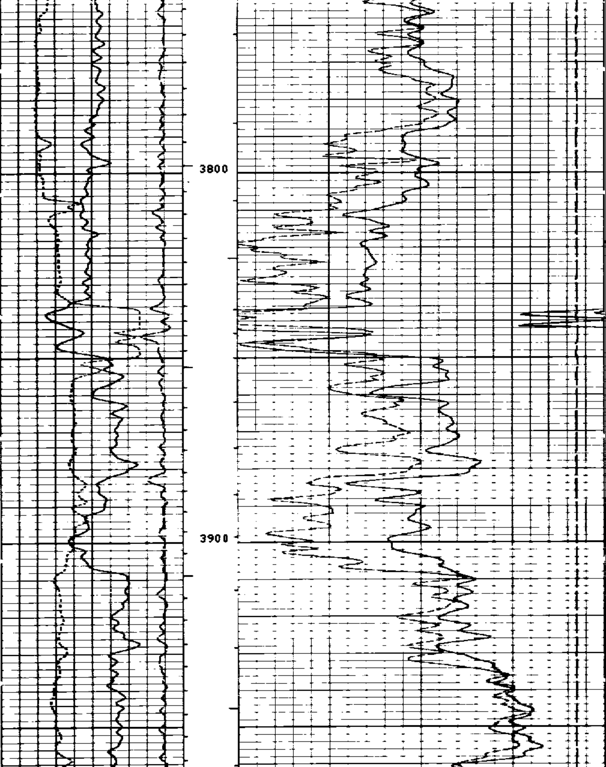


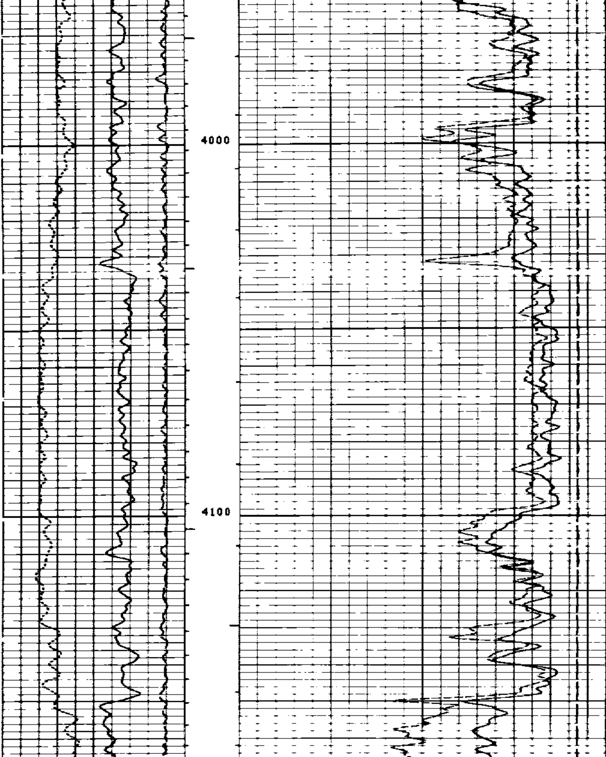


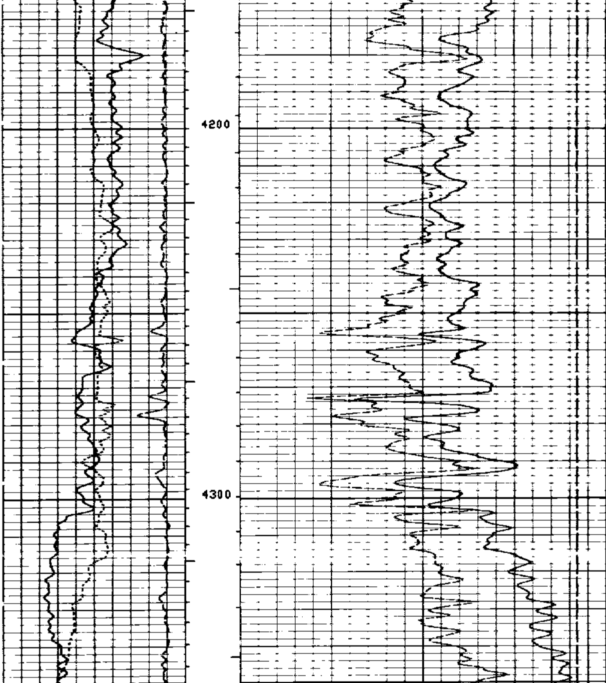


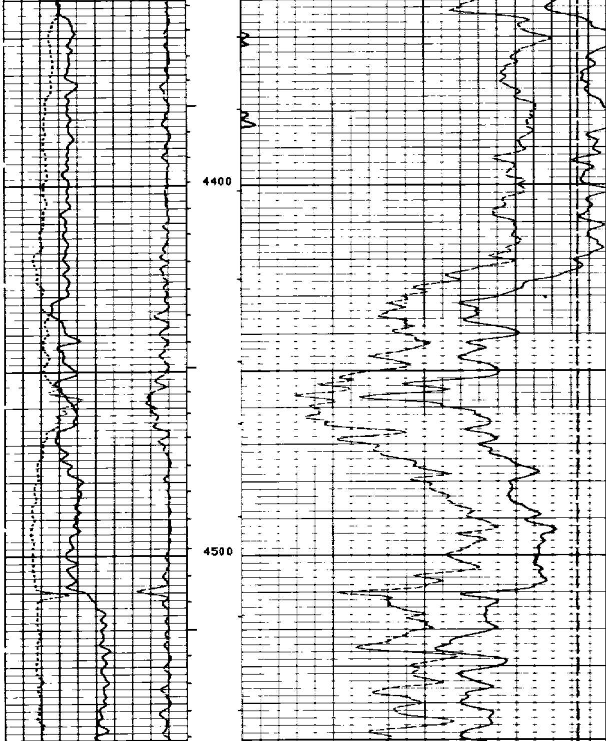


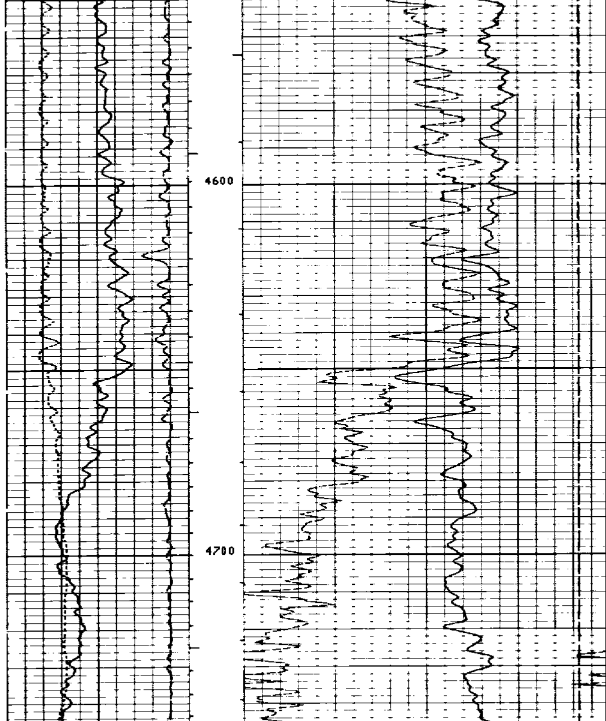


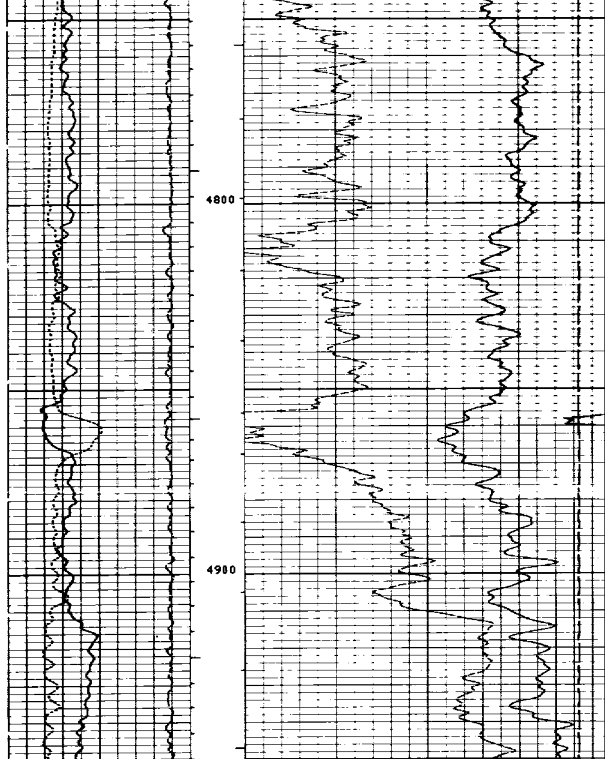


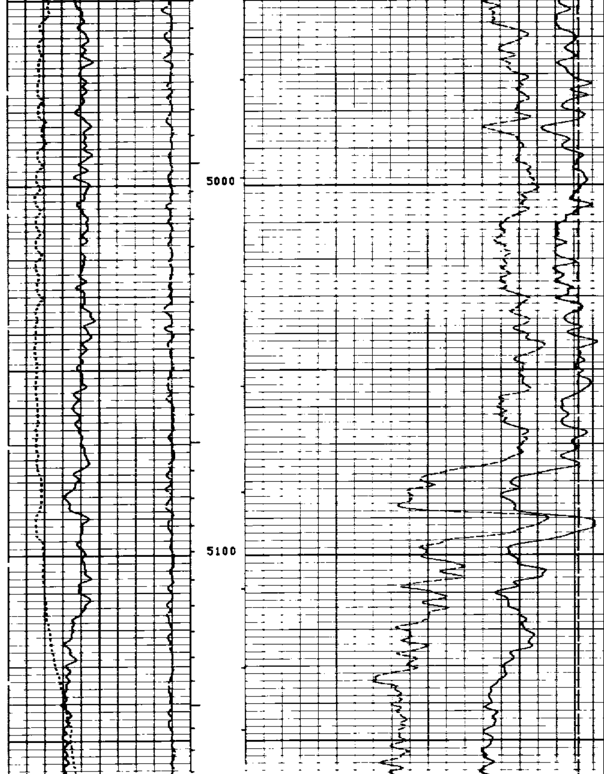


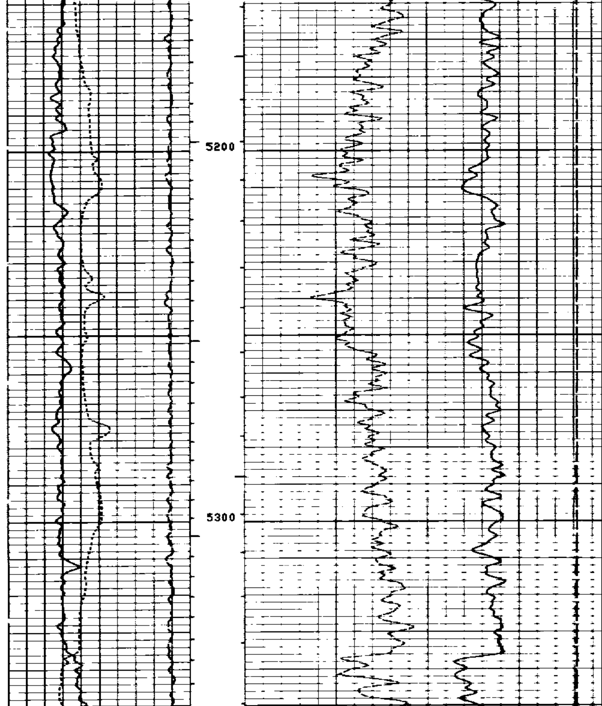


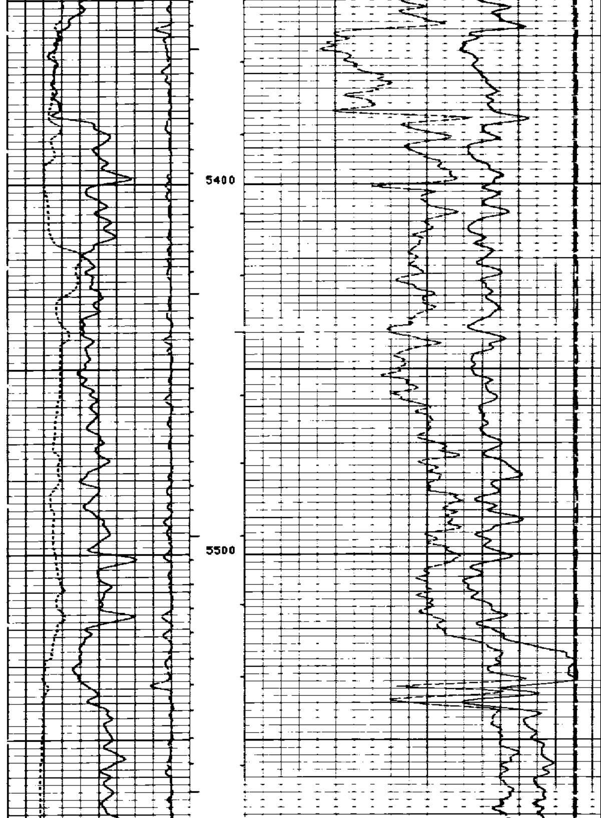


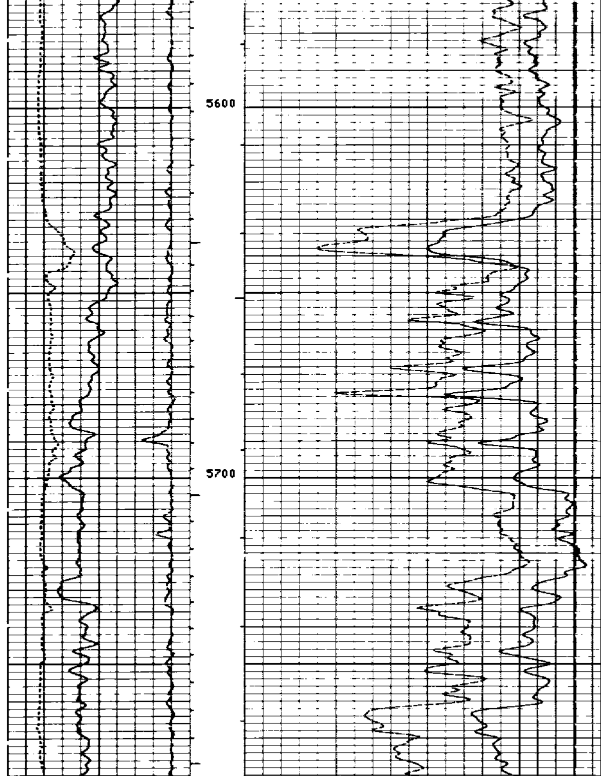


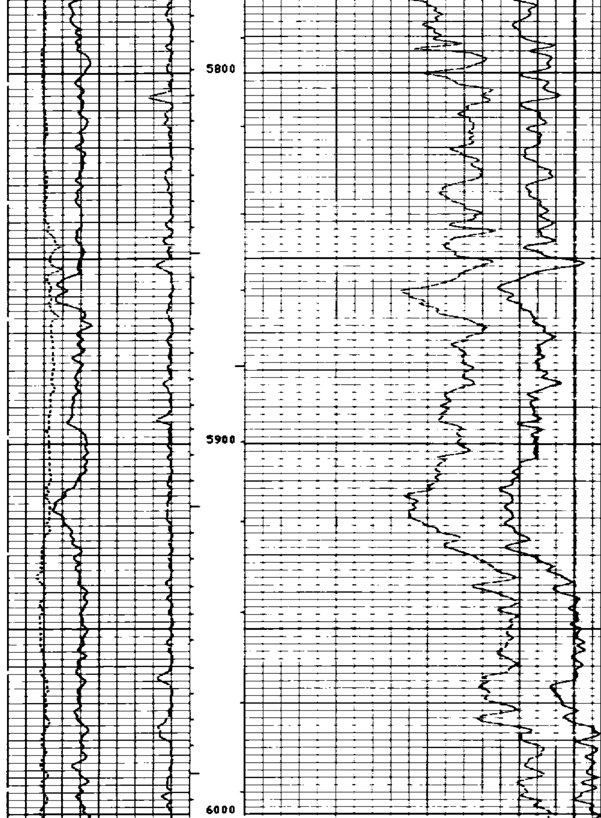


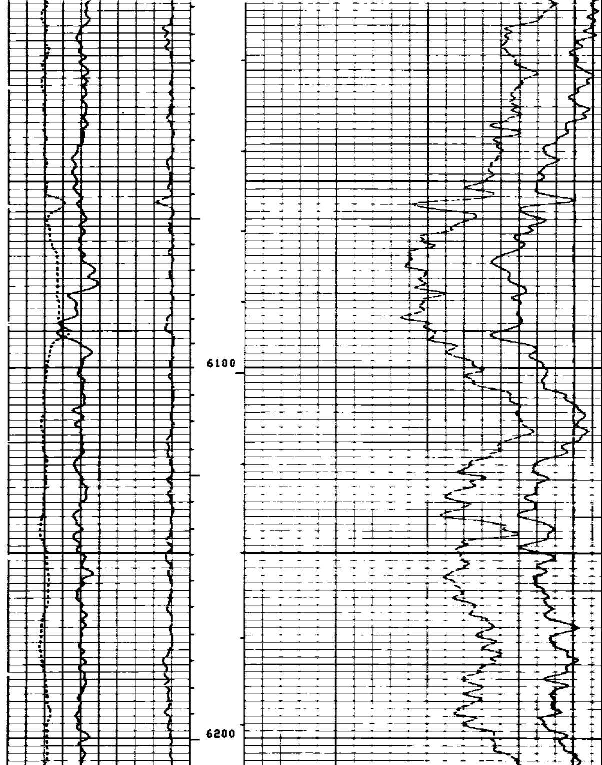


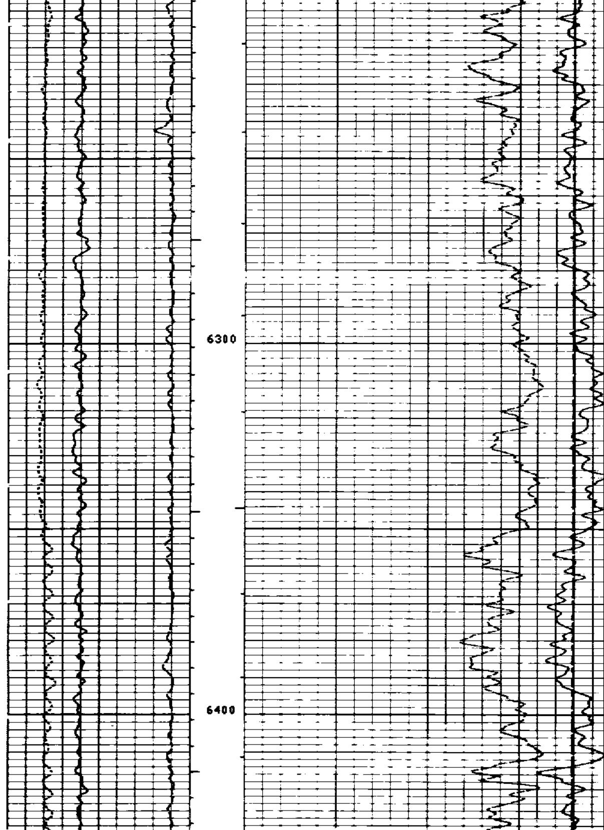


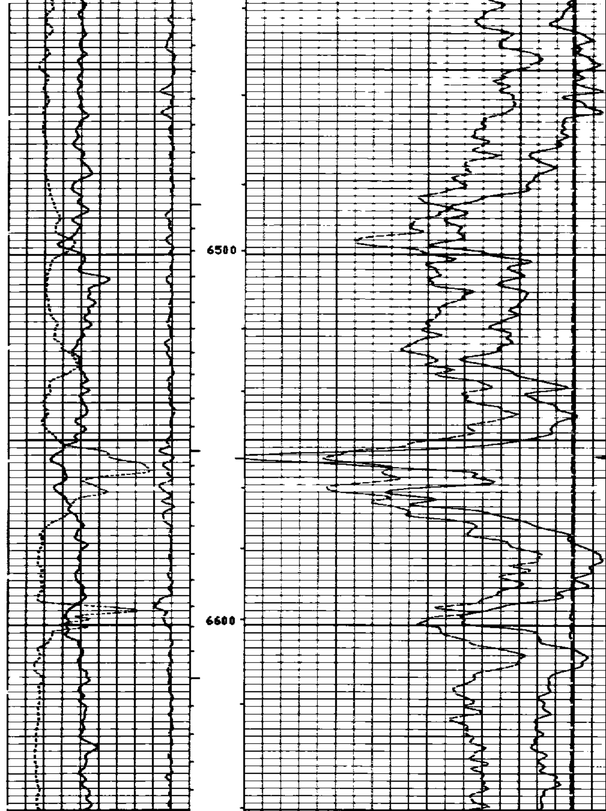


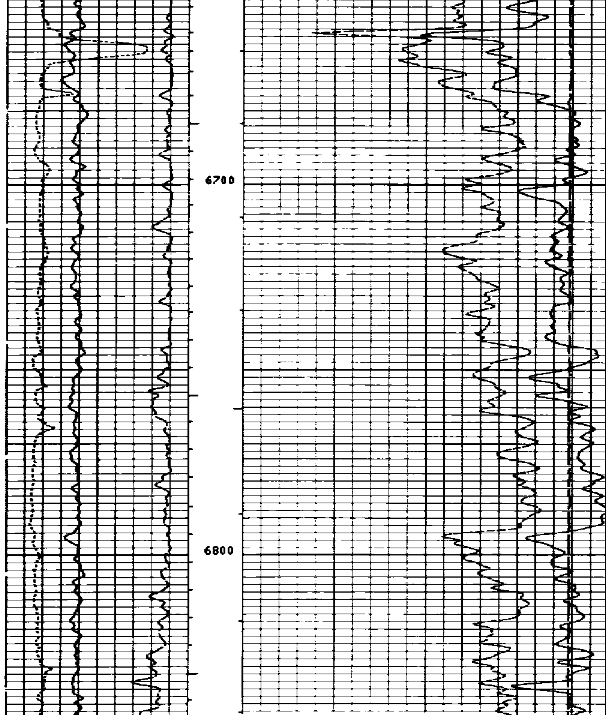


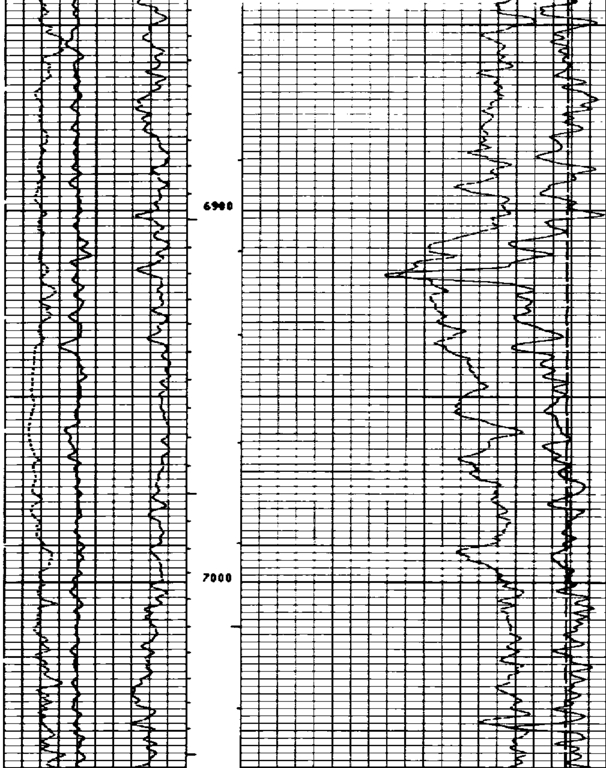


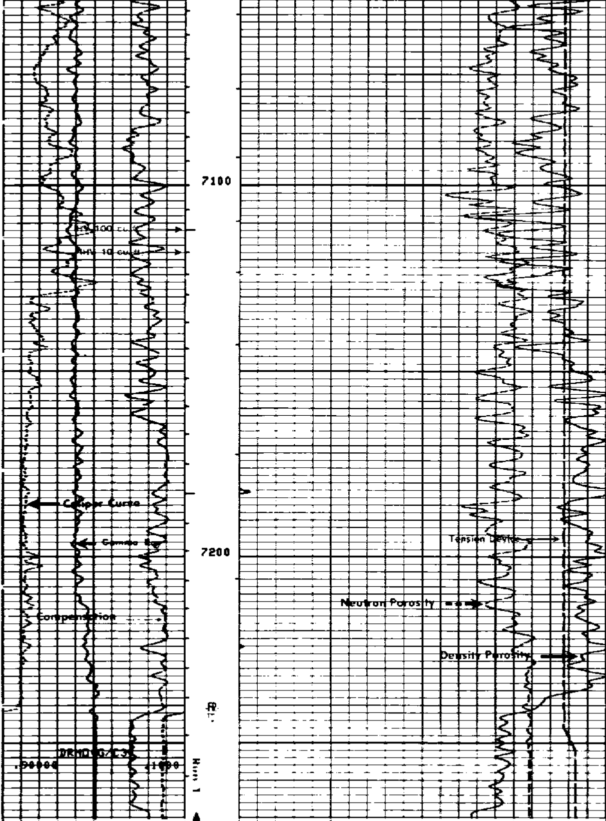


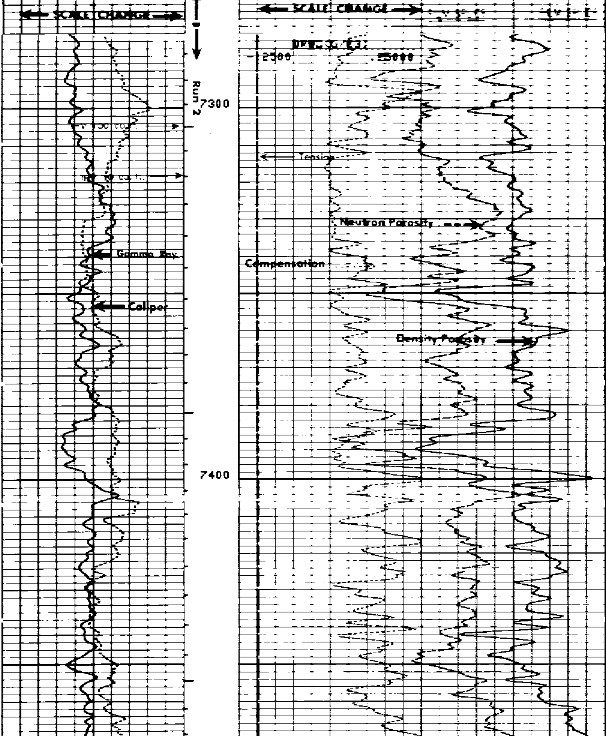


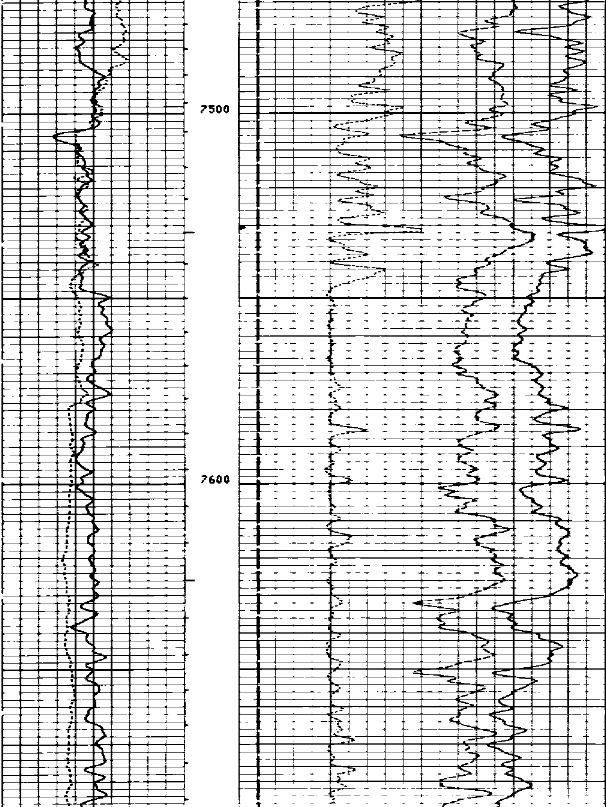


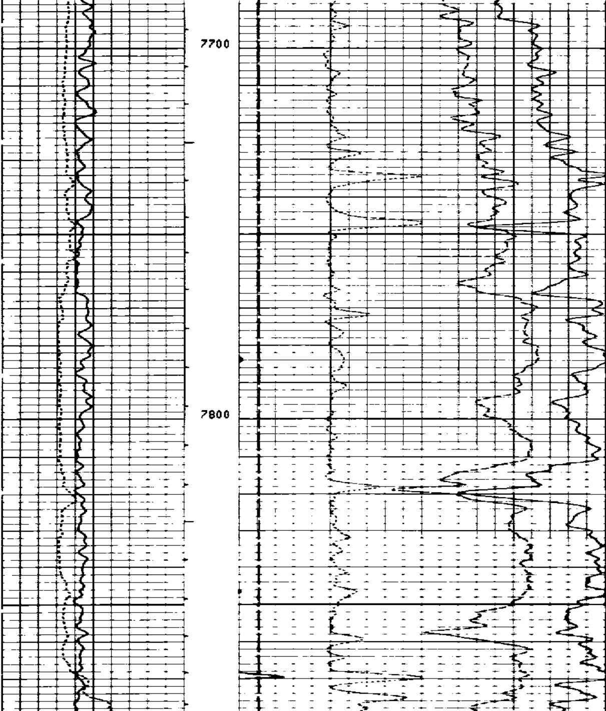


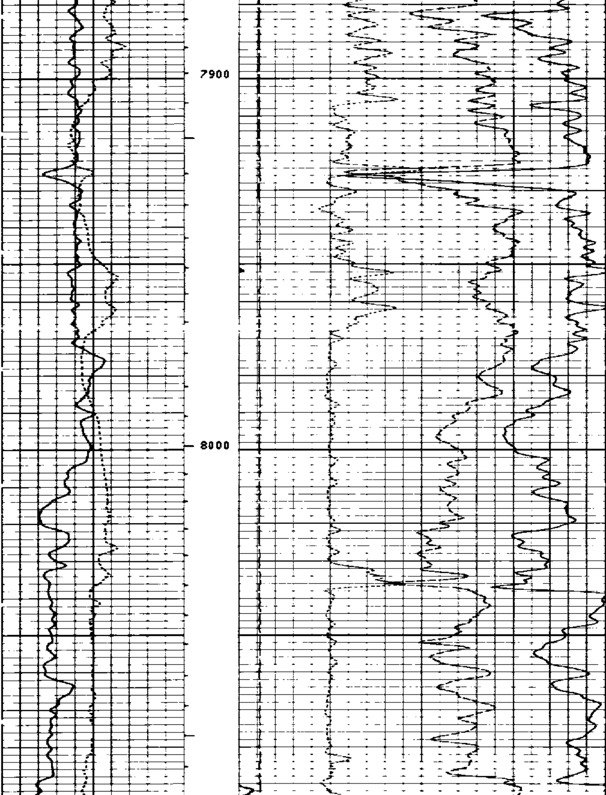


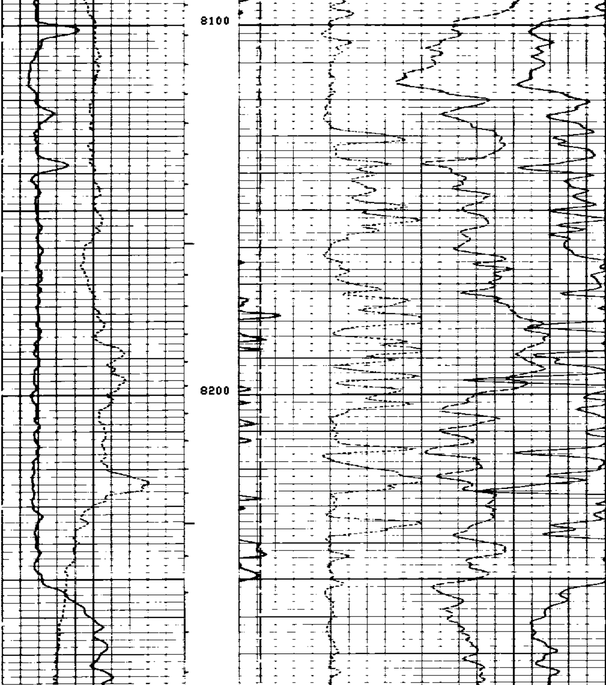


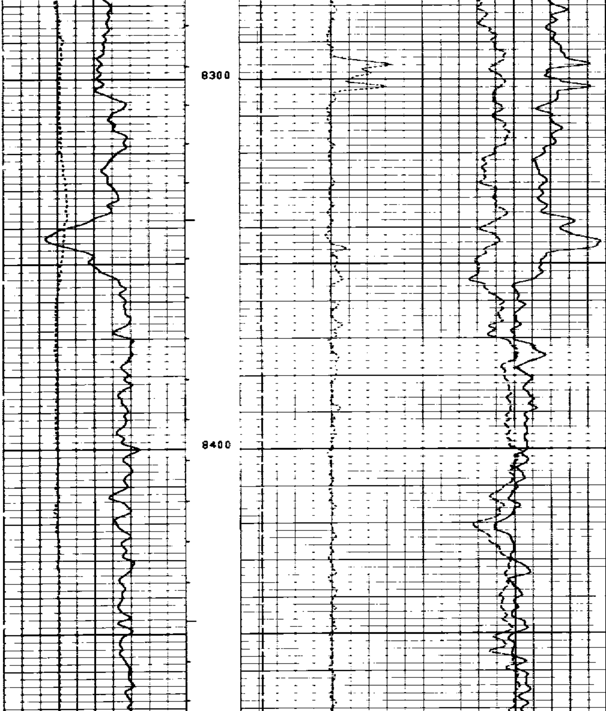


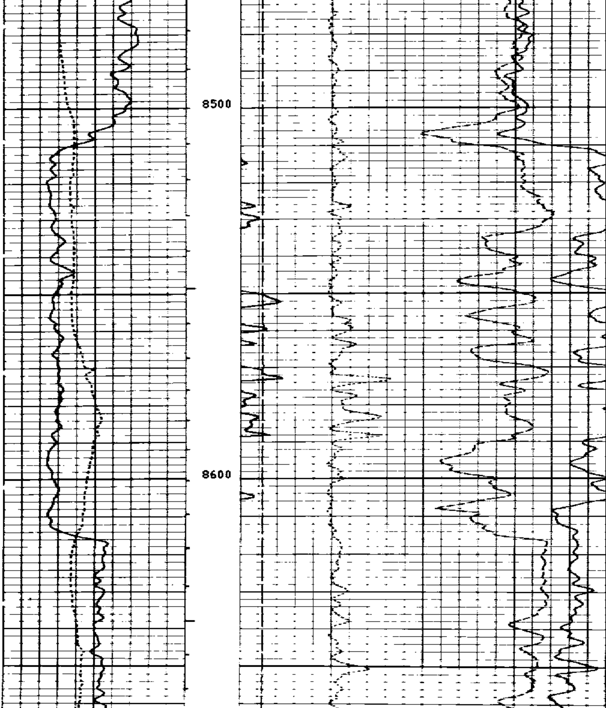


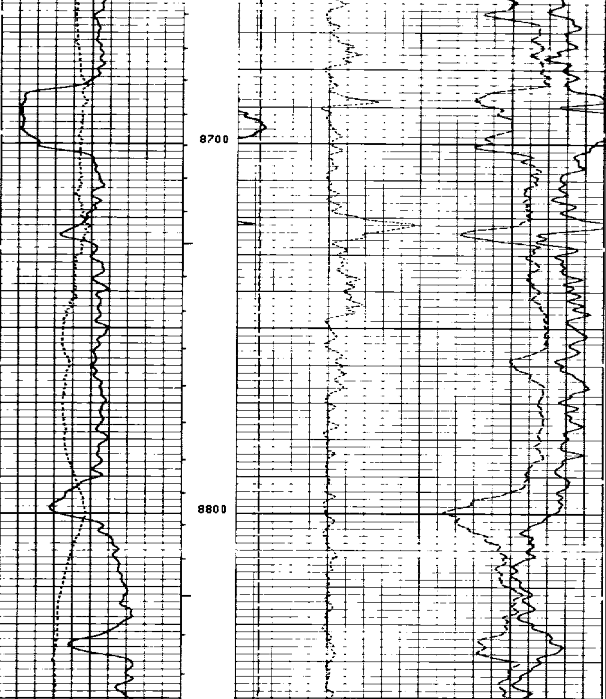


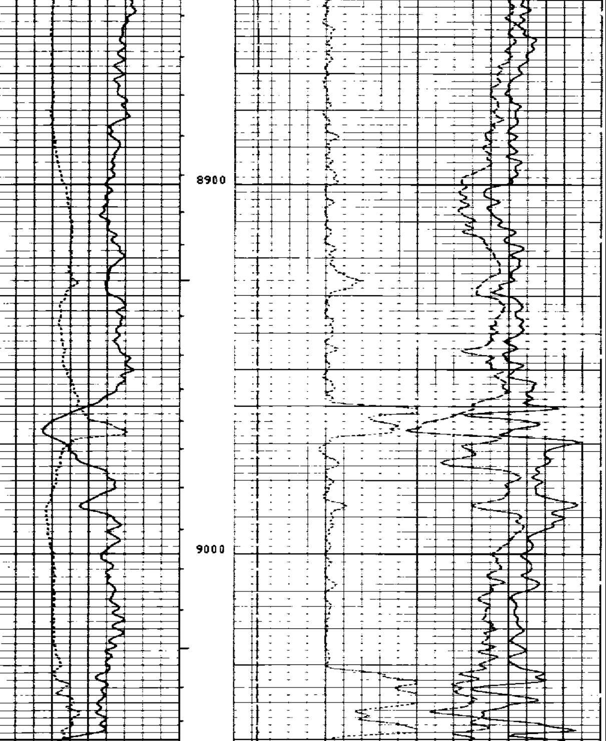


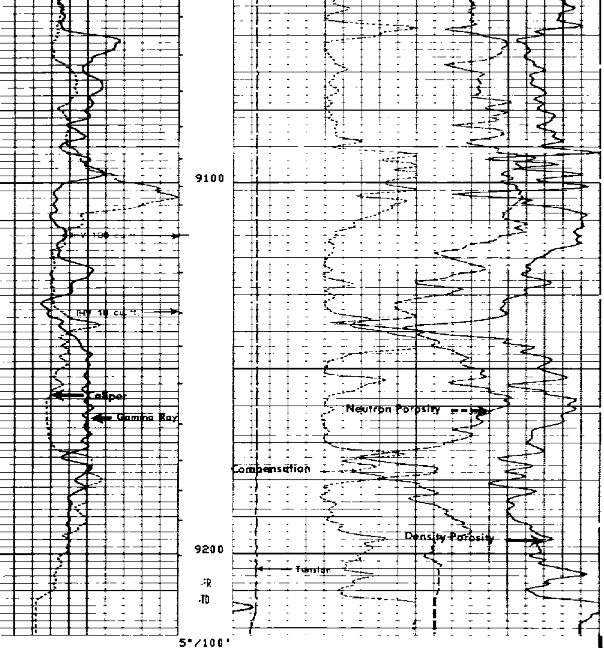












CP 30.4 FILE 20 24-AUG-88 18:26

	TENS(LB) 0.0 20000.
	DRHO(G/C3) -.2500 .25000
CALI(IN) 10.000 20.000	NPOR .60000 0.0
GR (GAPI) 0.0 150.00	DPHI .60000 0.0

```
                         SENSOR MEASURE POINT TO TOOL ZERO

            CFTC 18.1  FEET                          GR   26.6  FEET
            FFDC  2.7  FEET                          CNTC 17.6  FEET
            CALI  2.7  FEET                          NFDC  2.7  FEET
            TNRA 18.6  FEET                          TENS  -.3  FEET
```

```
                                    PARAMETERS

         NAME  VALUE       UNIT                  NAME  VALUE          UNIT

         BS    12.2500     IN                    BHS  OPEN
         HC    CALI                              FPHI SPHI
         BHFL WATE                               MATR SAND
         ANGL 0.0          DEG                   GGRD .0100000        DF/F
         SOCN .500000      IN                    FSAL -50000.0        PPM
         SDAT SOCN                               MCOR NATU
         MWCO NO                                 PTCO NO
         BSCO NO                                 FSCO NO
         SOCO NO                                 MCCO NO
         NPBC 0                                  HSCO YES
         MDEN 2.65000      G/C3                  FD   1.00000         G/C3
         DHF  WATE                               FDCC ALLD
         WMUD 8.70000      LB/G
```

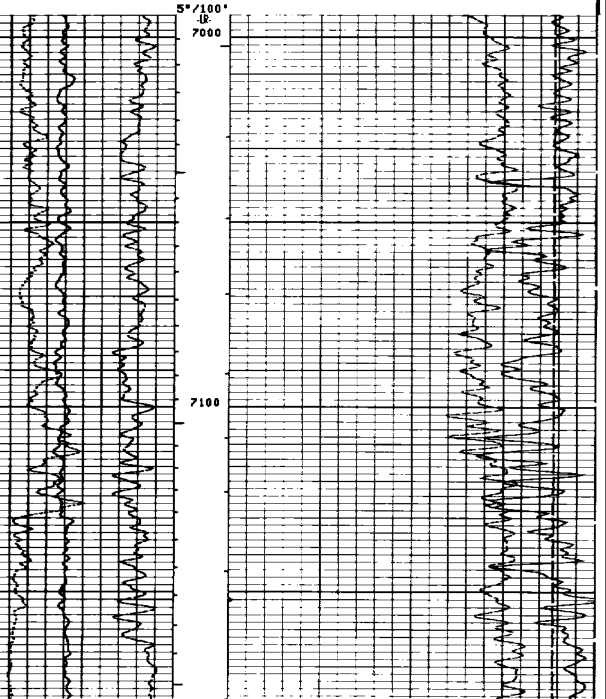
```
  EVENT MARK SUMMARY:

  OUTPUT   INTERVAL         DEPTH TRACK
           BETWEEN PIPS     EDGE

  INV      10.0000 F3       LEFT EDGE
  ICV      10.0000 F3       RIGHT EDGE
```

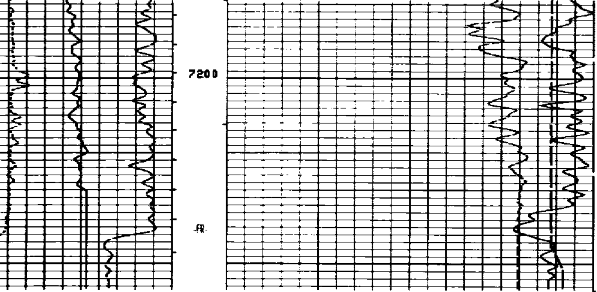
```
  CEMENT VOLUME = 103.905 F3
  HOLE VOLUME =    360.514 F3
  FROM  7256.0 TO   6993.0 FEET
```

```
       DRHO(G/C3)                                             TENS(LB  )
.90000           -.1000                                 10000.                   0.0
        CALI(IN  )                        NPOR
14.000           24.000          .60000                                          0.0
       GR  (GAPI)                         DPHI
0.0              150.00          .60000                                          0.0
```

REPEAT SECTION Run 2

```
CP 30.4          FILE    2      04-AUG-88 19:28
```





5"/100"

Run 2

CP 30.4 FILE 2 04-AUG-88 19:18

DRHO(G/C3) .90000 -.1000		TENS(LB) 10000. 0.0
CALI(IN) 14.000 24.000		NPOR .60000 0.0
GR (GAPI) .0 150.00		DPHI .60000 0.0

SENSOR MEASURE POINT TO TOOL ZERO

CFTC	18.1	FEET	GR	26.6	FEET
FFDC	2.7	FEET	CNTC	17.6	FEET
CALI	2.7	FEET	NFDC	2.7	FEET
TNRA	18.6	FEET	TENS	-.3	FEET

EVENT MARK SUMMARY:

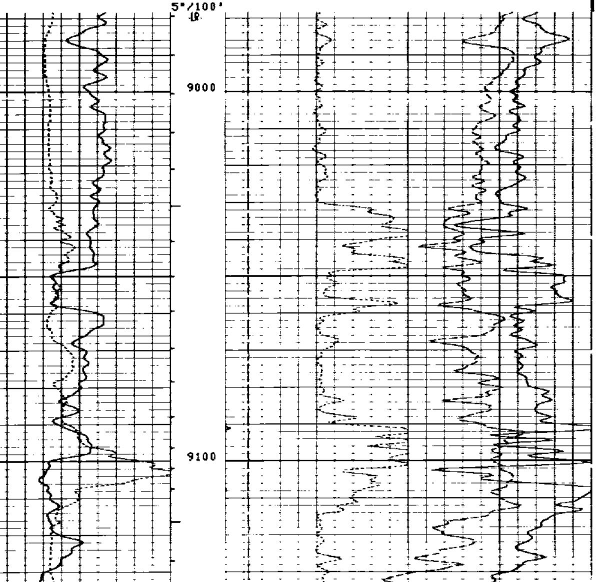
OUTPUT	INTERVAL BETWEEN PIPS	DEPTH TRACK EDGE
IHV	10.0000 F3	LEFT EDGE

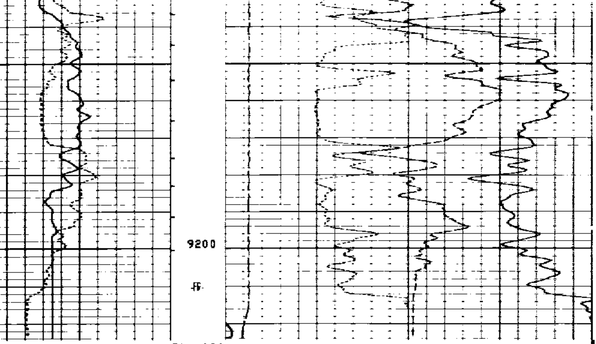
CEMENT VOLUME = 252.281 F3
HOLE VOLUME = 252.281 F3
FROM 9211.0 TO 8977.5 FEET

CALI(IN)	TENS(LB)
10.000 — 20.000	0.0 — 20000.
GR (GAPI)	DRHO(G/C3)
.0 — 150.00	-.2500 — .25000
	NPOR
	.60000 — 0.0
	DPHI
	.60000 — 0.0

REPEAT SECTION Run 3

CP 30.4 FILE 19 24-AUG-88 18:20





5"/100'

Run 3

CP 30.4 FILE 19 24-AUG-88 18:12

	TENS(LB)
	0.0 20000.
	DRHO(G/C3)
	-.2500 .25000
CALI(IN)	NPOR
10.000 20.000	.60000 0.0
GR (GAPI)	DPHI
0.0 150.00	.60000 0.0

SENSOR MEASURE POINT TO TOOL ZERO

CFTC	18.1	FEET	GR	26.6	FEET
FFDC	2.7	FEET	CNTC	17.6	FEET
CALI	2.7	FEET	MFDC	2.7	FEET
TNRA	18.6	FEET	TENS	-.3	FEET

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
BS	12.2500	IN	BHS	OPEN	
HC	CALI		FPHI	SPHI	
BHFL	WATE		MATR	SAND	
ANGL	0.0	DEG	GGRD	.0100000	DF/F
SOCN	.500000	IN	FSAL	-50000.0	PPM
SDAT	SOCN		MCOR	MATU	
MWCO	NO		PTCO	NO	
BSCO	NO		FSCO	NO	
SOCO	NO		MCCO	NO	
NPDC	0		HSCO	YES	
MDEN	2.65000	G/C3	FD	1.00000	G/C3
BHF	WATE		FDCC	ALLO	
WMUD	8.70000	LB/G			

```
         Run 2  BEFORE SURVEY CALIBRATION SUMMARY  Run 2

  PERFORMED:     03-AUG-88 13:07
  PROGRAM FILE: ISN    (VERSION    30.4    88/05/17  87/11/19)

SGTE                DETECTOR CALIBRATION SUMMARY

             MEASURED
           BKGD    JIG          CALIBRATED          UNITS
    GR      40     197             165              GAPI

BACK: 03-AUG-88 12:50    JIG: 03-AUG-88 12:57   COMP: 03-AUG-88 12:58


CNTA                DETECTOR CALIBRATION SUMMARY


    EQUIPMENT:

      NCCN (NEUTRON COMPENSATED CARTRIDGE #): 2359
      NSSN (NEUTRON SOURCE SERIAL #):         2312
      THHN (THERMAL HOUSING #):               0000
      TCNB (THERMAL CALIBRATOR NEUTRON BOX #): 2124


          INPUT     PLUS      SHOP      SHOP      BEFORE     GAIN
                 REFERENCE    TANK       JIG        JIG
                   COUNTS    COUNTS    COUNTS     COUNTS

          CNTC    6031.00   6066.44   3109.16   3102.84     .994
          CFTC    2793.00   2733.26   1495.59   1519.26    1.022


          RATIO     2.159     2.219     2.079     2.042

BACK: 03-AUG-88 12:50     JIG: 03-AUG-88 12:57    COMP:


PGTK                DETECTOR CALIBRATION SUMMARY

GAIN COMPUTED FROM SHOP BLOCK COUNTS

              BLOCK                             JIG
          INPUT  CALIBRATED             MEASURED   CALIBRATED      UNITS
  FFDC     459      337                    484        355           CPS
  NFDC     734      528                    732        527           CPS

BACK: 03-AUG-88 12:50    JIG: 03-AUG-88 12:57    COMP:


PGTK                CALIPER CALIBRATION SUMMARY

             MEASURED                          CALIBRATED
          SMALL   LARGE                    SMALL       LARGE        UNITS
  CALI    11.17    15.1                    8.00        12.0          IN

SMALL: 03-AUG-88 12:45  LARGE: 03-AUG-88 12:45  COMP: 03-AUG-88 12:46
```

```
              BACKGROUND RADIATION SUMMARY

  PERFORMED:     04-AUG-88 23:01
  PROGRAM FILE: ISN    (VERSION    30.4    88/05/17  87/11/19)

               BEFORE               AFTER
  FFDC          5.49 CPS             4.09 CPS
  NFDC           .12 CPS              .25 CPS
  CNTC           .50 CPS              .25 CPS
  CFTC          3.24 CPS             2.73 CPS

ENGINEER: DAVID ROTHERS
LOCATION: SACRAMENTO

                         TOOL SERIAL NUMBERS

PGS 86            CNC 2359            SGC 581            MLM 418



   CP 30.4          FILE    7      04-AUG-88 23:01



              AFTER SURVEY TOOL CHECK SUMMARY


  PERFORMED:     04-AUG-88 23:01
  PROGRAM FILE: ISN    (VERSION    30.4    88/05/17  87/11/19)

CNTA                     TOOL  CHECK


          INPUT    BEFORE JIG   AFTER JIG


          CNTC      3102.84      3120.00

          CFTC      1519.26      1536.95

CHANGE IN THERMAL POROSITY AT 20 PU IS   -.205  PU


BEFORE SURVEY:          BACK: 03-AUG-88 12:50    JIG: 03-AUG-88 12:57
AFTER SURVEY CHECK:     BACK: 04-AUG-88 22:53    JIG: 04-AUG-88 22:59


PGTK                     TOOL  CHECK

                     JIG
              BEFORE      AFTER     UNITS
  FFDC         355         355       CPS
  NFDC         527         514       CPS

  RHOB  CHANGE (WATER):  -.011 G/C3

BEFORE SURVEY:          BACK: 03-AUG-88 12:50    JIG: 03-AUG-88 12:57
AFTER SURVEY CHECK:     BACK: 04-AUG-88 22:53    JIG: 04-AUG-88 22:59

   CP 30.4          FILE    7      04-AUG-88 23:00
```

```
              SHOP SUMMARY


 PERFORMED:     01-AUG-88 11:08
 PROGRAM FILE: SHOP   (VERSION    30.4    87/11/19  87/11/19)

NTA                DETECTOR CALIBRATION SUMMARY


   EQUIPMENT:

     NCCN (NEUTRON COMPENSATED CARTRIDGE #): 2359
     NSSN (NEUTRON SOURCE SERIAL #):         2312
     TNHN (THERMAL HOUSING #):               0000
     TCNB (THERMAL CALIBRATOR NEUTRON BOX #): 2124


         INPUT     PLUS       SHOP       SHOP      GAIN
                REFERENCE     TANK       JIG
                  COUNTS     COUNTS     COUNTS

         CNTC    6031.00   6066.44   3109.16    .994
         CFTC    2793.00   2733.26   1495.59   1.022

         RATIO     2.159     2.219     2.079


         SHOP COUNTS TEMPERATURE AND HOUSING SIZE CORRECTED

ACK: 01-AUG-88 10:48    JIG: 01-AUG-88 10:55   COMP: 01-AUG-88 10:55

              SHOP SUMMARY


 PERFORMED:     01-AUG-88 11:52
 PROGRAM FILE: SHOP   (VERSION    30.4    87/11/19  87/11/19)

GTK                DETECTOR CALIBRATION SUMMARY

            BLOCK                         JIG
     MEASURED   CALIBRATED     MEASURED   CALIBRATED     UNITS

FFDC   459         337           487         358          CPS
NFDC   734         528           736         529          CPS

         (PGS:86  , PDH:1247, GSR:8016, SFT :477 )


       Run 3  BEFORE SURVEY CALIBRATION SUMMARY  Run 3


 PERFORMED:     24-AUG-88 17:27
 PROGRAM FILE: ISM    (VERSION    30.4    88/05/17  87/11/19)


GTE                DETECTOR CALIBRATION SUMMARY

           MEASURED
         BKGD    JIG         CALIBRATED          UNITS
   GR     28     187            165              GAPI

ACK: 24-AUG-88 17:14    JIG: 24-AUG-88 17:21   COMP: 24-AUG-88 17:21


NTA                DETECTOR CALIBRATION SUMMARY
```

```
   EQUIPMENT:

      MCCM (NEUTRON COMPENSATED CARTRIDGE #): 2359
      MSSM (NEUTRON SOURCE SERIAL #):         2312
      TMHM (THERMAL HOUSING #):               0000
      TCNB (THERMAL CALIBRATOR NEUTRON BOX #): 2124


         INPUT     PLUS        SHOP      SHOP      BEFORE     GAIN
                 REFERENCE     TANK       JIG       JIG
                   COUNTS     COUNTS    COUNTS    COUNTS

         CNTC    6031.00    6066.44   3109.16   3119.72    .994
         CFTC    2793.00    2733.26   1495.59   1517.92   1.022


         RATIO     2.159      2.219     2.079     2.055

ACK: 24-AUG-88 17:14    JIG: 24-AUG-88 17:21    COMP:

GTK                DETECTOR CALIBRATION SUMMARY

AIN COMPUTED FROM SHOP BLOCK COUNTS

              BLOCK                            JIG
         INPUT  CALIBRATED           MEASURED   CALIBRATED      UNITS
 FFDC     459      337                  483         355          CPS
 NFDC     734      528                  727         523          CPS

ACK: 24-AUG-88 17:14    JIG: 24-AUG-88 17:21    COMP:

GTK                CALIPER CALIBRATION SUMMARY

           MEASURED                        CALIBRATED
         SMALL    LARGE                 SMALL      LARGE        UNITS
 CALI    11.07    15.0                  8.00       12.0          IN

MALL: 24-AUG-88 17:11  LARGE: 24-AUG-88 17:12  COMP: 24-AUG-88 17:12

  CP 30.4            FILE   17        24-AUG-88 17:26


              AFTER SURVEY TOOL CHECK SUMMARY


 PERFORMED:     24-AUG-88 20:12
 PROGRAM FILE: ISM    (VERSION    30.4    88/05/17  07:11:19

NTA                      TOOL  CHECK


         INPUT    BEFORE JIG   AFTER JIG


         CNTC      3119.72     3119.53

         CFTC      1517.92     1528.58


HANGE IN THERMAL POROSITY AT 20 PU IS   -.239  PU
```

```
EFORE SURVEY:             BACK: 24-AUG-88 17:14     JIG: 24-AUG-88 17:21
FTER SURVEY CHECK:        BACK:                     JIG: 24-AUG-88 20:12


GTK                       TOOL  CHECK

                       JIG
             BEFORE        AFTER      UNITS
 FFDC         355           355        CPS
 NFDC         523           515        CPS

 RHOB  CHANGE (WATER):  -.007 G/C3

EFORE SURVEY:             BACK: 24-AUG-88 17:14     JIG: 24-AUG-88 17:21
FTER SURVEY CHECK:        BACK:                     JIG: 24-AUG-88 20:12

  CP 30.4            FILE   25       24-AUG-88 20:12



                  SHOP SUMMARY


 PERFORMED:     01-AUG-88 11:08
 PROGRAM FILE: SHOP   (VERSION     30.4     87/11/19  87/11/19)


NTA                   DETECTOR CALIBRATION SUMMARY


   EQUIPMENT:

      NCCN (NEUTRON COMPENSATED CARTRIDGE #): 2359
      NSSN (NEUTRON SOURCE SERIAL #):         2312
      TNHH (THERMAL HOUSING #):               0000
      TCNB (THERMAL CALIBRATOR NEUTRON BOX #): 2124


         INPUT     PLUS       SHOP       SHOP      GAIN
                 REFERENCE    TANK        JIG
                   COUNTS    COUNTS     COUNTS

         CNTC    6031.00    6066.44    3109.16    .994
         CFTC    2793.00    2733.26    1495.59   1.022

         RATIO     2.159      2.219      2.079


         SHOP COUNTS TEMPERATURE AND HOUSING SIZE CORRECTED

ACK: 01-AUG-88 10:48    JIG: 01-AUG-88 10:55   COMP: 01-AUG-88 10:55



                  SHOP SUMMARY


 PERFORMED:     01-AUG-88 11:50
 PROGRAM FILE: SHOP   (VERSION     30.4     87/11/19  87/11/19)


GTK                   DETECTOR CALIBRATION SUMMARY

            BLOCK                             JIG
     MEASURED   CALIBRATED     MEASURED   CALIBRATED     UNITS

 FFDC    459          337          487          358          CPS
 NFDC    734          528          736          524          CPS

          [illegible] , [illegible]:1247, GSR:8016, SFT :4[illegible]
```