COUNTY: COLUMBIA
FIELD MIST GAS STORAGE
LOCATION N 86-47-54 W 2085.04 & S 03-12-06
WELL IW 32-22-65
COMPANY NORTHWEST NATURAL GAS CO.

Schlumberger

FORMATION DENSITY COMPENSATED NEUTRON GAMMA RAY 5"

COMPANY NORTHWEST NATURAL GAS CO.

WELL IW 32-22-65

FIELD MIST GAS STORAGE

COUNTY: COLUMBIA **STATE:** OREGON

LOCATION
N 86-47-54 W 2085.04' & S 03-12-06
1827.47' FROM THE NE COR. OF SEC 22

API SERIAL NO.	SECT.	TWP.	RANGE
36-009-00325	22	6N	5W

Other Services:
INDUCTION
SONIC
FMS
DENSITY
NEUTRON
GAMMA RAY

Permanent Datum GROUND LEVEL **Elev.** 822.1 F
Log Measured From KELLY BUSHING 16.0 F **above Perm. Datum**
Drilling Measured From KELLY BUSHING

Elev.: K.B.838.1 F
D.F.
G.L.822.1 F

Date	25-NOV-1997		02-DEC-1997	
Run No.	ONE		TWO	
Depth Driller	1826.0 F		2600.0 F	
Depth Logger (Schl.)	1821.0 F		2590.0 F	
Btm. Log Interval	1820.0 F		2590.0 F	
Top Log Interval	0.0 F		1800.0 F	
Casing-Driller	13 3/8" @ 377.0 F	8 5/8" @ 1802.0 F	@	
Casing-Logger	376.0 F			
Bit Size	@	@	@	
Type Fluid in Hole	LSND		FLO-PRO	
Dens. | Visc.	10.00 LB/G	56.0 S	8.60 LB/G	48.0 S
pH | Fld. Loss	8.0		10.0	
Source of Sample	FLOWLINE		FLOWLINE	
Rm @ Meas. Temp.	1.510 OHMM @ 85.0 DEGF		.360 OHMM @ 74.0 DEGF	
Rmf @ Meas. Temp.	.880 OHMM @ 68.0 DEGF		.381 OHMM @	
Rmc @ Meas. Temp.	.511 OHMM @ 68.0 DEGF		.324 OHMM @ 68.0 DEGF	
Source: Rmf | Rmc	CELL	CELL	CELL	CELL
Rm @ BHT	1.323 OHMM @ 98.0 DEGF		.268 OHMM @ 102. DEGF	
TIME Circulation Ended	23:50 24-NOV-97		04:00 02-DEC-97	
TIME Logger on Bottom	SEE LOG		SEE LOG	
Max. Rec. Temp.	98.0 DEGF		102. DEGF	
Equip. | Location	8303	BAKERSFIELD	8303	BAKERSFIELD
Recorded By	GREG PERRY		GREG PERRY	
Witnessed By	MR. MEYER / MR. THOMAS		MR. MEYER / MR. THOMAS	

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.

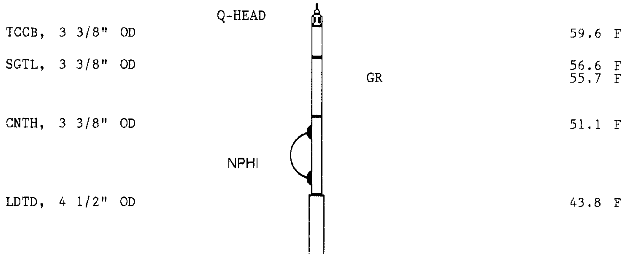
Run No.	ONE	TWO
Service Order No.		
Drilling Fluid Level	0.0 F	50.0 F
Salinity		
Rmf @ BHT	.629 OHMM @ 98.0 DEGF	@ 102. DEGF
Rmc @ BHT	.365 OHMM @ 98.0 DEGF	.223 OHMM @ 102. DEGF
Logging Speed	1800.0 F/HR	
EQUIPMENT DATA		
Tool Number 1	DIS 151	
Tool Number 2	DIC 159	
Tool Number 3	SLSWA	
Tool Number 4	SLC 432	
Tool Number 5	SGC 483	
Tool Number 6	TCCB 1289	
Tool Number 7	GPIT	
Tool Number 8	FMS	
Tool Number 9	DRS 4768	
Tool Number 10	NSCE 2979	
Tool Number 11	CNTH 1345	
Tool Number 12	AMS	

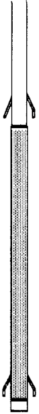
REMARKS:

RAN FLEX JOINTS ON INDUCTION AND SONIC.
RAN 6 ARM FINS ON SONIC.
RAN FLEX JOINTS ABOVE FMS AND ABOVE AMS.
DID NOT TAG TD DUE TO PUSH DOWN TOOLS.

CREW: DAN LEE.
TLC: DAVID BLYTHE.
THANKS FOR CHOOSING SCHLUMBERGER!!!!!

LOGGING TOOL STRING SKETCH





MESTC, 5" OD

CALI 29.2 F

26.5 F

GPIT

EV C2 C1 2.2 F

AZ 1.1 F 1.1 F

TOOL ZERO

TOTAL TOOL STRING LENGTH IS 61.6 F.
TOTAL TOOL STRING WEIGHT IS 1115. LB IN AIR.

MAIN PASS

FILES SPLICED	SPLICE DEPTH
22 TO 103	1805.0 F

ACCUMULATED INTEGRATION VALUES SUMMARY:

```
Integrated Hole Volume:   1674.23 F3    FROM 2609.50 F    TO 376.000 F
Integrated Cement Volume: 1305.73 F3    FROM 2609.50 F    TO 376.000 F
  (ASSUMING 5.50000 IN   O.D. CASING)
```

EVENT MARK SUMMARY:

OUTPUT	INTERVAL BETWEEN PIPS	DEPTH TRACK EDGE
Integrated Hole Volume	10.0000 F3	LEFT EDGE
Integrated Cement Volume	10.0000 F3	RIGHT EDGE

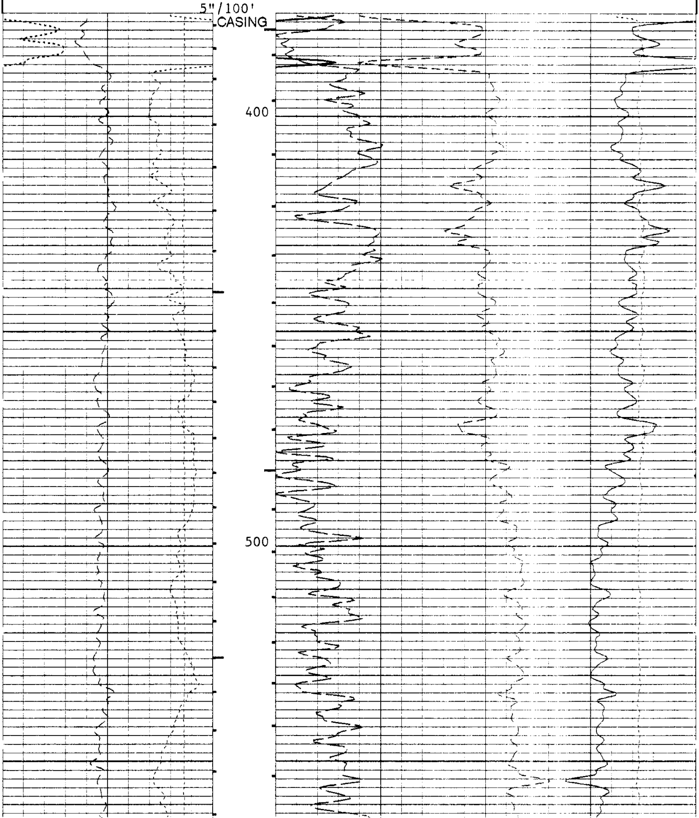
DRHO(G/C3)

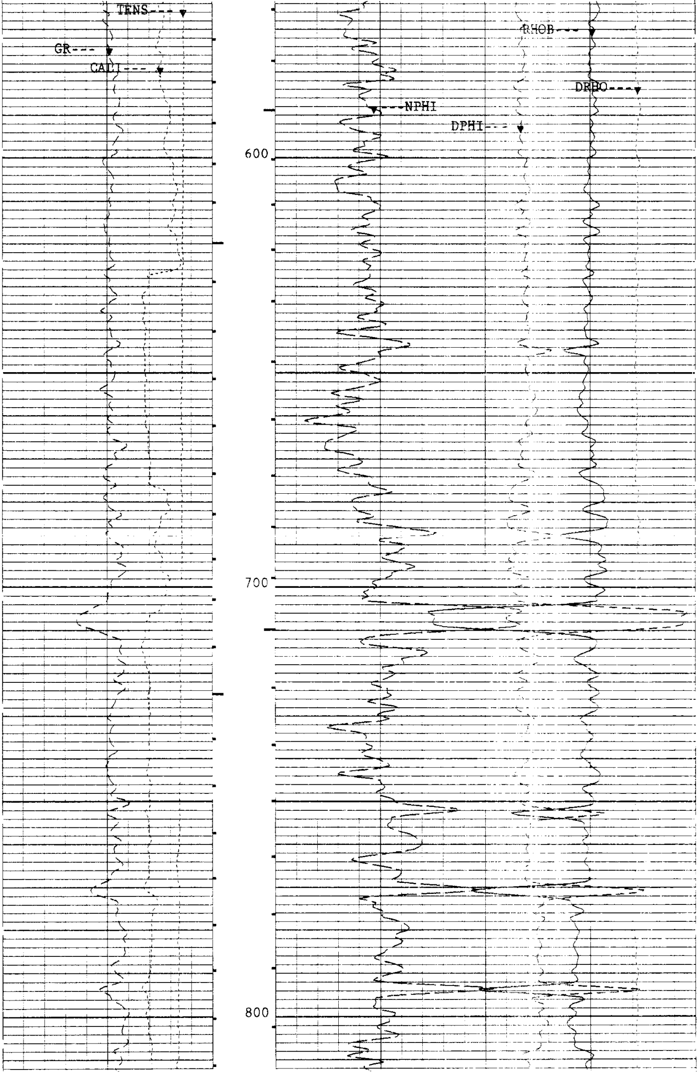
-.2500 .25000

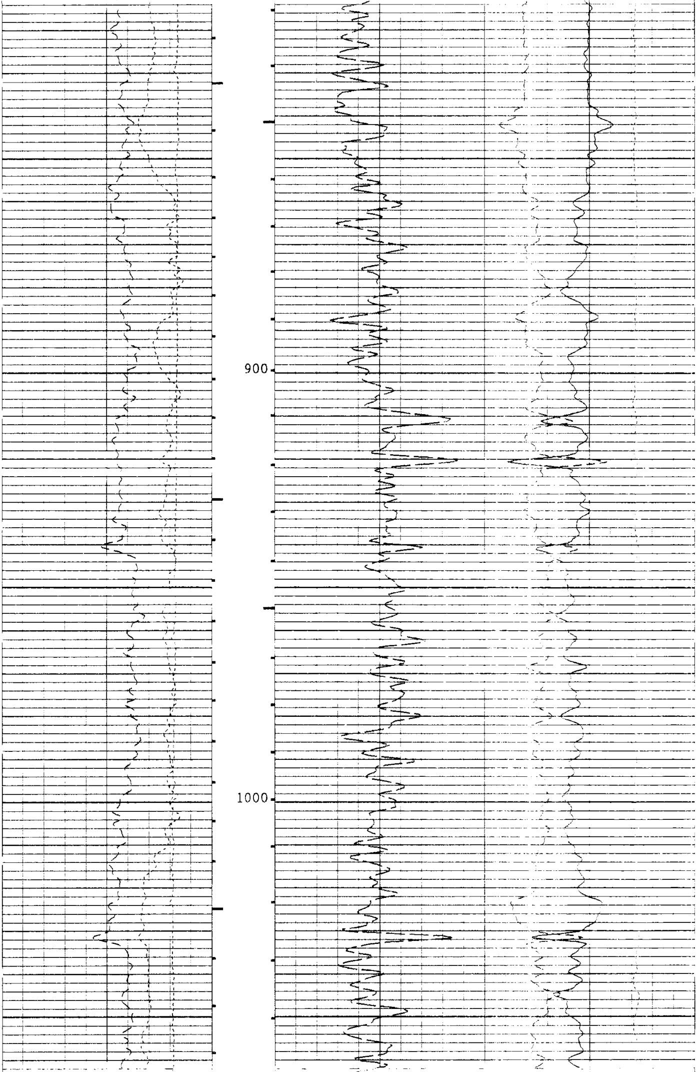
TENS(LBF)		RHOB(G/C3)	
10000.	0.0	3.0000	2.0000
GR(GAPI)		NPHI(V/V)	
0.0	150.00	.60000	0.0
CALI(IN)		DPHI(V/V)	
6.0000	16.000	.60000	0.0
		CROSSOVER	

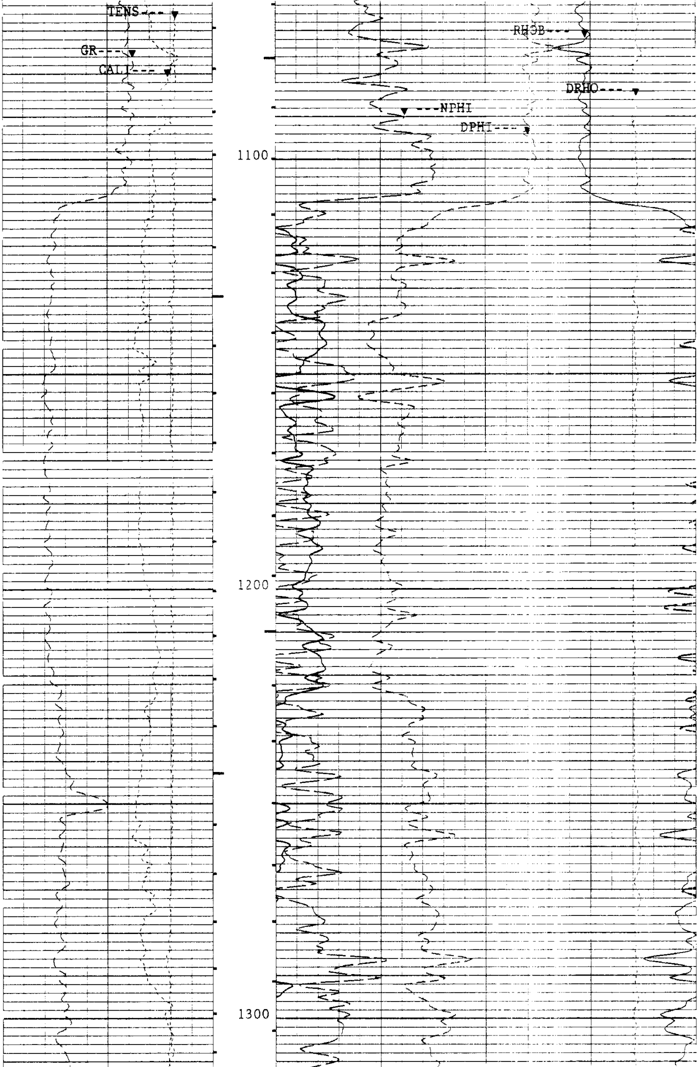
CP 44.2 FILE 116 02-DEC-1997 22:41

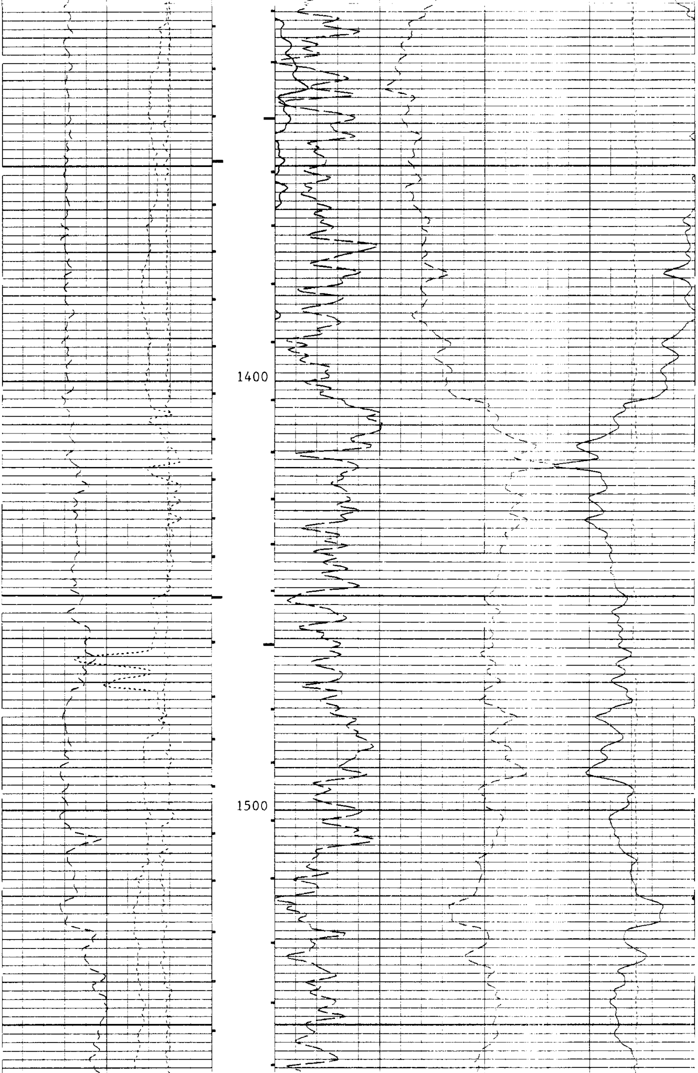
INPUT FILE(S) CREATION DATE
103 25-NOV-1997 16:42

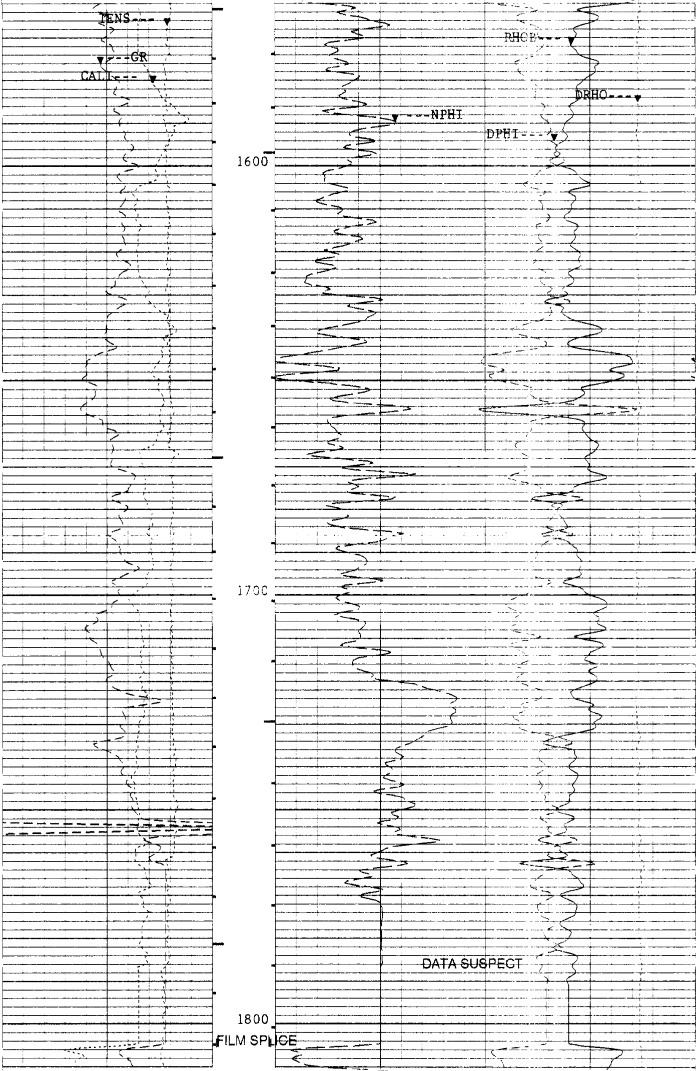


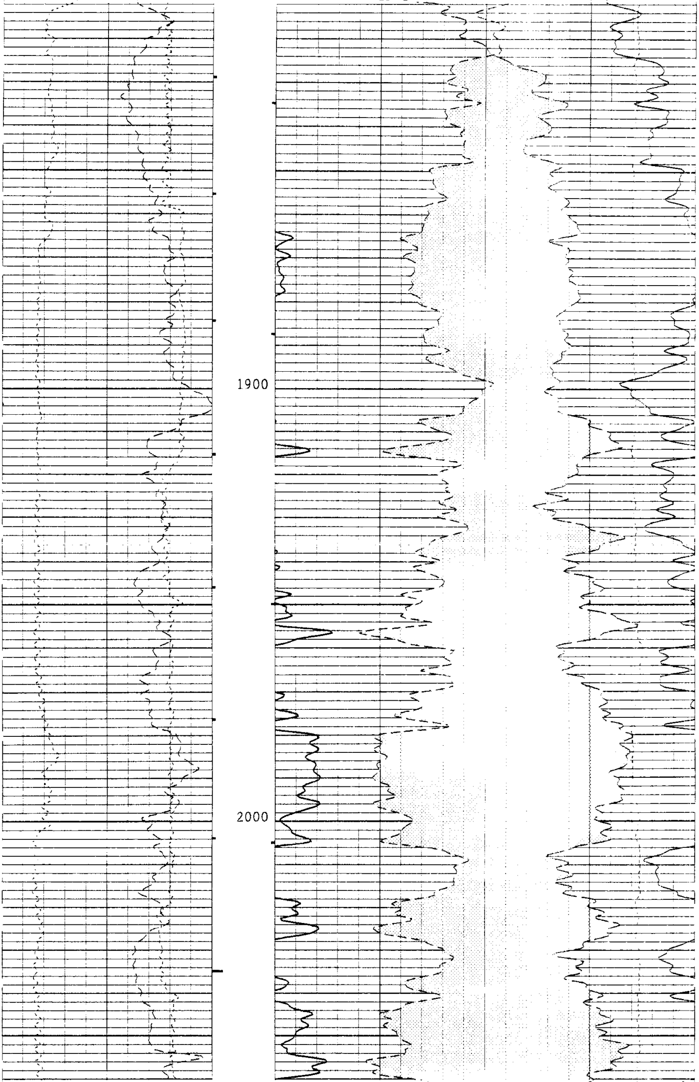


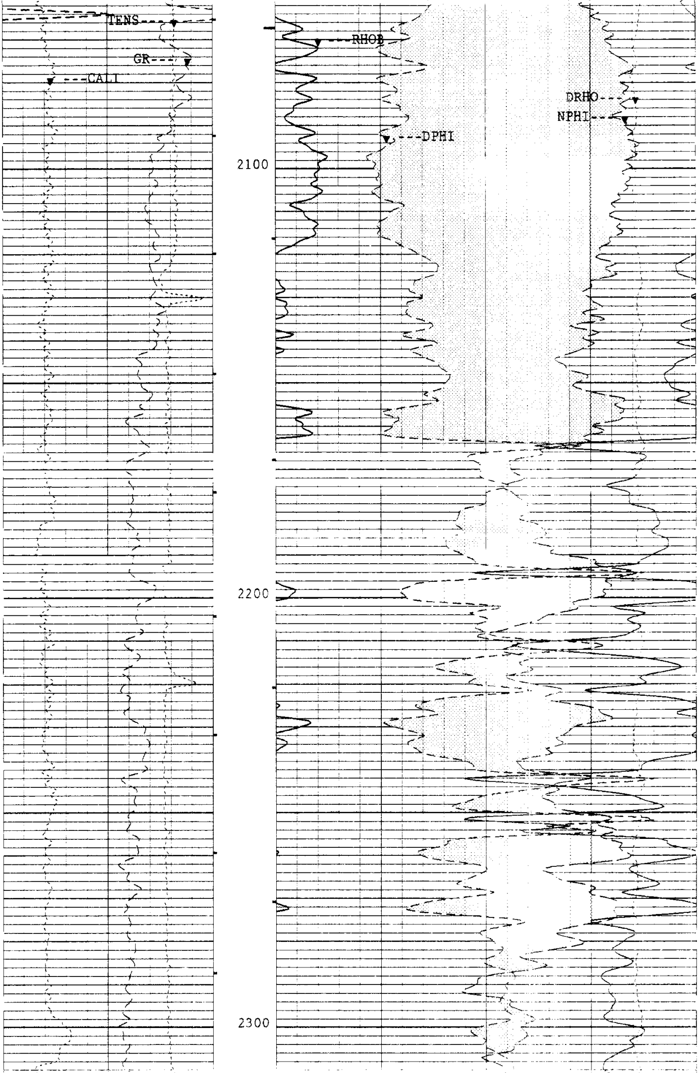


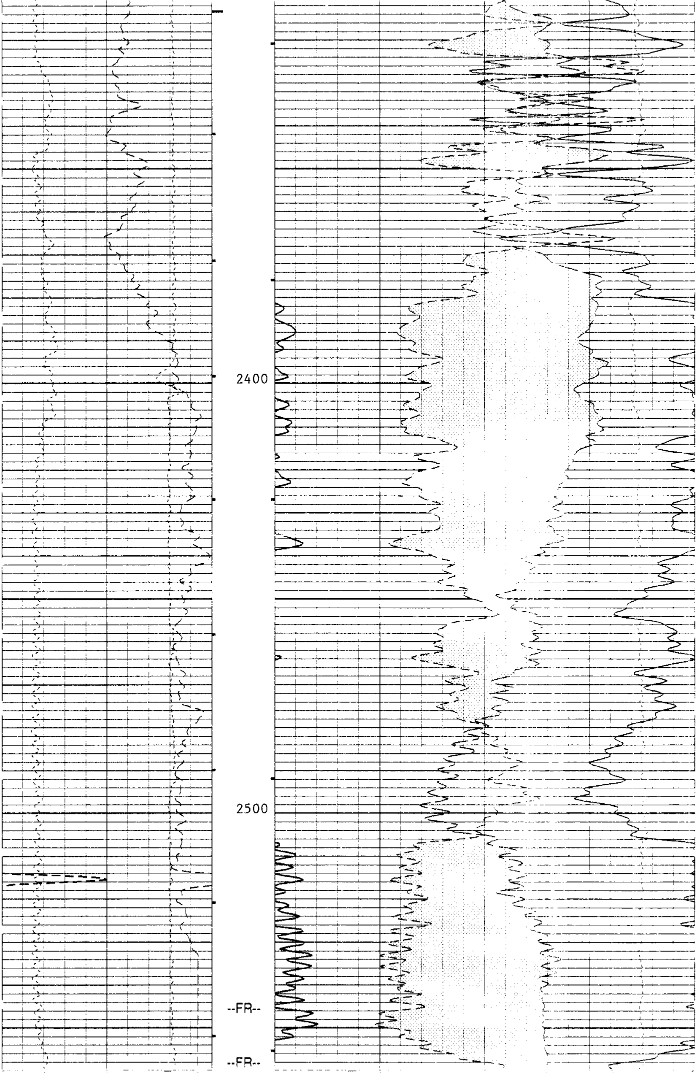


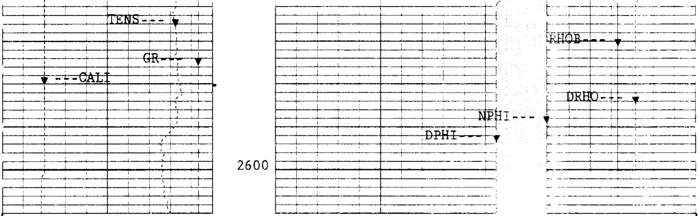








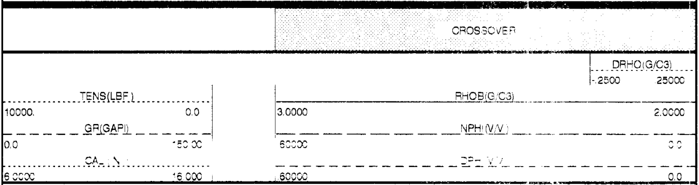




5"/100'

CP 44.2 FILE 116 02-DEC-1997 22:12

INPUT FILE(S) CREATION DATE
22 02-DEC-1997 21:19



SENSOR MEASURE POINT TO TOOL ZERO

LDTD	2.7	FEET	SGTL	29.2	FEET
CNTH	20.7	FEET	DTI	-2.9	FEET
AMS	38.4	FEET			

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
PP	NORM		DO	0.0	F
WMUD	8.60000	LB/G	NCJT	GSRY	
DHC	BS		BFM	LIQU	
NPDC	0		HSCO	YES	
SOCO	NO		MCCO	NO	
BSCO	NO		FSCO	NO	
MWCO	NO		PTCO	NO	
CCCO	NO		SDAT	SOCN	
MCOR	NATU		SOCN	.500000	IN
FSAL	-50000.0	PPM	ANGL	0.0	DEG
GGRD	.0100000	DF/F	BHFL	WATE	
MDEN	2.65000	G/C3	FD	1.00000	G/C3
DPPM	STAN		MATR	SAND	
HC	CALI		DTCI	0.0	F
FCD	5.50000	IN	DFD	8.60000	LB/G
RMFS	.381000	OHMM	MFST	68.0000	DEGF
BS	7.87500	IN	BHS	OPEN	

REPEAT SECTION

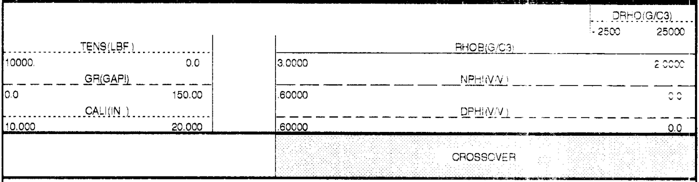
SPEED CORRECTION NOT APPLIED

ACCUMULATED INTEGRATION VALUES SUMMARY:

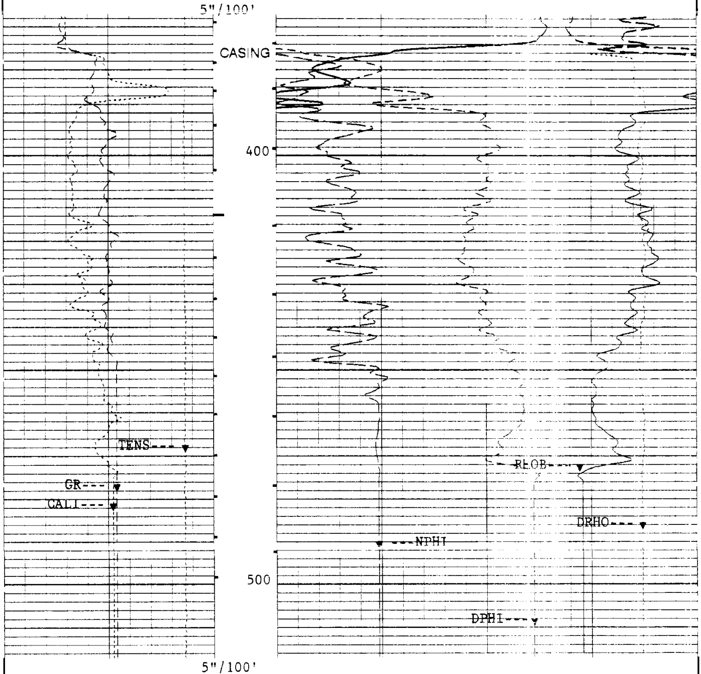
Integrated Hole Volume: 152.042 F3 FROM 509.000 F TO 367.000 F
Integrated Cement Volume: 93.9630 F3 FROM 509.000 F TO 367.000 F
(ASSUMING 8.67500 IN O.D. CASING)

EVENT MARK SUMMARY:

OUTPUT	INTERVAL BETWEEN PIPS	DEPTH TRACK EDGE
Integrated Hole Volume	10.0000 F3	LEFT EDGE
Integrated Cement Volume	10.0000 F3	RIGHT EDGE



CP 44.2 FILE 93 25-NOV-1997 05:46 (UP)



CP 44.2 FILE 93 25-NOV-1997 05:38 (UP)

CROSSOVER

DRHO(G/C3)
-.2500 .25000

TENS(LBF)
10000 0.0

RHOB(G/C3)
3.0000 2.0000

GR(GAPI)
0.0 150.00

NPHI(V/V)
.60000 0.0

CALI(IN)
10.000 20.000

DPHI(V/V)
.60000 0.0

SENSOR MEASURE POINT TO TOOL ZERO

```
LDTD 31.2  FEET                    SGTL 57.7  FEET
MESTC  2.2  FEET                    DTT  -10.9 FEET
CNTH 49.2  FEET                    GPIT  1.1  FEET
```

PARAMETERS

```
NAME  VALUE        UNIT                 NAME  VALUE        UNIT

PADT 0.0           DEG                  WMUD 10.0000       LB/G
NCJT GSRY                               DHC  BS
BFM  LIQU                               NPDC 0
HSCO YES                                SOCO NO
MCCO NO                                 BSCO NO
FSCO NO                                 MWCO NO
PTCO NO                                 CCCO NO
SDAT SOCN                               MCOR NATU
SOCN .500000       IN                   FSAL -50000.0      PPM
ANGL 0.0           DEG                  GGRD .0100000      DF/F
BHFL WATE                               MDEN 2.65000       G/C3
FD   1.00000       G/C3                 FCSR 0.1"
AFMO HAMM                               ICMO AUTO
MDEC 18.6290       DEG                  GLM  DIPM
ICSD -50000.0      F                    RBS  AUTO
PTYP MEC                                MLM  1800
SOFF -1.00000      IN                   CSR  .6"
ODFO RAW                                XMOD AUTO
XGAI 3                                  XOFF 0
DPPM STAN                               MATR SAND
HC   CALI                               FCD  8.67500       IN
SPCR DISA                               DSCA 40            DEG
SBUT 8                                  INT  4.00000       F
STEP 2.00000       F                    SPAN 4
SANG 35.0000                            DPAD AUTO
DMAX 90            DEG                  ELRA .500000       IN
SDFA .900000                            HQUA 14
LQUA 6                                  STDI 0.0           DEG
STDA 0.0           DEG                  CSBL 2
STEM 45.0000       DEGF                 DFD  10.0000       LB/G
RMFS .880000       OHMM                 RMS  1.51000       OHMM
MST  85.0000       DEGF                 MFST 68.0000       DEGF
BS   12.2500       IN                   BHS  OPEN
```

CALIBRATIONS

BEFORE SURVEY CALIBRATION Summary

```
Performed:    23-NOV-1997 11:01
Program File: NSDIP  (Version    44.2    95/07/25  95/07/25)


MEST             Caliper Calibration Summary
```

```
             MEASURED                           CALIBRATED
           Small    Large                     Small      Large          UNITS
    C1     8.70     12.65                     7.88       12.00           IN
    C2     8.75     12.56                     7.88       12.00           IN

Small: 23-NOV-1997 10:55 Large: 23-NOV-1997 10:56 Comp: 23-NOV-1997 10:56


GPIC             Calibration Summary

 MAGNETOMETER MANUFACTURER CODE:                3
 MAGNETOMETER SERIAL NUMBER:                   10
 MAGNETOMETER REFERENCE TEMPERATURE :          20.0  DEGC


GPIC             Calibration Summary

 ACCELEROMETER MANUFACTURER CODE:                3
 ACCELEROMETER SERIAL NUMBER:                  339
 ACCELEROMETER REFERENCE TEMPERATURE :          20.0  DEGC


CNTH             Detector Calibration Summary

      Neutron Cartridge Number     : 1345
      Neutron Source Number        : 2576
      Thermal Housing Number       : 4431
      Alpha detectors              : Yes

          Input     Plus       Shop     Gain      Shop      Before      Tol.
                 Reference     Tank                Bkg        Bkg        Bkg
                   Counts     Counts             Counts     Counts     Counts

          CNTC    6031.00    5998.75    1.005     24.754     25.907      3.713
          CFTC    2793.00    2640.31    1.058     30.245     40.242      4.537

          Ratio      2.159      2.272


Before Survey Calibrations done: 23-NOV-1997 10:26


LDTD             Detector Calibration Summary

        Density Resistivity Sonde Number    :    4768
        Nuclear Services Cartridge Number   :    2979
        Powered Detector Housing Number     :    1989
        Powered Gamma-Gamma Detector Number :    1989
        LDT Logging Source Number           :    1925
        LDT Calibration Mode                :    WATE

                 Measured      Shop  Values
                   Bkgd       Al+Fe    Al       Units
          LL       20.1        91.5  100.0       CPS
          LU       77.6       137.2  150.3       CPS
          LS       58.9       160.1  175.1       CPS
         LITH       5.6        42.3   66.5       CPS
          SS1      18.3       174.5  191.0       CPS
          SS2      12.4       250.6  271.1       CPS

           HV Settings            Detector Resolutions
          HV LS:  1233.2 V             LS:  8.9 %
          HV SS:  1206.3 V             SS:  8.9 %

Wellsite Calibration done: 23-NOV-1997 10:31


SGTL             Detector Calibration Summary

             MEASURED
           BKGD     JIG         CALIBRATED          UNITS
    GR      0        0              0               GAPI

Back:                      Jig:                   Comp:


LDTD             Caliper Calibration Summary
```

```
              MEASURED                         CALIBRATED
            Small   Large                    Small     Large        UNITS
   CALI     6.55    10.82                    7.88      12.00         IN

Small: 23-NOV-1997 10:59 Large: 23-NOV-1997 11:00 Comp: 23-NOV-1997 11:00

   CP 44.2             FILE     0       23-NOV-1997 11:01



                SHOP Summary


  Performed:    20-OCT-1997 09:46
  Program File: CCSHOP (Version    44.2    95/07/25  95/07/25)


DITE            Calibration Summary

Sonde Serial Number: 151
Cartridge Serial Number: 159

                        SHOP CONSTANTS

Test Loop Calibration:  Calibration of internal reference
                        to test loop standard


        Cons.   Gain     Valid Range      Cons.   Phase    Valid Range
                (---)      (---)                  ( DEG )    ( DEG )

10KHz:
  ILD:  DGF1     .999   .900 => 1.100    DPH1      .15   -1.50 =>  1.50
  ILM:  MGF1    1.054   .900 => 1.100    MPH1     -.32   -1.50 =>  1.50

20KHz:
  ILD:  DGF2    1.009   .900 => 1.100    DPH2     -.00   -2.00 =>  2.00
  ILM:  MGF2    1.058   .900 => 1.100    MPH2    -1.08   -3.00 =>  1.00

40KHz:
  ILD:  DGF4    1.023   .900 => 1.100    DPH4    -1.09   -4.00 =>  2.00
  ILM:  MGF4    1.083   .900 => 1.100    MPH4    -2.65   -5.00 =>  1.00


Sonde Error Corrections:  Correction for sonde response in Zero
                          Conductivity Environments

            Cons.  Sonde Error    Valid Range
                   Correction
                    (MM/M )        (MM/M )


10KHz:
  IRD SEC:  DRE1      31.60      -50.0 => 125.0
  IXD SEC:  DXE1     221.33     -250.0 => 350.0
  IRM SEC:  MRE1      63.89      -50.0 => 140.0
  IXM SEC:  MXE1      27.25    -1300.0 =>1300.0

20KHz:
  IRD SEC:  DRE2      11.56      -30.0 =>  30.0
  IXD SEC:  DXE2     124.49     -125.0 => 200.0
  IRM SEC:  MRE2      17.10      -50.0 =>  50.0
  IXM SEC:  MXE2      39.01     -650.0 => 650.0

40KHz:
  IRD SEC:  DRE4       1.24      -15.0 =>  15.0
  IXD SEC:  DXE4      79.27      -75.0 => 125.0
  IRM SEC:  MRE4       3.45      -30.0 =>  30.0
  IXM SEC:  MXE4      46.63     -350.0 => 350.0


NOTE: All Sonde Error Corrections have been normalized to 25 DegC.


               Shop Electronic Calibration Summary

Electronic Calibration:  Calibration of System Electronics
                         using the internal reference

Induction Electronics:
```

```
      Offset   Valid Range    Gain  Valid Range     Phase   Valid Range
      (MM/M )   (MM/M )       (--)     (---)        (DEG.)    (DEG.)

10 KHz:
  IRD   20.1 -375. => 375.    .936   .75 => 1.25
  IXD   47.4 -375. => 375.    .942   .75 => 1.25    10.99  -5.00 => 20.00
  IRM   64.2 -900. => 900.    .954   .75 => 1.25
  IXM    1.5 -900. => 900.    .917   .75 => 1.25     8.98  -5.00 => 20.00

20 KHz:
  IRD    8.0 -150. => 150.    .983   .75 => 1.25
  IXD   19.6 -150. => 150.    .989   .75 => 1.25     9.11  -5.00 => 20.00
  IRM   26.2 -350. => 350.    .997   .75 => 1.25
  IXM     .7 -350. => 350.    .958   .75 => 1.25     8.51  -5.00 => 20.00

40 KHz:
  IRD    5.2 -100. => 100.    .979   .75 => 1.25
  IXD   13.1 -100. => 100.    .984   .75 => 1.25    24.78 -10.00 => 35.00
  IRM   17.0 -200. => 200.   1.003   .75 => 1.25
  IXM     .5 -200. => 200.    .964   .75 => 1.25    25.13 -10.00 => 35.00

SFL Electronics:

       Offset  Valid Range    Units      Gain   Valid Range

  SFV     .5  -16.0 => 16.0    MV         .988   .75 => 1.25
  SFC    -.0     -.7 =>   .7   MA         .987   .75 => 1.25


DITE            Electronics Calibration Summary

Sonde SN#: 151
Cartridge SN#: 159
Induction Freq: 20  KHz

Induction Electronics:

      Offset   Valid Range    Gain  Valid Range     Phase   Valid Range
      (MM/M )   (MM/M )       (--)     (---)        (DEG.)    (DEG.)

  IRD    8.0 -117. => 133.    .982   .84 => 1.18
  IXD   19.6 -105. => 145.    .988   .84 => 1.19     9.13  -5.89 => 24.11
  IRM   26.2 -199. => 251.    .995   .85 => 1.20
  IXM     .7 -224. => 226.    .956   .81 => 1.15     8.57  -6.49 => 23.51

SFL Electronics:

       Offset  Valid Range    Units      Gain   Valid Range

  SFV     .5  -14.5 => 15.5    MV         .99   .84 => 1.19
  SFC    -.0     -.6 =>   .6   MA         .99   .84 => 1.18

   CP 44.2          FILE    0      20-OCT-1997 09:45



                SHOP Summary


  Performed:     12-AUG-1997 11:13
  Program File: CCSHOP (Version    44.2    95/07/25  95/07/25)


CNTH            Detector Calibration Summary

      CNC #               : 4431
      Neutron Source #    : 2576
      Thermal Housing #   : 4431
      Alpha detectors     : Yes

          Input      Plus       Shop    Gain      Shop
                  Reference     Tank              Bkg
                    Counts     Counts            Counts
```

```
          CNTC    6031.00   5998.75   1.005    24.754
          CFTC    2793.00   2640.31   1.058    30.245

          RATIO     2.159     2.272

          Shop Counts temperature and housing size corrected

Shop Tank Calibration done: 12-AUG-1997 11:13

   CP 44.2            FILE     0       12-AUG-1997 11:13



                SHOP Summary


  Performed:    12-AUG-1997 14:06
  Program File: CCSHOP (Version    44.2    95/07/25  95/07/25)


LDTD            Detector Calibration Summary

        Density Resistivity Sonde Number     :  4768
        Nuclear Service Cartridge Number     :  2979
        Powered Detector Housing Number      :  1989
        Powered Gamma-Gamma Detector Number :  1989
        LDT Logging Source Number            :  1925
        LDT Calibration Mode                 :  WATE

                     Master Calibrated
                    Bkgd   Al+Fe     Al  Units
              LL    19.9    91.5   100.0   CPS
              LU    76.0   137.2   150.3   CPS
              LS    58.0   160.1   175.1   CPS
            LITH     5.6    42.3    66.5   CPS
             SS1    18.2   174.5   191.0   CPS
             SS2    12.4   250.6   271.1   CPS

          HV Settings          Detector Resolutions
        HV LS:  1230.1 V            LS:  8.7 %
        HV SS:  1201.1 V            SS:  8.7 %

                  Spectrum Quality Ratios
          Computed Value       Nominal Value    Tolerance
   QRLS         .666                0.65          +/- 0.05
   QRSS         .704                0.72          +/- 0.10
   QRLI         .380                0.39          +/- 0.06
   QLIR        1.436                1.39          +/- 0.06
   QR          1.000                1.00          +/- 0.02

Shop Block Calibration done: 12-AUG-1997 13:57

   CP 44.2            FILE     0       12-AUG-1997 14:06
```

COMPANY	NORTHWEST NATURAL GAS CO.		
WELL	IW 32-22-65		
FIELD	MIST GAS STORAGE		
COUNTY:	COLUMBIA	**STATE:**	OREGON

SCHL.	**FR**	2590.0 F
SCHL.	**TD**	2590.0 F
DRLR.	**TD**	2600.0 F
Elev:	**KB**	838.1 F
	DF	
	GL	822.1 F

Schlumberger

FORMATION DENSITY COMPENSATED NEUTRON GAMMA RAY 5"