FORMATION DENSITY COMPENSATED NEUTRON GAMMA RAY 2"

NORTHWEST NATURAL GAS CO.

IW 32-22-65

MIST GAS STORAGE

COLUMBIA **STATE:** OREGON

085.04' & S 03-12-06

THE NE COR. OF SEC 22

	SECT.	**TWP.**	**RANGE**
	22	6N	5W

Other Services:
INDUCTION
SONIC
FMS
DENSITY
NEUTRON
GAMMA RAY

LEVEL **Elev.** 822.1 F
SHING 16.0 F **above Perm. Datum**
SHING

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

		02-DEC-1997	
		TWO	
		2600.0 F	
		2590.0 F	
		2590.0 F	
		1800.0 F	
77.0 F	8 5/8"	@ 1802.0 F	@
		@	@
		FLO-PRO	
	56.0 S	8.60 LB/G	48.0 S
		10.0	
		FLOWLINE	
	@ 85.0 DEGF	.360 OHMM	@ 74.0 DEGF
	@ 68.0 DEGF	.381 OHMM	@
	@ 68.0 DEGF	.324 OHMM	@ 68.0 DEGF
	CELL	CELL	CELL
	@ 98.0 DEGF	.268 OHMM	@ 102. DEGF
97		04:00 02-DEC-97	
		SEE LOG	
		102. DEGF	
	BAKERSFIELD	8303	BAKERSFIELD
		GREG PERRY	
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.

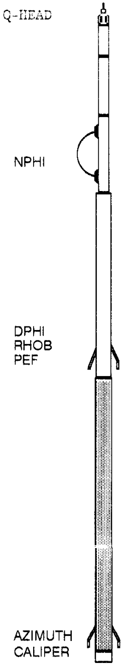
Run No.	ONE	TWO
Service Order No.		
Drilling Fluid Level	0.0 F	50.0 F
Salinity		
Rmf @ BHT	.629 OHMM @ 98.0 DEGF	@ 102. DEGF
Rmc @ BHT	.365 OHMM @ 98.0 DEGF	.223 OHMM @ 102. DEGF
Logging Speed	1800.0 F/HR	
EQUIPMENT DATA		
Tool Number 1	DIS 151	
Tool Number 2	DIC 159	
Tool Number 3	SLSWA	
Tool Number 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



TCCB, 3 3/8" OD		59.6 F
SGTL, 3 3/8" OD		56.6 F
	GR	55.7 F
CNTH, 3 3/8" OD		51.1 F
LDTD, 4 1/2" OD		43.8 F
	CALI	29.2 F
MESTC, 5" OD		26.5 F
	EV C2 C1	2.2 F
GPIT	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:

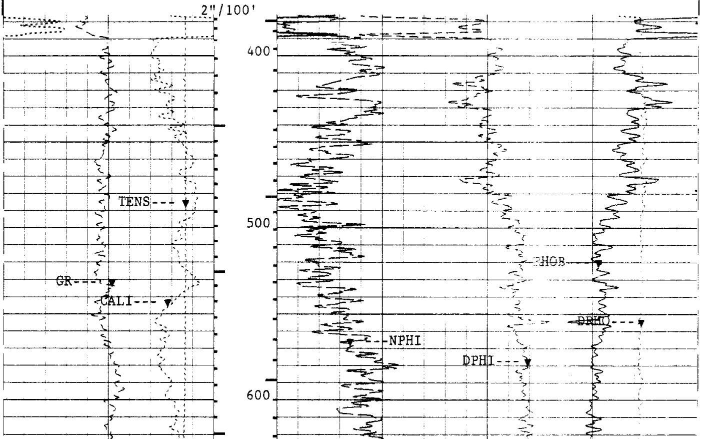
OUTPUT	INTERVAL BETWEEN PIPS	DEPTH TRACK EDGE
Integrated Hole Volume	10.0000 F3	LEFT EDGE
Integrated Cement Volume	10.0000 F3	RIGHT EDGE

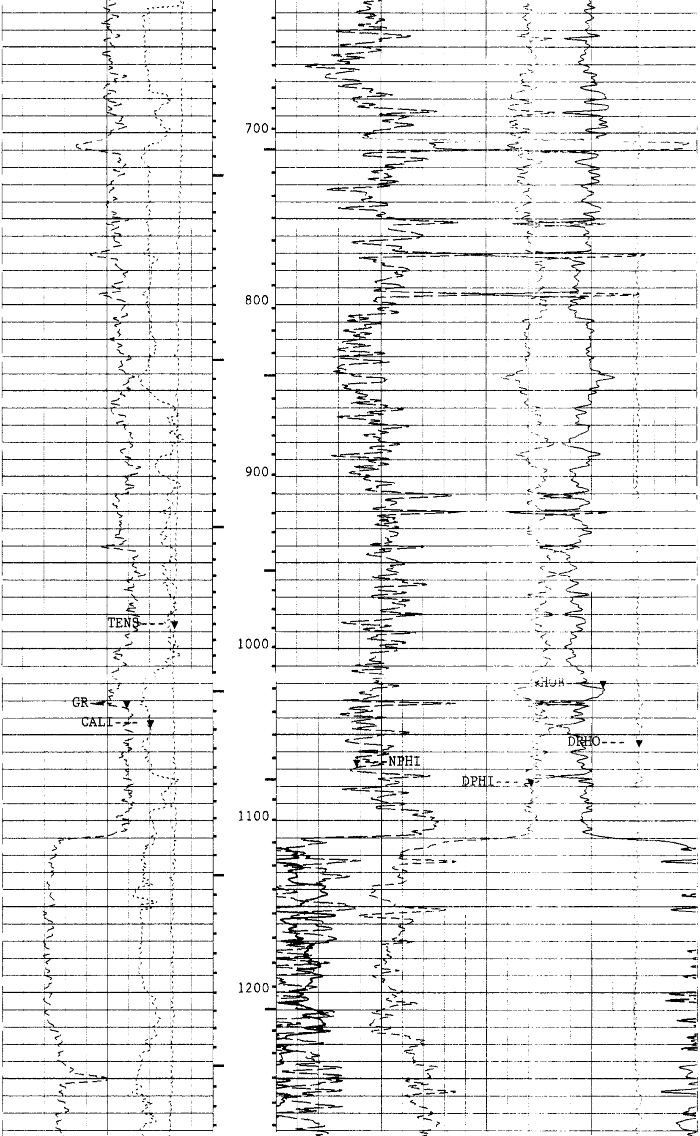
Curve	Left scale	Right scale
DRHO(G/C3)	-.2500	.25000
TENS(LBF)	10000.	0.0
RHOB(G/C3)	3.0000	2.0000
GR(GAPI)	0.0	150.00
NPHI(V/V)	.60000	0.0
CALI(IN)	6.0000	16.000
DPHI(V/V)	.60000	0.0

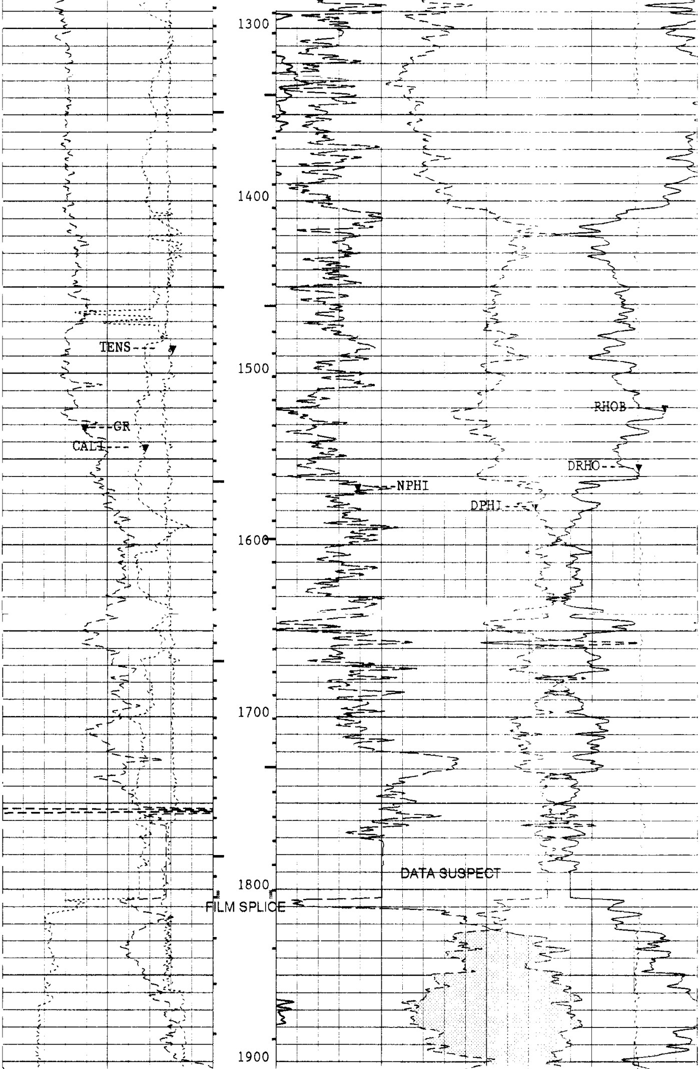
CROSSOVER

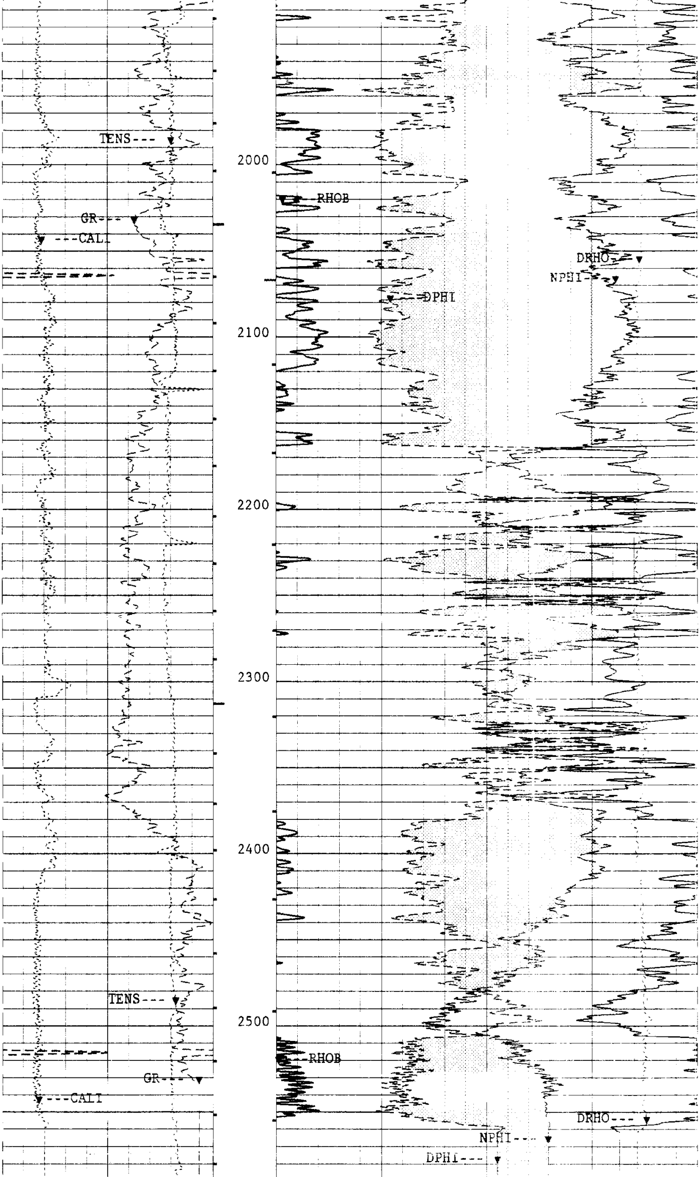
CP 44.2   FILE 116   02-DEC-1997 22:41

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









2"/100'

CP 44.2　　FILE 116　　02-DEC-1997 22:12

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

CROSSOVER

DRHO(G/C3)
-.2500　　.25000

TENS(LBF)
10000.　　0.0

GR(GAPI)
0.0　　150.00

CALI(IN)
6.0000　　16.000

RHOB(G/C3)
3.0000　　2.0000

NPHI(V/V)
.60000　　0.0

DPHI(V/V)
.60000　　0.0

SENSOR MEASURE POINT TO TOOL ZERO

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

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
PP	NORM		DO	0.0	F
WMUD	8.60000	LB/G	NCUT	GSRI	
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
```

DRHO(G/C3)
-.2500 25000

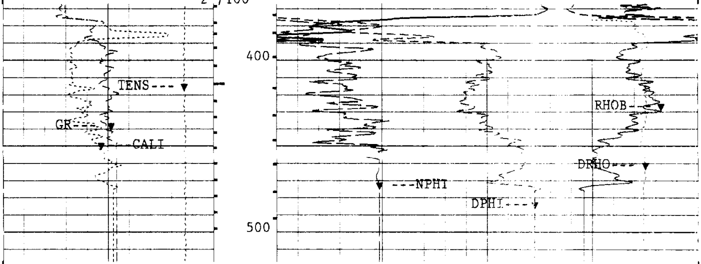
TENS(LBF)
10000. 0.0
GR(GAPI)
0.0 150.00
CALI(IN)
10.000 20.000

RHOB(G/C3)
3.0000 2.0000
NPHI(V/V)
.60000 0.0
DPHI(V/V)
.60000 0.0

CROSSOVER

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

2"/100'



2"/100'

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

CROSSOVER

DRHO(G/C3)
-.2500 25000

TENS(LBF)
10000. 0.0
GR(GAPI)
0.0 150.00
CALI(IN)
10.000 20.000

RHOB(G/C3)
3.0000 2.0000
NPHI(V/V)
.60000 0.0
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    40.292      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  -5.39 => 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.			SCHL.	FR	2590.0 F
				SCHL.	TD	2590.0 F
WELL	IW 32-22-65			DRLR.	TD	2600.0 F
FIELD	MIST GAS STORAGE			Elev:	KB	838.1 F
					DF	
COUNTY:	COLUMBIA	**STATE:**	OREGON		GL	822.1 F

Schlumberger

FORMATION DENSITY COMPENSATED NEUTRON GAMMA RAY 2"