Schlumberger

DUAL INDUCTION / SP GAMMA RAY / SONIC 2"

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

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		**Elev.: K.B.** 838.1 F
Log Measured From	KELLY BUSHING	16.0 F	**above Perm. Datum**	**D.F.**
Drilling Measured From	KELLY BUSHING			**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 wilful 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

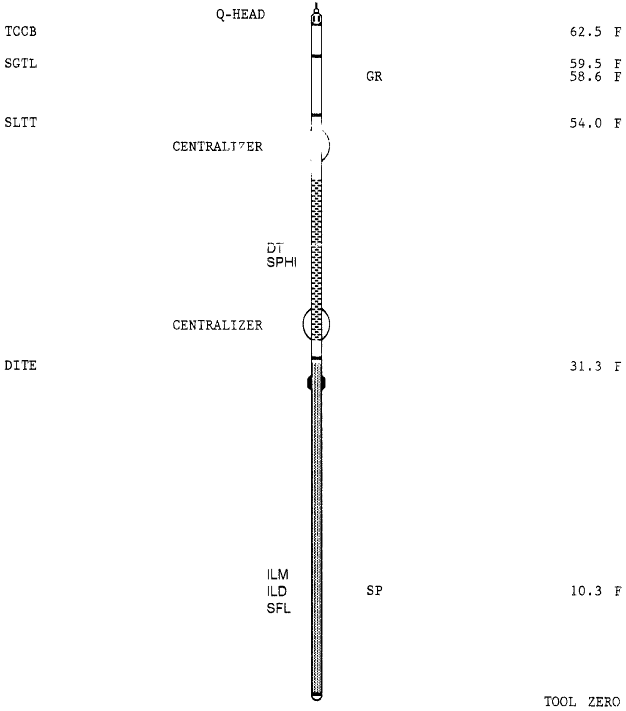
Run No.	ONE		TWO	
Service Order No.				
Drilling Fluid Level	0.0 F		50.0 F	
Salinity				
Rmf @ BHT	.629 OHMM	@ 98.0 DEGF		@ 102. DEGF
Rmc @ BHT	.365 OHMM	@ 98.0 DEGF	.223 OHMM	@ 102. DEGF
Logging Speed	1800.0 F/HR			
EQUIPMENT DATA				
Tool Number 1	DIS 151			
Tool Number 2	DIC 159			
Tool Number 3	SLSWA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

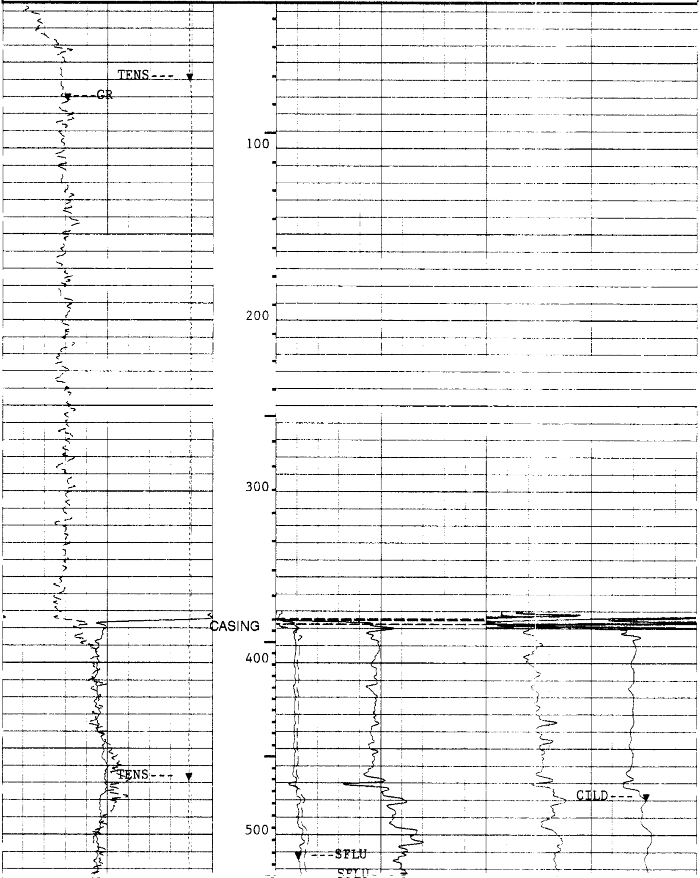
CREW: DAN LEE.
TLC: DAVID BLYTHE.
THANKS FOR CHOOSING SCHLUMBERGER!!!!!

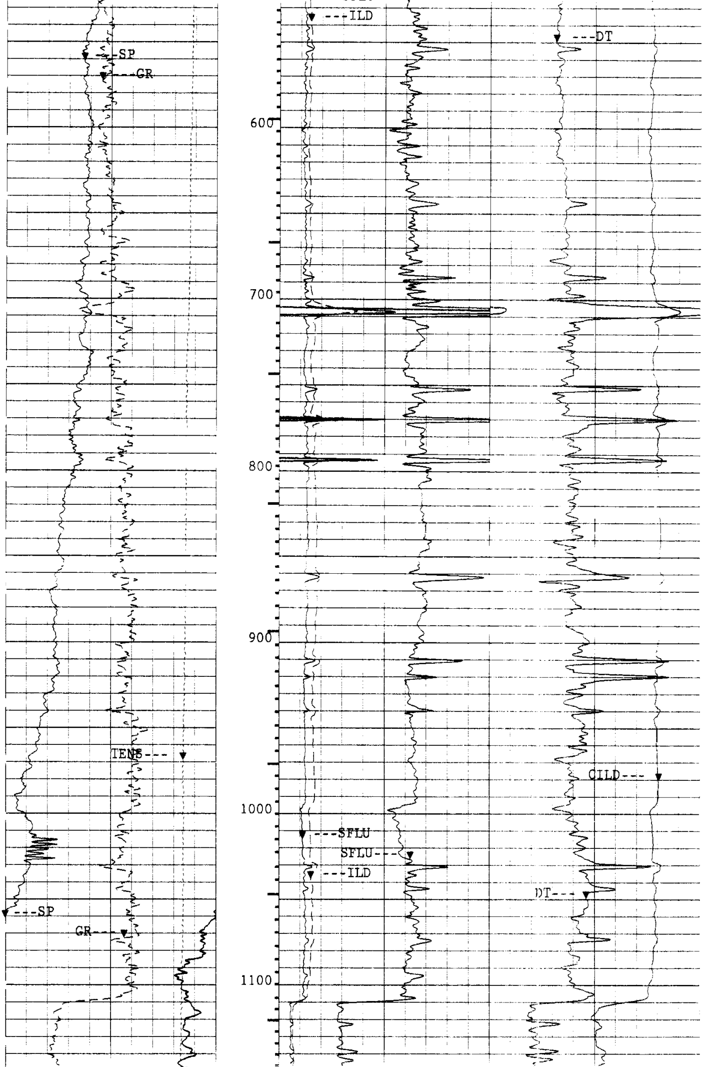
LOGGING TOOL STRING SKETCH

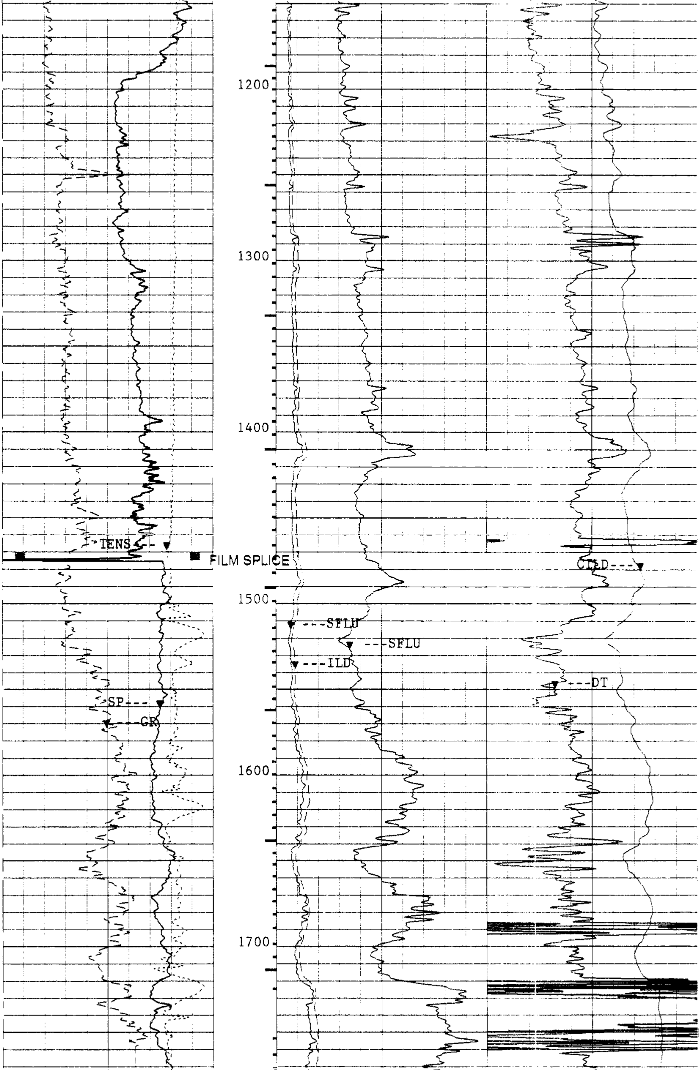


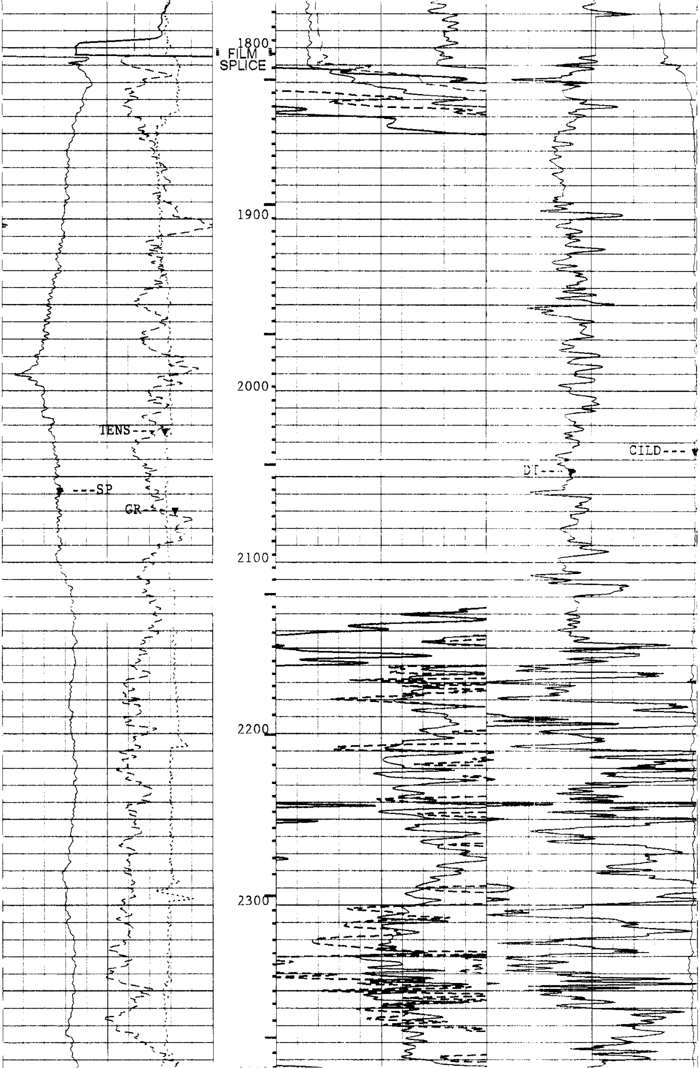
TOTAL TOOL STRING LENGTH IS 64.7 F.
TOTAL TOOL STRING WEIGHT IS 1032. LB IN AIR.

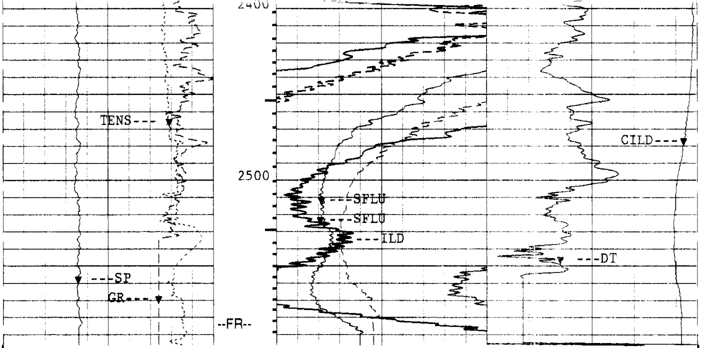
MAIN PASS











2"/100'

CP 44.2 FILE 115 02-DEC-1997 14:31

INPUT FILE(S) CREATION DATE
9 02-DEC-1997 12:54

TENS(LBF)		SFLU(OHMM)			
10000	0.0	0.0	30.000		
SP(MV)		SFLU(OHMM)		CILD(MMHO)	
-50.00	50.000	0.0	6.0000	1000.0	0.0
GR(GAPI)		ILD(OHMM)		DT(US/F)	
0.0	150.00	0.0	30.000	175.00	75.000

SENSOR MEASURE POINT TO TOOL ZERO

MTEM	71.8	FEET	SP	10.3	FEET
GR	62.6	FEET	MRES	71.8	FEET
SRAT	39.1	FEET	AMPL	41.6	FEET
TT1	40.6	FEET	CBL	41.6	FEET
TT3	37.8	FEET	TT2	41.6	FEET
T0	41.6	FEET	TT4	36.8	FEET
TTSL	41.6	FEET	TT	41.6	FEET
IXM	6.0	FEET	CBSL	41.6	FEET
IXD	9.5	FEET	IRM	6.0	FEET
SPA	10.3	FEET	ITEM	6.5	FEET
SFC	6.5	FEET	SFB	6.5	FEET
IRD	9.5	FEET	SFV	6.5	FEET
HTEN	0.0	FEET	TENS	0.0	FEET
NOIS	0.0	FEET			

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
SMB	DISA		VDLR	2IN	
TOCA	DISA		RATE	15	HZ
DG	AUTO		DETE	E2	
NMSG	180	US	CBLG	35	US
AMPL	2		CBL	2	
WFM	1		SS	FAST	

```
TOD  DISA                       SLC  UA
DTF  189.000     US/F           DTM  56.0000     US/F
CDTS 100.000                    SPFS R-H
PP   NORM                       DO   3.00000     F
WMUD 8.60000     LB/G           TD   32768.0     F
IFRS 20          KHZ            SBR  1.00000     OHMM
MXE2 39.0062     MM/M           DXE2 124.493     MM/M
MRE2 17.0971     MM/M           DRE2 11.5626     MM/M
MPH2 -1.08185    DEG            DPH2 -.001757    DEG
MGF2 1.05831                    DGF2 1.00935
DESP DISA                       SFLE ALLO
DCAS -50000.0    F              ITEN ALLO
DEVI 85.0000     DEG            DSES H48
IPRO STAN                       IPHA NORM
DWCO 512                        DSIN 5           US
DDEL 200         US             NCJT GSRY
GTSE TEMP                       SHT  45.0000     DEGF
BHT  85.0000     DEGF           DTCI 0.0         F
SPAE DISA                       BS   7.87500     IN
BHS  OPEN
```

REPEAT SECTION

ACCUMULATED INTEGRATION VALUES SUMMARY:

Integrated Transit Time: .0193556 S FROM 498.500 F TO 366.500 F

EVENT MARK SUMMARY:

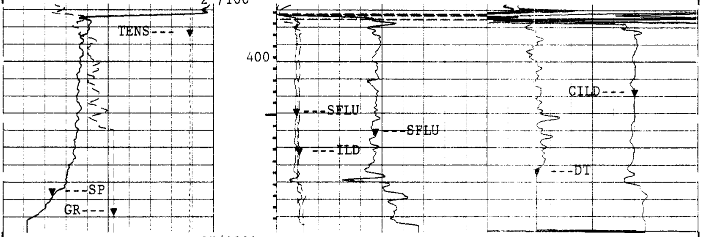
OUTPUT	INTERVAL BETWEEN PIPS	DEPTH TRACK EDGE
Integrated Transit Time	.00100000 S	RIGHT EDGE

TENS(LBF)		SFLU(OHMM)	
10000. 0.0		0.0 30.000	
SP(MV)		SFLU(OHMM)	CILD(MM/M)
-50.00 50.000		0.0 6.0000	1000.0 0.0
GR(GAPI)		ILD(OHMM)	DT(US/F)
0.0 150.00		0.0 30.000	175.00 75.000

CP 44.2 FILE 1 25-NOV-1997 20:12

INPUT FILE(S) CREATION DATE
87 25-NOV-1997 03:35

2"/100'



2"/100'

CP 44.2 FILE 1 25-NOV-1997 20:11

INPUT FILE(S) CREATION DATE
87 25-NOV-1997 03:35

TENS(LBF) 10000. — 0.0	SFLU(OHMM) 0.0 — 30.000	
SP(MV) -50.00 — 50.000	SFLU(OHMM) 0.0 — 6.0000	CILD(MM/M) 1000.0 — 0.0
GR(GAPI) 0.0 — 150.00	ILD(OHMM) 0.0 — 30.000	DT(US/F) 175.00 — 75.000

SENSOR MEASURE POINT TO TOOL ZERO

DITE	10.3	FEET	SGTL	62.6	FEET
AMS	71.8	FEET	DTT	3.0	FEET
SLTT	41.6	FEET			

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
SMB	DISA		VDLR	2IN	
TOCA	DISA		RATE	15	HZ
DG	AUTO		DETE	E2	
NMSG	180	US	CBLG	35	US
AMPL	2		CBL	2	
WFM	1		SS	FAST	
TOD	DISA		SLC	UA	
DTF	189.000	US/F	DTM	56.0000	US/F
CDTS	100.000		SPFS	R-H	
PP	NORM		DO	0.0	F
WMUD	10.0000	LB/G	TD	32768.0	F
IFRS	20	KHZ	SBR	1.00000	OHMM
MXE2	39.0062	MM/M	DXE2	124.493	MM/M
MRE2	17.0971	MM/M	DRE2	11.5626	MM/M
MPH2	-1.08185	DEG	DPH2	-.001757	DEG
MGF2	1.05831		DGF2	1.00935	
DESP	DISA		SFLE	ALLO	
DCAS	-50000.0	F	ITEN	ALLO	
DEVI	0.0	DEG	DSES	H48	
IPRO	STAN		IPHA	NORM	
DWCO	512		DSIN	5	US
DDEL	200	US	NCJT	GSRY	
GTSE	TEMP		SHT	45.0000	DEGF
BHT	85.0000	DEGF	DTCI	0.0	F
SPAE	DISA		BS	12.2500	IN
BHS	OPEN				

CALIBRATIONS

BEFORE SURVEY CALIBRATION Summary

Performed: 02-DEC-1997 12:54
Program File: TOH (Version 44.2 95/07/25 95/07/25

SGTL Detector Calibration Summary

	MEASURED BKGD	MEASURED JIG	CALIBRATED	UNITS
GR	35	192	165	GAPI

Back: 29-AUG-1997 10:04 Jig: 29-AUG-1997 10:08 Comp: 29-AUG-1997 10:08

DITE Electronics Calibration Summary

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

Induction Electronics:

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

```
  IRD    7.9 -117. => 133.     .986   .84 => 1.18
  IXD   20.0 -105. => 145.     .993   .84 => 1.19     8.64  -5.89 => 24.11
  IRM   26.1 -199. => 251.     .999   .85 => 1.20
  IXM     .3 -224. => 226.     .959   .81 => 1.15     8.11  -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

Plus Measurement performed at: 02-DEC-1997 12:53

Shop cals used were performed: 29-AUG-1997 11:39

   CP 44.2           FILE    8      02-DEC-1997 12:53



                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

DUAL INDUCTION / SP
GAMMA RAY / SONIC 2"