COLLINS AND WARE
MR. JIM ORSETH

SHORT RADIUS HORIZONTAL PROSPECT
POPE NO. 14
LEA COUNTY, NEW MEXICO

BEFORE EXAMINER CATANACH
OIL CONSERVATION DIVISION
~~COLLINS+WARE~~ EXHIBIT NO 9
CASE NO 10814, 10815, 10816

BAKER HUGHES INTEQ

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COVER LETTER

BAKER HUGHES INTEQ

2105 Market Street Midland, Texas 79703
915-694-9517 Fax 915-694-5648

September 3, 1993 CW090393.SJK

Collins and Ware
Mr. Jim Orseth
303 West Wall, Suite 200
Midland, Texas 79701

RE: Pope No. 14, Lea County, New Mexico

Dear sir;

Baker Hughes *INTEQ* is pleased to have the opportunity to present the following preliminary proposal for providing horizontal drilling services on your above referenced well.

Baker Hughes *INTEQ* pioneered the development of Horizontal Drilling as known today. Our engineers and drilling personnel are the leading experts in planning and executing horizontal wells. Our company is the world's largest supplier of horizontal drilling services, offering three general profiles for horizontal drilling. They are: Short-Radius, Medium-Radius and Long-Radius. We continue to strive for improved quality and service to each customer on each drilling application.

We would like to discuss the project in more detail before finalizing any contractual or technical aspects of this proposal. Please contact us at your convenience, if we can assist you in any way.

Regards,
Baker Hughes *INTEQ*

Scott King
Drilling Engineer
SJK/cas

PROJECT DISCUSSION

Collins and Ware
Mr. Jim Orseth

September 3, 1993
CW090393.SJK

PROJECT DISCUSSION
POPE NO. 14
LEA COUNTY, NEW MEXICO

The above well is located in the Denton field of Lea County, New Mexico. The project objective is the short radius horizontal re-entry into the top of the Devonian to resolve a water coning problem that lead to the temporary abandonment of the well in the late 1970's.

The 5-1/2" 20# casing will be section-milled from 12,052' to 12,102' and cement set from 11,900' to 12,200'. The cement will be dressed to the KOP at 12,082' with a 4-5/8" milltooth bit. The hole will then be surveyed utilizing a surface readout gyro.

The curve will be drilled from 12,082' to 12,148' with the short radius angle build assembly and a 4-1/2" tri-cone bit. At this point, the bottom hole assembly will be tripped out of the hole and replaced with the short radius angle hold assembly and a ballaset-style bit to drill the lateral from 12,148' to TD at 12,,806'.

COLLINS & WARE

Structure : POPE Well : #14

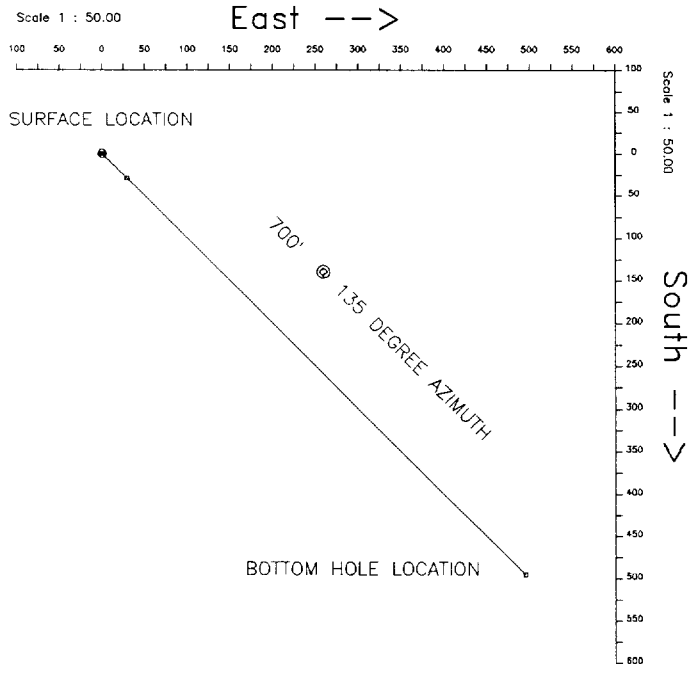
Field : DENTON Location : LEA COUNTY, NEW MEXICO

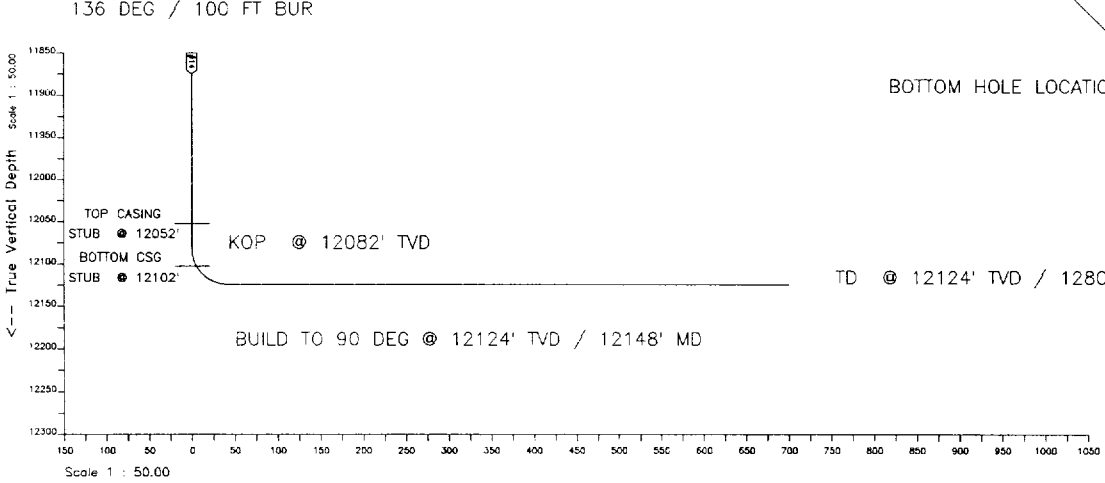
---- WELL PROFILE DATA ----

Point	MD	Inc	Dir	TVD	North	East
Tie on	0	0.00	135.00	0	0	0
KOP	12082	0.00	135.00	12082	0	0
End of Build	12148	90.00	135.00	12124	-30	30
Target	12806	90.00	135.00	12124	-495	495

MAGNETIC DECLINATION
8 DEGREES EAST

BAKER HUGHES INTEQ





Vertical Section on 135.00 azimuth with reference 0.00 N, 0.00 E from structure

COLLINS & WARE
POPE

#14
slot #1
DENTON
LEA COUNTY, NEW MEXICO

P R O P O S A L L I S T I N G

by
Baker Hughes INTEQ

Your ref :
Our ref : prop531
License :

Date printed : 2-Sep-93
Date created : 2-Sep-93
Last revised : 2-Sep-93

Field is centred on 0.000,0.000,0.00000,+
Structure is centred on 0.000,0.000,0.00000,N

Slot location is n0 0 0.000,w4 29 18.843
Slot Grid coordinates are N 0.000, E 0.000
Slot local coordinates are 0.00 N 0.00 E
Reference North is Grid North

Measured Depth	Inclin. Degrees	Azimuth Degrees	True Vert. Depth	RECTANGULAR COORDINATES	Dogleg Deg/100Ft	Vert Sect
0.00	0.00	135.00	0.00	0.00 N 0.00 E	0.00	0.00
500.00	0.00	135.00	500.00	0.00 N 0.00 E	0.00	0.00
1000.00	0.00	135.00	1000.00	0.00 N 0.00 E	0.00	0.00
1500.00	0.00	135.00	1500.00	0.00 N 0.00 E	0.00	0.00
2000.00	0.00	135.00	2000.00	0.00 N 0.00 E	0.00	0.00
2500.00	0.00	135.00	2500.00	0.00 N 0.00 E	0.00	0.00
3000.00	0.00	135.00	3000.00	0.00 N 0.00 E	0.00	0.00
3500.00	0.00	135.00	3500.00	0.00 N 0.00 E	0.00	0.00
4000.00	0.00	135.00	4000.00	0.00 N 0.00 E	0.00	0.00
4500.00	0.00	135.00	4500.00	0.00 N 0.00 E	0.00	0.00
5000.00	0.00	135.00	5000.00	0.00 N 0.00 E	0.00	0.00
5500.00	0.00	135.00	5500.00	0.00 N 0.00 E	0.00	0.00
6000.00	0.00	135.00	6000.00	0.00 N 0.00 E	0.00	0.00
6500.00	0.00	135.00	6500.00	0.00 N 0.00 E	0.00	0.00
7000.00	0.00	135.00	7000.00	0.00 N 0.00 E	0.00	0.00
7500.00	0.00	135.00	7500.00	0.00 N 0.00 E	0.00	0.00
8000.00	0.00	135.00	8000.00	0.00 N 0.00 E	0.00	0.00
8500.00	0.00	135.00	8500.00	0.00 N 0.00 E	0.00	0.00
9000.00	0.00	135.00	9000.00	0.00 N 0.00 E	0.00	0.00
9500.00	0.00	135.00	9500.00	0.00 N 0.00 E	0.00	0.00
10000.00	0.00	135.00	10000.00	0.00 N 0.00 E	0.00	0.00
10500.00	0.00	135.00	10500.00	0.00 N 0.00 E	0.00	0.00
11000.00	0.00	135.00	11000.00	0.00 N 0.00 E	0.00	0.00
11500.00	0.00	135.00	11500.00	0.00 N 0.00 E	0.00	0.00
12000.00	0.00	135.00	12000.00	0.00 N 0.00 E	0.00	0.00
12082.00	0.00	135.00	12082.00	0.00 N 0.00 E	0.00	0.00
12147.97	90.00	135.00	12124.00	29.70 S 29.70 E	136.42	42.00
12500.00	90.00	135.00	12124.00	278.62 S 278.62 E	0.00	394.03
12805.97	90.00	135.00	12124.00	494.97 S 494.97 E	0.00	700.00

All data is in feet unless otherwise stated
Coordinates from structure and TVD from wellhead.
Vertical section is from wellhead on azimuth 135.00 degrees.
Declination is 0.00 degrees, Convergence is 0.00 degrees.
Calculation uses the minimum curvature method.
Presented by Baker Hughes INTEQ

Casing positions in string 'A'

Top MD	Top TVD	Rectangular Coords.		Bot MD	Bot TVD	Rectangular Coords.		Casing
12052.00	12052.00	0.00N	0.00E	12102.84	12102.00	3.58S	3.58E	PRODUCTION

All data is in feet unless otherwise stated
Coordinates from structure and TVD from wellhead.
Bottom hole distance is 700.00 on azimuth 135.00 degrees from wellhead.
Vertical section is from wellhead on azimuth 135.00 degrees.
Declination is 0.00 degrees, Convergence is 0.00 degrees.
Calculation uses the minimum curvature method.
Presented by Baker Hughes INTEQ

TIME STUDY & PROGNOSIS

SHORT RADIUS HORIZONTAL DRILLING TIME ESTIMATE

OPERATOR: **COLLINS & WARE** **DATE:** 9-3-93
PROSPECT: **POPE #14**

DEPTH INTERVAL	SECTION	BHA	PROPOSED BIT	EST. ROP FT./HR.	DRILLING HOURS	TRIP HOURS	CIRC. HOURS	RMNG/CONN/ SURV. HOURS	TOTAL HOURS	STD-BY HOURS
12052 TO 12102	MILL 50' CASING SECTION		THIRD	PARTY						
11900 TO 12200	SET CMT PLUG		THIRD	PARTY					0.0	
11900 TO 12082	STD-BY DRESS CMT GYRO TO KOP		4-5/8" MT	1-1.5 MIN/FT 10,000# 45 RPM					0.0	24.0
12082 TO 12148	BUILD CURVE TO 90.0 DEG.	3-3/4" SRAB	4-1/2" STC M88F	3	22.0	12.0	5.0	5.0	44.0	0.0
12148 TO 12806	DRILL LATERAL @ 90.0 DEG.	3-3/4" SRAH	4-1/2" HTC S-725	4	164.5	30.0	20.0	20.0	234.5	0.0
TO									0.0	0.0
					DRILLING HOURS	TRIP HOURS	CIRC. HOURS	RMNG/CONN/ SURV HOURS	TOTAL HOURS	STD-BY HOURS
				TOTAL	186.5	42.0	25.0	25.0	278.5	24.0

*TTL DRLG DAYS : 11.6
TTL STAND-BY DAYS: 1.0
TTL JOB DAYS : 12.6

COMMENTS : THE USE OF A POLYMER DRILLING FLUID IS STRONGLY RECOMMENDED.
TUBULARS SHOULD BE COMPLETELY FREE OF RUST AND SCALE.
A FINE MESH FLOWLINE CLEANER IS HIGHLY RECOMMENDED.

SHORT RADIUS HORIZONTAL DRILLING PROGNOSIS

OPERATOR: **COLLINS & WARE**
PROSPECT: **POPE #14**
DATE: **9-3-93**

STEP	DEPTH FEET	HOLE SIZE	CASING	MUD	OPERATION
1	12052.00 TO 12102.00		5.5", 20# LINER @ 12635'	8.6-8.8 # 90-120 FV	MILL 50' SECTION IN 5-1/2"
2	11900.00 TO 12200.00		5.5", 20# LINER @ 12635'	8.4 - 8.8# FW	SPOT 300' CMT PLUG WOC. CMT SHOULD HAVE +3000 PSI CS F/ KO.
3	11900.00 TO 12082.00	4.625	OH	8.4-8.8# FW	DRESS CMT TO KOP GYRO F/ SURFACE TO KOP
4	12082.00 TO 12148.00	4.5	OH	8.4 - 8.8# **POLYMER 1.5#/BBL**	DRILL CURVE TO 90 DEG SURVEY W/ STEERING TOOL
5	12148.00 TO 12806.00	4.5	OH	8.4 - 8.8# **POLYMER 1.5#/BBL**	DRILL LATERAL TO TD TD - 12124' TVD / 12806' MD SURVEY W/ STEERING TOOL
6	TO				
7	TO				

COMMENTS:

1. STRONGLY RECOMMEND USE OF XCD POLYMER MUD SYSTEM, FULLY CONCENTRATED @ 1.5#/BBL, FOR THE LATERAL PORTION OF THE HOLE.
2. REQUIRES +/- 800' 2-7/8" P-105 TBG W/ PH-6 CONNECTIONS FOR THE CURVE AND LATERAL SECTION OF THE WELL.
3. REQUIRES ROTARY SHOULDERED DRILL PIPE W/ MIN. 2-1/8" ID.
4. RECOMMEND USE OF A FLOWLINE-TYPE MUD CLEANER TO KEEP POLYMER MUD SOLIDS AT A MINIMUM.
5. SURVEYS WILL BE PERFORMED W/ THE USE OF A STEERING TOOL & SIDE ENTRY SUB USING A WET CONNECT.

COST ESTIMATE

SHORT RADIUS HORIZONTAL DRILLING COST ESTIMATE

OPERATOR: COLLINS & WARE
PROSPECT: POPE #14
DATE: 9-3-93

SHORT RADIUS HORIZONTAL DRILLING DAY RATE

	Qty	UNIT PRICE	TOTAL PRICE
MOB/DEMOB	1	$3,000.00	$3,000.00
DAY RATE	12	$9,900.00	$118,800.00
STAND-BY	1	$2,500.00	$2,500.00
COMPUTER/ENGINEERING CHARGE	1	$1,000.00	$1,000.00
INSPECTION AND REPAIR, ESTIMATE	1	$4,000.00	$4,000.00
PARTIAL LIH COVERAGE (50%)	12	$500.00	$6,000.00
ESTIMATED TOTAL DRILLING CHARGE:			**$135,300.00**

BITS

HUGHES CHRISTENSEN DRILL BITS			
1 STC M88F 4-1/2"	1	$3,700.00	$3,700.00
1 HTC S-725 4-1/2"	1	$12,500.00	$12,500.00
ESTIMATED TOTAL BIT COST:			**$16,200.00**

SURVEY CHARGES

SURFACE TO KOP	1	$4,500.00	$4,500.00
ESTIMATED TOTAL SURVEY CHARGE:			**$4,500.00**

ESTIMATED GRAND TOTAL CHARGES: $156,000.00

HYDRAULICS

RECOMMENDED BIT: **S-725**

COMPANY: COLLINS & WARE
WELL NAME: POPE #14
FORMATION: DEVONIAN

FIELD: DENTON
COUNTY (PARISH): LEA
STATE: NEW MEXICO

HOLE SIZE:	**4.500**	TYPE SURFACE CONNECTION:	3
DEPTH IN:	12082	MAXIMUM OPERATING PRESSURE:	**3300**
DEPTH OUT:	12806	MOTOR TYPE:	3.75
CALCULATED DEPTH IN:	12082	PUMPING RANGE (gpm):	106-185
CALCULATED DEPTH OUT:	12806	BIT SPEED RANGE (rpm):	210-370

	O.D.	WEIGHT	EQUIV. I.D.	LENGTH
TOP DRILL PIPE:	2.8750	10.70	2.1520	11265
BOTTOM DRILL PIPE:	0.0000	0.00	0.0000	0
TOP HEAVY WEIGHT:	0.0000	0.00	0.0000	0
BOTTOM HEAVY WEIGHT:	0.0000	0.00	0.0000	0
TOP DRILL COLLARS:	2.8750	8.70	2.2500	800
BOTTOM DRILL COLLARS:	3.7500	25.00	1.5000	17

PIPE DEPTH: **12082**

FLOW RATE **10.00** GPM INCREMENTS:	**165.00**	**175.00**	**185.00**
TOTAL AVAILABLE HYDRAULIC HORSEPOWER:	317.68	336.93	356.18
ANNULAR VELOCITY (FT/MIN):			
TOP DRILL PIPE:	277.57	294.40	311.22
BOTTOM DRILL PIPE:	0.00	0.00	0.00
TOP HEAVY WEIGHT:	0.00	0.00	0.00
BOTTOM HEAVY WEIGHT:	0.00	0.00	0.00
TOP DRILL COLLARS:	277.57	294.40	311.22
BOTTOM DRILL COLLARS:	461.12	489.06	517.01
SURFACE EQUIPMENT PRESSURE LOSS:	4.80	5.36	5.94
TOP DRILL PIPE BORE PRESSURE LOSS:	1548.03	1727.08	1915.14
BOTTOM DRILL PIPE BORE PRESSURE LOSS:	0.00	0.00	0.00
TOP HEAVY WEIGHT BORE PRESSURE LOSS:	0.00	0.00	0.00
BOTTOM HEAVY WEIGHT BORE PRESSURE LOSS:	0.00	0.00	0.00
TOP DRILL COLLARS BORE PRESSURE LOSS:	88.54	98.78	109.54
BOTTOM DRILL COLLARS BORE PRESSURE LOSS:	13.50	15.06	16.70
TOP DRILL PIPE ANNULAR PRESSURE LOSS:	458.26	515.49	576.08
BOTTOM DRILL PIPE ANNULAR PRESSURE LOSS:	0.00	0.00	0.00
TOP HEAVY WEIGHT ANNULAR PRESSURE LOSS:	0.00	0.00	0.00
BOTTOM HEAVY WEIGHT ANNULAR PRESSURE LOSS:	0.00	0.00	0.00
TOP DRILL COLLARS ANNULAR PRESSURE LOSS:	32.54	36.61	40.91
BOTTOM DRILL COLLARS ANNULAR PRESSURE LOSS:	3.53	3.97	4.44
MOTOR PRESSURE DIFFERENTIAL:	200.00	200.00	200.00
TURBINE PRESSURE DIFFERENTIAL (MWD):	0.00	0.00	0.00
TOTAL PRESSURE DROP FOR SYSTEM (LESS BIT):	2349.21	2602.35	2868.76
AVAILABLE PRESSURE FOR BIT (PSI):	950.79	697.65	431.24
FLOW RATE **10.00** GPM INCREMENTS:	**165.00**	**175.00**	**185.00**
GIVEN TOTAL FLOW AREA: **3-15/32**	**0.5170**	**0.5170**	**0.5170**
PRESSURE DROP ACROSS BIT (PSI):	80.67	90.75	101.42
TOTAL PRESSURE EXPENDITURE FOR SYSTEM (PSI):	**2429.89**	**2693.10**	**2970.17**
STANDPIPE PRESSURE AVAILABLE (PSI):	870.11	606.90	329.83
JET VELOCITY ACROSS BIT FACE (FT/SEC):	102.45	108.66	114.86
HYDRAULIC IMPACT FORCE (LBS):	75	85	95
HYDRAULIC HORSEPOWER AT BIT (HHP):	8	9	11
HYDRAULIC HORSEPOWER PER SQUARE INCH (HSI):	**0.49**	**0.58**	**0.69**
MAXIMIZED TOTAL FLOW AREA WITHOUT TOOLS:	0.1369	0.1644	0.2072
PRESSURE DROP ACROSS BIT (PSI):	1150.79	897.65	631.25
JET VELOCITY ACROSS BIT FACE (FT/SEC):	386.93	341.73	286.57
HYDRAULIC IMPACT FORCE (LBS):	284	266	236
HYDRAULIC HORSEPOWER AT BIT w/o TOOLS:	111	92	68
HYDRAULIC HORSEPOWER PER SQUARE INCH w/o TOOLS:	6.97	5.76	4.28
MAXIMIZED TOTAL FLOW AREA WITH TOOLS:	0.1506	0.1865	0.2507
PRESSURE DROP ACROSS BIT (PSI):	950.79	697.65	431.24
JET VELOCITY ACROSS BIT FACE (FT/SEC):	351.70	301.27	236.86
HYDRAULIC IMPACT FORCE (LBS):	258	235	195
HYDRAULIC HORSEPOWER AT BIT WITH TOOLS:	92	71	47
HYDRAULIC HORSEPOWER PER SQUARE INCH w/ TOOLS:	5.75	4.48	2.93

DEPTH IN

RECOMMENDED BIT: S-725

COMPANY: COLLINS & WARE
WELL NAME: POPE #14
FORMATION: DEVONIAN

FIELD: DENTON
COUNTY (PARISH): LEA
STATE: NEW MEXICO

HOLE SIZE:	4.500	TYPE SURFACE CONNECTION:	3
DEPTH IN:	12082	MAXIMUM OPERATING PRESSURE:	3300
DEPTH OUT:	12806	MOTOR TYPE:	3.75
CALCULATED DEPTH IN:	12082	PUMPING RANGE (gpm):	106-185
CALCULATED DEPTH OUT:	12806	BIT SPEED RANGE (rpm):	210-370

	O.D.	WEIGHT	EQUIV. I.D.	LENGTH
TOP DRILL PIPE:	2.8750	10.70	2.1520	11989
BOTTOM DRILL PIPE:	0.0000	0.00	0.0000	0
TOP HEAVY WEIGHT:	0.0000	0.00	0.0000	0
BOTTOM HEAVY WEIGHT:	0.0000	0.00	0.0000	0
TOP DRILL COLLARS:	2.8750	8.70	2.2500	800
BOTTOM DRILL COLLARS:	3.7500	25.00	1.5000	17

PIPE DEPTH: 12806

FLOW RATE 10.00 GPM INCREMENTS:	165.00	175.00	185.00
TOTAL AVAILABLE HYDRAULIC HORSEPOWER:	317.68	336.93	356.18
ANNULAR VELOCITY (FT/MIN):			
TOP DRILL PIPE:	277.57	294.40	311.22
BOTTOM DRILL PIPE:	0.00	0.00	0.00
TOP HEAVY WEIGHT:	0.00	0.00	0.00
BOTTOM HEAVY WEIGHT:	0.00	0.00	0.00
TOP DRILL COLLARS:	337.31	357.76	378.20
BOTTOM DRILL COLLARS:	653.33	692.93	732.53
SURFACE EQUIPMENT PRESSURE LOSS:	4.91	5.48	6.08
TOP DRILL PIPE BORE PRESSURE LOSS:	1680.42	1874.78	2078.92
BOTTOM DRILL PIPE BORE PRESSURE LOSS:	0.00	0.00	0.00
TOP HEAVY WEIGHT BORE PRESSURE LOSS:	0.00	0.00	0.00
BOTTOM HEAVY WEIGHT BORE PRESSURE LOSS:	0.00	0.00	0.00
TOP DRILL COLLARS BORE PRESSURE LOSS:	90.31	100.75	111.73
BOTTOM DRILL COLLARS BORE PRESSURE LOSS:	13.77	15.36	17.03
TOP DRILL PIPE ANNULAR PRESSURE LOSS:	497.45	559.57	625.35
BOTTOM DRILL PIPE ANNULAR PRESSURE LOSS:	0.00	0.00	0.00
TOP HEAVY WEIGHT ANNULAR PRESSURE LOSS:	0.00	0.00	0.00
BOTTOM HEAVY WEIGHT ANNULAR PRESSURE LOSS:	0.00	0.00	0.00
TOP DRILL COLLARS ANNULAR PRESSURE LOSS:	54.59	61.41	68.63
BOTTOM DRILL COLLARS ANNULAR PRESSURE LOSS:	9.92	11.15	12.46
MOTOR PRESSURE DIFFERENTIAL:	200.00	200.00	200.00
TURBINE PRESSURE DIFFERENTIAL (MWD):	0.00	0.00	0.00
TOTAL PRESSURE DROP FOR SYSTEM (LESS BIT):	2551.37	2828.51	3120.21
AVAILABLE PRESSURE FOR BIT (PSI):	748.63	471.49	179.79
FLOW RATE 10.00 GPM INCREMENTS:	165.00	175.00	185.00
GIVEN TOTAL FLOW AREA: 3-15/32	0.5170	0.5170	0.5170
PRESSURE DROP ACROSS BIT (PSI):	82.55	92.86	103.78
TOTAL PRESSURE EXPENDITURE FOR SYSTEM (PSI):	2633.92	2921.37	3223.98
STANDPIPE PRESSURE AVAILABLE (PSI):	666.08	378.63	76.02
JET VELOCITY ACROSS BIT FACE (FT/SEC):	102.45	108.66	114.86
HYDRAULIC IMPACT FORCE (LBS):	77	87	97
HYDRAULIC HORSEPOWER AT BIT (HHP):	8	9	11
HYDRAULIC HORSEPOWER PER SQUARE INCH (HSI):	0.50	0.60	0.70
MAXIMIZED TOTAL FLOW AREA WITHOUT TOOLS:	0.1525	0.1923	0.2702
PRESSURE DROP ACROSS BIT (PSI):	948.63	671.49	379.80
JET VELOCITY ACROSS BIT FACE (FT/SEC):	347.29	292.19	219.74
HYDRAULIC IMPACT FORCE (LBS):	261	233	185
HYDRAULIC HORSEPOWER AT BIT w/o TOOLS:	91	69	41
HYDRAULIC HORSEPOWER PER SQUARE INCH w/o TOOLS:	5.74	4.31	2.58
MAXIMIZED TOTAL FLOW AREA WITH TOOLS:	0.1717	0.2294	0.3928
PRESSURE DROP ACROSS BIT (PSI):	748.63	471.49	179.79
JET VELOCITY ACROSS BIT FACE (FT/SEC):	308.51	244.84	151.19
HYDRAULIC IMPACT FORCE (LBS):	232	195	127
HYDRAULIC HORSEPOWER AT BIT WITH TOOLS:	72	48	19
HYDRAULIC HORSEPOWER PER SQUARE INCH w/ TOOLS:	4.53	3.03	1.22

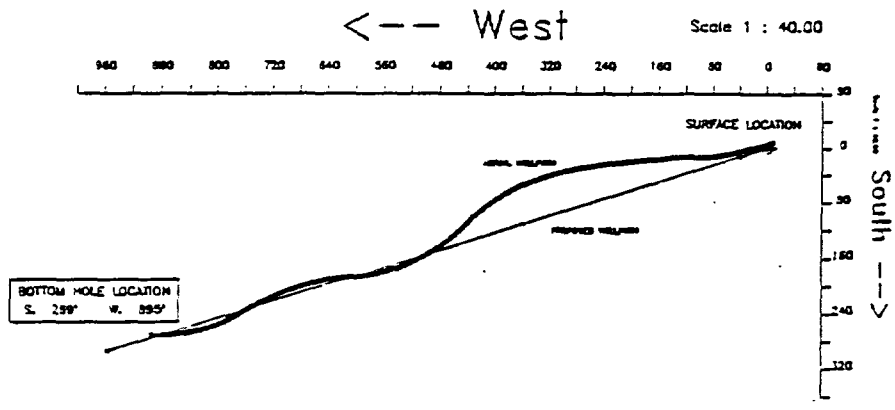
DEPTH OUT

COMPLETED WELL PROFILES

Location : PECOS CO., TEXAS

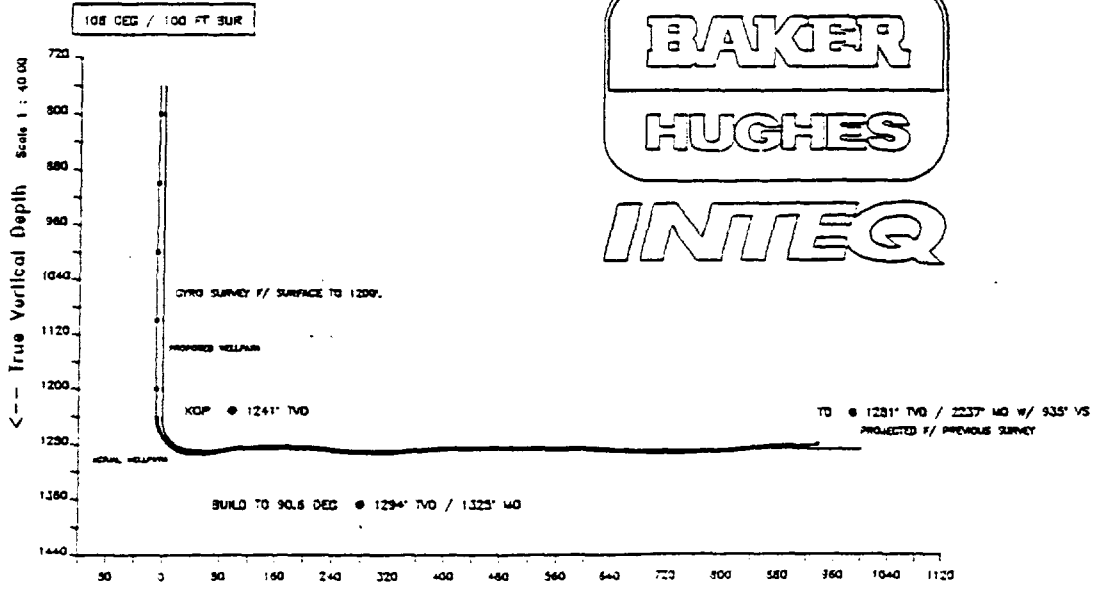
WELL PROFILE DATA

Point	MD	Inc	Dir	TVD	Northings	Eastings
Tie on	0	0.00	253.00	0	0	0
KOP	1245	0.00	253.00	1245	0	0
End of Build	1312	90.00	253.00	1258	-12	-41
Target	2270	90.00	253.00	1258	-292	-956



MAGNETIC DECLINATION 6 DEGREES EAST

BAKER HUGHES INTEQ



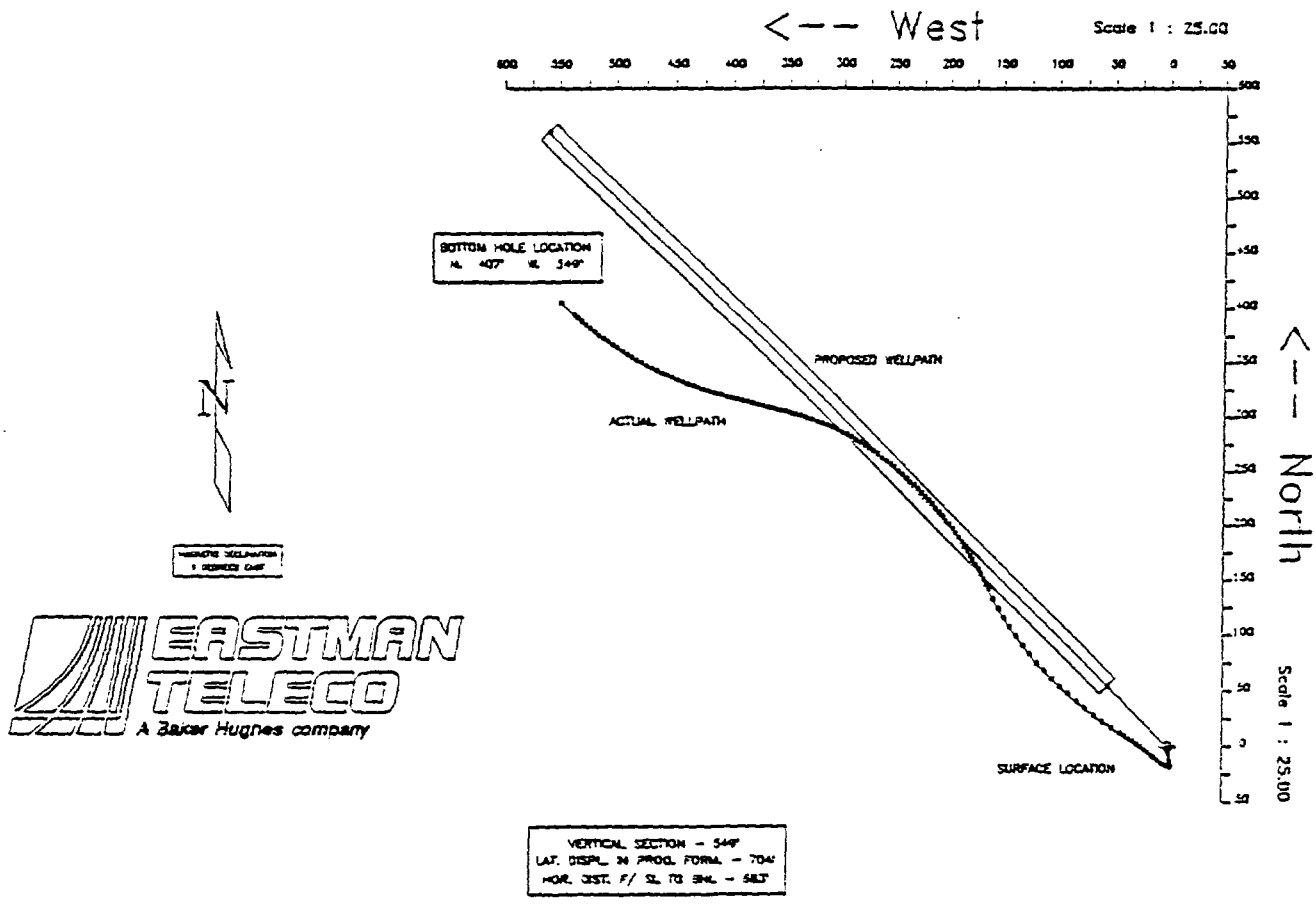
Scale 1 : 40.00

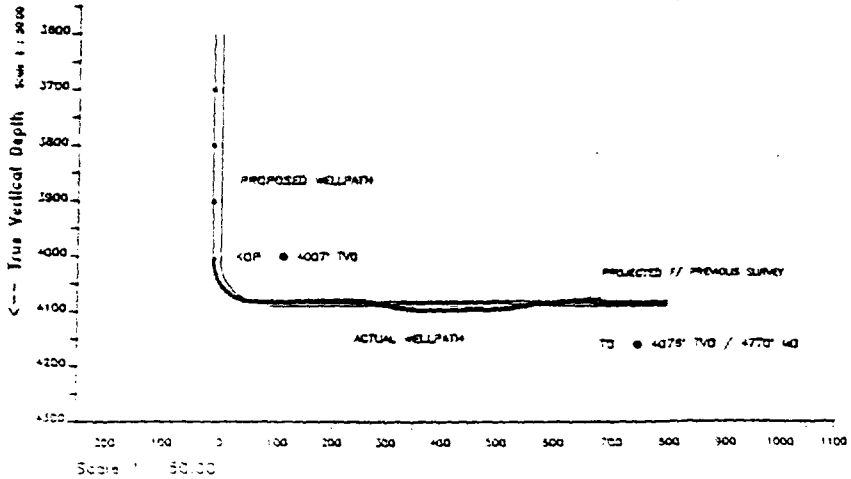
Vertical Section on 253.00 azimuth with reference 0.00 N, 0.00 E from structure

Location : CHAVES COUNTY, NEW MEXICO

WELL PROFILE DATA

Point	MD	Inc	Dir	TVD	North	East
	0	0.00	315.00	0	0	0
	4007	0.00	315.00	4007	0	0
KOP Build	4130	30.00	315.00	4085	55	-55
	4844	30.00	315.00	4085	581	-581





Scale 1 : 50.00

Vertical Section on 315.00 azimuth with reference 0.00 N, 0.00 E from structure

Location : LEA COUNTY, NEW MEXICO

WELL PROFILE DATA

Point	MD	Inc	Dir	TVD	North	East
Tie on	6758	0.27	314.00	6757	0	-32
KOP	6758	0.27	314.00	6758	0	-32
End of Build	6824	68.63	30.54	6800	40	-111
Target	7140	88.63	30.54	6814	398	65

VERTICAL SECTION - 403'
CLOSURE - 403'
HOR. DISP. IN TARGET - 374'

MAGNETIC DECLINATION
9 DEGREES EAST

BAKER HUGHES INTEQ

1.22 DEG / 100 FT BUR

East -->

BOTTOM HOLE LOCATION
N. 398' E. 65'

ACTUAL WELLPATH

PROPOSED WELLPATH

SURFACE LOCATION

GYRO SURVEY
12/21/92
0-6457'

<-- North

Scale 1 : 10.00

<-- True Vertical Depth Scale 1 : 50.00

TOP OF TARGET @ 6800'

KOP @ 6758' TVD

PROPOSED WELLPATH

BOTTOM OF TARGET @ 6814'

ACTUAL WELLPATH

TD @ 6814' TVD / 7197' MD

BUILD TO 88.5 DEG @ 6824' TVD / 6953' MD

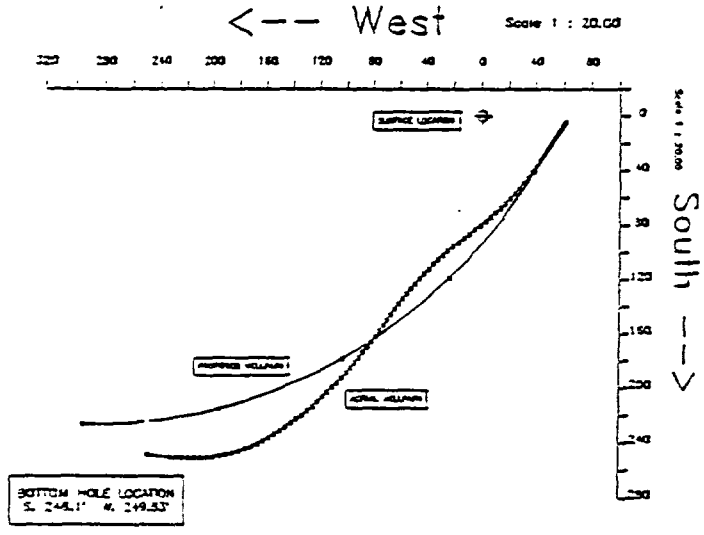
Scale : 50.00

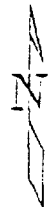
Vertical Section on 30.54 azimuth with reference 0.00 N, 0.00 E from structure

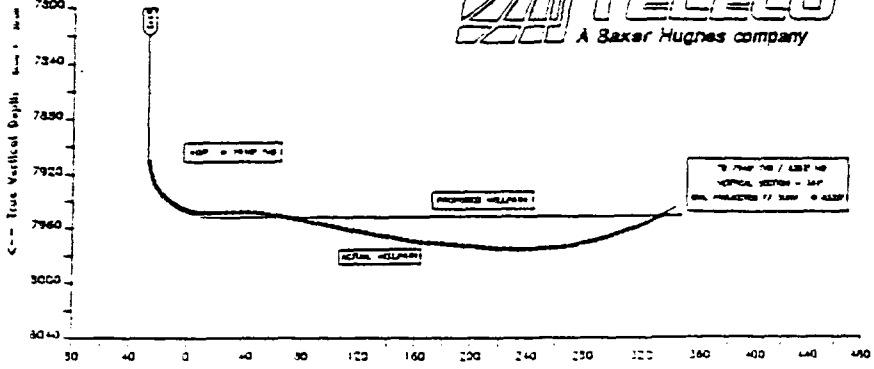
Location : GLASSCOCK COUNTY, TEXAS

WELL PROFILE DATA

Point	MD	Inc	Dir	TVD	North	East
Tie on	0	0.00	211.00	0	0	0
KOP	7910	0.00	211.00	7910	0	0
End of Build	7976	90.00	211.00	7952	-40	-24
Target	7976	90.00	211.00	7952	-40	-24
Target	8076	90.00	226.00	7952	-118	-73
Target	8176	90.00	241.00	7952	-178	-164
Target	8276	90.00	256.00	7952	-214	-196
Target	8376	90.00	271.00	7952	-225	-228



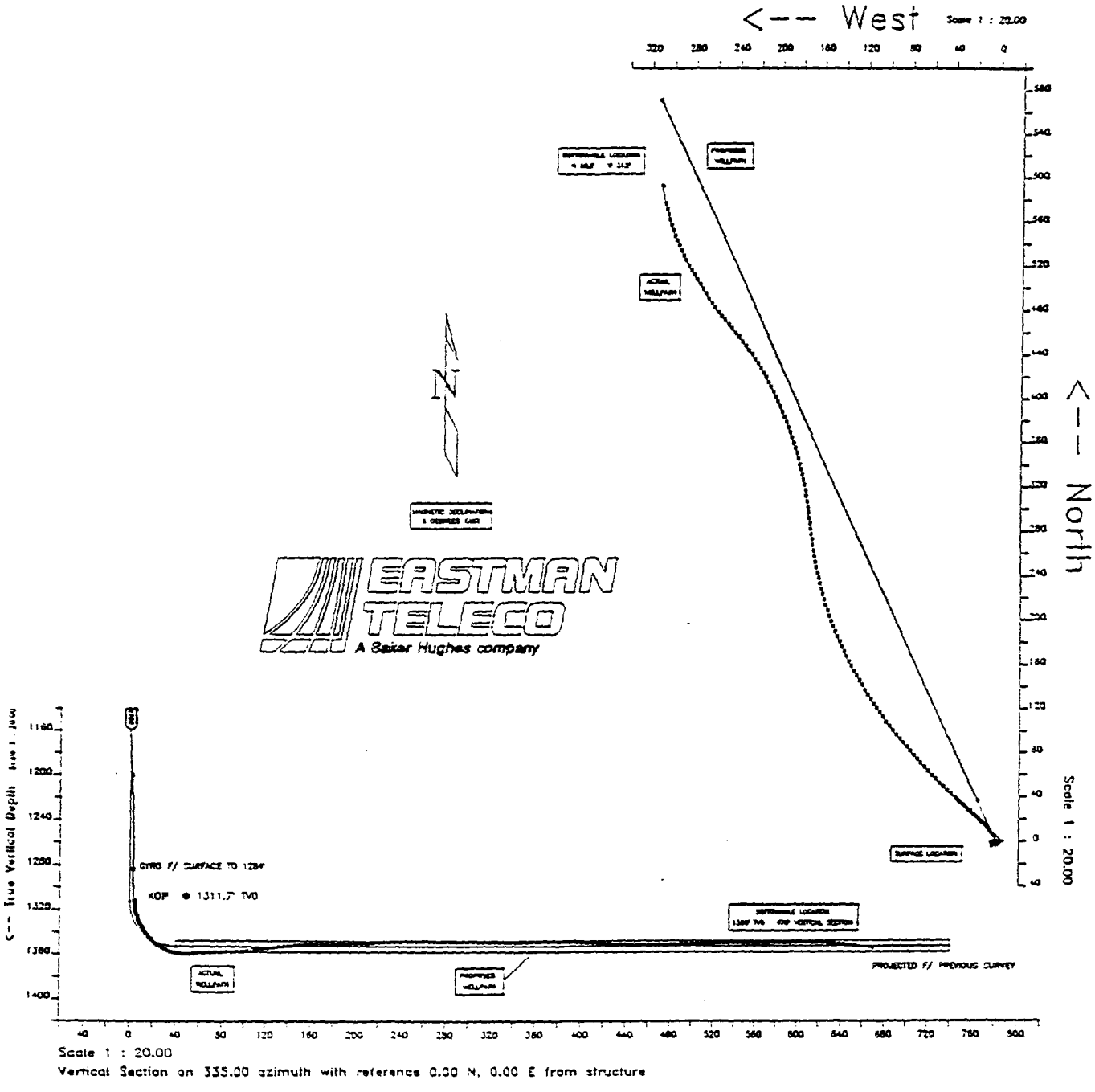




Location : PECOS CO., TEXAS

WELL PROFILE DATA

Point	MD	Inc	Dir	TVD	Northings	Eastings
Tie on	0	0.00	335.00	0	0	0
KOP	1311	0.00	335.00	1311	0	0
End of Build	1378	90.00	335.00	1353	38	-17
Target	2076	90.00	335.00	1353	677	-313



Scale 1 : 20.00

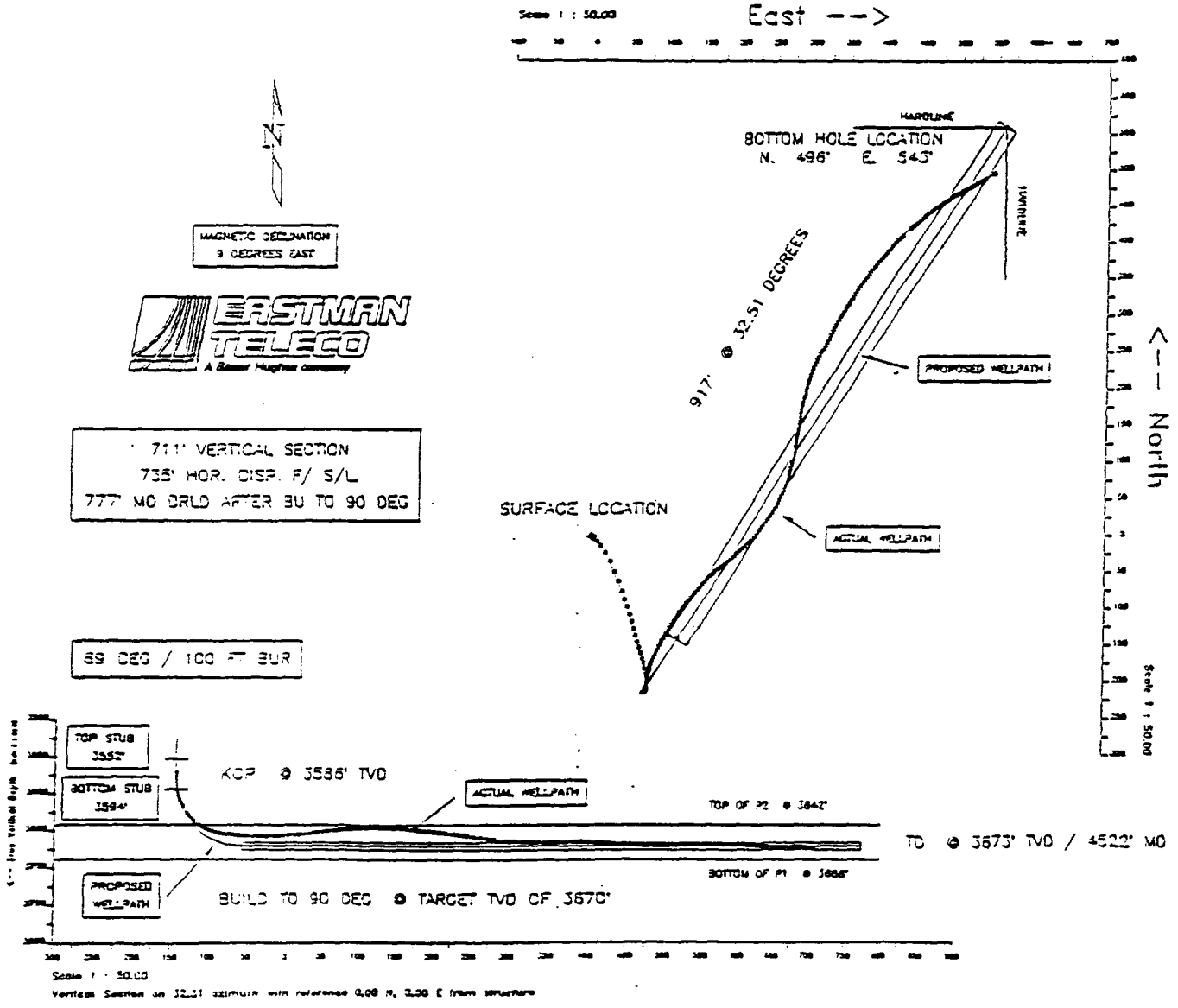
Vertical Section on 335.00 azimuth with reference 0.00 N, 0.00 E from structure

Well :

Location : CHAVES COUNTY, NEW MEXICO

WELL PROFILE DATA

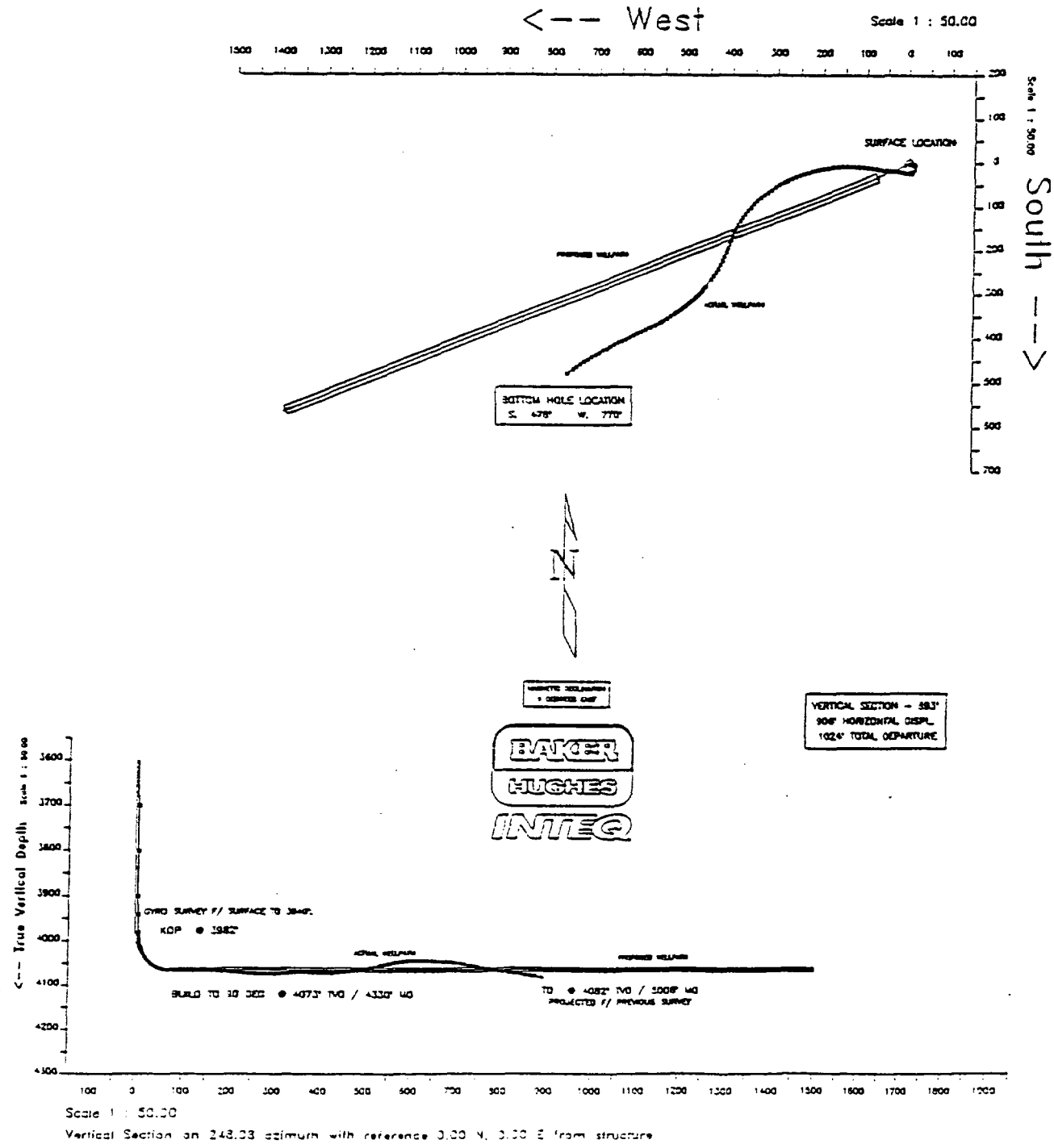
Point	MD	Inc	Dir	TVD	North	East
Tie on	3556	1.01	32.51	3545	-213	671
End of Hold	3597	1.01	32.51	3586	-213	681
End of Build	3720	90.00	32.51	3670	-141	1131
End of Hold	4561	90.00	32.51	3670	560	5501



Location : CHAVES COUNTY, NEW MEXICO

WELL PROFILE DATA

Point	MD	Inc	Dir	TVD	Northings	Eastings
Tie on	0	0.00	248.08	0	0	0
KOP	3984	0.00	248.08	3984	0	0
End of Build	4416	90.00	248.08	4064	-30	-74
Target	5530	90.00	248.08	4064	-580	-1382



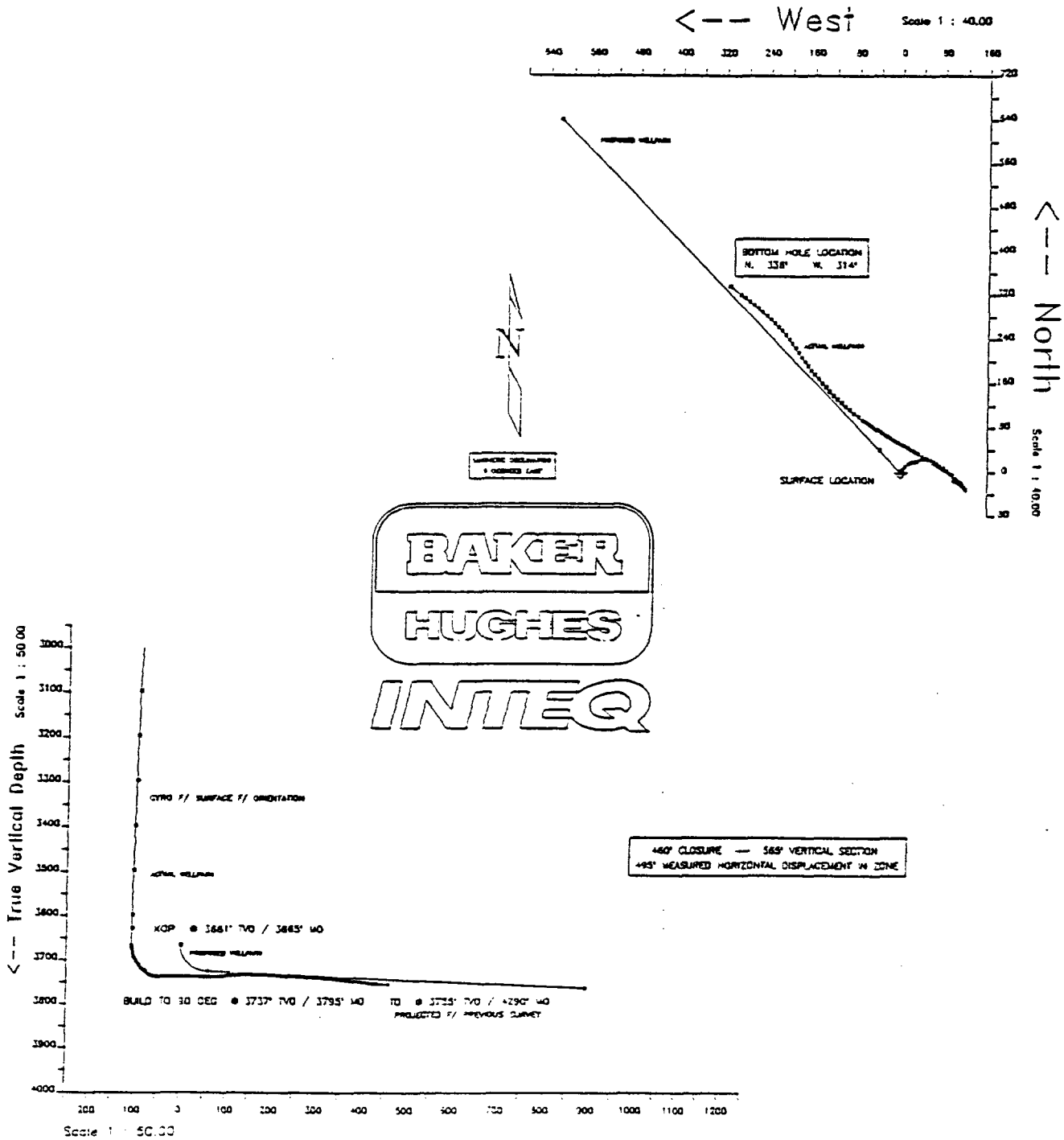
Scale 1 : 50.00

Vertical Section on 248.08 azimuth with reference 0.00 N, 0.00 E from structure

Location : CHAVES COUNTY, NEW MEXICO

WELL PROFILE DATA

Point	MD	Inc	Dir	TVD	North	East
Tie on	3664	0.00	315.82	3664	0	0
KOP	3665	0.00	315.82	3665	0	0
End of Build	3756	27.33	315.82	3725	41	-40
Target	4584	27.33	315.82	3764	341	-423



Scale 1 : 50.00

Vertical Section on 315.82 azimuth with reference 0.00 N, 0.00 E from structure

POLYMER FLUID INFORMATION

Kelco Oil Field Group

XANVIS®

Horizontal Drilling Applications

TECHNICAL BULLETIN

Xanvis Improves Horizontal Drilling Operations

XANVIS is a completion grade, xanthan biopolymer, field-proven to be a cost effective viscosifier for drilling and completing horizontal wells. XANVIS formulated fluids, initially proven successful in the Austin Chalk in Central Texas, have reduced operational costs by:

- Improving down-hole motor performance and penetration rates due to enhanced hydraulic efficiency.
- Increasing cuttings transport and suspension properties of the fluid to reduce stuck pipe.
- Minimizing solics accumulation in the annulus to improve lubricity and allow predictable pipe movement.
- Providing formation protection to maintain production potential.

Horizontal Drilling Applications

In the horizontal section, turbulent flow has been proposed as the ideal flow profile for solics transport. In many cases, however, turbulent flow may not be possible due to limited pump rates, pipe eccentricity, or hole enlargement which reduces annular velocity. In addition, turbulent flow may not be desirable where unstable hole conditions exist, including unconsolidated or severely fractured formations. To achieve turbulent flow at typical annular velocities requires a low viscosity fluid. During non-circulating periods, however, low viscosity fluids allow solics to settle rapidly. In the horizontal section, this can be detrimental. Well-bore simulations show that when flow is initiated, settled solics tend to move along the bottom of the hole as waves or dunes. This solics build-up can result in increased torque, drag, and the inability to transfer weight to the bit. In addition, it can lead to erratic pipe movement and sudden changes in hole direction.

To prevent solids build-up during non-circulating periods requires high suspension properties, measured at extremely low shear rates of less than 0.1 sec^{-1}. XANVIS formulated fluids provice this type of viscosity for exceptional suspension properties as indicated in Table 1. This feature is unique to XANVIS and is not common to the celluiosics or polyacrylamides often used as substitute additives for rheology control. Under dynamic conditions, XANVIS fluids maintain their functionality by providing effective annular viscosity for optimum solics transport.

A key issue in the application of XANVIS for horizontal drilling is to minimize solics settling from the onset. This is best accomplished by mudding-up early with XANVIS at a concentration of 1.25 to 1.5 lb/bbl. Preferably, this should be done mid-way through the angle-building section, at 45° to 60° deviation. In so doing the drilling related problems associated with inadequate hole cleaning can be avoided.

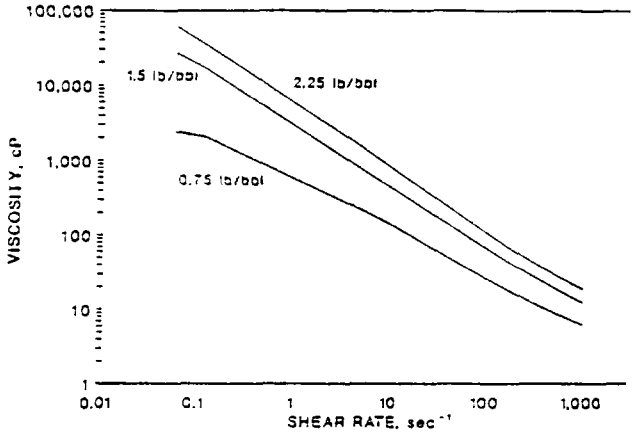
Xanvis — Properties and Performance

Fluid efficiency is based primarily on the unique rheology XANVIS provides to a wide variety of drilling fluids, ranging from fresh water to saturated sodium chloride brines. Significantly, viscosity is provided where needed, that is, at the lower shear rates. High viscosity at the lower shear rates provides optimum solics transport under a variety of annular conditions. It is also the feature that describes true suspen-

Table 1
RHEOLOGICAL PROPERTIES OF XANVIS
(2% KCl, 80°F)

XANVIS lb/bbl	FUNNEL VISCOSITY sec/qt	PLASTIC VISCOSITY cP	YIELD POINT $lb/100ft^2$	VISCOSITY @ 5.1 sec cP^{-1}	VISCOSITY @ 0.06 sec^{-1} cP
.5	28	2	4	100	250
1.0	31	4	9	340	5,500
1.25	32	5	12	500	11,500
1.5	34	5	16	700	21,500
2.0	41	7	23	1,140	47,500

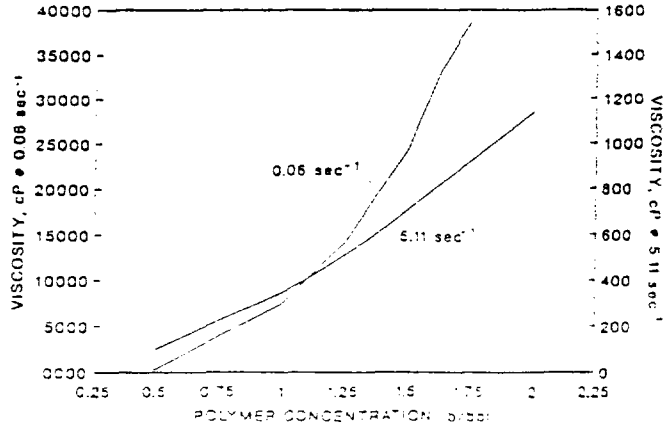
Figure 1
VISCOSITY VS SHEAR RATE WITH XANVIS
(Fresh water, 80°F)



sion properties of a fluid. As depicted in Figure 1, XANVIS exhibits highly pseudoplastic rheology. At 1.5 lb/bbl, XANVIS provides over 20,000 cP at 0.067 sec^{-1} while at 1,022 sec^{-1} the same fluid provides 12 cP. This demonstrates how readily viscosity decreases with increasing flow rates such as inside the drill pipe. As a result, friction pressure losses are greatly reduced. This feature allows more hydraulic horsepower to be delivered to the down-hole motor and bit for maximum efficiency and optimum penetration rates. When displacing native mud or water with a XANVIS formulated fluid, a reduction in circulating pressure of up to 35% can be expected. This is usually the first evidence of improved fluid efficiency. Typically, it is followed by an increase in penetration rate, and a more immediate and predictable transfer of weight to the bit. Shortly afterwards, fluid returns at the flowline show a steady delivery of drilled cuttings. When circulation is interrupted, solids left in the annulus will more readily remain in suspension as a direct result of the high viscosity developed under static conditions.

Polymer concentration is essential in developing fluid functionality and achieving the benefits made possible with XANVIS formulated fluids. Laboratory testing indicates that a significant increase in viscosity occurs after a critical concentration of XANVIS has been attained (see Figure 2). Above this concentration, polymer chains associate with each other to form a physical network. This molecular entanglement explains the excellent suspension properties of XANVIS based fluids.

Figure 2
VISCOSITY VS POLYMER CONCENTRATION
(XANVIS IN FRESH WATER @ 80°F)



The amount of polymer required to reach this critical concentration is dependent on fluid temperature, the presence of other solids and salinity. Elevated temperatures will increase the amount of polymer required. The presence of solids usually decreases the amount of polymer needed and is directly related to the activity of the solids present. Under high salinity conditions, increased shear is required to fully develop low shear rate viscosity.

The desired concentration of XANVIS will depend on the application. If friction pressure reduction is of prime importance, then 0.75 to 1.0 lb/bbl should be adequate. However, in most applications, concentrations of 1.25 to 1.5 lb/bbl are recommended since solids suspension during non-circulating periods is more critical in the horizontal rather than the vertical section. Even at the higher polymer concentrations, high shear rate viscosity remains relatively unchanged, allowing hydraulic efficiency to be maintained. In general, hole conditions should determine the need to increase polymer concentration.

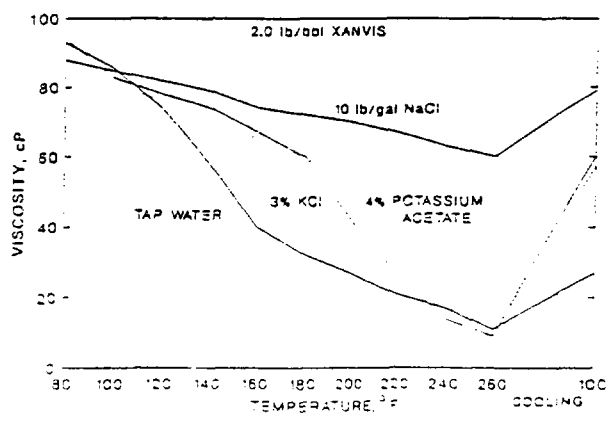
Components of the System

Fluid formulations will vary dependent on the ultimate requirements of the fluid and the type of formation being drilled horizontally. Assuming the formation under consideration is the pay zone, the fluid should be treated as a drill-in or completion fluid. Bentonite should be avoided and other additives used in the system should be chosen based on their impact on formation damage. Each product serves a specific function and its concentration should depend on fluid properties required for optimum performance under existing hole conditions. The system may be a fresh or salt water base and weight materials can vary from soluble salts to suspended solids, dependent once again on the need for formation protection.

XANVIS — Used as the primary viscosifier and suspending additive with minimum formation damage potential. Optimum concentration is 1.25 to 1.5 bb/bbl.

SALTS — The preferred method of increasing density and providing formation protection is to use salts such as sodium or potassium chloride. Calcium chloride can also be used, however, for maximum polymer stability the use of XANVIS should be limited to less than saturated brines, that is, in the 10.5 to 11.0 ppg range. The addition of salt, even at low concentrations of 2% will also improve temperature stability of XANVIS, offering better viscosity retention under down hole conditions (Figure 3).

Figure 3
EFFECTS OF SALT AND TEMPERATURE
ON VISCOSITY @ 100 sec^{-1}



WEIGHT MATERIALS — Most types of conventional weight materials including calcium and iron carbonate, hematite and barite can be used. Material preference will depend on requirements for acid solubility, impact on mud rheology, formation damage concerns and overall system objectives.

FLUID LOSS CONTROL ADDITIVES — Fluid loss control additives similar to those recommended for workover and completion fluids would be the preferred additives, including sized salts and certain resins. Consideration should be given first to water or acid soluble materials in combination with small amounts of polymeric additives. In addition, the viscous nature of XANVIS at low shear rates will help impede fluid flow in the formation.

pH CONTROL ADDITIVES — Caustic soda and potassium hydroxide can be used in this system to increase the pH. They should always be added as a dilute solution through a chemical barrel. Maintain the system pH from 7-9 and do not exceed 10.5 for maximum polymer stability. The pH should not be adjusted in the calcium brines.

BIOCIDES — A preservative may be required in this system under some environmental conditions. A biocide should always be used to insure maximum polymer stability or if a system is to be stored. Effective biocides include sodium dimethyl-dithiocarbamate, formaldehyde and glutaraldehyde, however the two latter additives may be incompatible with the oxygen scavengers, ammonium bisulfite and sodium sulfite. Other additives commonly used to preserve starch in conventional drilling fluids can also be applied with XANVIS.

CORROSION CONTROL ADDITIVES — Corrosion control and polymer stability is best obtained in this system through the use of oxygen scavengers. An oxygen scavenger is recommended for polymer stability when the bottom hole temperature exceeds 200°F. Ammonium bisulfite and sodium sulfite will work effectively in this fluid. Some of the coating amines (cationics) are incompatible with XANVIS, therefore pilot tests should be conducted prior to their use.

DEFLOCCULANTS — These should be used only when increased viscosity is due to high solids concentrations such as in high density systems. Since the clay content of these fluids is typically low, only small concentrations of deflocculants are generally required. Low molecular weight acrylates are functional in these systems at concentrations of 0.5 to 1.0 lb/bbl.

Maintaining the System

1. Material additions should be based on water dilution and the need to maintain desired product concentrations and fluid properties. Whole mud dilution is an effective technique with this system.
2. An effective solids control program is important in maintaining optimum mud properties. If undesirable solids build up in the fluid, rheology will be compromised and formation damage potential may increase. High speed shakers with 100 mesh screens or finer are highly recommended with this system.
3. While rheological properties should be based on overall hole conditions and the need to maintain hole cleaning efficiency, the following guidelines can be applied.
   - Plastic viscosity & funnel viscosity - these values are typically indicators of high shear rate viscosity and possible solids contamination. They will generally run lower than those values obtained with conventional clay based systems. *Do not use funnel viscosity* to predict hole cleaning capacity.
   - Yield Point - With a XANVIS based fluid this value is usually maintained in the 10-20 lb/100 ft² range.
   - Initial gel or 3 rpm reading - Typically this property is an indicator of low shear rate viscosity, and is essential for suspension during non-circulating periods. To increase this property use XANVIS, not cellulosics. A minimum value of 5 is desirable in unweighted systems and as high as 10-15 in high density fluids. The 10 minute gel should not exceed 3 times the initial gel. High 10 minute gels would be an indicator of solids contamination.
4. Solids - maintain low gravity (drilled) solids at less than 4% by volume or 35 lb/bbl to optimize rheological performance of the system.
5. Fluid loss - in many cases fluid loss additives have not been used. Products added to the system should have minimal effect on formation permeability since the system is treated as a completion fluid as opposed to a conventional drilling fluid.
6. Formation Damage. Since damage to the production zone is a primary concern in most horizontal drilling applications, the use of efficient polymer mixing equipment to assure proper hydration of all additives is highly recommended. Complete polymer hydration and the elimination of "fish-eyes" is essential in order to minimize particulate plugging of the formation.

TECHNICAL SERVICE — Kelco has a highly trained and experienced technical staff who welcome the opportunity to discuss XANVIS with you. Fully equipped laboratories in Houston and San Diego are available to help you in the development of the most effective fluid system.

Kelco Oil Field Group

Kelco Oil Field Group, Inc.

XANVIS™
POLYMER HYDRATION

TECHNICAL BULLETIN

Introduction

When polymers are used in workover/completion applications where the viscosified fluid penetrates the formation matrix, there is major concern for formation damage. The degree of this damage is dependent on the size and concentration of solids present in the fluid entering the formation. Often, these solids are the result of partially hydrated polymer brought about by improper mixing techniques. Technical papers have documented the amount of damage caused by poorly mixed polymers.[1,2] They have also reported on the benefit of high shear mixing and filtration, and the significant improvement in return permeability tests. For this reason, proper polymer handling procedures must be emphasized.

Mixing Guidelines

As with any other polymer, XANVIS™ should be properly mixed in order to achieve full hydration and obtain maximum performance potential. Generally, the rate at which XANVIS hydrates is dependent on fluid pH, salinity, temperature and to the amount of shear applied. Although XANVIS is easily mixed at any pH, it disperses best at pH 3 to 6 and hydrates fastest at pH 8 to 10. Allow additional time for complete hydration at pH 3-6. Typically, a combination of *chemical* and *mechanical* hydration is used to assure optimum mixing and hydration. The chemical aspect involves lowering the pH (2.0-4.0) to achieve maximum polymer *dispersion* and then raising pH (8.0-9.0) to increase *hydration* rate. Upon raising pH of the fluid, some type of mechanical shear is required to achieve full viscosity development and minimize the size and concentration of filterable solids.

FIELD MIXING — A variety of high shear devices are available and vary from specially designed equipment to proven modifications of existing equipment. The shear applied can be in the form of a high differential pressure (800-1,600 psi) while pumping at a low flow rate (1-2 bpm) through a restricted orifice. The second approach involves pumping higher volumes (3-8 bpm) through combinations of shear plates at a lower pressure differential (50-200 psi). Care should be exercised when using high pressure differentials due to the possibility of shear degradation of the viscosified fluid.

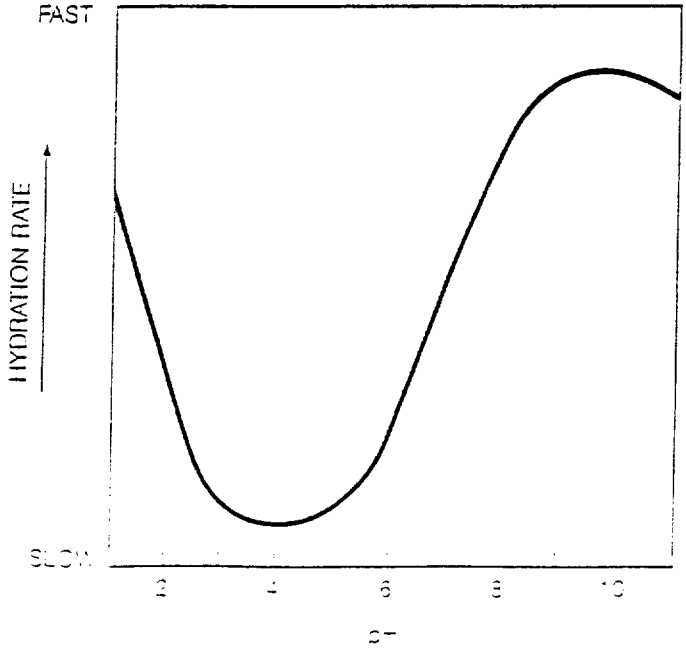
LAB MIXING — In the lab, mechanical shear is applied using various types of high rpm spindle mixers or blenders. About 20 minutes of mixing at low speed (11,000 rpm) on a Hamilton Beach mixer is sufficient to hydrate the equivalent of 48 lb XANVIS/1,000 gal 2% KCl brine (Table 1). Longer mix times are needed for higher polymer concentrations and when more saline base fluids are used. Shorter mixing times may be needed when XANVIS is partially hydrated in fresh water.

PREFERRED PROCEDURE — *Where circumstances allow,* the following mixing procedure is preferred and recommended.

- Start with fresh water.
- Lower pH between 3 and 4 using citric acid (0.08 to 0.14%). In addition to lowering pH for optimum dispersability, citric acid provides a means of chelating soluble iron which could have a cross-linking effect on the polymer fluid.
- Add polymer while stirring the fluid.
- After the polymer is visually judged to be well dispersed, raise the pH between 8 and 9 to speed hydration. Figure 1 shows the correlation between pH and polymer dispersion/hydration.
- Shear until the fluid passes a filterability test. Various tests may be used, however, the procedure suggested in API RP13B is preferred because it is well known. A properly hydrated XANVIS fluid should empty the test cell in less than five minutes without separating visible polymer particles on the filter paper.
- Add sufficient salt (NaCl, KCl, NH_4Cl) to provide the desired salinity.
- Stir until the salt is dissolved and retest filterability.
- Shear additionally if needed until the fluid passes the filtration test.

Figure 1

pH Effect on Hydration Rate of XANVIS™



CONTINUED

Monitoring Criteria

It is important not to over shear the fluid. To monitor, two procedures may be used. First, the viscosity may be measured using a Brookfield LVT Viscometer with the #2 cylindrical spindle at 0.3 rpm. This provides a shear rate of approximately 0.07 sec^{-1}. To be considered properly hydrated, viscosity should reach a maximum plateau. Table 1 illustrates a comparison between viscosity development and filterability of 2.0 lb/bbl (5.7 Kg/m^3) XANVIS in 2% KCl brine using a high shear mixing device. The second procedure is to perform a sand suspension test similar to the intended application of the polymer fluid. For example, 180 gm of 20-40 mesh sand mixed in an 8 oz jar with 150 gm of a XANVIS solution containing 1.5 lb/bbl polymer should have a half-life of more than 80 min. The half-life is the time required for the sand to settle to a mid-point between being fully suspended and completely settled. The fluid is properly hydrated when it provides its intended functionality.

Table 1

Effect of Mixing Time on Viscosity Development and Filterability of 2.0 lb/bbl XANVIS™ in 2% KCl

Shear Rate, Sec^{-1}	Viscosity, cP				
	3 min	6 min	10 min	15 min	20 min
1022	20.2	19.6	16.2	15.5	15.5
511	30.2	30.6	26.2	25.4	25.4
340	39.9	39.6	34.8	33.6	33.9
170	61.8	63.0	58.2	57.0	57.0
10.2	450	510	550	560	580
5.1	780	940	1.040	1060	1080
1.5	2030.5	2554.5	2882	2947.5	2882
0.07	9000	39000	42500	41500	43000
Filterability	Plugged Filter	Plugged Filter	375 sec/ 200 cc	37 sec/ 200 cc	15 sec/ 200 cc

*Measured @ 20 psi through 47 mm diameter Whatman No. 1 filter paper.

LITERATURE CITED

1. Ashton, J. P., and Nix, C. A.: "Polymer Shear Mixer: A Device for Improving the Quality of Polymer Viscosified Brines", SPE 14829, presented at the 7th. Symposium on Formation Damage Control, Lafayette, La. Feb. 26-27, 1986.
2. Houchin, L. R., Hudson, L. M., Caothien, S., Daccazio, G., and Hashemi, R.: "Reducing Formation Damage Through Two-Stage Polymer Filtration", SPE 15408 presented at the 61st. Annual Technical Conference and Exhibition of the SPE, New Orleans, La. Oct. 5-8, 1986.

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Kelco Oil Field Group

XANVIS® L

A LIQUID XANTHAN BIOPOLYMER

PRODUCT BULLETIN

Xanvis L — A Premium Grade Xanthan Slurry

- **REDUCES FRICTION PRESSURE**
- **PROVIDES SUPERIOR SOLIDS TRANSPORT AND EXCELLENT SUSPENSION PROPERTIES**
- **MINIMIZES FORMATION DAMAGE**
- **ENVIRONMENTALLY SAFE — CONTAINS NO OIL**

XANVIS L is a completion grade xanthan slurry designed to mix easily in water to save time, eliminate waste and improve polymer performance. Its unique rheological properties enable minimum friction pressure and superior solids transport capabilities. As a liquid it can be poured into most systems to produce an effective polymer solution. This would include applications such as coiled tubing and other operations where dry-powder mixing equipment is not available. XANVIS L can be mixed without forming lumps or "fisheyes" to minimize formation damage potential. After hydrating, XANVIS L provides the same high viscosity fluid as XANVIS powder. For a complete description of XANVIS powder see Kelco Oil Field Group brochure X-1.

XANVIS L improves polymer utility for many applications where mixing equipment is not designed to efficiently disperse and hydrate dry polymers. When inadequate mixing equipment exists, poor dispersion will result because of the polymer's high affinity for water. Polymers that are not dispersed can form lumps when the outer particles wet, stopping the penetration of water to the inner particles. Partially dispersed or wetted polymer can settle, stick to the fluid handling equipment or adhere to suspended solids, resulting in a loss of material. At low shear mixing, XANVIS L will disperse to eliminate waste and allow complete viscosity development. XANVIS L provides maximum formation protection since it does not contain clay or other solids. It is easy to mix, compatible with most additives, pH stable, salt tolerant, thermally stable and has high suspending ability, making it a most versatile viscosifier. XANVIS L solutions have low-toxicity and since the slurry does not contain oil it is suitable for both onshore and offshore applications without any special disposal requirements.

Xanvis L Applications

XANVIS L is a cost-effective additive in applications where dry-powder mixing equipment is not available. This would include most water well drilling, coiled tubing and many workover or completion operations. In coiled tubing operations XANVIS L enables solids removal or liquid displacement operations that previously were not possible due to low pumping rates. By reducing friction pressure it enables pumping rates of twice that of water. The higher solids transport capacity and increased pump rate has enabled high-density solids removal from deep hot wells. In workover or completion operations, XANVIS L provides the optimum rheology to improve success rates and reduce costs with minimum formation damage potential.

Unique Properties

RHEOLOGY — XANVIS L fluids exhibit a rheological property called pseudoplasticity or shear-thinning viscosity as illustrated in Figure 1. This means the viscosity of the fluid will decrease with increasing shear rates and immediately revert to a higher viscosity when shear is reduced. It is this shear-thinning property and the low viscosity at the high shear rates (over 1000 sec^{-1}) that enable the low friction pressures. The high viscosity at the low shear rates provide the high solids transport capacity and superior suspension properties.

Table 1
TYPICAL PROPERTIES IN FRESH WATER

	Gallons XANVIS L per 10 bbl Water				
	1	2	3	4	5
Funnel Viscosity, sec/qt	29	31	34	37	41
Plastic Viscosity, cP	2.5	4	4.5	6	6
Yield Point, lb/100 ft²	3.5	5	12	16	21
3 rpm Viscosity, cP	30	230	660	900	1360

COMPATIBILITY — XANVIS L is compatible with most additives used in water-based fluids. Being slightly anionic caution must be observed when it is used with strong cationic materials, such as some corrosion or scale inhibitors and quaternary amines. Compatibility tests should be run to determine the short and long term effect on the viscous properties of the system. Incompatible materials may cause a complete loss of viscosity.

pH STABILITY — XANVIS L is stable in systems at a pH from 2-13. For maximum stability the pH should be maintained between 6 to 10. If cement contamination is anticipated, pretreat and maintain an excess of SAPP (sodium acid pyrophosphate) or bicarbonate of soda.

FORMATION DAMAGE — XANVIS L has been specifically designed to provide maximum formation protection. Laboratory tests and field results indicate low damaging characteristics. This feature of xanthan gum is attributed to the lack of particulate plugging and non-film forming characteristics of the material. It is also because much lower polymer concentrations are required to accomplish the operation.

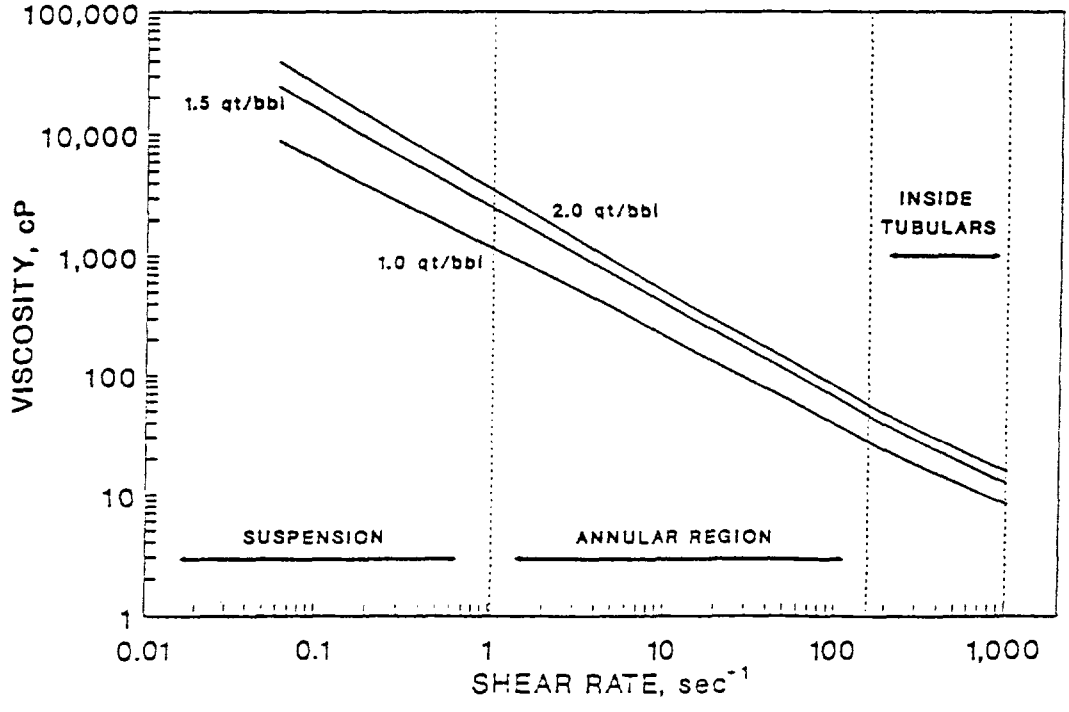
TEMPERATURE STABILITY — Fluids formulated with XANVIS L exhibit high resistance to thermal thinning as illustrated in Figure 2. If the working temperature exceeds 200° F (93° C), the use of an oxygen scavenger and the addition of salt (NaCl or KCl) will improve polymer performance. Special fluids formulations have been used at temperature above 300° F (150° C).

Mixing and Handling Procedures

XANVIS L should be poured slowly through a hopper, into an agitated tank or near the suction of a circulating pump. The slurry must be completely dispersed for proper hydration. *It should not be added to a tank without vigorous agitation as the partially hydrated slurry will settle in quiet areas.* Occasionally viscosity development will be delayed because of electrolytes or salts in the fluid. This situation can usually be improved by increasing mixing shear, raising the temperature or reducing the total hardness.

MIXING IN SALT WATERS — XANVIS L can be used in most salt waters up to saturation. This allows its use in NaCl and KCl systems, field brines, seawater, as well as heavy brines containing NaBr, or KBr. When mixing in brines containing $CaCl_2$, $CaBr_2$, or $ZnBr_2$, special mixing procedures may be needed. Prehydrating as a polymer

Figure 1
VISCOSITY VS SHEAR RATE WITH XANVIS L
(2% KCl @ 80°F)



concentrate (3-5 lb/bbl) in less saline water may be required for complete viscosity development.

CONCENTRATION — The amount of XANVIS L required will depend upon the effective viscosity or friction pressure reduction needed. For comparison one quart of XANVIS L is equivalent to one pound of dry XANVIS. For friction pressure reduction 0.5-1.0 qt/bbl XANVIS L should be adequate. For high hole cleaning capacity 1.0-2.0 qt/bbl XANVIS L may be required.

PRESERVATIVES — As packaged, the XANVIS L slurry is resistant to bacterial degradation. After mixing in water it is biodegradable and a preservative is recommended for maximum polymer stability under certain field conditions. These would include fresh water - neutral pH or low salinity systems that are to be stored or circulated for more than one day.

WEIGHTED FLUIDS — XANVIS L is effective as the primary viscosifier in high density fluids with salts, calcium carbonate, barite, hematite or other weighting additives. Because of its excellent suspending ability, no other viscosifier is needed to suspend the weight materials.

TOXICOLOGY AND SAFETY — XANVIS L fluids are not classified as hazardous materials and can be safely used in environmentally sensitive areas. See the Material Safety Data Sheet for emergency and first aid procedures. XANVIS L exceeds 900,000 ppm in the standard API 96 hour LC50 test.

General Information

Principle Components:
Xanthan gum and Polyethylene Glycol

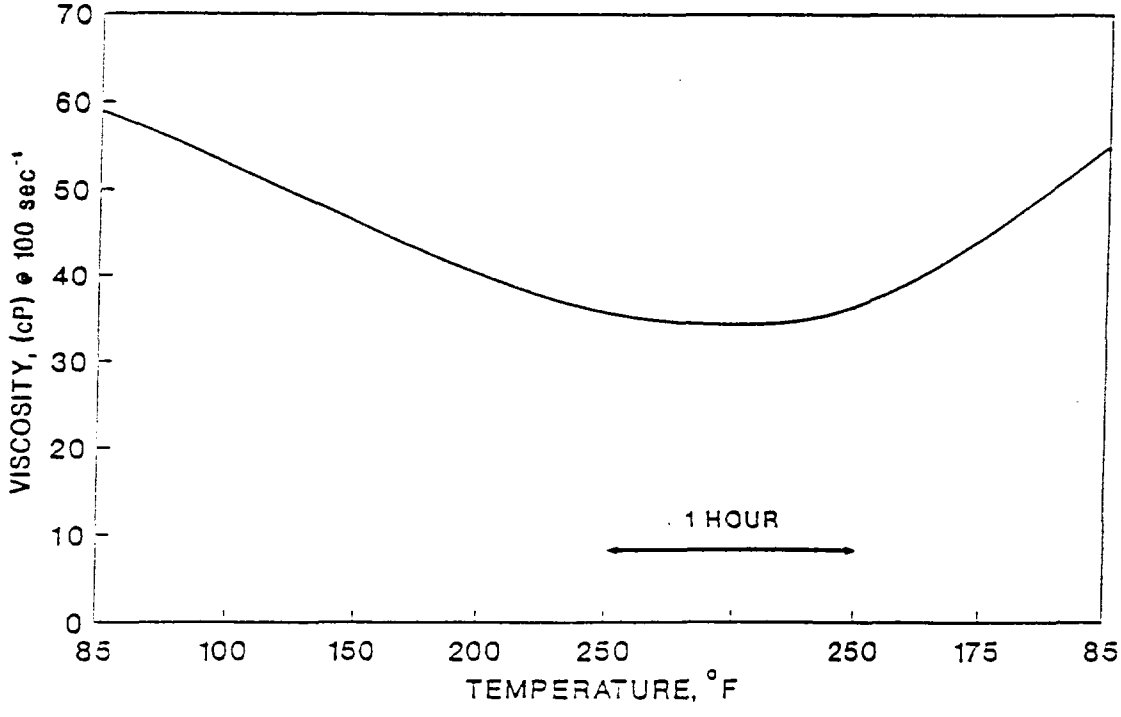
Physical Data:
Appearance — Cream colored fluid suspension.
Boiling Point: > 392° F
Flash Point: > 200° F

DOT Classification:
Non-hazardous.

Packaging:
5 gallon (49 lb net) plastic pails.

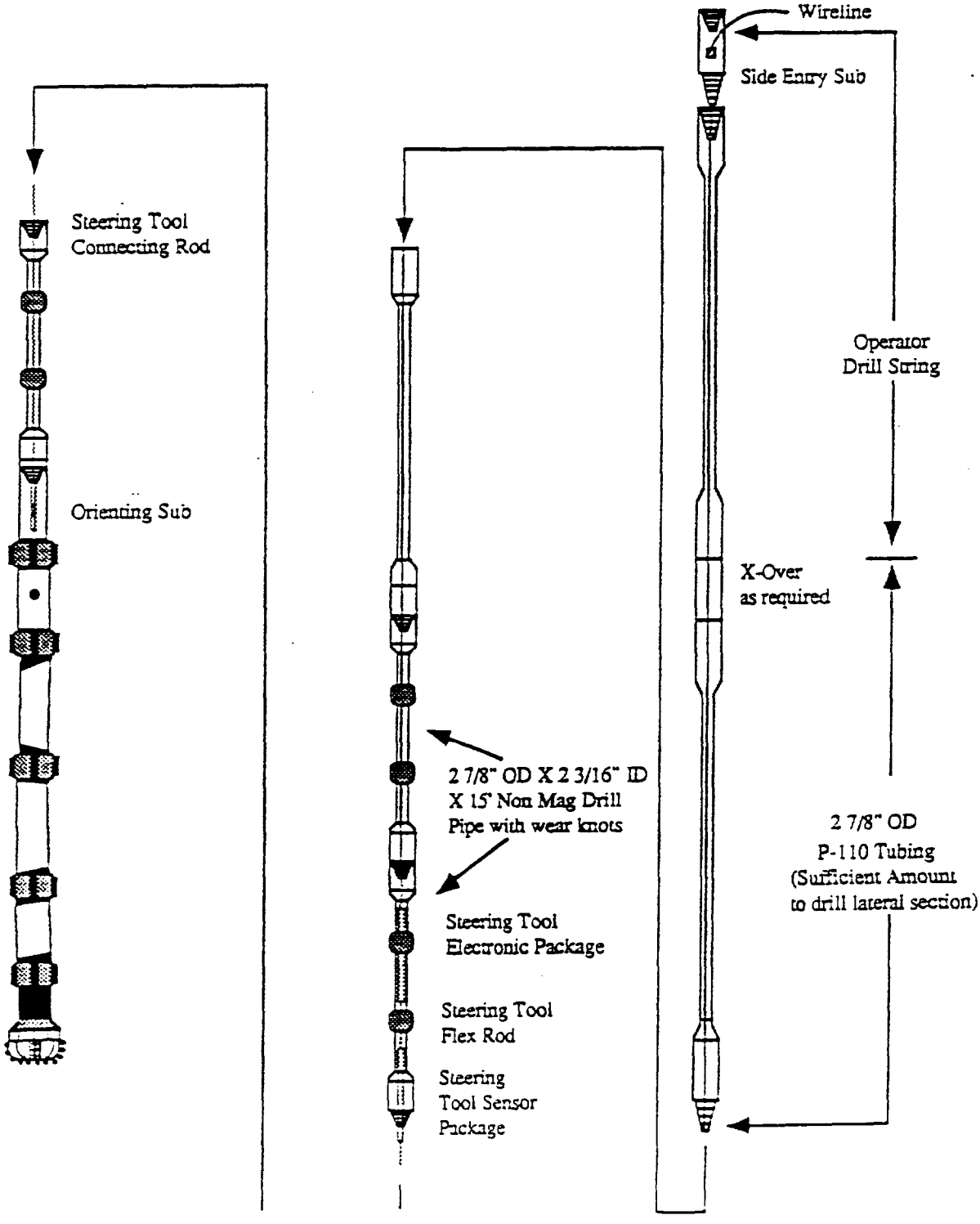
TECHNICAL SERVICE — Kelco has a highly trained and experienced technical staff who welcome the opportunity to discuss XANVIS L with you. Fully equipped laboratories in Houston and San Diego are available to help you in the development of the most effective fluid system.

Figure 2
VISCOSITY vs TEMPERATURE
(1.5 lb/bbl XANVIS in 2% KCl)



BOTTOM HOLE ASSEMBLIES

Bottomhole Assembly
Steering Tool



RESPONSIBILITIES

TERMS AND CONDITIONS

Products and Services - provided by Baker Hughes *INTEQ* are expressly limited to the terms and conditions contained herein. Customer acknowledges that the price for equipment and services is based upon the warranties, remedies and limitations on liability as set forth herein.

Liability - The only guarantee given by Baker Hughes *INTEQ* is that the equipment is free from defect in workmanship and materials. The liability in such a case is restricted to the replacement of the part returned for inspection and proven to be defective. Liability is only accepted if the part concerned was used for the purpose for which it was designed. This guarantee expires on year after the date of shipment of the material from our stock point. The shipping expenses covering the round trip of the product found to be defective will be paid by Baker Hughes *INTEQ*. This guarantee is exclusive of any other liability for whatever cause in whatever form, particularly in any respect of any damages suffered because of the defective part.

THE PARTIES AGREE THAT ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY, ARE EXCLUDED. ALL WARRANTIES AND OBLIGATIONS OF Baker Hughes *INTEQ* SHALL TERMINATE IF CUSTOMER FAILS TO PERFORM ITS OBLIGATIONS UNDER THIS OR ANY OTHER AGREEMENT BETWEEN THE PARTIES OR FAILS TO PAY ANY CHARGES OTHERWISE DUE Baker Hughes *INTEQ*.

Risk of Operation - All tools and equipment provided hereunder are furnished and operated at Customer's risk; Baker Hughes *INTEQ* shall not be liable for any direct, contingent, incidental or consequential damages arising from use of the tools or equipment. In no event will Baker Hughes *INTEQ* be liable for (1) lost profits, well damages or any other incidental or consequential damages; (2) damages caused by Customer's failure to perform its responsibilities; or (3) repair or alterations done without written approval of Baker Hughes *INTEQ*. Well conditions which prevent satisfactory operations of such tools do not relieve Customer of its responsibilities for payment as provided in the sale or contract. Customer shall be responsible for any sub-surface damage to the well or for surface damage to persons or property which may result from the use of such tools (irrespective of the cause of such damage and whether or not occasioned by Baker Hughes *INTEQ*'s negligence). Customer shall defend, indemnify and hold harmless Baker Hughes *INTEQ* at Customer's sole cost from any and all claims, lawsuits, liabilities and causes of action for injury to or death of any person or for damage to or destruction of property caused by the tools rented hereunder whether or not such injury or damage is occasioned by Baker Hughes *INTEQ*'s negligence. Customer shall provide Baker Hughes *INTEQ* with all information about well conditions required for the safe and efficient performance of its products and services. Customer shall notify Baker Hughes *INTEQ* in advance of hazardous or unusual circumstances existing in the well.

Damages or Lost Tools - In the event Baker Hughes *INTEQ* equipment is lost, destroyed, damaged beyond repair, or abandoned, regardless of the cause (including "acts of God"), in transit or otherwise after delivery to Customer for transport to the well, and before its redelivery to Baker Hughes INTEQ, the Customer shall pay Baker Hughes *INTEQ* for such loss up to the maximum applicable loss charge. Lost equipment subsequently recovered shall be returned to Baker Hughes *INTEQ*. All rights in and to equipment shall at all times remain that of Baker Hughes *INTEQ*, notwithstanding payment of loss charges.

Lost-in-Hole insurance coverage is available for some rental equipment as noted. Insurance must be purchased by the Customer prior to equipment leaving Baker Hughes *INTEQ* premises for said coverage to take effect.

All Baker Hughes *INTEQ* rental equipment is to be returned to Baker Hughes *INTEQ* by the Customer in the same good order an condition as when it left Baker Hughes *INTEQ*'s premises, less ordinary wear and tear normal in oilfield use within Baker Hughes *INTEQ* recommended environmental and operating parameters. The Customer is liable for costs to repair equipment damaged beyond such normal wear and tear.

Operations/Modification of Tools - Baker Hughes *INTEQ* equipment shall not be operated, services, altered, or in any way modified, without prior written approval of Baker Hughes *INTEQ*.

Change of Design - Baker Hughes *INTEQ* expressly reserves the right to change or modify the design and construction of any product, in due course of its manufacturing procedure, without incurring any obligation or liability to furnish or install such changes, modifications or improvements on products previously or subsequently sold.

Patents - Baker Hughes *INTEQ* warrants that the use or sale of materials and apparatus sold by it to Customer hereunder will not infringe patents of others by reason of the use or sale of such materials and apparatus per se, and hereby agrees to indemnify Customer against judgment for damages for infringement of any such patent, provided that Customer shall promptly notify Baker Hughes *INTEQ* in writing upon receipt of any claim for infringements, or upon the filing of any such suit for infringement, whichever first occurs, and shall afford Baker Hughes *INTEQ* full opportunity, at Baker Hughes *INTEQ*'s option and expense, to answer such claim or threat of suit, assume the control of the defense of such suit, and settle or compromise same in any way Baker Hughes *INTEQ* sees fit. Baker Hughes *INTEQ* does not warrant that such materials and apparatus (a)will not infringe any such patent when not of Baker Hughes *INTEQ*'s manufacture, or especially made, in whole or in part, to the Customer's design specifications, or (b)if used, or sold in combination with other materials or apparatus or used in the practice or processes, will not, as a result of such combination or use, infringe any such patent; and Baker Hughes *INTEQ* shall not be liable and does not indemnify Customer for damages or losses of any nature whatsoever resulting from actual or alleged patent infringement arising pursuant to clauses (a) or (b) above. THIS PARAGRAPH STATES THE ENTIRE RESPONSIBILITY OF Baker Hughes *INTEQ* CONCERNING PATENT INFRINGEMENT.

Confidentiality of Results - Baker Hughes *INTEQ* shall maintain results obtained from its services in strict confidence, subject only to disclosure required by law or legal process.

Third Party Charges - Customer shall be responsible to pay any charges or fees for transporting Baker Hughes *INTEQ* equipment between the facility and the well. Customer shall also pay all other third-party charges as set forth in Baker Hughes *INTEQ*'s price schedule.

Taxes - Customer shall pay any sales, use, rental or other taxes that may be applicable.

Shipping Terms, Transportation & Delivery - Shipping terms shall always be understood to be F.O.B. Baker Hughes *INTEQ*'s plant, stocking point or other shipping point, unless otherwise specified by Customer in writing or formal purchase order. All shipments will be packed for domestic delivery unless otherwise specified by Customer or required for safe transport of product. Skidding charges will be 1% of total invoice value of item. Export packing charges will be those incurred as invoiced by designated freight forwarder or export packer. Risk of loss shall pass to Customer as soon as the goods depart Baker Hughes *INTEQ*'s plant, or stocking point. Baker Hughes *INTEQ* shall not be held liable for the delays or failure in performance when the same are caused by strikes, labor disturbances, walkouts, riot, fire, embargoes or other conditions beyond Baker Hughes *INTEQ*'s control. All transportation charges shall be paid by Customer. Common carrier rates shall apply. When tools and equipment are delivered by Baker Hughes *INTEQ* and common carrier rates do not apply, charges shall be in accordance with Baker Hughes *INTEQ*'s current price list.

Payment Terms - All charges for products, rental, services or transportation are net and payable in 30 days. Interest will be charged at the maximum rate allowed by law after sixty (60) days from date of invoice.

Cancellation - In the event an order is canceled after it has been accepted by Baker Hughes *INTEQ*, a 25% restocking charge will be made along with actual costs of transportation. No merchandise may be returned without the written consent of Baker Hughes *INTEQ*.

Modification of Orders - Orders as received constitute the complete and final agreement between Baker Hughes *INTEQ* and the Customer, and no other agreement in any way modifying any of the terms and conditions appearing will be binding upon the parties unless made in writing and signed by their authorized representatives. No employee or agent of Baker Hughes *INTEQ* or Operator is empowered to alter the above terms and conditions.

Conditions - Should Customer violate any terms and conditions of this agreement, become bankrupt, insolvent, to into receivership or should any creditor or other person attach or levy Customer's property or equipment, Baker Hughes *INTEQ* shall immediately have the right without notice to retake and remove its tools and equipment wherever they may be found. Customer shall defend, indemnify and hold Baker Hughes *INTEQ* harmless from any and all liens and encumbrances against the tools furnished hereunder and shall return the same promptly to Baker Hughes *INTEQ* free of any liens or encumbrances.

Failure of Operator or Baker Hughes *INTEQ* to enforce any of the above terms and conditions shall not prevent a subsequent enforcement of such terms or conditions or be deemed a waiver of any subsequent breach. All of the above terms and conditions shall also apply in favor of any manufacturer or supplier of any tools or equipment supplied to Customer hereunder.

Force Majeure - The failure of Baker Hughes *INTEQ* to perform any of its obligations if occasioned by an "act of God" or the public enemy, fire explosion, flood, drought, war, riots, sabotage, vandalism, accident, embargo, government priority, requisition or allocation or other action of any governmental authority, or as circumstance of like or different character beyond the reasonable control of such party, or by interruption of or delay in transportation, inadequacy, shortage or failure of supply of materials or equipment, breakdowns, shutdowns for repairs, plant accidents, labor shortage, strikes, labor trouble, or by compliance with any order or request of the United States government or any officer, department, agency, instrumentality or committee thereof, or by compliance with the request of any manufacturer for material purposes of producing articles for national defense, shall not subject Baker Hughes *INTEQ* to any liability to Customer.

Execution Entire Agreement - This agreement is the complete and exclusive statement of all the terms and conditions of the Agreement between Baker Hughes *INTEQ* and Customer, and contains all representations of the parties and supersedes all prior oral or written agreements or representations. Customer has not relied on any representations other than those contained in this agreement. This agreement shall not be varied, supplemented, qualified, or interpreted by any prior course of dealing between the parties or by any usage of trade. This agreement may be amended only by a subsequent written instrument duly executed by Customer and by an officer of Baker Hughes *INTEQ*.

Severance - Should any provision of this contract, or a portion thereof, be unenforceable or in conflict with the country, state, province, or local law which govern this contract, then the validity of the remaining provisions, and portions thereof, shall not be affected by such unenforceability or conflict and this agreement shall be construed as if such provisions, or portion thereof were not contained herein.

Governing Law - The rights and obligations of Customer shall be governed by the law of the State of Texas.

DEFINITIONS OF TERMS USED HEREIN

Land Location - any rig site located on land that is accessible by ordinary means of transportation.

Marine or Inaccessible Land Locations - any location, land or water, which is not contiguous and connected by suitable roads or accessible by ordinary land transportation.

Day - term Day as used herein is any 24-hour period beginning and ending at midnight.

Job - a job consists of all operations from any individual location under an individual work order from the Customer.

Run - a trip or successive trips down hole with a specified tool(s) without interceding use of another tool(s).