



STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION



BRUCE KING
GOVERNOR

ANITA LOCKWOOD
CABINET SECRETARY

August 20, 1993

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

Texaco Exploration and Production Company
P.O. Box 730
Hobbs, NM 88241

Attention: T.L. Frazier

CF 4852

CF 7591

PMX-111

PDEV0020700170

PMX-120

PDEV0020700120

**RE: Injection Pressure Increase, Vacuum
Grayburg San Andres Unit, Lea
County, New Mexico**

Dear Mr. Fraizer:

Reference is made to your request dated August 8, 1993 to increase the surface injection pressure on five wells in your Vacuum Grayburg San Andres Unit. This request is based on step rate tests conducted on this well between July 9 and July 20, 1993. The results of the test have been reviewed by my staff and we feel an increase in injection pressure on this well justified at this time.

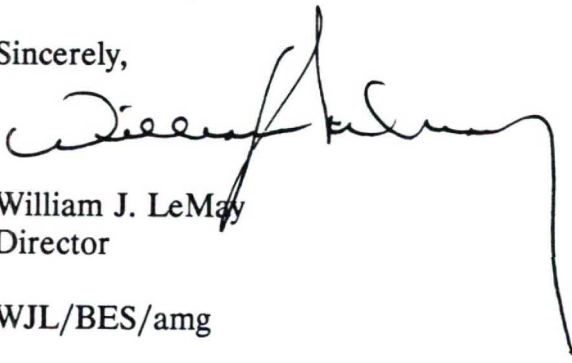
You are therefore authorized to increase the surface injection pressure on the following well:

Well and Location	Maximum Injection Surface Pressure
VGSAU Well No. 4 Unit M, Section 1, Township 18 South, Range 34 East	1310 PSIG
VGSAU Well No. 18 Unit K, Section 1, Township 18 South, Range 34 East	1410 PSIG
VGSAU Well No. 32 Unit L, Section 1, Township 18 South, Range 34 East	1700 PSIG
VGSAU Well No. 59 Unit E, Section 2, Township 18 South, Range 34 East	1295 PSIG

Well and Location	Maximum Injection Surface Pressure
VGSAU Well No. 67 Unit L, Section 35, Township 17 South, Range 34 East	1750 PSIG
These wells located in Lea County, New Mexico.	

The Division Director may rescind this injection pressure increase if it becomes apparent that the injected water is not being confined to the injection zone or is endangering any fresh water aquifers.

Sincerely,



William J. LeMay
Director

WJL/BES/amg

cc: Oil Conservation Division - Hobbs
File: Case No. 4852
Case No. 7591
PMX-111
PMX-120

NO WAITING PERIOD

COMPANY: TEXACO EXPLORATION AND PRODUCTION, INC.
ADDRESS: P.O. Box 730
CITY, STATE, ZIP: Hobbs, New Mexico 88241
ATTENTION: Mr. T.L. Frazier

Re: Injection Pressure Increase
Vacuum Grayburg San Andres Unit
Lea County, New Mexico

Dear Sir:

Reference is made to your request dated August 8, 1993, to increase the surface injection pressure on 5 wells in your Vacuum Grayburg San Andres Unit. This request is based on step rate tests conducted on these wells between July 9, and July 20, 1993. The results of the tests have been reviewed by my staff and we feel an increase in injection pressure on these wells is justified at this time.

You are therefore authorized to increase the surface injection pressure on the following wells:

<u>Well & Location</u>	<u>Maximum Injection Surface Pressure</u>
VGSAU Well No.4 Unit M, Section 1, T18S, R34E	1310 psig
VGSAU Well No.18 Unit K, Section 1, T18S, R34E	1410 psig
VGSAU Well No.32 Unit L, Section 1, T18S, R34E	1700 psig
VGSAU Well No.59 Unit E, Section 2, T18S, R34E	1295 psig
VGSAU Well No.67 Unit L, Section 35, T17S, R34E	1750 psig

The Division Director may rescind this injection pressure increase if it becomes apparent that the injected water is not being confined to the injection zone or is endangering any fresh water aquifers.

William J. LeMay
Director

WJL/BES

xc: **OCD - Hobbs**
 FILE - Case Nos.4852; 7591; PMX-111, PMX-120



Texaco E & P

Field Office
Hobbs Area Manager
Hobbs, NM 88240

N/R

August 8, 1993

Mr. David R. Catanach
New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division
State Land Office Building
310 Old Santa Fe Trail
P.O. Box 2088
Santa Fe, New Mexico 87504

SUBJECT: REQUEST FOR INCREASED SURFACE INJECTION PRESSURE ON
SELECTED WELLS IN THE VACUUM GRAYBURG SAN ANDRES UNIT
LEA COUNTY, NEW MEXICO

Mr. David Catanach:

Texaco request that the surface injection pressure limit be increased for the five wells on the attached list. The requested increases are based on step rate tests which are attached for your review.

The increases in surface injection pressure are necessary to maintain adequate injection rates, thus ensuring the optimum performance of the waterflood.

Should you have any questions or require additional information, please contact Todd Lackey at (505) 393-7191.

Yours very truly,

T. L. Frazier/RSF

T. L. Frazier
Hobbs Area Manager

WTL

cc: Mr. Jerry Sexton
Oil Conservation Division
P.O. Box 1980
Hobbs, NM 88240

Vacuum Grayburg San Andres Unit
Texaco Exploration and Production Inc.
Lea County, New Mexico

<u>Well</u>	<u>Present Allow Inj Press (PSIG)</u>	<u>Observed Surface Parting Press (PISG)</u>	<u>Requested Allow Inj Press (PSIG)</u>
VGSAU Well #4	1250	1360	1310 OK
VGSAU Well #18	1260	1460	1410 OK
VGSAU Well #32	1220	1750	1700 OK
VGSAU Well #59	1110	1345	1295 OK
VGSAU Well #67	1380	1800	1750 OK

JOHN WEST ENGINEERING COMPANY

Hobbs, New Mexico

STEP RATE INJECTION TEST

CLIENT: TEXACO EXPLORATION & PRODUCTION

DATE: JULY 12, 1993

WELL NAME: VACUUM GRAYBURG SAN ANDRES UNIT NO. 4

WO#: 93-14-1282

Lea County, New Mexico

MID-PERFS. = 4524 - 4777

TBG = 4475

MDR = 4790

BHP GAUGE DEPTH = 4650

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psi)	(5) CORRECTED TUBING PRESS. (psi) (1)-(4)	(6) INJECTION RATE (gpm) (8)/34.2857	(7) MEASURED BHP (psi)
CASING PRESS	9:55	1215.4				1215.4		3333
0	10:00	1237.0	0.6	172.8	1.606	1235.4	5.04	3349
PSI	10:05	1233.3	1.2	172.8	1.606	1231.7	5.04	3355
	10:10	1235.9	1.7	144.0	1.146	1234.8	4.20	3358
	10:15	1233.3	2.3	172.8	1.606	1231.7	5.04	3360
	10:20	1189.3	2.9	172.8	1.606	1187.7	5.04	3362
1	10:25	1212.2	3.4	144.0	1.146	1211.1	4.20	3363
				163.9				
CASING PRESS	10:30	1228.7	4.7	374.4	6.712	1222.0	10.92	3380
0	10:35	1224.9	6.0	374.4	6.712	1218.2	10.92	3384
PSI	10:40	1228.9	7.3	374.4	6.712	1222.2	10.92	3387
	10:45	1238.0	8.6	374.4	6.712	1231.3	10.92	3389
	10:50	1235.7	9.9	374.4	6.712	1229.0	10.92	3391
2	10:55	1241.1	11.2	374.4	6.712	1234.4	10.92	3391
				374.4				
CASING PRESS	11:00	1266.6	13.6	691.2	20.866	1245.7	20.16	3410
0	11:05	1264.3	16.0	691.2	20.866	1243.4	20.16	3415
PSI	11:10	1254.3	18.4	691.2	20.866	1233.4	20.16	3417
	11:15	1254.3	20.7	662.4	19.286	1235.0	19.32	3419
	11:20	1254.3	23.1	691.2	20.866	1233.4	20.16	3420
3	11:25	1275.8	25.5	691.2	20.866	1254.9	20.16	3422
				686.4				
CASING PRESS	11:30	1297.2	29.1	1036.8	44.179	1253.0	30.24	3438
0	11:35	1288.3	32.8	1065.6	46.476	1241.8	31.08	3442
PSI	11:40	1293.2	36.4	1036.8	44.179	1249.0	30.24	3445
	11:45	1293.2	40.1	1065.6	46.476	1246.7	31.08	3447
	11:50	1319.2	43.8	1065.6	46.476	1272.7	31.08	3449
4	11:55	1319.5	47.4	1036.8	44.179	1275.3	30.24	3450
				1051.2				

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psi)	(5) CORRECTED TUBING PRESS. (psi) (1)-(4)	(6) INJECTION RATE (gpm) (3)/34.2857	(7) MEASURED BHP (psi)
CASING PRESS 0 PSI	12:00	1348.7	52.7	1526.4	90.358	1258.3	44.52	3467
	12:05	1348.8	58.0	1526.4	90.358	1258.4	44.52	3470
	12:10	1347.5	63.3	1526.4	90.358	1257.1	44.52	3473
	12:15	1372.8	68.6	1526.4	90.358	1282.4	44.52	3478
	12:20	1386.6	74.0	1555.2	93.537	1293.1	45.36	3480
5	12:25	1394.2	79.3	1526.4	90.358	1303.8	44.52	3482
				1531.2				
CASING PRESS 0 PSI	12:30	1481.5	86.3	2016.0	151.178	1330.3	58.80	3494
	12:35	1486.6	93.5	2073.6	159.265	1327.3	60.48	3496
	12:40	1475.2	100.7	2073.6	159.265	1315.9	60.48	3496
	12:45	1474.0	107.6	1987.2	147.207	1326.8	57.96	3498
	12:50	1467.8	114.7	2044.8	155.197	1312.6	59.64	3499
6	12:55	1471.6	121.7	2016.0	151.178	1320.4	58.80	3501
				2035.1				
CASING PRESS 0 PSI	1:00	1533.7	130.2	2448.0	216.512	1317.2	71.40	3510
	1:05	1537.5	138.6	2419.2	211.823	1325.7	70.56	3511
	1:10	1541.3	147.0	2419.2	211.823	1329.5	70.56	3514
	1:15	1538.9	155.5	2448.0	216.512	1322.4	71.40	3515
FALLOFF		OUT	OF	WATER				
	1:16	1283.2				1283.2		3490
	1:17	1284.5				1284.5		3480
	1:18	1276.9				1276.9		3473
	1:19	1269.3				1269.3		3467
	1:20	1271.9				1271.9		3463
	1:25	1251.7				1251.7		3447
	1:30	1244.1				1244.1		3436
	1:35	1240.3				1240.3		3428
	1:40	1237.7				1237.7		3422
	1:45	1236.4				1236.4		3418

- △ RECORDED WELLHEAD PRESSURE
- CORRECTED WELLHEAD PRESSURE BASED ON 2 3/8" TUBING
- BOTTOM HOLE PRESSURE @ 4790 FEET

1600

1500

1400

1300

1200

PSIG

WELLHEAD PRESSURE

TEXACO EXPLORATION AND PRODUCTION
 VACUUM GRAYBURG SAN ANDRES UNIT NO.4
 STEP-RATE INJECTION TEST
 LEA COUNTY, NEW MEXICO
 JULY 12, 1993

3600

PSIG

3500

3400

3300

BOTTOM HOLE PRESSURE

B W P D

100

500

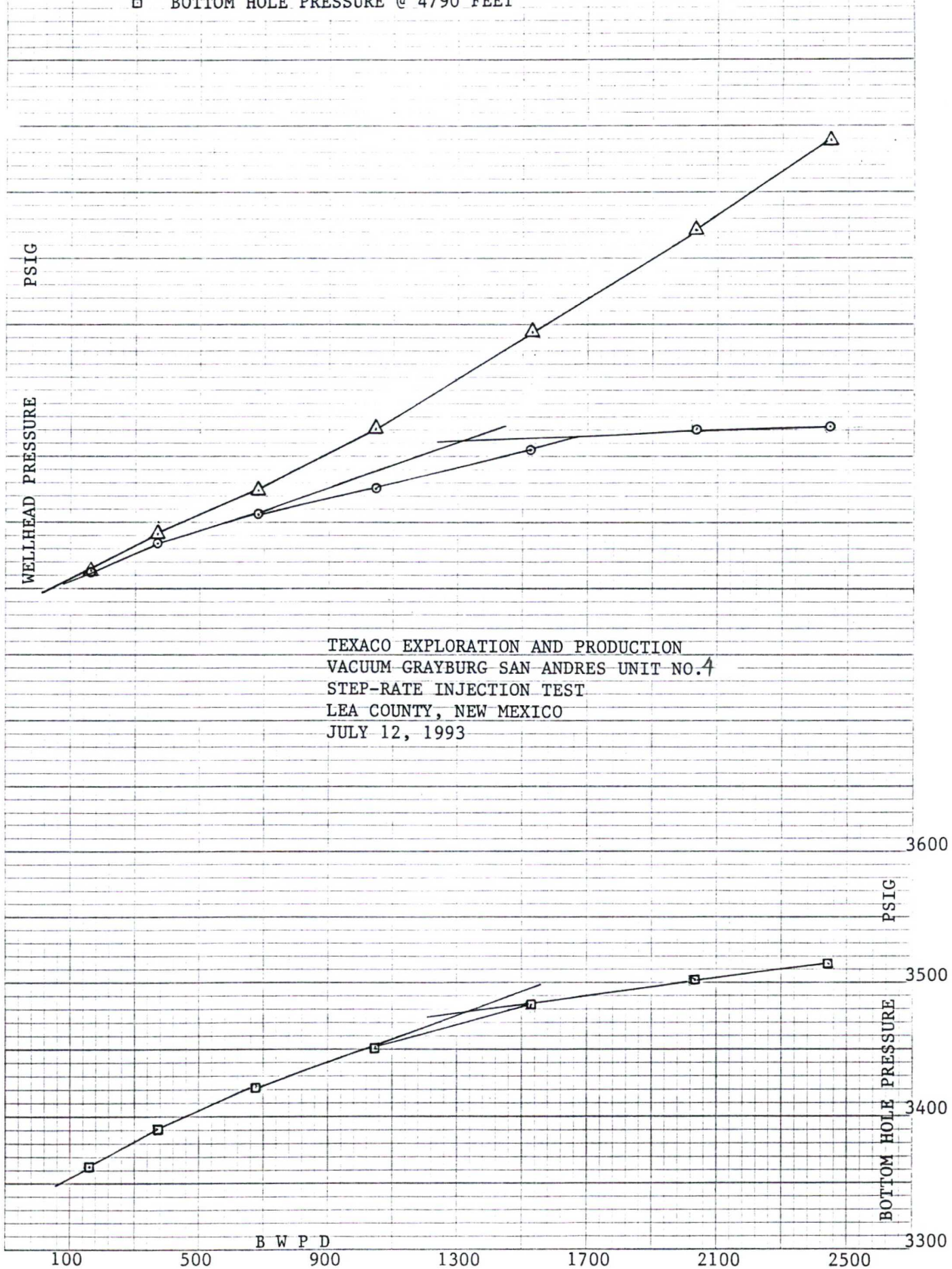
900

1300

1700

2100

2500



JOHN WEST ENGINEERING COMPANY

Hobbs, New Mexico

STEP RATE INJECTION TEST

CLIENT: TEXACO EXPLORATION AND PRODUCTION

DATE: JULY 9, 1983

WELL NAME: VACUUM GRAYBURG SAN ANDRES UNIT NO. 18

WO#: 93-14-1281

Lea County, New Mexico

MID-PERFS. = 4311 - 4735

TBG = 4260

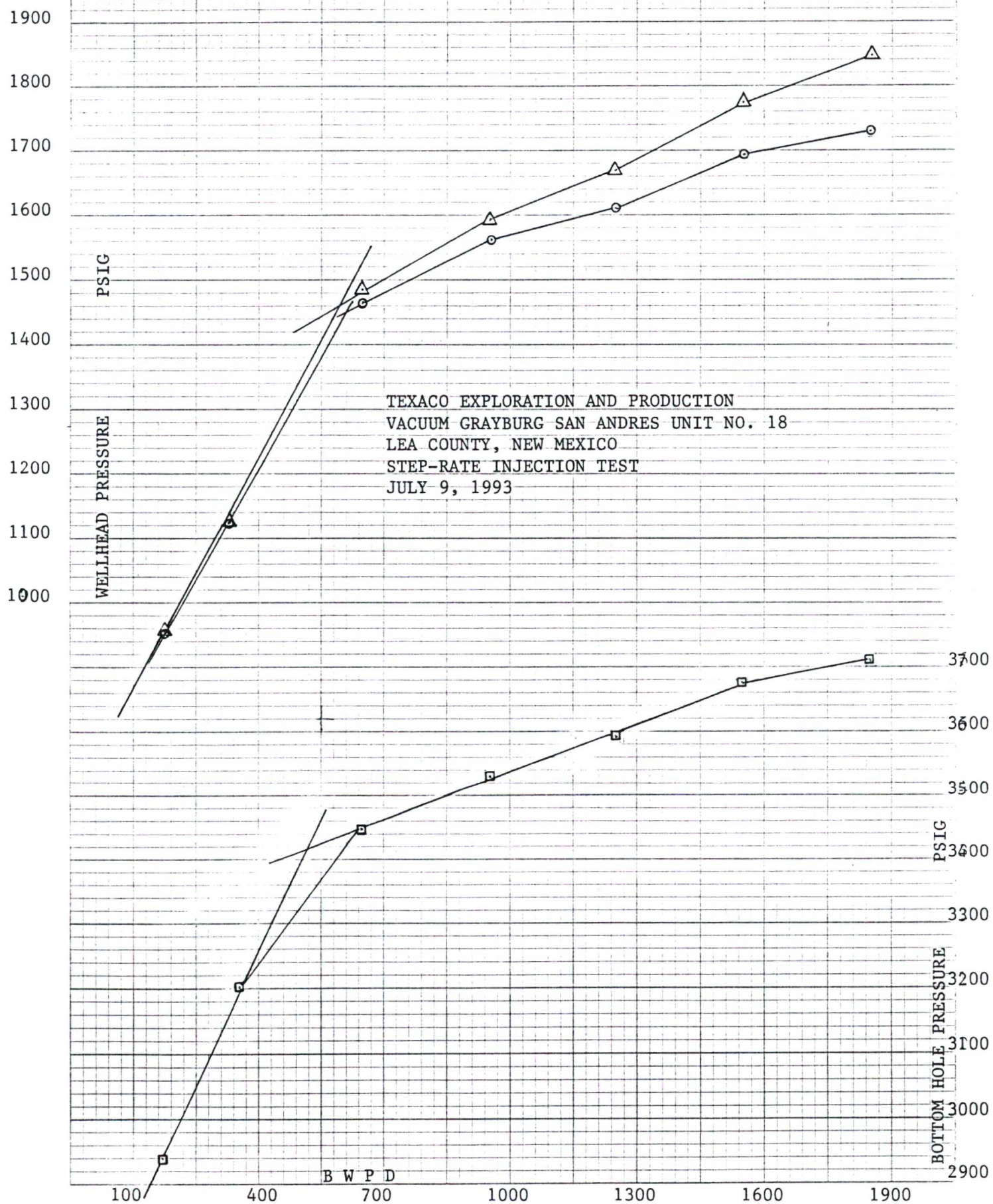
MDR = 4295

BHP GAUGE DEPTH = 4290

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psi)	(5) CORRECTED TUBING PRESS. (psi) (1)-(4)	(6) INJECTION RATE (gpm) (3)/34.2857	(7) MEASURED BHP (psi)
CASING	9:30	652.6				652.6		2641
PRESS	9:35	805.0	0.6	172.8	1.440	803.6	5.04	2781
0	9:40	839.0	1.2	172.8	1.440	837.6	5.04	2825
PSIG	9:45	870.5	1.8	172.8	1.440	869.1	5.04	2854
	9:50	908.4	2.4	172.8	1.440	907.0	5.04	2889
	9:55	935.0	3.0	172.8	1.440	933.6	5.04	2920
1	10:00	957.9	3.6	172.8	1.440	956.5	5.04	2940
				172.8				
CASING	10:05	1080.7	4.9	374.4	6.018	1074.7	10.92	3055
PRESS	10:10	1111.2	6.0	316.8	4.418	1106.8	9.24	3090
0	10:15	1146.7	7.2	345.6	5.190	1141.5	10.08	3126
PSIG	10:20	1182.2	8.4	345.6	5.190	1177.0	10.08	3162
	10:25	1208.8	9.7	374.4	6.018	1202.8	10.92	3186
2	10:30	1126.6	10.9	345.6	5.190	1121.4	10.08	3203
				350.4				
CASING	10:35	1389.9	13.1	633.6	15.928	1374.0	18.48	3362
PRESS	10:40	1426.6	15.3	633.6	15.928	1410.7	18.48	3395
0	10:45	1445.6	17.6	662.4	17.293	1428.3	19.32	3409
PSIG	10:50	1468.4	19.8	633.6	15.928	1452.5	18.48	3430
	10:55	1473.5	22.1	662.4	17.293	1456.2	19.32	3437
3	11:00	1482.3	24.3	633.6	15.928	1466.4	18.48	3449
				643.2				
CASING	11:05	1657.0	27.5	921.6	31.857	1625.1	26.88	3610
PRESS	11:10	1669.7	30.9	979.2	35.639	1634.1	28.56	3613
0	11:15	1617.8	34.2	950.4	33.724	1584.1	27.72	3562
PSIG	11:20	1601.3	37.5	950.4	33.724	1567.6	27.72	3546
	11:25	1592.5	40.9	979.2	35.639	1556.9	28.56	3538
4	11:30	1595.1	44.2	950.4	33.724	1561.4	27.72	3532
				955.2				

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
STEP NO. & REMARKS	TIME	SURFACE TUBING PRESS. (psig)	CUMULATIVE VOL. INJECTED (bbls)	INJECTION RATE (bbls/day)	FRICTION HEAD LOSS (psi)	CORRECTED TUBING PRESS. (psi) (1)-(4)	INJECTION RATE (gpm) (3)/34.2857	MEASURED BHP (psi)
CASING	11:35	1672.3	48.7	1296.0	59.859	1612.4	37.80	3588
PRESS	11:40	1662.2	53.0	1238.4	55.030	1607.2	36.12	3583
0	11:45	1667.2	57.3	1238.4	55.030	1612.2	36.12	3592
PSIG	11:50	1669.8	61.6	1238.4	55.030	1614.8	36.12	3586
	11:55	1666.0	65.9	1238.4	55.030	1611.0	36.12	3587
5	12:00	1668.5	70.3	1267.2	57.421	1611.1	36.96	3589
				1252.8				
CASING	12:05	1769.8	75.7	1555.2	83.871	1685.9	45.36	3667
PRESS	12:10	1767.2	81.1	1555.2	83.871	1683.3	45.36	3658
50	12:15	1762.2	86.5	1555.2	83.871	1678.3	45.36	3655
PSIG	12:20	1787.5	91.9	1555.2	83.871	1703.6	45.36	3692
	12:25	1787.5	97.3	1555.2	83.871	1703.6	45.36	3688
6	12:30	1776.1	102.6	1526.4	81.020	1695.1	44.52	3675
				1550.4				
CASING	12:35	1848.3	109.0	1843.2	114.846	1733.5	53.76	3717
PRESS	12:40	1850.8	115.4	1843.2	114.846	1736.0	53.76	3717
140	2:45	1857.2	121.8	1843.2	114.846	1742.4	53.76	3718
PSIG	12:50	1855.9	128.3	1872.0	118.188	1737.7	54.60	3723
	12:55	1855.9	134.7	1843.2	114.846	1741.1	53.76	3721
7	1:00	1844.5	141.1	1843.2	114.846	1729.7	53.76	3710
				1847.9				
FALLOFF	1:01	1534.5				1534.5		3530
	1:02	1511.8				1511.8		3507
	1:03	1491.5				1491.5		3486
	1:04	1475.1				1475.1		3470
	1:05	1461.2				1461.2		3456
	1:10	1403.0				1403.0		3398
	1:15	1362.5				1362.5		3358

- △ RECORDED WELLHEAD PRESSURE
- CORRECTED WELLHEAD PRESSURE BASED ON 2 3/8" TUBING
- BOTTOM HOLE PRESSURE @ 4260 FEET



JOHN WEST ENGINEERING COMPANY

Hobbs, New Mexico

STEP RATE INJECTION TEST

CLIENT: TEXACO EXPLORATION & PRODUCTION

DATE: JULY 13, 1983

WELL NAME: VACUUM GRAYBURG SAN ANDRES UNIT NO. 32

WO#: 83-14-1290

Lea County, New Mexico

MID-PERFS. = 4333 - 4781

TBG = 4254

MDR = 4322

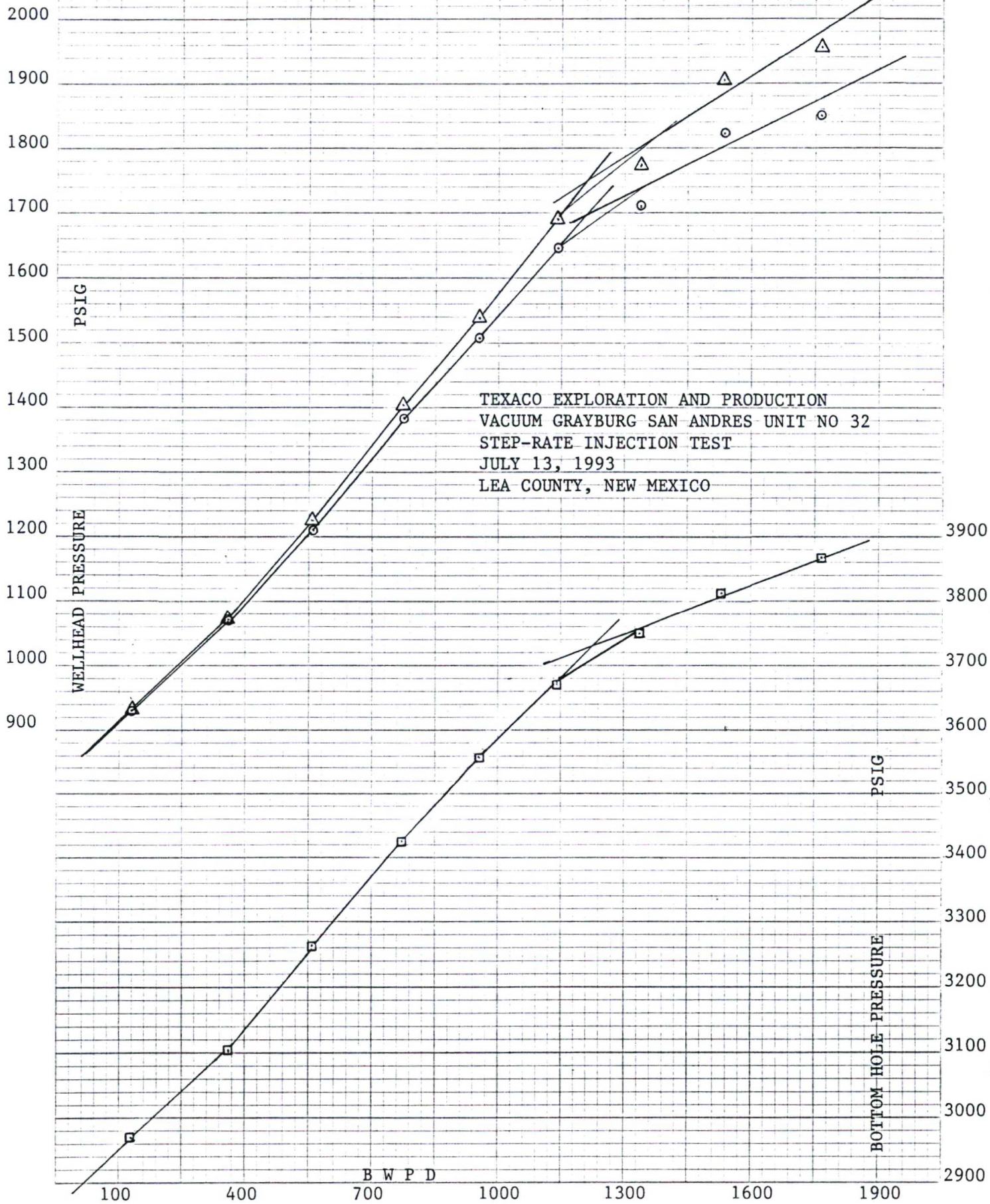
BHP GAUGE DEPTH = 4320

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psi)	(5) CORRECTED TUBING PRESS. (psi) (1)-(4)	(6) INJECTION RATE (gpm) (3)/34.2857	(7) MEASURED BHP (psi)
CASING	9:15	862.3				862.3		2883
PRESS	9:20	908.4	0.4	115.2	0.684	907.7	3.36	2925
0	9:25	917.4	0.9	144.0	1.034	916.4	4.20	2938
PSI	9:30	921.4	1.4	144.0	1.034	920.4	4.20	2952
	9:35	924.2	1.8	115.2	0.684	923.5	3.36	2957
	9:40	935.6	2.3	144.0	1.034	934.6	4.20	2962
1	9:45	933.0	2.7	115.2	0.684	932.3	3.36	2969
				129.6				
CASING	9:50	996.1	3.9	345.6	5.223	990.9	10.08	3026
PRESS	9:55	1017.5	5.1	345.6	5.223	1012.3	10.08	3050
0	10:00	1032.7	6.3	345.6	5.223	1027.5	10.08	3066
PSIG	10:05	1049.3	7.6	374.4	6.056	1043.2	10.92	3079
	10:10	1060.7	8.8	345.6	5.223	1055.5	10.08	3095
2	10:15	1068.2	10.0	345.6	5.223	1063.0	10.08	3103
				350.4				
CASING	10:20	1151.7	12.0	576.0	13.437	1138.3	16.80	3178
PRESS	10:25	1170.6	13.9	547.2	12.221	1158.4	15.96	3197
0	10:30	1179.4	15.8	547.2	12.221	1167.2	15.96	3222
PSI	10:35	1199.5	17.7	547.2	12.221	1187.3	15.96	3239
	10:40	1207.0	19.7	576.0	13.437	1193.6	16.80	3253
3	10:45	1223.4	21.6	547.2	12.221	1211.2	15.96	3263
				556.8				
CASING	10:50	1330.9	24.3	777.6	23.411	1307.5	22.68	3357
PRESS	10:55	1344.8	27.0	777.6	23.411	1321.4	22.68	3368
0	11:00	1363.8	29.7	777.6	23.411	1340.4	22.68	3389
PSI	11:05	1380.4	32.4	777.6	23.411	1357.0	22.68	3407
	11:10	1394.6	35.1	777.6	23.411	1371.2	22.68	3422
4	11:15	1402.3	37.7	748.8	21.833	1380.5	21.84	3429
				772.8				

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psi)	(5) CORRECTED TUBING PRESS. (psi) (1) - (4)	(6) INJECTION RATE (gpm) (3)/34.2857	(7) MEASURED BHP (psi)
CASING PRESS	11:20	1473.3	41.1	979.2	35.863	1437.4	28.56	3493
0	11:25	1501.3	44.4	950.4	33.936	1467.4	27.72	3511
PSI	11:30	1514.0	47.7	950.4	33.936	1480.1	27.72	3525
	11:35	1506.5	51.0	950.4	33.936	1472.6	27.72	3535
	11:40	1520.4	54.3	950.4	33.936	1486.5	27.72	3547
5	11:45	1539.4	57.6	950.4	33.936	1505.5	27.72	3559
				955.2				
CASING PRESS	11:50	1630.5	61.6	1152.0	48.441	1582.1	33.60	3623
0	11:55	1659.5	65.5	1123.2	46.225	1613.3	32.76	3646
PSI	12:00	1660.8	69.5	1152.0	48.441	1612.4	33.60	3661
	12:05	1689.9	73.5	1152.0	48.441	1641.5	33.60	3668
	12:10	1692.4	77.4	1123.2	46.225	1646.2	32.76	3672
6	12:15	1691.1	81.4	1152.0	48.441	1642.7	33.60	3674
				1142.4				
CASING PRESS	12:20	1759.5	86.1	1353.6	65.281	1694.2	39.48	3728
0	12:25	1755.6	90.7	1324.8	62.735	1692.9	38.64	3733
PSI	12:30	1750.6	95.4	1353.6	65.281	1685.3	39.48	3740
	12:35	1767.1	100.0	1324.8	62.735	1704.4	38.64	3742
	12:40	1744.7	104.6	1324.8	62.735	1682.0	38.64	3748
7	12:45	1774.8	109.2	1324.8	62.735	1712.1	38.64	3750
				1334.4				
CASING PRESS	12:50	1857.1	114.6	1555.2	84.398	1772.7	45.36	3809
0	12:55	1871.0	120.0	1555.2	84.398	1786.6	45.36	3816
PSI	1:00	1883.7	125.3	1526.4	81.530	1802.2	44.52	3821
	1:05	1903.9	130.6	1526.4	81.530	1822.4	44.52	3829
	1:10	1915.3	135.9	1526.4	81.530	1833.8	44.52	3828
8	1:15	1903.9	141.2	1526.4	81.530	1822.4	44.52	3815
				1535.9				
CASING PRESS	1:20	1963.4	147.4	1785.6	108.976	1854.4	52.08	3890
0	1:25	1965.9	153.4	1728.0	102.562	1863.3	50.40	3894
PSI	1:30	1962.1	159.6	1785.6	108.976	1853.1	52.08	3876
	1:35	1960.9	165.8	1785.6	108.976	1851.9	52.08	3871
	1:40	1960.9	171.9	1756.8	105.746	1855.2	51.24	3869
9	1:45	1958.3	178.0	1756.8	105.746	1852.6	51.24	3867
				1766.4				

Page 3

- △ RECORDED WELLHEAD PRESSURE
- CORRECTED WELLHEAD PRESSURE BASED ON 2 3/8" TUBING
- BOTTOM HOLE PRESSURE @ 4322 FEET



JOHN WEST ENGINEERING COMPANY

Hobbs, New Mexico

STEP RATE INJECTION TEST

CLIENT: TEXACO EXPLORATION AND PRODUCTION

DATE: JULY 16, 1983

WELL NAME: VACUUM GRAYBURG SAN ANDRES UNIT NO. 59
Lea County, New Mexico

WO#: 93-14-1287

MID-PERFS. = 4507-4736

TUBING = 4443

MDR = 4382

BHP GAUGE DEPTH = 4380

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psf)	(5) CORRECTED TUBING PRESS. (psf) (1)-(4)	(6) INJECTION RATE (gpm) (3)/34.2867	(7) MEASURED BHP (psf)
CASING PRESS	9:10	533.2				533.2		2561
0	9:15	620.2	0.9	259.2	3.110	617.1	7.56	2626
PSI	9:20	653.0	1.9	288.0	3.779	649.2	8.40	2662
	9:25	683.4	2.8	259.2	3.110	680.3	7.56	2688
	9:30	696.0	3.7	259.2	3.110	692.9	7.56	2709
	9:35	704.9	4.6	259.2	3.110	701.8	7.56	2729
1	9:40	730.1	5.6	288.0	3.779	726.3	8.40	2752
				268.8				
CASING PRESS	9:45	800.8	7.5	547.2	12.390	788.4	15.96	2814
0	9:50	829.7	9.4	547.2	12.390	817.3	15.96	2849
PSI	9:55	863.8	11.3	547.2	12.390	851.4	15.96	2886
	10:00	887.9	13.3	576.0	13.624	874.3	16.80	2913
	10:05	903.2	15.1	518.4	11.211	892.0	15.12	2938
2	10:10	927.4	17.0	547.2	12.390	915.0	15.96	2961
				547.2				
CASING PRESS	10:15	1029.8	20.0	864.0	28.845	1001.0	25.20	3024
0	10:20	1055.3	22.9	835.2	27.091	1028.2	24.36	3055
PSI	10:25	1093.3	25.8	835.2	27.091	1066.2	24.36	3086
	10:30	1135.2	28.8	864.0	28.845	1106.4	25.20	3111
	10:35	1144.1	31.9	892.8	30.649	1113.5	26.04	3130
3	10:40	1160.6	34.9	864.0	28.845	1131.8	25.20	3152
				859.2				
CASING PRESS	10:45	1248.0	38.9	1152.0	49.114	1198.9	33.60	3196
0	10:50	1268.2	43.0	1180.8	51.410	1216.8	34.44	3220
PSI	10:55	1280.9	47.0	1152.0	49.114	1231.8	33.60	3239
	11:00	1293.6	51.0	1152.0	49.114	1244.5	33.60	3254
	11:05	1313.9	55.1	1180.8	51.410	1262.5	34.44	3265
4	11:10	1330.3	59.1	1152.0	49.114	1281.2	33.60	3279
				1161.6				

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psi)	(5) CORRECTED TUBING PRESS. (psi) (1)-(4)	(6) INJECTION RATE (gpm) (3)/34.2887	(7) MEASURED BHP (psi)
CASING PRESS 75 PSI	11:15	1398.7	64.1	1440.0	74.214	1324.5	42.00	3310
	11:20	1435.4	69.1	1440.0	74.214	1361.2	42.00	3323
	11:25	1450.6	74.2	1468.8	76.984	1373.6	42.84	3329
	11:30	1436.7	79.2	1440.0	74.214	1362.5	42.00	3343
	11:35	1438.0	84.2	1440.0	74.214	1363.8	42.00	3351
5	11:40	1454.5	89.2	1440.0	74.214	1380.3	42.00	3351
				1444.8				
CASING PRESS 130 PSI	11:45	1574.8	95.5	1814.4	113.808	1461.0	52.92	3383
	11:50	1562.1	101.8	1814.4	113.808	1448.3	52.92	3388
	11:55	1573.5	108.2	1843.2	117.173	1456.3	53.76	3391
	12:00	1572.3	114.5	1814.4	113.808	1458.5	52.92	3394
	12:05	1574.8	120.8	1814.4	113.808	1461.0	52.92	3398
6	12:10	1576.1	127.0	1785.6	110.489	1465.6	52.08	3402
				1814.4				
CASING PRESS 175 PSI	12:15	1705.2	134.8	2246.4	168.954	1536.2	65.52	3429
	12:20	1729.3	142.4	2188.8	161.027	1568.3	63.84	3437
	12:25	1724.2	150.0	2188.8	161.027	1563.2	63.84	3444
	12:30	1741.9	157.6	2188.8	161.027	1580.9	63.84	3447
	12:35	1758.4	165.1	2160.0	157.129	1601.3	63.00	3453
7	12:40	1778.7	172.7	2188.8	161.027	1617.7	63.84	3456
				2193.6				
FALLOFF	12:41	1401.6				1401.6		3399
	12:42	1372.4				1372.4		3387
	12:43	1354.7				1354.7		3377
	12:44	1348.4				1348.4		3369
	12:45	1345.9				1345.9		3362
	12:50	1325.7				1325.7		3332
	12:55	1297.9				1297.9		3310

- △ RECORDED WELLHEAD PRESSURE
- CORRECTED WELLHEAD PRESSURE BASED ON 2 3/8" TUBING
- BOTTOM HOLE PRESSURE @ 4382 FEET

1800

1700

1600

1500

PSIG

1400

1300

1200

WELLHEAD PRESSURE

1100

1000

900

800

700

TEXACO EXPLORATION & PRODUCTION
 STEP-RATE INJECTION TEST
 VACUUM GRAYBURG SAN ANDRES UNIT NO. 59
 JULY 16, 1993
 LEA COUNTY, NEW MEXICO

350

PSIG

340

PSIG

320

PSIG

300

PSIG

B W P D

200

500

800

1100

1400

1700

2000

2300

270

280

290

300

310

320

330

340

270

280

290

300

310

320

330

340

JOHN WEST ENGINEERING COMPANY

Hobbs, New Mexico

STEP RATE INJECTION TEST

CLIENT: TEXACO EXPLORATION & PRODUCTION

DATE: JULY 20, 1983

WELL NAME: VACUUM GRAYBURG SAN ANDRES UNIT NO. 87

WO#: 93-14-1284

Lea County, New Mexico

MID-PERF8. = 4483 - 4755

TBG = 4334

MDR = 4720

BHP GAUGE DEPTH = 4619

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psi)	(5) CORRECTED TUBING PRESS. (psi) (1)-(4)	(6) INJECTION RATE (gpm) (8)/34.2857	(7) MEASURED BHP (psi)
CASING	9:30	650.1				650.1		2727
PRESS	9:35	798.3	0.5	144.0	1.129	797.2	4.20	2874
190	9:40	843.0	1.0	144.0	1.129	841.9	4.20	2912
PSI	9:45	903.0	1.6	172.8	1.582	901.4	5.04	2960
	9:50	919.6	2.2	172.8	1.582	918.0	5.04	3001
	9:55	951.5	2.8	172.8	1.582	949.9	5.04	3026
1	10:00	970.6	3.4	172.8	1.582	969.0	5.04	3046
				163.2				
CASING	10:05	1087.1	4.6	345.6	5.704	1081.4	10.08	3155
PRESS	10:10	1130.6	5.6	288.0	4.071	1126.5	8.40	3193
190	10:15	1163.9	6.7	316.8	4.856	1159.0	9.24	3233
PSI	10:20	1184.3	7.8	316.8	4.856	1179.4	9.24	3265
	10:25	1206.0	9.0	345.6	5.704	1200.3	10.08	3296
2	10:30	1221.3	10.1	316.8	4.856	1216.4	9.24	3322
				321.6				
CASING	10:35	1367.2	11.5	420.4	8.195	1359.0	12.26	3454
PRESS	10:40	1413.3	13.5	558.7	13.870	1399.4	16.30	3509
150	10:45	1447.8	15.5	576.0	14.675	1433.1	16.80	3551
PSI	10:50	1478.4	17.5	576.0	14.675	1463.7	16.80	3583
	10:55	1501.3	19.4	547.2	13.346	1488.0	15.96	3611
3	11:00	1526.5	21.3	547.2	13.346	1513.2	15.96	3636
				537.6				
CASING	11:05	1612.1	24.0	777.6	25.567	1586.5	22.68	3706
PRESS	11:10	1641.7	26.6	748.8	23.843	1617.9	21.84	3738
150	11:15	1680.2	29.2	748.8	23.843	1656.4	21.84	3765
PSI	11:20	1685.3	31.8	748.8	23.843	1661.5	21.84	3790
	11:25	1715.6	34.4	748.8	23.843	1691.8	21.84	3811
4	11:30	1751.0	36.9	720.0	22.174	1728.8	21.00	3830
				748.8				

STEP NO. & REMARKS	TIME	(1) SURFACE TUBING PRESS. (psig)	(2) CUMMULATIVE VOL. INJECTED (bbls)	(3) INJECTION RATE (bbls/day)	(4) FRICTION HEAD LOSS (psi)	(5) CORRECTED TUBING PRESS. (psig) (1)-(4)	(6) INJECTION RATE (gpm) (3)/34.2857	(7) MEASURED BHP (psi)
CASING PRESS 150 PSI	11:35	1835.4	40.3	979.2	39.165	1796.2	28.56	3881
	11:40	1856.0	43.6	950.4	37.061	1818.9	27.72	3907
	11:45	1885.5	46.9	950.4	37.061	1848.4	27.72	3928
	11:50	1901.0	50.3	979.2	39.165	1861.8	28.56	3950
	11:55	1924.0	53.6	950.4	37.061	1886.9	27.72	3967
5	12:00	1944.6	56.9	950.4	37.061	1907.5	27.72	3982
				960.0				
CASING PRESS 150 PSI	12:05	1994.5	61.0	1180.0	55.306	1939.2	34.42	4013
	12:10	2009.8	65.0	1152.0	52.902	1956.9	33.60	4032
	12:15	2022.4	69.0	1152.0	52.902	1969.5	33.60	4045
	12:20	2032.4	73.0	1152.0	52.902	1979.5	33.60	4058
	12:25	2044.6	77.0	1152.0	52.902	1991.7	33.60	4069
6	12:30	2058.3	81.0	1152.0	52.902	2005.4	33.60	4079
				1156.8				
CASING PRESS 150 PSI	12:35	2137.8	85.8	1382.4	74.124	2063.7	40.32	4106
	12:40	2163.4	90.7	1411.2	77.006	2086.4	41.16	4120
	12:45	2177.6	95.5	1382.4	74.124	2103.5	40.32	4129
	12:50	2189.2	100.4	1411.2	77.006	2112.2	41.16	4136
	12:55	2200.6	105.3	1411.2	77.006	2123.6	41.16	4141
7	1:00	2206.5	110.1	1382.4	74.124	2132.4	40.32	4146
				1396.8				
FALLOFF	1:01	2056.4				2056.4		4117
	1:02	2048.7				2048.7		4105
	1:03	2039.7				2039.7		4095
	1:04	2029.4				2029.4		4086
	1:05	2021.7				2021.7		4078
	1:10	1988.3				1988.3		4042
	1:15	1960.0				1960.0		4014

