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SANTOS LIMITED

E. MEREENIE WELL NO. 37
P3-230/250 TSO FRAC TREATMENT

PR95-65

14 FEBRUARY 1996

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E. MEREENIE WELL NO. 37
P3-230/250 TSO FRACTURE TREATMENT

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14 February 1996

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SUMMARY

On 31 July 1995, a tip-screenout (TSO) fracture treatment was performed on Santos' East Mereenie Well No. 37 through "P3-190" and "P3-23/250" sand perforations at 5020-5083 ft. While a pre-frac PBU test was attempted, this failed. Reservoir properties were estimated to be an average permeability of 10 md, a skin of +20, and a reservoir pressure of 1770 psi (no depletion). The wellbore deviation through the pay was 28^{o}

Prior to the treatment, pre-frac tests were conducted to evaluate closure stress, fluid efficiency, and fracture geometry for final design formulation. The results indicated a closure pressure of 3280 psi and a fluid efficiency of 0.43 from pressure decline analysis. This gave an efficiency during injection, using the Mereenie correlation of decline to injection efficiency, of 0.20. A reasonably good model history match of the minifrac was obtained using (1) a stress of 4500 psi in the shalier region between the P3-230/250 and P3-120/130 alternative pay zone, (2) a modulus of $6.5x10^{6}$ psi in the pay and $7.5\text{-}8x10^{6}$ psi in the barriers, and (3) a leak-off coefficient of 0.005 ft/sq.rt. minute in the 190/230/250. This "calibrated" model was used to design the final treatment.

With the desire to limit fracture growth to below the P3-120/130, the final treatment design required 2000 gals of pad and an additional 3900 gals of gel carrying 14,800 lbs of 20/40 Carbo-Lite proppant at 0.5-8 ppg and at a rate of 15 bpm. The model-predicted TSO occurred at the beginning of the 3 ppg stage and net BHTP went from 1080 to 2700 psi with a corresponding average fracture width increase from 0.06 to 0.18 inches. Other fracture dimensions were a propped half-length of 116 ft, a maximum height of 123 ft (at base of 120/130), an average conductivity of 1874 md-ft, and an average in-situ concentration of 1.0 lbs/sq.ft.

The treatment was pumped fairly close to design, placing 106% (15,750 lbs) of the designed proppant amount in the fracture with 99% (5815 gals) of the design gel volume. The TSO did occur as predicted with a net BHTP gain of 1300 psi as compared to the design prediction of 1600 psi. To model history match this behavior required (1) relaxing the lower boundary stress from 5000 to 4500 psi and (2) reducing the leak-off coefficient from 0.005 to 0.0044 ft/sq.rt minute. Resultant dimensions were a propped

half-length of 118 ft, maximum height of 141 ft, an average conductivity of 1608 md-ft, and an average in-situ concentration of 0.9 lbs/sq.ft. Based on this analysis, the treatment came fairly close to design goals.

DISCUSSION

Introduction:

This report details the design, execution, and analysis of the tip-screenout (TSO) fracturing treatment performed in Santos' East Mereenie Well No. 37 on 31 July 1995. The treatment was pumped through Pacoota P3-190 and P3-230/250 perforations at 5020-5083 ft (MD), 4689-4745 ft (TVD), as shown in Fig. 1. Reservoir parameters were estimated to be an average permeability of 10 md, a reservoir pressure of 1770 psi (no depletion), and a BHT of 143°F. While a pressure buildup test was attempted, this failed. Skin, though, was expected to be high as observed on the EM35 and EM36 wells, i.e. approximately +20. Prior to the attempted PBU test, the well came on line at a clean oil rate of around 130 bopd before declining to a rate of 65 bopd after only 3 weeks (Fig. 2). The average porosity from log analysis was on the order of 9.5% and the estimated GOR was only 100 scf/stb. The wellbore deviation through the pay was 28°.

The fracture treatment, performed by Halliburton, was preceded with pre-frac injection/decline tests to evaluate closure pressure, fluid efficiency, and fracture geometry for final design formulation. Bottomhole pressure was obtained with SRO wireline gauges during testing and with electronic memory gauges set in the tailpipe during the treatment. The following discusses the details of this testing and treatment.

Preliminary Fracture Treatment Design:

The objective of the EM #37 treatment was to obtain as much propped penetration as possible ($\leq$100 ft) with an in-situ proppant concentration of at least 1.0 lb/sq.ft. without fracturing into the P3-120/130 alternative pay zone at 4643 ft-TVD (46 ft above top P3-190 perf). At the indicated BHT, 30 ppt borate XL gel (Boragel H3595) was recommended and 20/40 mesh Carbo-Lite was used to insure good conductivity. The design injection rate was 15 bpm with plans to pump down 2-7/8 inch tubing. Other design parameters included a modulus of 5.5×10^6 psi in the pay and $6.5\text{-}7.5 \times 10^6$ psi in the boundary layers (based on Mereenie correlation of modulus to porosity and EM35 and EM36 P3-230/250 treatment analysis), a toughness of 3000 psi/sq.rt. inch in all

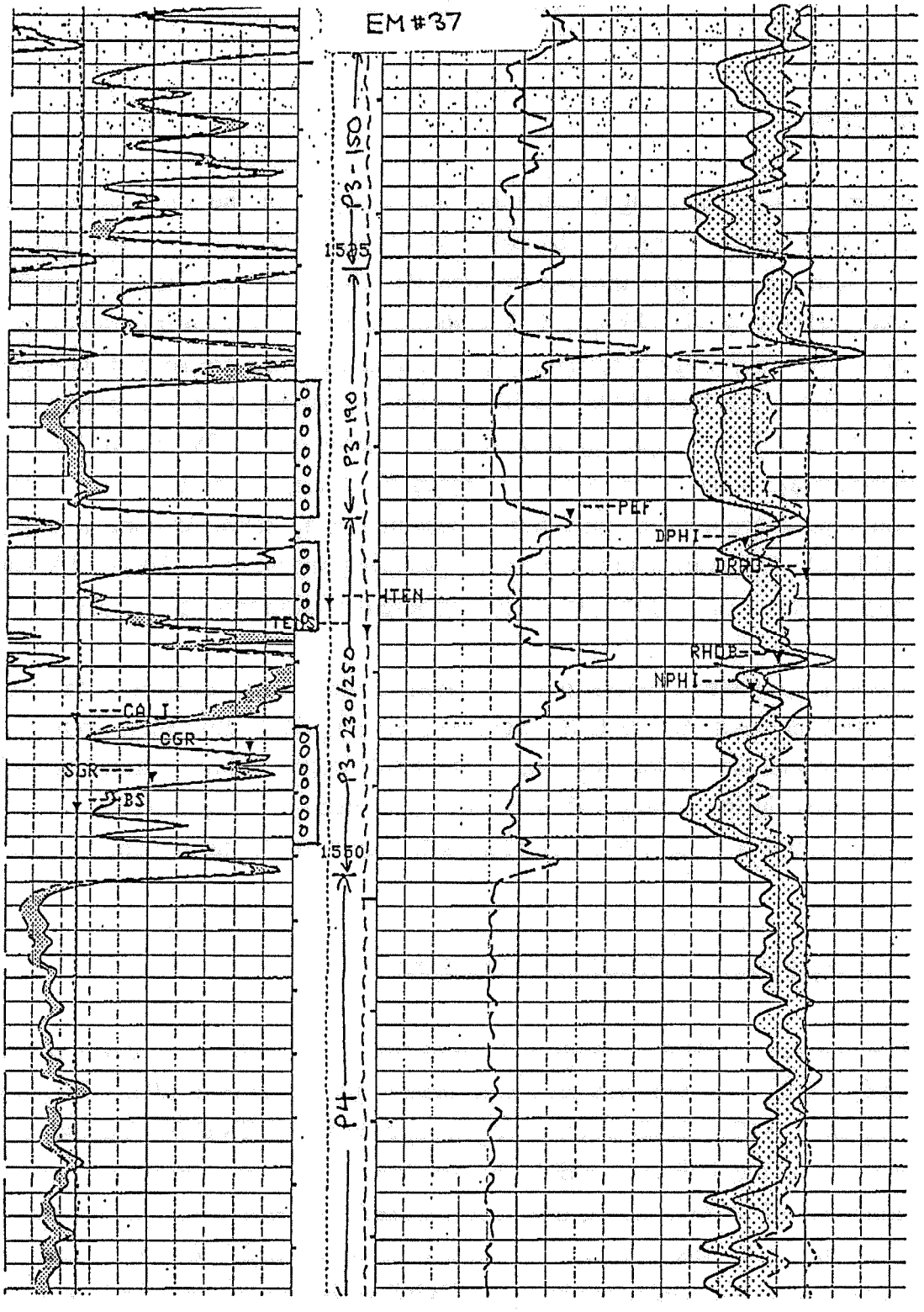

FIG. 1 - Log section thru pay interval and boundary layers, E. Mereenie 37.

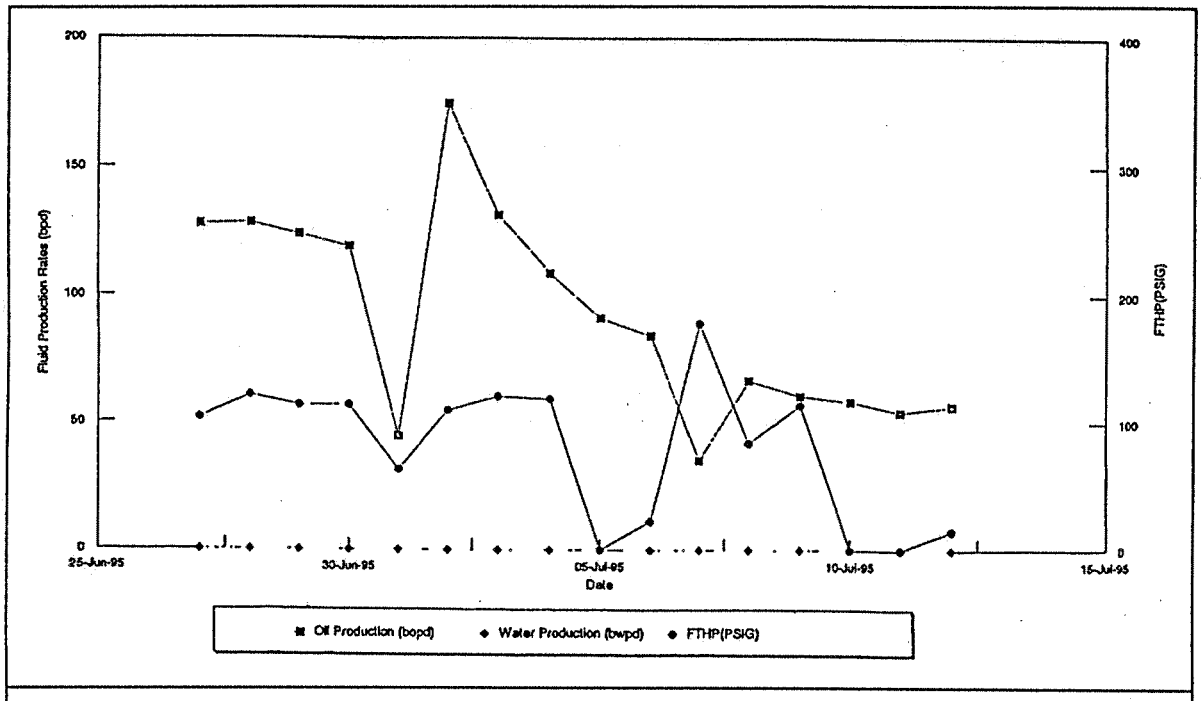

FIG. 2 - Pre-frac production history, E. Mereenie 37.

layers, and a leak-off coefficient of 0.012 ft/sq.rt. minute. From the established Mereenie correlation of reservoir to closure pressure, closure pressure was estimated to be on the order of 3400 psi in the pay and based on past treatment pressure response, boundary stresses were expected to be on the order of 3850-4000 psi.

Table 1 shows the preliminary design schedule. The pad size was limited to 2250 gals to prevent growth into the P3-120/130 and the resultant slurry stages included 2800 gals of gel carrying 8550 lbs of proppant at concentrations of 0.5-6 ppg. With multiple zones perforated, i.e. P3-190 and 230/250, and distinct shale layers between these, the preliminary design looked at three possible fracture initiation schemes to evaluate height growth - (1) across the entire perforated interval, (2) in only the P3-190, and (3) in only the P3-230/250. For the first scheme, the model-predicted a TSO in the 1.0 ppg stage, with net BHTP going from 460 to 2530 psi over the remainder of the treatment (Fig. 3). Model-predicted dimensions were a propped half-length of 43 ft, a maximum height at the wellbore of 100 ft (top at 4649 ft or only 6 ft below the 120/130), an average conductivity of 2332 md-ft, and an average in-situ concentration of 1.2 lbs/sq.ft. These are shown in Figs. 4-6, with the model I/O included in Appendix Table A-1.

TABLE 1 - Preliminary treatment design schedule, E. Mereenie 37.

Fluid Type	Slur. Vol. (gal)	Fluid Vol. (gal)	Prop Conc. (ppg)	Prop Amt. (lbs)	Avg. Q (bpm)	Pump t (min)
Boragel H3595	2250	2250	0.00	0	15.00	3.57
Boragel H3595	511	500	0.50	250	15.00	0.81
Boragel H3595	418	400	1.00	400	15.00	0.66
Boragel H3595	435	400	2.00	800	15.00	0.69
Boragel H3595	340	300	3.00	900	15.00	0.54
Boragel H3595	353	300	4.00	1200	15.00	0.56
Boragel H3595	488	400	5.00	2000	15.00	0.77
Boragel H3595	632	500	6.00	3000	15.00	1.00
	5427	5050		8550		8.60

Note: Proppant 20/40 Carbo-Lite.

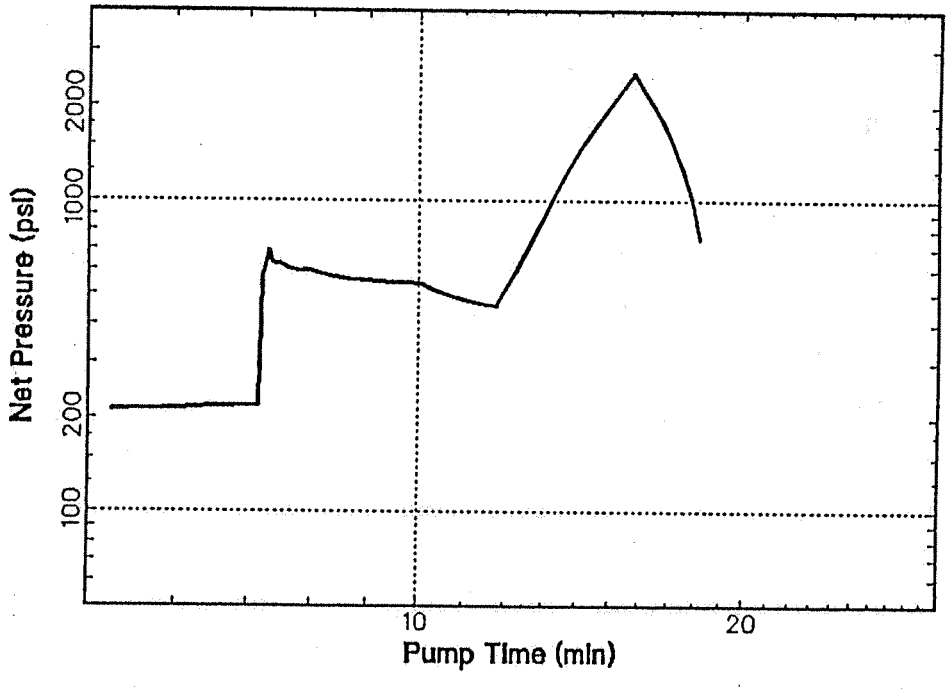

FIG. 3 - Preliminary treatment design predicted net BHTP, E. Mereenie 37.

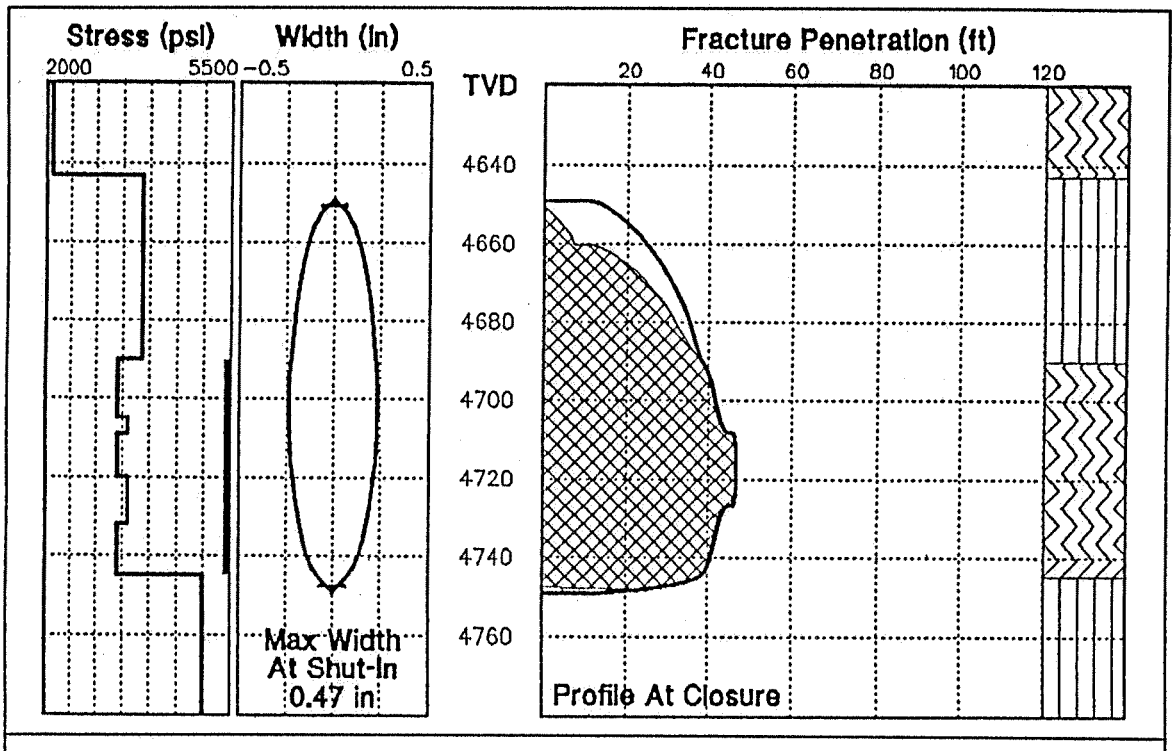

FIG. 4 - Preliminary treatment design predicted frac Geometry, E. Mereenie 37.

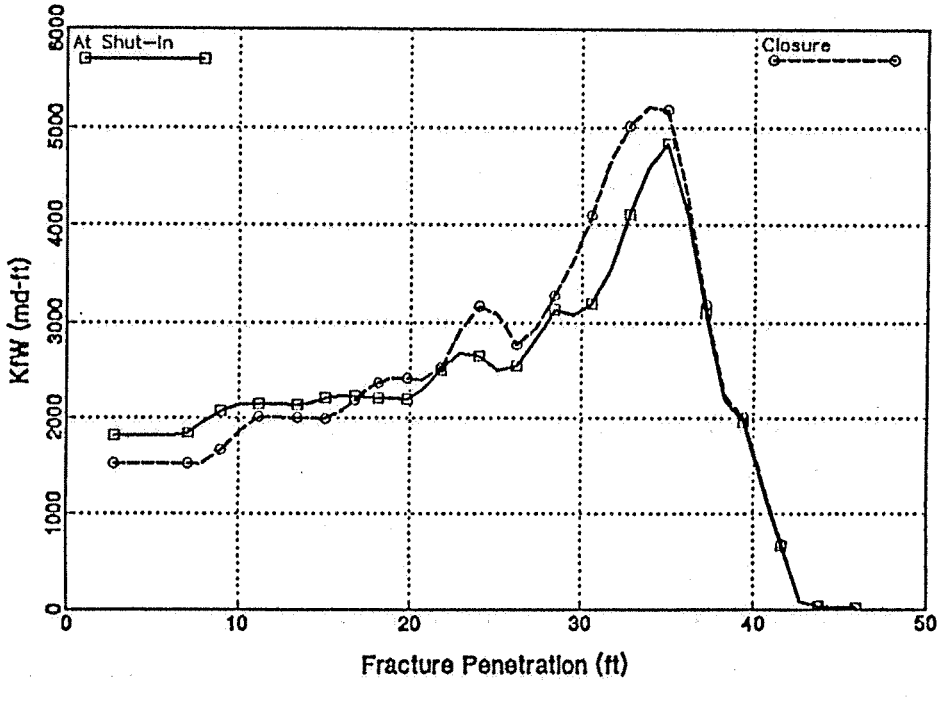

FIG. 5 - Preliminary treatment design predicted conductivity, E. Mereenie 37.

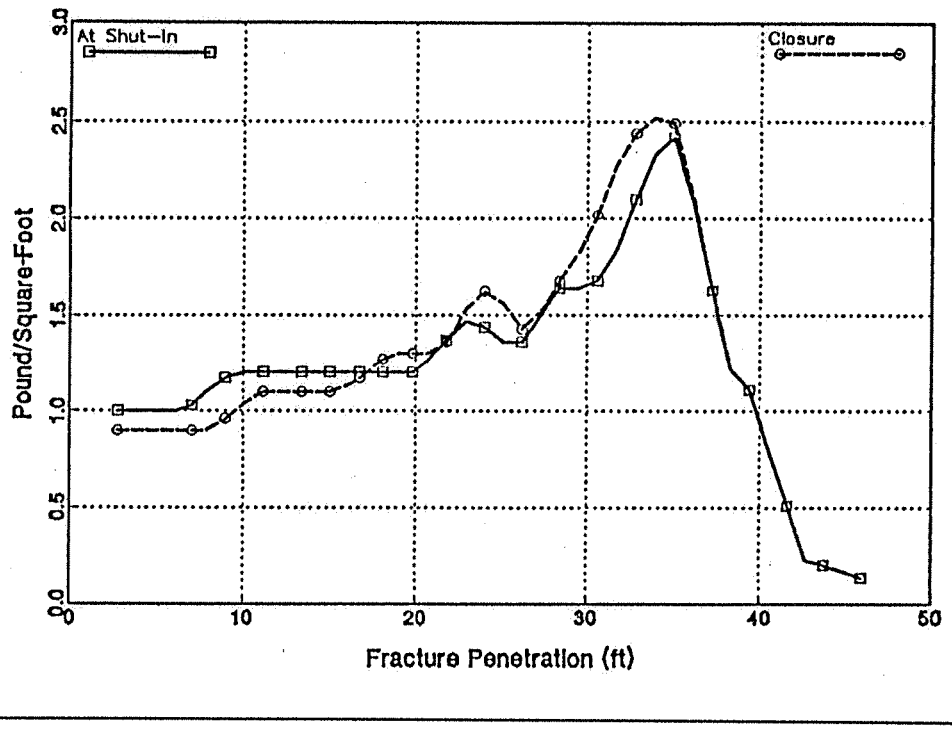

FIG. 6 - Preliminary treatment design predicted in-situ conc., E. Mereenie 37.

For the second scenario, with the modeled fracture initiating in only the P3-190, the TSO also occurred in the 1.0 ppg stage and net BHTP went from 430 to 2680 psi. Predicted dimensions in this case were a propped half-length of 48 ft, a maximum height of 100 ft (top at 4654 ft or 11 ft from the 120/130), an average conductivity of 3340 md-ft, and an average in-situ concentration of 1.8 lbs/sq.ft. (model I/O in Appendix Table A-2). In the final scheme, with the fracture initiating in only the P3-230/250, the TSO occurred in the 3 ppg stage, with net BHTP going from 430 to 1820 psi. Predicted dimensions were a propped half-length of 50 ft, a maximum height of 111 ft (top at 4649 ft or again only 6 ft from the 120/130), an average conductivity of 1810 md-ft, and an average in-situ concentration of 1.0 lbs/sq.ft. (model I/O in Appendix Table A-3).

Based on these simulations, the preliminary treatment schedule was expected to give fracture dimensions sufficient to by-pass the near-wellbore damage region, provide good conductivity through this region, and limit vertical fracture growth to below the P3-120/130 alternative pay zone.

Pre-Frac Test Analysis:

Pre-frac testing consisted of (1) a 10 bbl slick water pump-in/shut-in (PI/SI) test at 5 bpm, (2) a slick water step-rate test (SRT)/SI at rates of 0.5-8 bpm, and (3) a 1500 gal, 30 ppt borate XL gel (Boragel H3595) minifrac at 15 bpm. The first two tests were designed to evaluate closure pressure and the minifrac was used to determine fluid efficiency and fracture geometry.

Fig. 7 shows the gauge BHP for the first PI/SI test. After an initial breakdown of 4625 psi, pressure dropped to about 3950 psi and then further declined to 3688 psi just prior to shut-down. At shut-down it was difficult to pick an ISIP as shown in Fig. 8. From the Horner plot of the pressure decline, Fig. 9, the pressure extrapolated to 1769 psi or very close to the expected reservoir pressure (no depletion). The square-root of SI time plot, Fig. 10, indicated a closure pressure at 3238 psi.

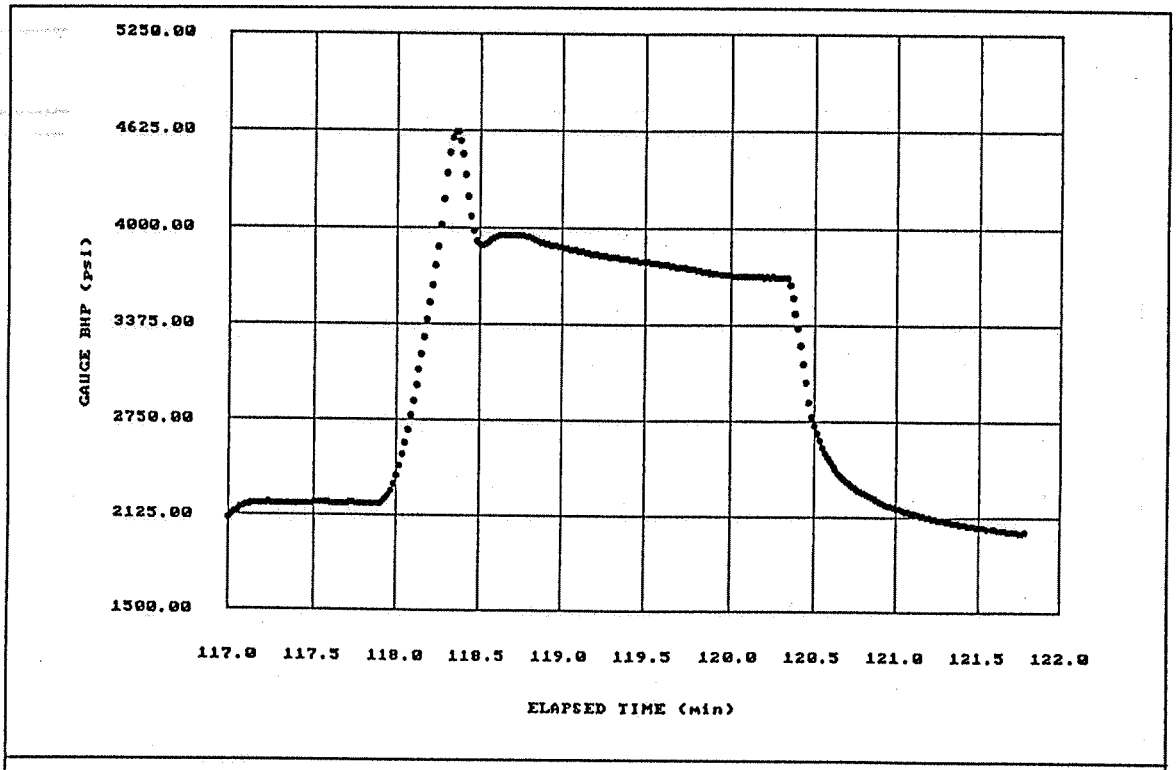

FIG. 7 - Slick water PI/SI test BHP record, E. Mereenie 37.

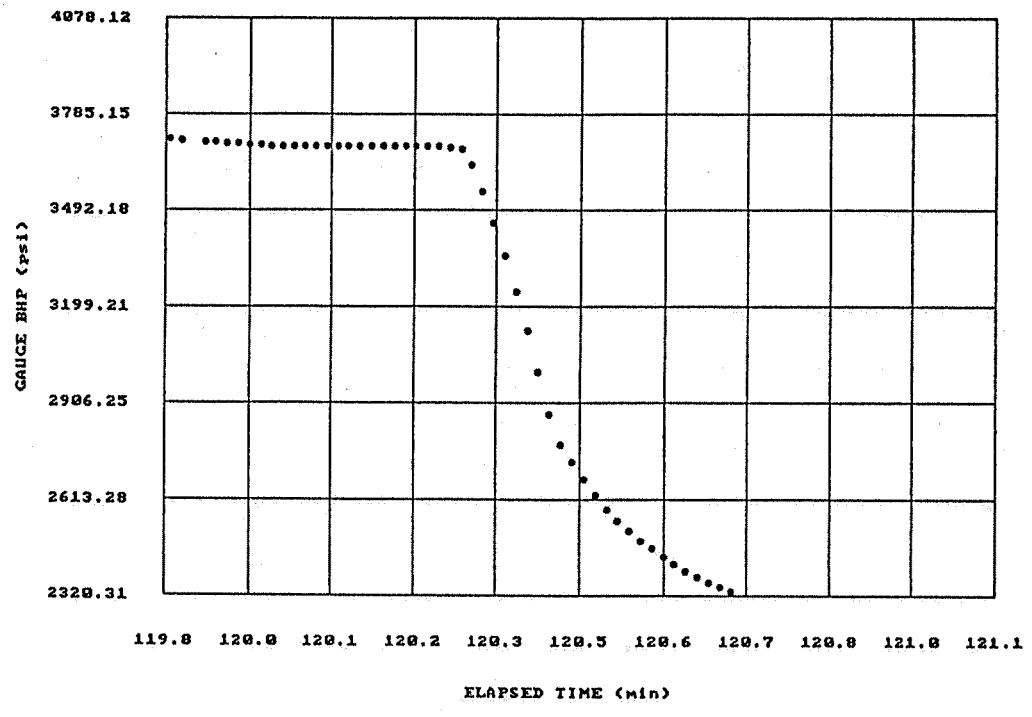

FIG. 8 - Slick water PI/SI test BHP ISIP evaluation, E. Mereenie 37.

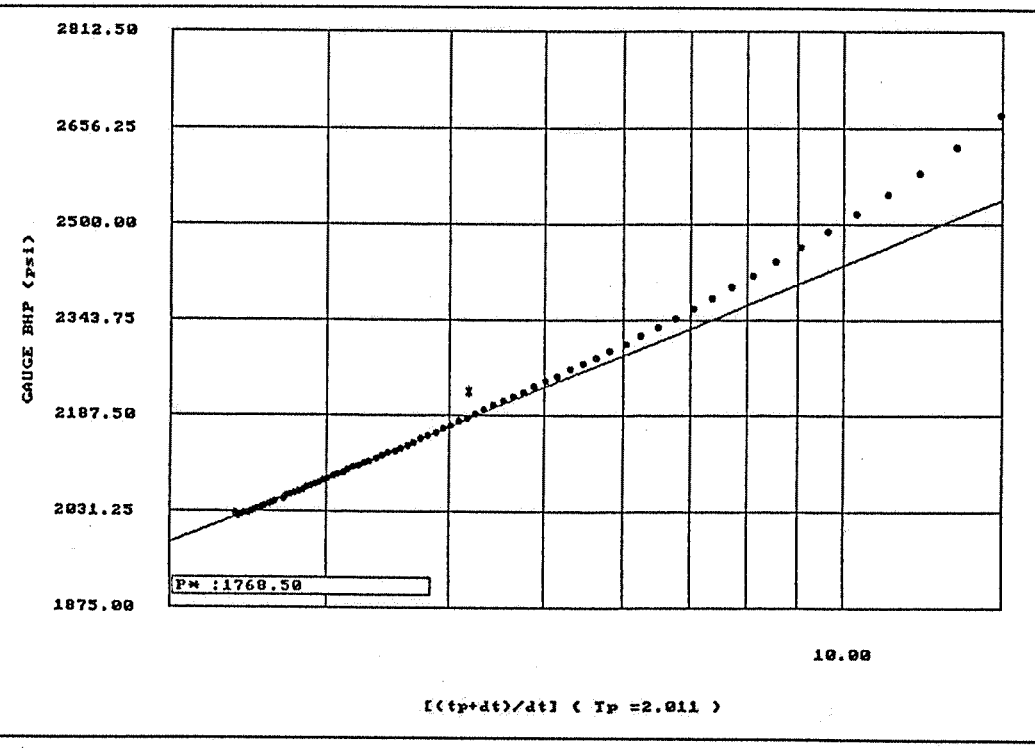

FIG. 9 - Slick water PI/SI test BHP horner plot, E. Mereenie 37.

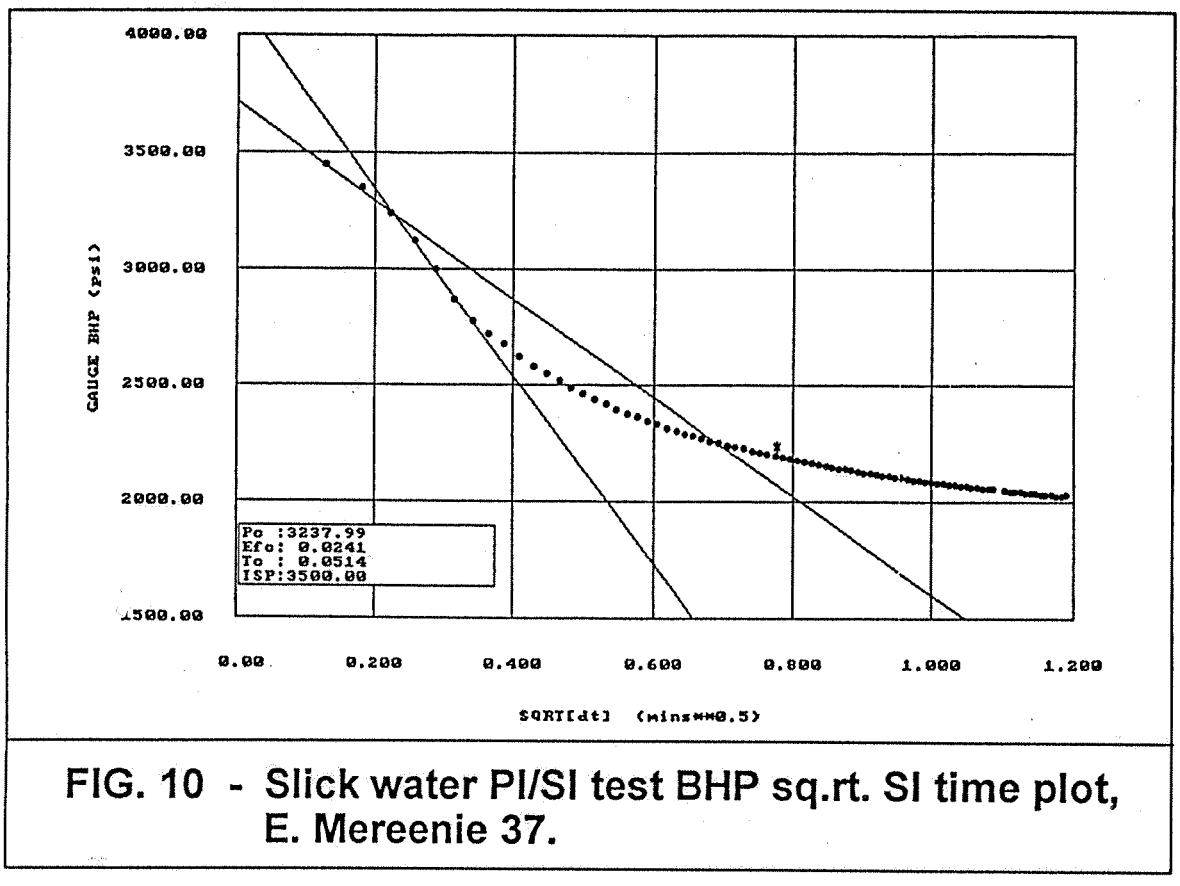

FIG. 10 - Slick water PI/SI test BHP sq.rt. SI time plot, E. Mereenie 37.

Fig. 11 shows the gauge BHP record for the SRT/SI. BHP never flattened out as expected, making it difficult to determine fracture extension pressure. Based on the ISIP, Fig. 12, fracture extension pressure was somewhere around 3330 psi, which was consistent with the closure pressure pick from the preceding test. From the square-root of SI time plot, Fig. 13, closure was picked at 3261 psi or again reasonably close to the results of the prior test.

Fig. 14 shows the gauge BHP record for the minifrac. To minimize the effect of the residual wellbore fluid ahead of the crosslinked gel on determining fluid efficiency, the leading edge of the gel was pumped to near bottom at 5 bpm to bullhead the slick water into the fracture. This was followed by a 4 minute shut-in to allow this fluid to leak-off to the formation and the fracture to close prior to injecting the XL gel. At the end of the minifrac, displaced with slick water to the top perforation, the BHTP was 4782 psi. At shut-down, the ISIP appeared to be at 4213 psi, Fig. 15, indicating a downhole "excess" pressure of 569 psi or fairly large.

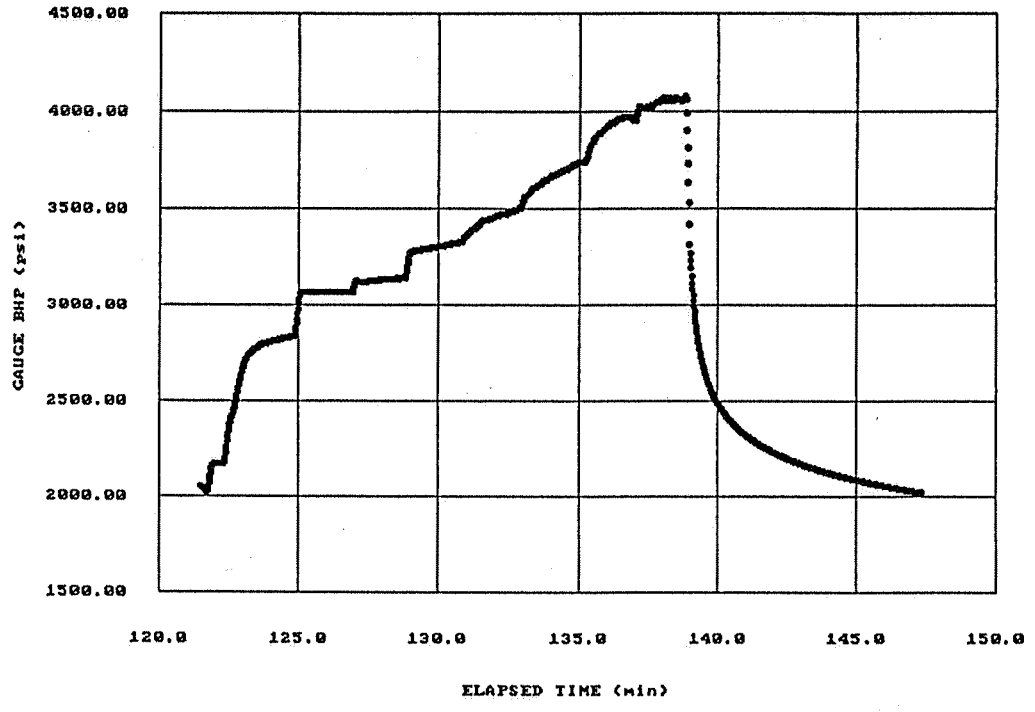

FIG. 11 - Slick water SRT/SI test BHP record, E. Mereenie 37.

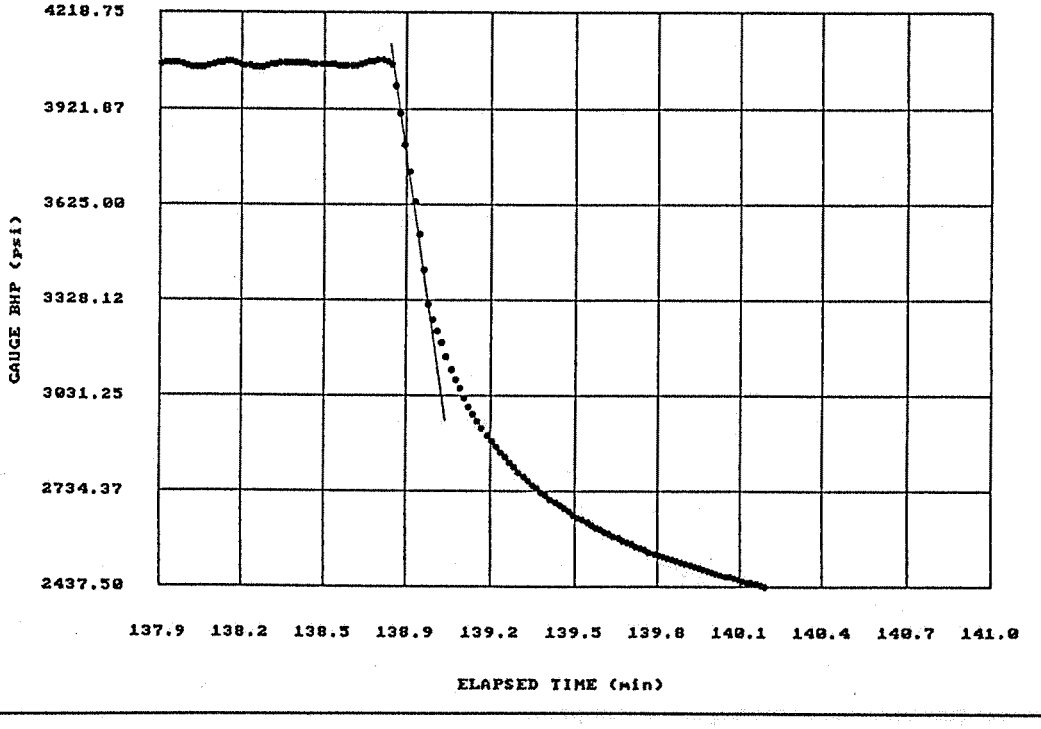

FIG. 12 - Slick water SRT/SI test BHP ISIP evaluation, E. Mereenie 37.

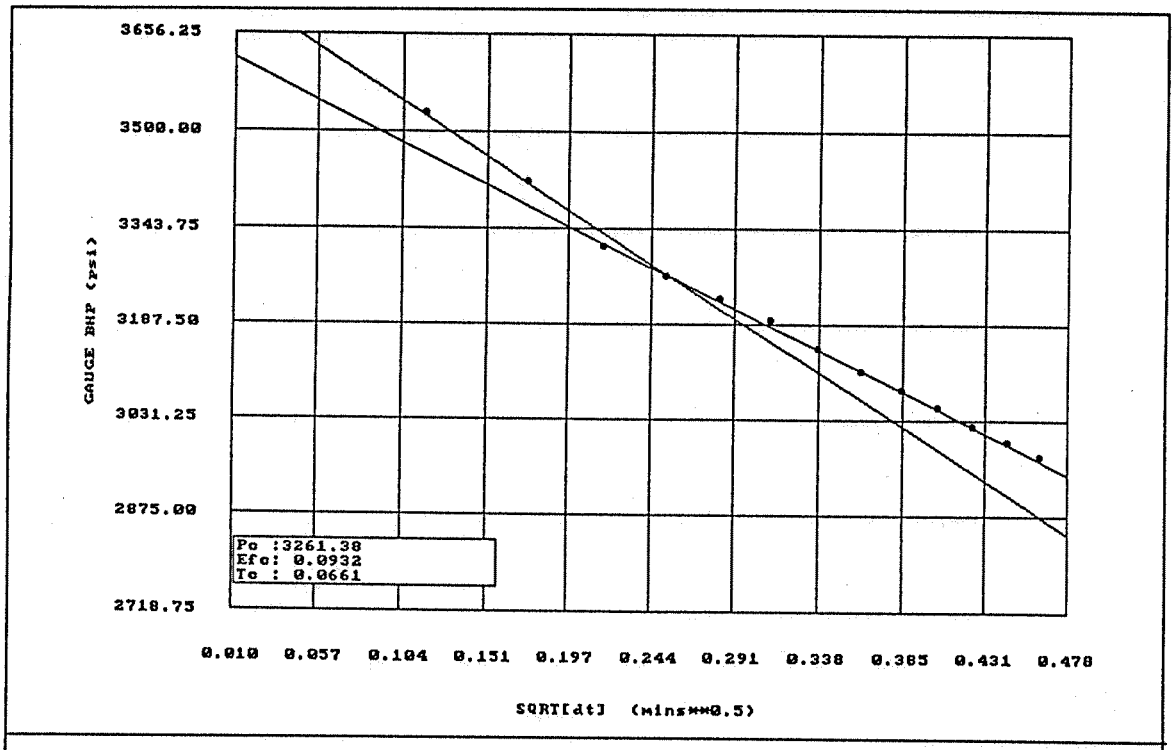

FIG. 13 - Slick water SRT/SI test BHP sq.rt. SI time plot, E. Mereenie 37.

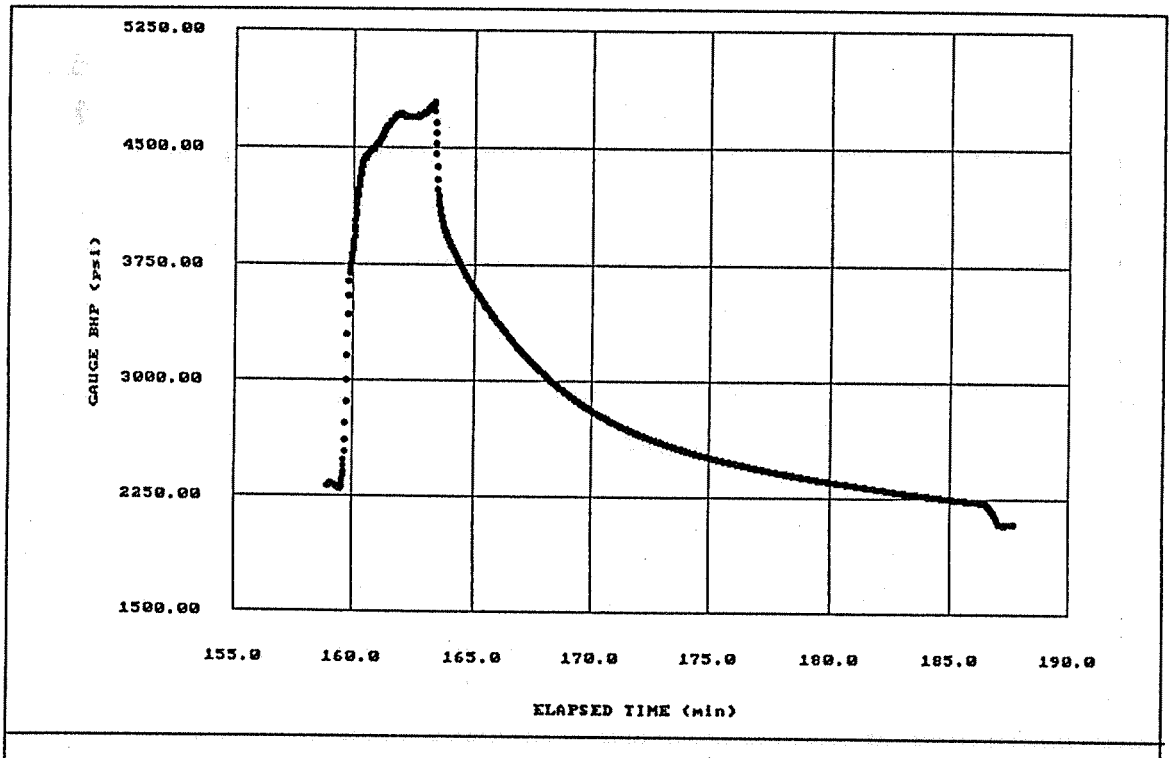

FIG. 14 - Boragel minifrac/SI test BHP record, E. Mereenie 37.

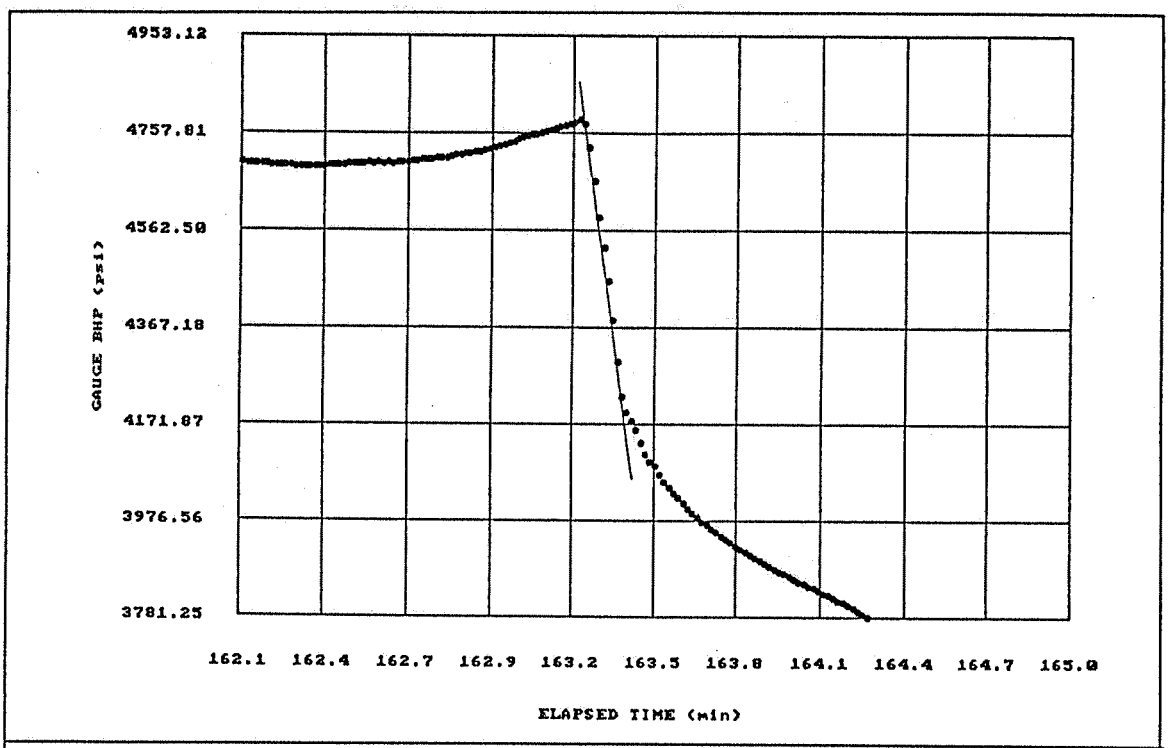

FIG. 15 - Boragel minifrac/SI test BHP ISIP evaluation, E. Mereenie 37.

From the minifrac pressure decline analysis, closure picked at 3768 psi on the square-root of SI time plot, Fig. 16, which corresponded to a fluid efficiency of 0.20 and a net BHTP (BHTP-closure P) of 445 psi. This closure, however, was above the ISIP on the SRT (expected fracture extension pressure) and thought to be more indicative of a shalier layer and not the primary pay zone. There was no indication of the lower closure pick from the previous tests at around 3200 psi. From the G-function plot, Fig. 17, however, closure could be picked at 3205 psi with a corresponding fluid efficiency of 0.43 and a net BHTP of about 1000 psi. From the Nolte type-curve match, Fig. 18, the indicated fluid efficiency was also 0.44.

Based on the combined analysis of the three tests, closure pressure was thought to be at 3280 psi (depth corrected from gauge to mid-perf), fluid efficiency from pressure decline analysis was 0.43, and net BHTP for the XL gel at 15 bpm was on the order of 1000 psi. From the established Mereenie correlation of efficiency during injection to that determined from the decline, the injection efficiency was 0.20.

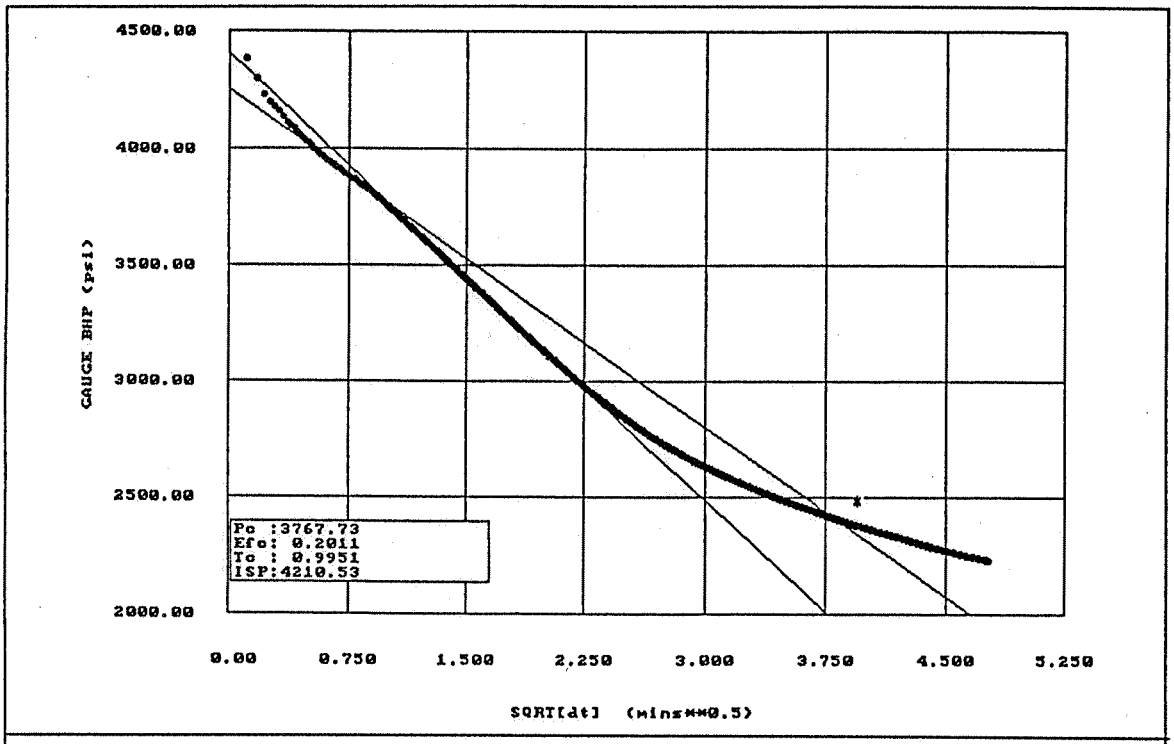

FIG. 16 - Boragel minifrac/SI test BHP sq.rt. SI time plot, E. Mereenie 37.

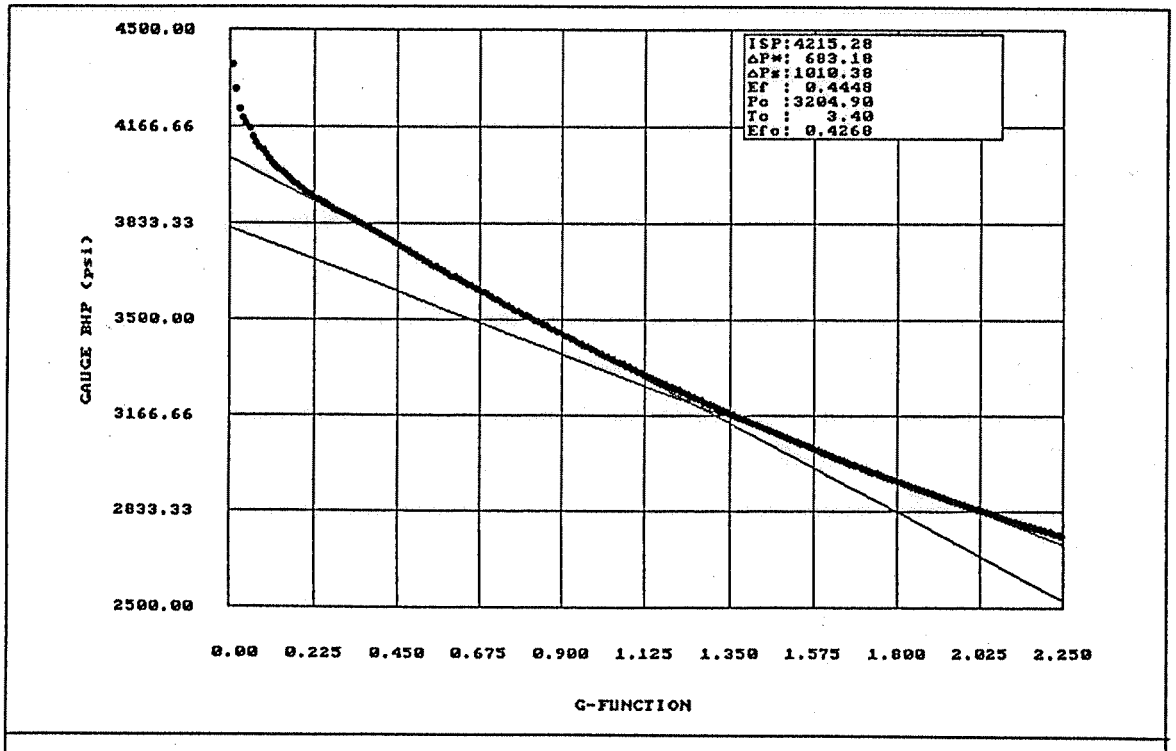

FIG. 17 - Boragel minifrac/SI test BHP g-function plot, E. Mereenie 37.

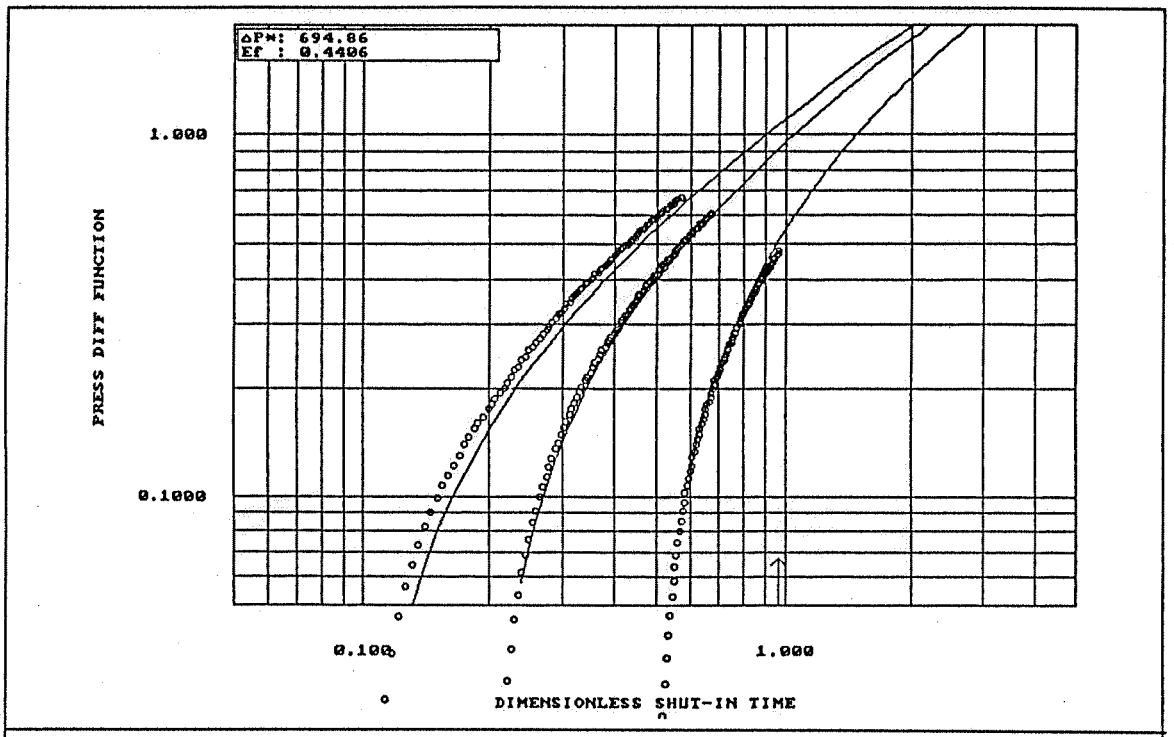

FIG. 18 - Boragel minifrac/SI test BHP type-curve match, E. Mereenie 37.

To further the minifrac analysis and generate a "calibrated" model for final design evaluation, the minifrac injection profile was history matched. Shown in Fig. 19, the match required to simulate the increasing, relatively high net BHTP and resultant fluid efficiency at the end of injection of 0.20 required (1) a closure stress of 4000 psi in the shalier region between the P3-230/250 and P3-190, and boundary stresses of 4500 psi, (2) an increase in the preliminary design pay zone modulus from 5.5 to 6.5×10^6 psi and from 6.5 to $7.5\text{-}8 \times 10^6$ psi in the boundaries, and (3) a decrease in the preliminary design leak-off coefficient from 0.012 to 0.005 ft/sq.rt. minute. The model-predicted fracture dimensions were a created half-length of 79 ft and a maximum height at the wellbore of 82 ft (better confinement than expected). This is shown in Fig. 20 with the model I/O included in Appendix Table A-4.

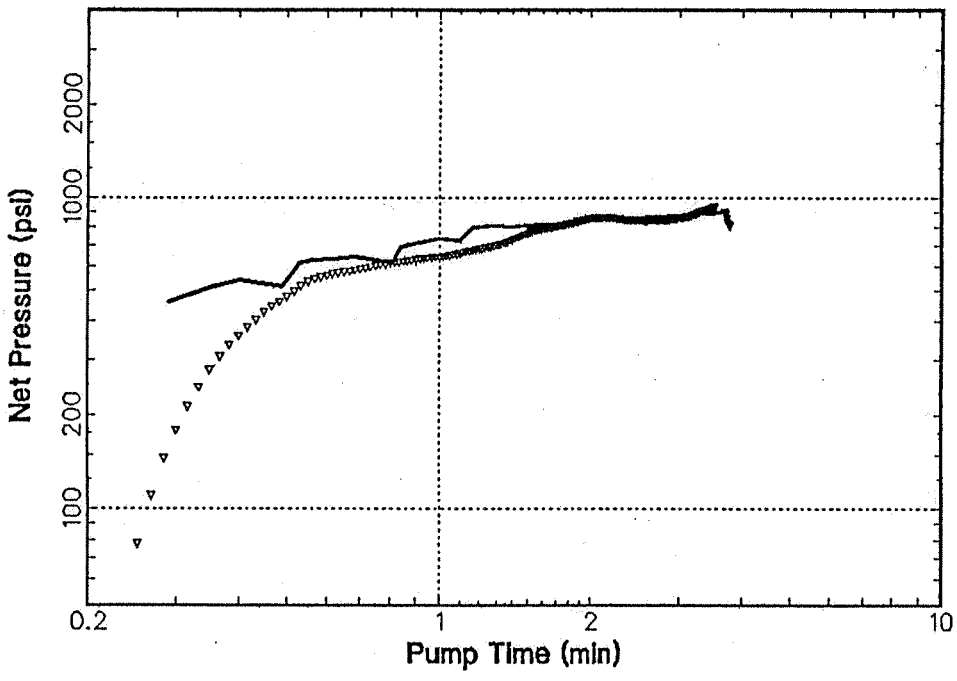

FIG. 19 - Boragel minifrac net BHTP model history match, E. Mereenie 37.

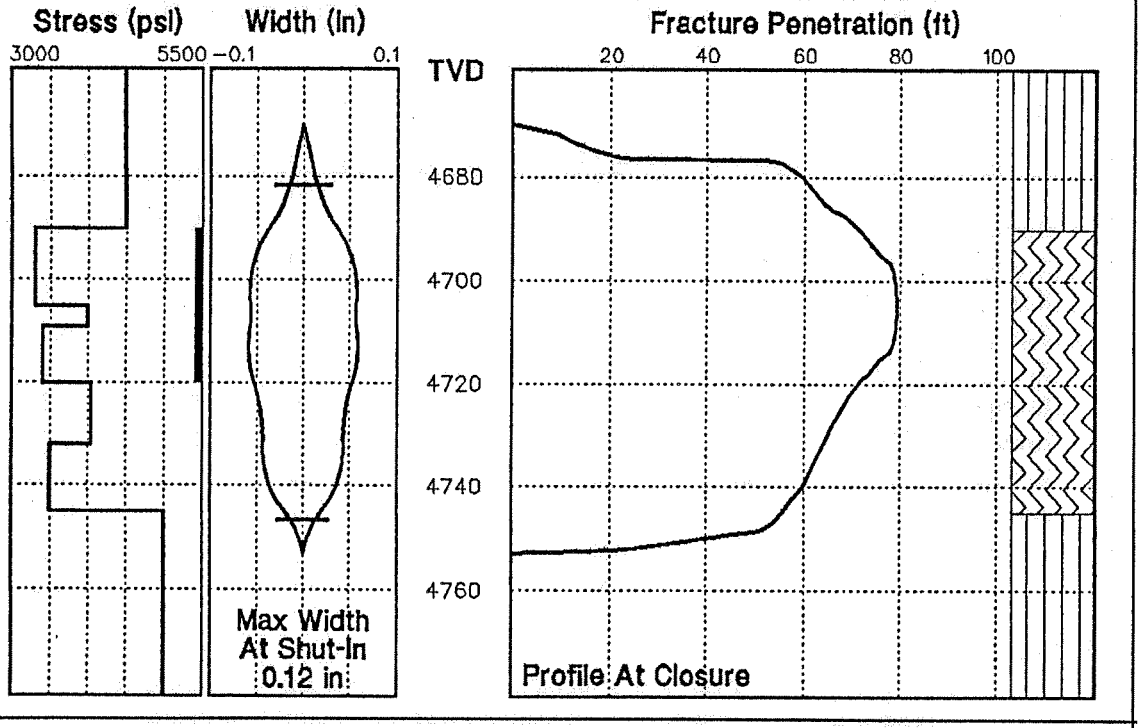

FIG. 20 - Boragel minifrac net BHTP model history match predicted frac geometry, E. Mereenie 37.

Final Treatment Design:

Using the "calibrated" design model, the final design pad stage was limited to 2000 gals to prevent upward growth into the P3-120/130 sands (Table 2). With this pad and the design injection rate of 15 bpm, the model-predicted TSO started at the beginning of the 3 ppg stage. The slurry stages consisted of 3900 gals of gel carrying 14,800 lbs of 20/40 Carbo-Lite at 0.5-8 ppg. With this pad and the design injection rate of 15 bpm, the model-predicted TSO started at the beginning of the 3 ppg stage (Fig. 21) and net BHTP increased from 1080 to 2700 psi with a corresponding average fracture width increase from 0.06 to 0.18 inches. At the wellbore, the final predicted average and maximum widths were 0.25 and 0.45 inches. Other modeled dimensions were a propped half-length of 116 ft, a maximum height at the wellbore of 123 ft (frac top at 4642 ft or at base of 120/130), an average conductivity of 1874 md-ft, and an average in-situ concentration of 1.0 lbs/sq.ft. These are shown in Figs. 22-24 with the model I/O included in Appendix Table A-5.

TABLE 2 - Final treatment design schedule, E. Mereenie 37.

Fluid Type	Slur. Vol, (gal)	Fluid Vol, (gal)	Prop Conc, (ppg)	Prop Amt, (lbs)	Avg. Q (bpm)	Pump t (min)
Boragel H3595	2000	2000	0.00	0	15.00	3.17
Boragel H3595	613	600	0.50	300	15.00	0.81
Boragel H3595	522	500	1.00	500	15.00	0.66
Boragel H3595	435	400	2.00	800	15.00	0.69
Boragel H3595	453	400	3.00	1200	15.00	0.54
Boragel H3595	470	400	4.00	1600	15.00	0.56
Boragel H3595	488	400	5.00	2000	15.00	0.77
Boragel H3595	506	400	6.00	2400	15.00	0.80
Boragel H3595	523	400	7.00	2800	15.00	0.83
Boragel H3595	541	400	8.00	3200	15.00	0.86
	6551	5900		14800		10.39

Note: (1) Proppant 20/40 Carbo-Lite.
(2) SP (raw) breaker ramped from 0.5-5 ppt in 1-8 ppg stages. Opti-flo II (encapsulated) breaker ramped from 5-2 ppt throughout treatment.

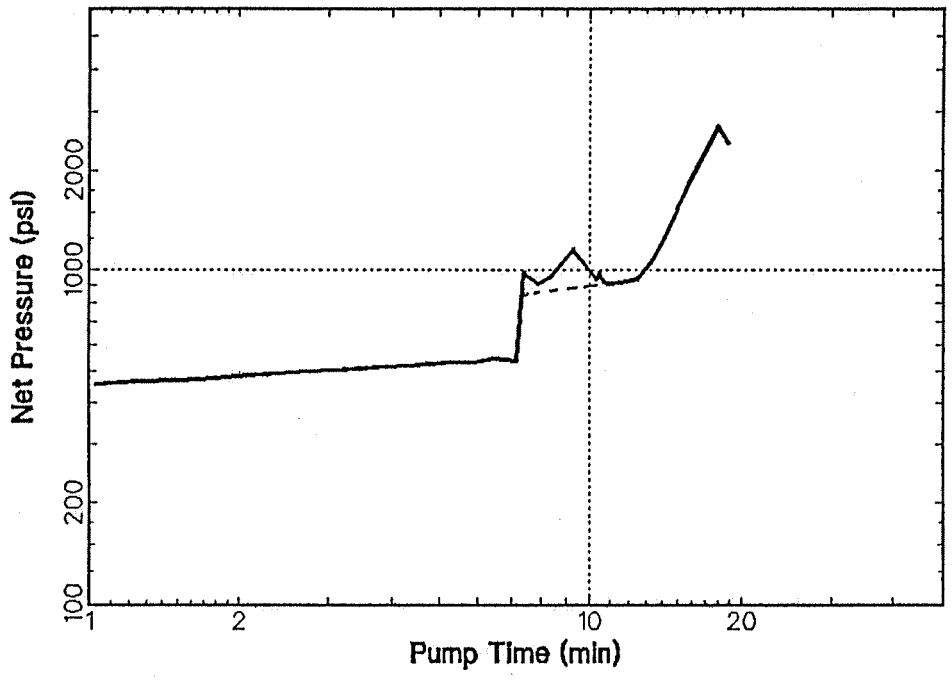

FIG. 21 - Final treatment design predicted net BHTP, E. Mereenie 37.

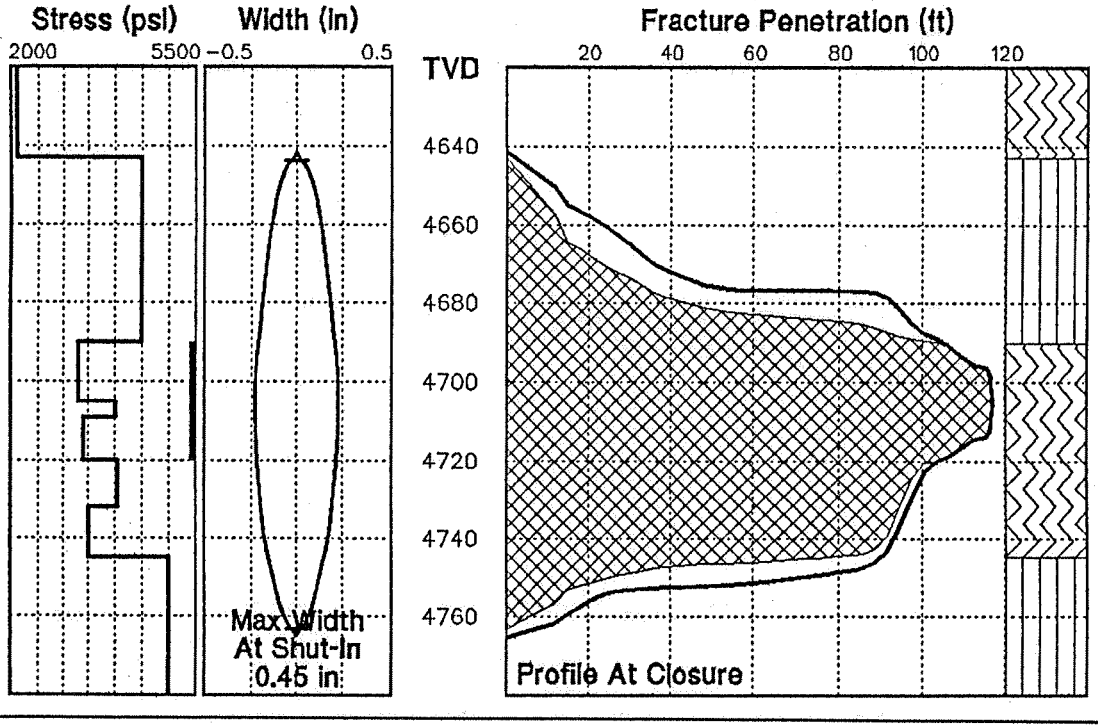

FIG. 22 - Final treatment design predicted frac geometry, E. Mereenie 37.

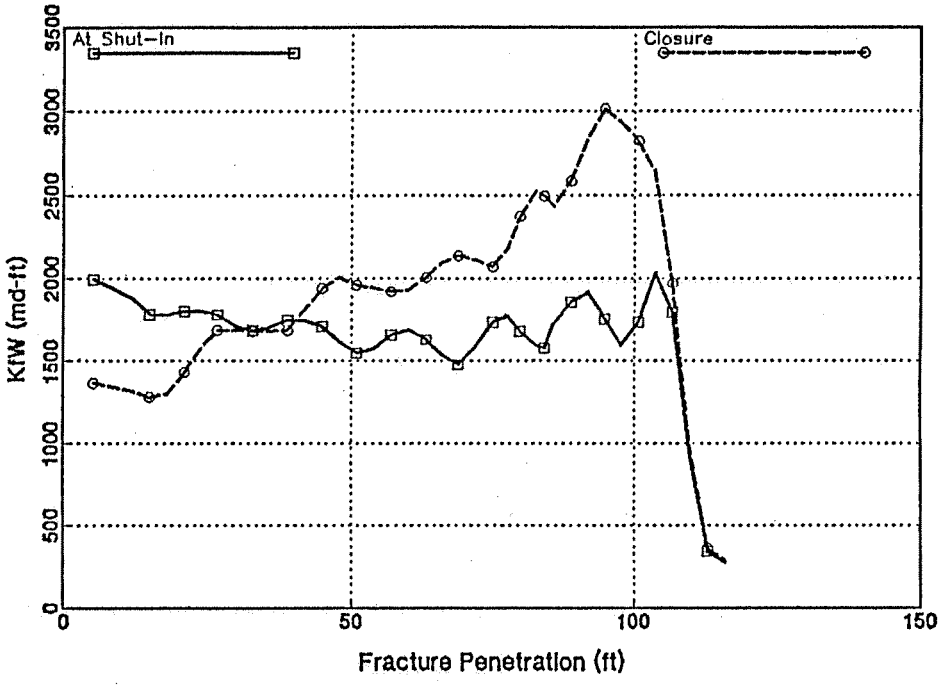

FIG. 23 - Final treatment design predicted conductivity, E. Mereenie 37.

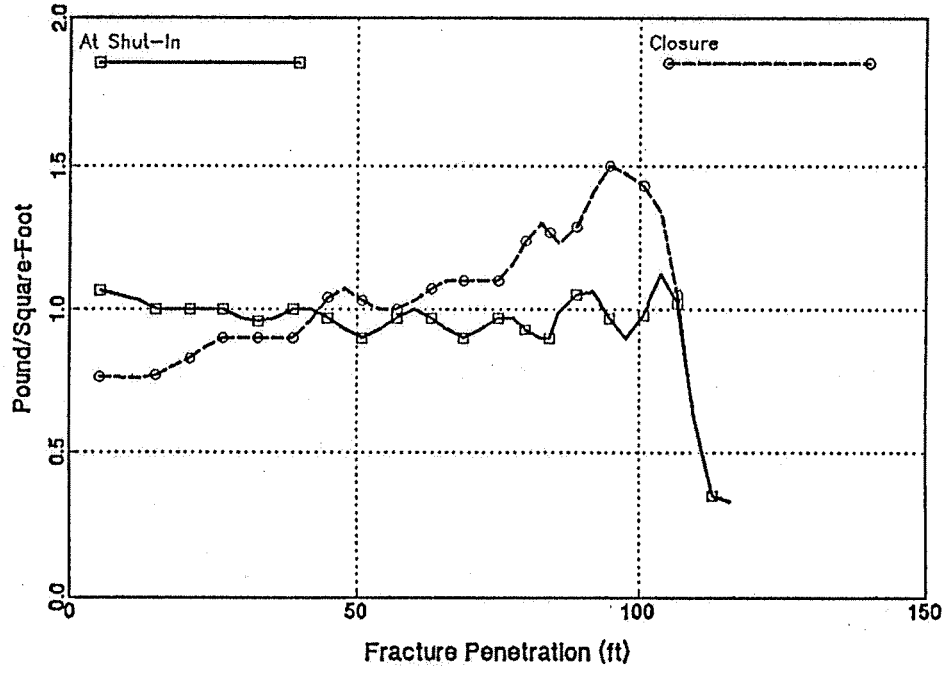

FIG. 24 - Final treatment design predicted in-situ conc., E. Mereenie 37.

Treatment Execution:

Samples of the gel were tested on-site prior to the treatment and found to possess the proper characteristics with respect to base gel viscosity, pH, and crosslink time/consistency. While this was not the smallest treatment performed to date in Mereenie, its relatively small size and short pump time required precise execution. To minimize the effect of the bullheaded residual wellbore fluid ahead of the pad, the pad was pumped to the bottom of the tubing at 5 bpm. The rate was then increased to 15 bpm for the remainder of the treatment.

The treatment was pumped without any mechanical or blending mishaps. Fig. 25 shows the surface treating parameters. From this it was difficult to detect whether or not a TSO had occurred. Table 3 shows the surface schedule from Halliburton's computer printout. This indicated a total of 14,586 lbs of proppant pumped with 7436 gals of gel and flush. Based on the amount of proppant loaded/pumped (18,000 lbs) and accounting for 500 lbs spillage, though, this was 20% low. With this correction made in Table 4, the 17,500 lbs of proppant was pumped with 7308 gals of gel and flush. This

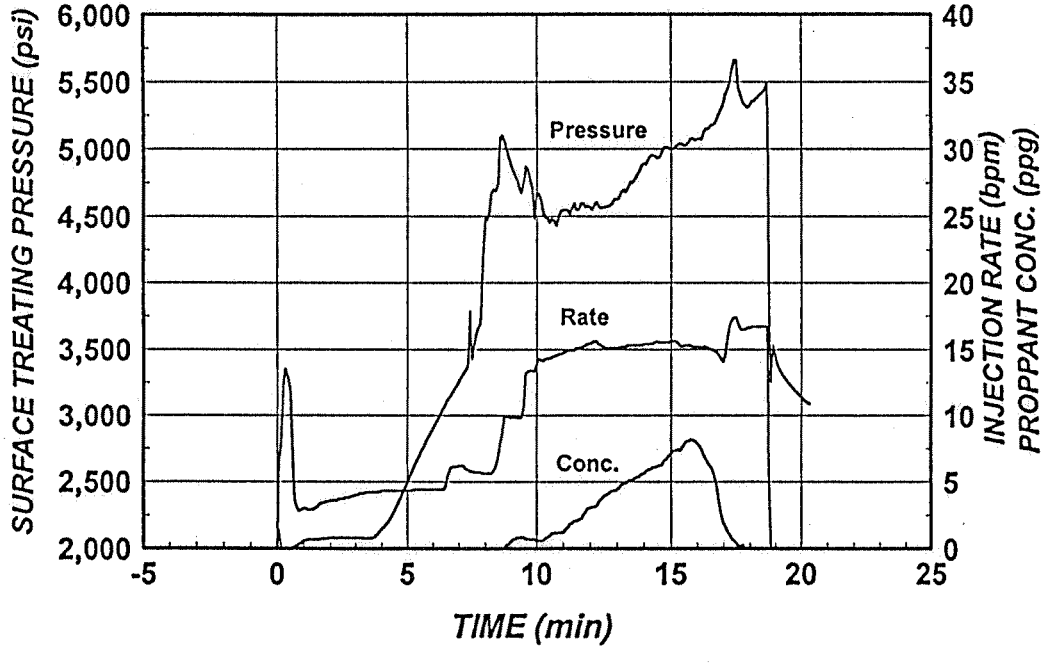

FIG. 25 - Boragel frac treatment summary of surface treating parameters, E. Mereenie 37.

TABLE 3 - Halliburton computed surface pump schedule, E. Mereenie 37.

Fluid Type	Slur. Vol. (gal)	Fluid Vol. (gal)	Prop Conc. (ppg)	Prop Amt. (lbs)	Avg. Q (bpm)	Pump t (min)
Boragel H3595	1664	1664	0.00	0	4.80	8.25
Boragel H3595	192	192	0.00	0	8.31	0.55
Boragel H3595	284	278	0.53	146	9.90	0.68
Boragel H3595	568	554	0.57	315	13.75	0.98
Boragel H3595	481	460	1.06	486	14.62	0.78
Boragel H3595	489	450	1.98	892	15.19	0.77
Boragel H3595	471	416	3.01	1253	15.29	0.73
Boragel H3595	692	588	4.04	2372	15.21	1.08
Boragel H3595	627	514	5.01	2573	15.44	0.97
Boragel H3595	455	359	6.07	2181	15.48	0.70
Boragel H3595	352	272	6.70	1821	15.24	0.55
Boragel H3595	180	142	6.00	855	15.13	0.28
Boragel H3595	53	43	5.36	230	15.15	0.08
Flush	126	103	5.02	518	15.00	0.20
Flush	94	79	4.17	331	14.92	0.15
Flush	71	63	2.90	183	14.49	0.12
Flush	60	55	1.86	103	14.29	0.10
Flush	269	258	0.98	252	16.01	0.40
Flush	273	270	0.28	75	16.96	0.38
Flush	676	676	0.00	0	16.10	1.00
	8077	7436		14586		18.75

Note: (1) Proppant 20/40 Carbo-Lite.
(2) Loaded 18,000 lbs and allowing for 500 lbs spillage, this is 20% more than computer indicated (densiometer error).

schedule was used to determine the downhole treatment schedule shown in Table 5. From this, a total of 15,746 lbs of proppant (106% of design) was placed in the fracture with 5815 gals of gel (99% design). When compared to the design proppant schedule, the actual schedule came very close as shown in Fig. 26.

TABLE 4 - "Corrected" surface pump schedule, E. Mereenie 37.

Fluid Type	Slur. Vol. (gal)	Fluid Vol. (gal)	Prop Conc. (ppg)	Prop Amt. (lbs)	Avg. Q (bpm)	Pump t (min)
Boragel H3595	1664	1664	0.00	0	4.80	8.25
Boragel H3595	192	192	0.00	0	8.31	0.55
Boragel H3595	284	276	0.63	175	9.90	0.68
Boragel H3595	568	551	0.69	378	13.75	0.98
Boragel H3595	481	455	1.28	583	14.62	0.78
Boragel H3595	489	442	2.42	1070	15.19	0.77
Boragel H3595	471	405	3.71	1503	15.29	0.73
Boragel H3595	692	567	5.02	2846	15.21	1.08
Boragel H3595	627	491	6.29	3087	15.44	0.97
Boragel H3595	455	340	7.70	2617	15.48	0.70
Boragel H3595	352	256	8.54	2185	15.24	0.55
Boragel H3595	180	135	7.61	1026	15.13	0.28
Boragel H3595	53	41	6.75	276	15.15	0.08
Flush	126	99	6.29	621	15.00	0.20
Flush	94	77	5.19	397	14.92	0.15
Flush	71	61	3.59	220	14.49	0.12
Flush	60	55	2.27	124	14.29	0.10
Flush	269	256	1.18	302	16.01	0.40
Flush	273	269	0.33	90	16.96	0.38
Flush	676	676	0.00	0	16.10	1.00
	8077	7308		17500		18.75

Note: (1) Proppant 20/40 Carbo-Lite.
(2) Flush volume from blender to top perf = 1571 gals.

TABLE 5 - Treatment downhole pump schedule, E. Mereenie 37.

Fluid Type	Slur. Vol. (gal)	Fluid Vol. (gal)	Prop Conc. (ppg)	Prop Amt. (lbs)	Avg. Q (bpm)	Pump t (min)
WB/Line Fluid	1569	1569	0.00	0	4.80	7.78
Boragel H3595	95	95	0.00	0	4.80	0.47
Boragel H3595	192	192	0.00	0	8.31	0.55
Boragel H3595	284	284	0.00	0	9.90	0.68
Boragel H3595	568	568	0.00	0	13.75	0.98
Boragel H3595	481	481	0.00	0	14.62	0.78
Boragel H3595	236	236	0.00	0	15.19	0.37
Boragel H3595	284	276	0.63	175	15.20	0.44
Boragel H3595	568	551	0.69	378	15.27	0.89
Boragel H3595	481	455	1.28	583	15.21	0.75
Boragel H3595	489	442	2.42	1070	15.40	0.76
Boragel H3595	471	405	3.71	1503	15.46	0.73
Boragel H3595	692	567	5.02	2846	15.29	1.08
Boragel H3595	318	249	6.29	1566	15.02	0.50
Boragel H3595	131	103	6.29	645	14.40	0.22
Boragel H3595	178	139	6.29	876	16.01	0.26
Boragel H3595	91	68	7.70	523	16.01	0.14
Boragel H3595	273	204	7.70	1570	16.96	0.38
Boragel H3595	91	68	7.70	524	16.10	0.13
Boragel H3595	352	256	8.54	2185	16.10	0.52
Boragel H3595	180	135	7.61	1026	16.10	0.27
Boragel H3595	76	41	6.75	276	16.10	0.08
	8077	7384		15746		18.76

Note: (1) Proppant 20/40 Carbo-Lite.
(2) Actual prop amt. placed = 106.4% of design. Act. gel vol. placed = 98.6% of design. Avg. conc. (slurry) = 3.98 ppg (design - 3.79 ppg).

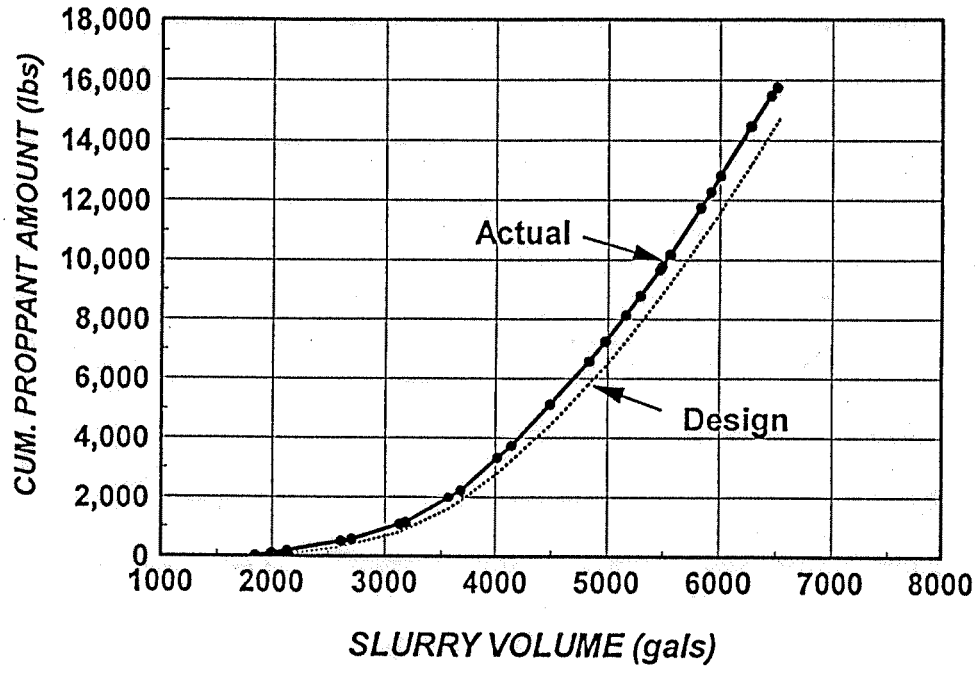

FIG. 26 - Comparison of actual to design prop schedule, E. Mereenie 37.

Post-Frac Evaluation:

Fig. 27 shows the gauge BHTP record plotted with the corresponding rate and downhole proppant concentration. From this it was apparent that the TSO started somewhere around 13 minutes, with a pressure gain of 1300 psi as compared to the design prediction of 1600 psi. To history match this pressure behavior, net BHTP was calculated using the closure pressure of 3280 psi and the downhole "excess" pressure of 570 psi from the minifrac for the higher rate, crosslinked gel portion of the treatment.

Fig. 28 shows the best model match obtained for both the low rate wellbore fluid injection and the main treatment. To obtain this match required only minor changes to the final design model, these including (1) relaxing the lower boundary stress from 5000 to 4500 psi and (2) reducing the leak-off coefficient from 0.005 to 0.0044 ft/sq.rt. minute and increasing spurt from 0.2 to 0.45 gals/100 sq.ft. With the actual downhole treatment schedule, this model predicted fracture dimensions of a propped half-length of 118 ft

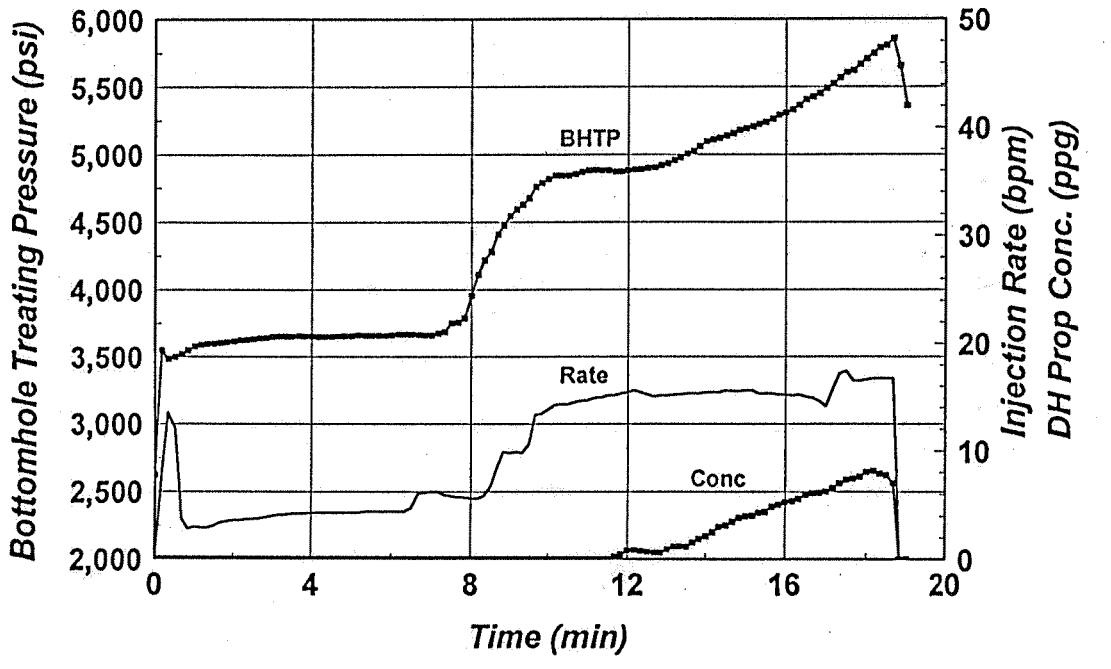

FIG. 27 - Boragel treatment summary of BH treating parameters, E. Mereenie 37.

(design - 116 ft), a maximum height of 141 ft (design - 123 ft), an average conductivity of 1608 md-ft (design -1874 md-ft), and an average in-situ concentration of 0.9 lbs/sq.ft. (design - 1.0 lbs/sq.ft.). These are shown in Figs. 29-31 with the model I/O included in Appendix Table A-6. The predicted top of the fracture was at 4647 ft-TVD or 4 ft from the bottom of the 120/130. The resultant average and maximum widths at the wellbore at the end of the treatment were 0.23 and 0.44 inches, respectively.

With this first history match being somewhat "rough" in the early part of the high rate portion of the treatment, a second history match was attempted without the initial low rate stage (assuming this had minimal impact on fracture dimensions). To obtain the match shown in Fig. 32 required two changes to the previous model, i.e. a further reduction in leak-off to 0.0034 ft/sq.rt. minute and a reduction in spurt from 0.45 to 0.25 gals/100 sq.ft. This was not that surprising, given that the wellbore fluid would have a much higher leak-off than the crosslinked gel. The resultant dimensions were a propped half-length of 118 ft (same as before), a maximum height of 135 ft (6 ft less than before),

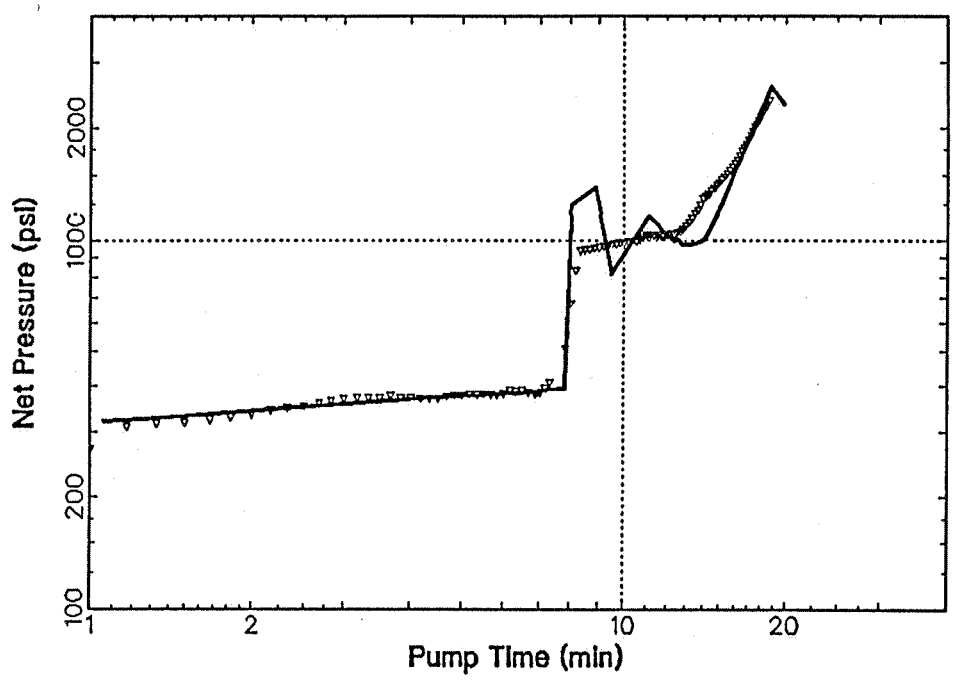

FIG. 28 - Boragel treatment post-frac net BHTP history match #1, E. Mereenie 37.

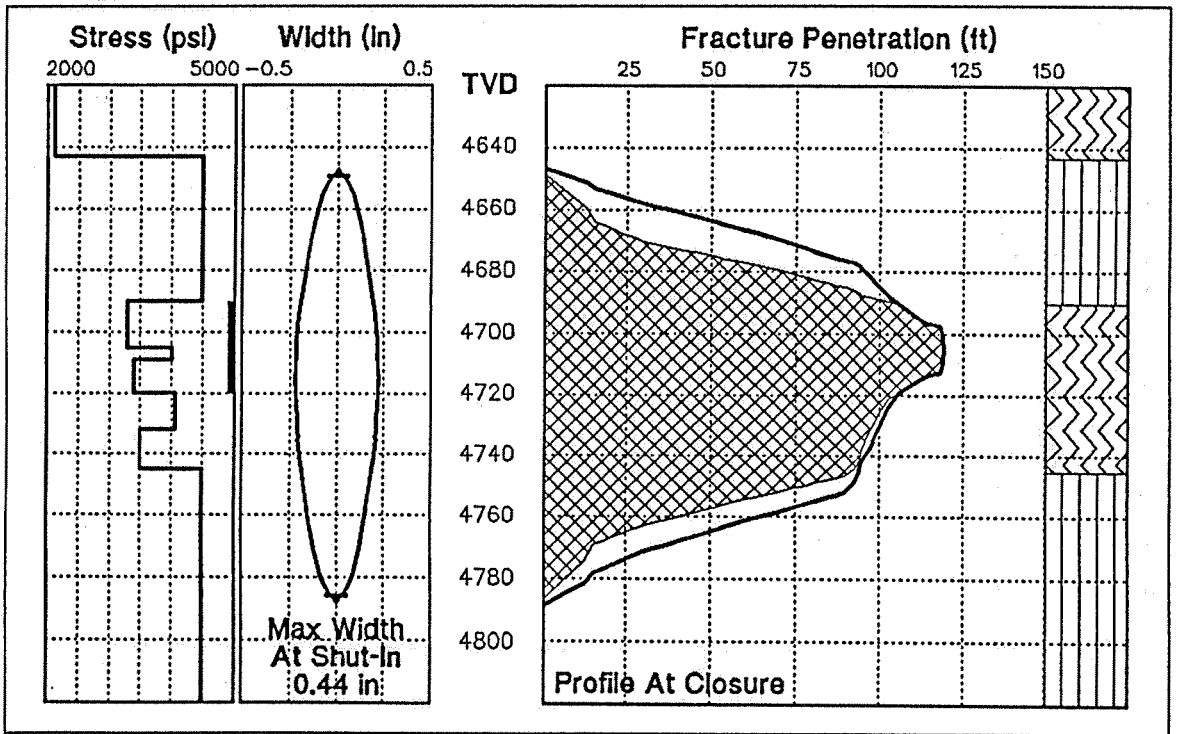

FIG. 29 - Boragel treatment history match #1 predicted frac geometry, E. Mereenie 37.

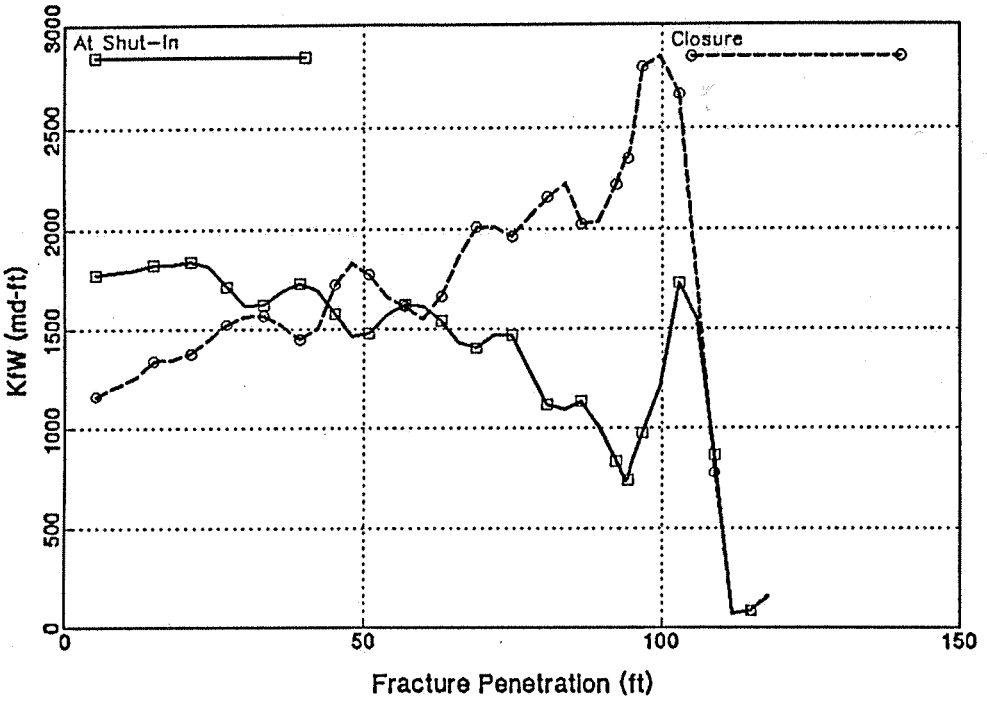

FIG. 30 - Boragel treatment history match #1 predicted conductivity, E. Mereenie 37.

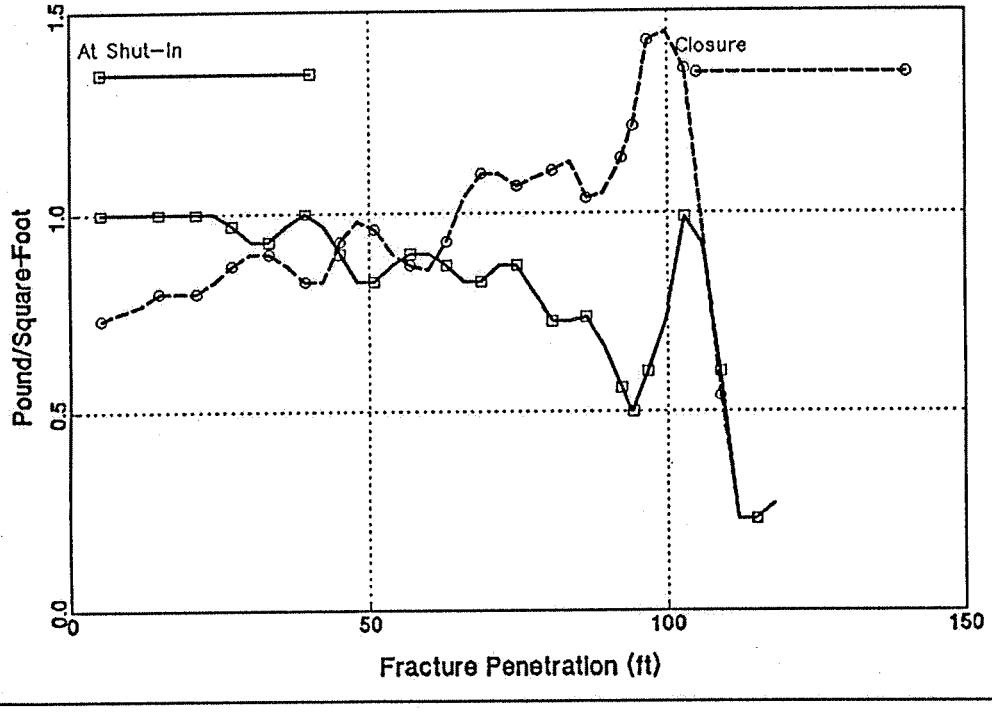

FIG. 31 - Boragel treatment history match #1 predicted in-situ conc., E. Mereenie 37.

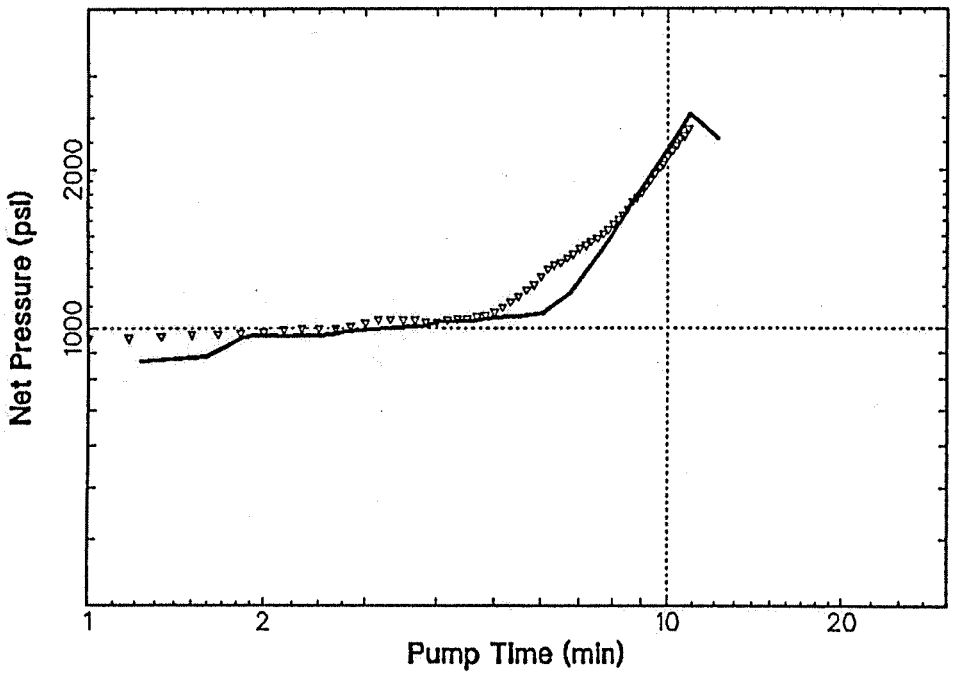

FIG. 32 - Boragel treatment post-frac net BHTP history match #2, E. Mereenie 37.

an average conductivity of 1519 md-ft, and an average in-situ concentration of 0.9 lbs/sq.ft. These are shown in Figs. 33-35 with the model I/O in Appendix Table A-7.

In summary, the fracture appears to extend 118 ft from the wellbore with an average conductivity of 1500-1600 md-ft. It does not appear that the fracture grew into the P3-120/130.

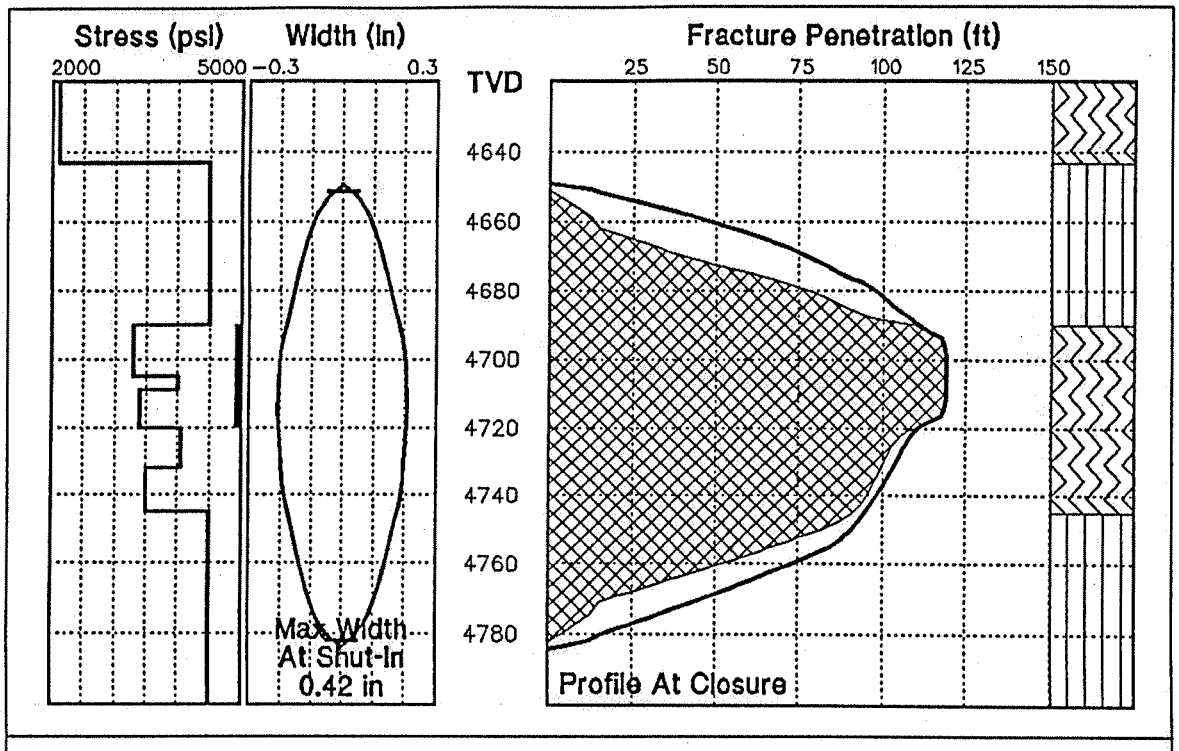

FIG. 33 - Boragel treatment history match #2 predicted frac geometry, E. Mereenie 37.

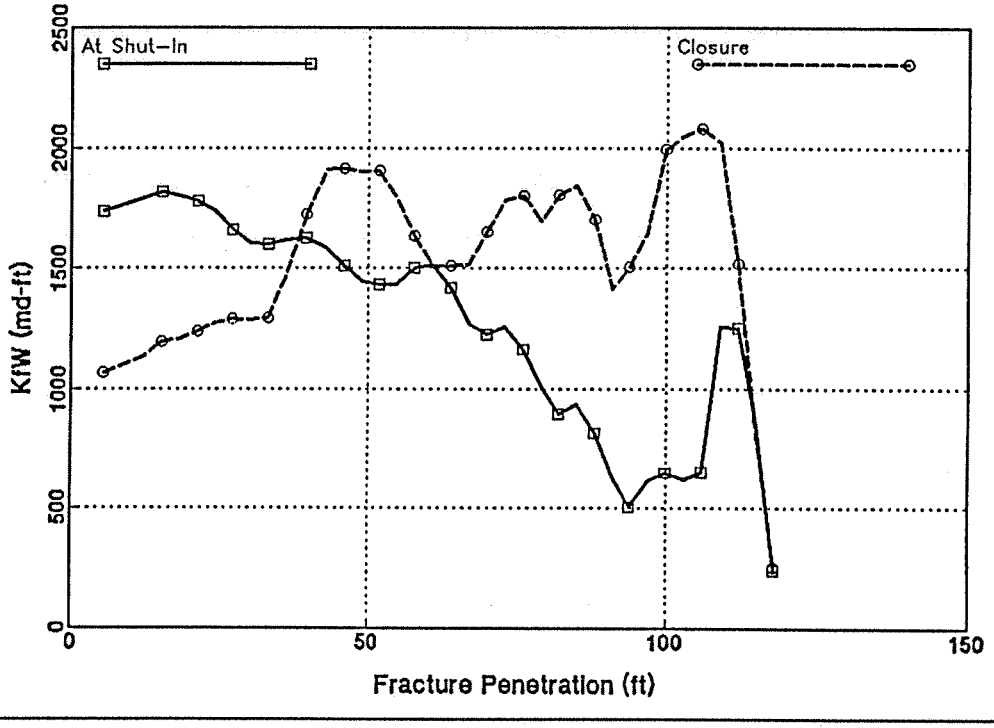

FIG. 34 - Boragel treatment history match #2 predicted conductivity, E. Mereenie 37.

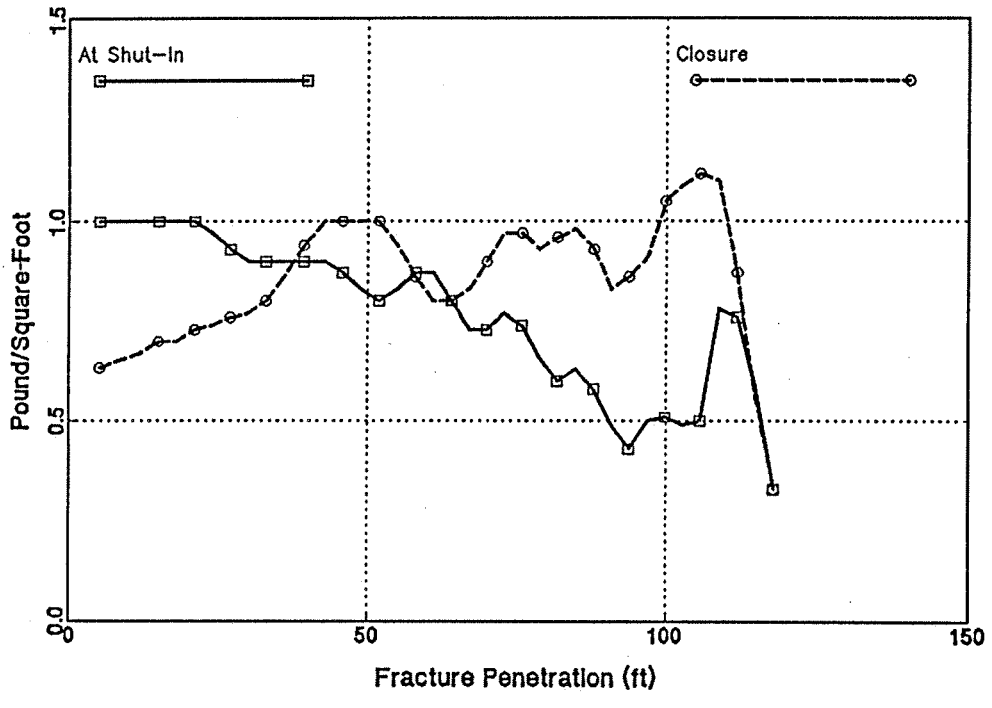

FIG. 35 - Boragel treatment history match #2 predicted in-situ conc., E. Mereenie 37.

CONCLUSIONS / RECOMMENDATIONS

From pre-frac test analysis, closure pressure was 3280 psi (0.695 psi/ft), fluid efficiency from pressure decline analysis was 0.43, and net BHTP was on the order of 1000 psi with the XL gel at 15 bpm. Using the Mereenie correlation of fluid efficiency from pressure decline to injection efficiency, the efficiency was reduced to only 0.20 for final design formulation. A fairly high downhole "excess" pressure of 570 psi was measured on the minifrac. This was thought to be due to the wellbore deviation and poor alignment of the wellbore with the preferred fracture azimuth. This did not cause any problems in pumping the treatment.

The treatment, kept small in size to stay out of the alternative P3-120/130 pay zone, was pumped fairly close to design, placing 106% of the designed proppant amount in the fracture with 99% of the design gel volume. The TSO did occur as planned, with a net BHTP gain of 1300 psi as compared to the design prediction of 1600 psi. When compared to the design model, the post-frac history match required relaxing the lower boundary stress from 5000 to 4500 psi and reducing the leak-off coefficient from 0.005 to 0.0044 ft/sq.rt. minute. Model-predicted dimensions were a propped half-length of 118 ft (design - 116 ft), a maximum height of 141 ft (design - 123 ft), an average conductivity of 1608 md-ft (design - 1874 md-ft), and an average in-situ concentration of 0.9 lbs/sq.ft. (design - 1.0 lbs/sq.ft.). The modeled fracture top was at 4647 ft-TVD or 4 ft below the P3-120/130. Based on this analysis, the treatment came fairly close to design predictions.

APPENDIX A

Fracture Model Simulations

INIT. OVER ENTIRE PERFS.

StimPlan 2.50 (TM). NSI Technologies, Tulsa, OK
Licensed To: Internal Use - NSI Technologies

WELL ID:
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

DEPTH:	Well Depth (ft)	4690
PRESSURE:	Reservoir Pressure (psi)	1770
	Closure Pressure (psi)	3400
TEMPERATURE:	Bottom Hole Temperature (deg_F)	143

** Pumping Schedule **

Sl Vol (MGal)	Fl Vol (MGal)	Conc (_PPG_)	Rate (_BPM)	Fluid Type	Prop Type	Cum Prop (MLbs)	Pump Time (min)
1.50	1.50	0.0	5.00	1	1	0.0	7.1
2.25	2.25	0.0	15.00	2	1	0.0	3.6
0.51	0.50	0.5	15.00	2	1	0.3	0.8
0.42	0.40	1.0	15.00	2	1	0.7	0.7
0.44	0.40	2.0	15.00	2	1	1.4	0.7
0.34	0.30	3.0	15.00	2	1	2.4	0.5
0.35	0.30	4.0	15.00	2	1	3.6	0.6
0.49	0.40	5.0	15.00	2	1	5.6	0.8
0.63	0.50	6.0	15.00	2	1	8.6	1.0

Total Slurry ...	6.9	Total Fluid ...	6.6
Total Proppant ...	8.6	Avg. Conc	1.3
Total Pump Time	15.8 min		

Proppant ID No. 1 — 20- 40 CARBO-LITE

Specific Gravity	2.72
'Damage Factor'	0.60

Proppant Stress (Mpsi)	0	2	4	8	16
KfW @ 2 #/sq ft (md-ft)	10500	9200	7600	3200	500

Fluid ID No. 1 — 10#_SLICK_WATER

Specific Gravity 1.04

	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	5	5	5	5	5	5
non-Newtonian n'	0.90	0.90	0.90	0.90	0.90	0.90
K(lb·sec/ft^2)x1000	0.17	0.17	0.17	0.17	0.17	0.17

Q (_BPM)	dP/dL (psi/100ft)
5.0	30.0
10.0	32.0
15.0	40.0
20.0	60.0

Measured Depth (ft) ... 4950.0

Frac Summary * SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN
Filename: EM37PD1.FRK ; Jul 28, 95

Design Data

FLUID LOSS LAYERS:	Top (ft)	Bottom (ft)	Thick (ft)	Loss Coef. (ft/sqrt(min))	Spurt (Gal/100 ft^2)
	4610.0	4643.0	33.0	0.01600	0.50
	4643.0	4690.0	47.0	0.00300	0.00
	4690.0	4745.0	55.0	0.01200	0.40
	4745.0	4900.0	155.0	0.00010	0.00

FORMATION:	Modulus (e6_psi)	5.65
	Perforated Height (ft)	55.0
	Permeability (md)	10.000
TEMPERATURE:	Bottom Hole (deg_F)	143
PRESSURE:	Reservoir Pressure (psi)	1770.0
	Closure Pressure (psi)	3400.0
DEPTH:	Well Depth (ft)	4690.0

FORMATION LAYER DATA - Multi-Layer Height Growth

-----Depth(ft)------ Top	Botm	Thick	-Stress (psi)-- Top	Botm	Gradient (psi/ft)	Modulus (e6_psi)	Toughness (psi/in)
4610.0	4643.0	33.0	2100.0	2100.0	0.000	5.50	3000.0
4643.0	4675.0	32.0	3850.0	3850.0	0.000	6.50	3000.0
4675.0	4690.0	15.0	3850.0	3850.0	0.000	6.50	3000.0
4690.0	4705.0	15.0	3400.0	3400.0	0.000	5.50	3000.0
4705.0	4709.0	4.0	3600.0	3600.0	0.000	6.00	3000.0
4709.0	4720.0	11.0	3400.0	3400.0	0.000	5.50	3000.0
4720.0	4732.0	12.0	3600.0	3600.0	0.000	6.00	3000.0
4732.0	4745.0	13.0	3400.0	3400.0	0.000	5.50	3000.0
4745.0			5000.0		0.000	7.50	3000.0

Fluid Pressure Gradient (psi/ft)		0.450
Initial Fracture Top (ft)		4690
Initial Fracture Bottom (ft)		4745
3-D SIMULATOR	Step Size (ft)	1.1
PROGRAM CONTROL	Time Step (min)	0.5

Calculated Results
from 3-D Simulator
STIMPLAN (TM) , NSI , Tulsa,OK
Licensed To: Internal Use - NSI Technologies

1/2 LENGTH:	'Hydraulic' length (ft)	46.6
	Propped length (ft)	43.3
PRESSURE:	Max Net Pressure (psi)	2529.0
	Surface Pres-End of Pad (psi)	3238.6
	Surface Pres-Start of Flush (psi) .	5988.9
	Surface Pres-End of Job (psi)	5797.0
	Maximum Hydraulic Horsepower	2246
TIME:	Max Exposure to Form. Temp. (min)	2.5
	Time to Close (min)	2.4
RATE:	Fluid Loss Rate during pad (_BPM) ..	14.44
EFFICIENCY:	at end of pumping schedule	0.16
PROPPANT:	Average In Situ Conc. (#/sq ft)	1.2
	Average Conductivity (md-ft)	2332
HEIGHT:	Max Fracture Height (ft)	100.0
WIDTH:	Avg width at end of pumping (in) ...	0.22

TABLE A-1

Fluid ID No. 2	BORAGEL_H3595					
Specific Gravity					1.04	
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	325	275	225	175	10	2
non-Newtonian n'	0.38	0.40	0.41	0.42	0.90	0.95
K(lb·sec/ft^2)x1000	160.82	122.80	95.44	70.51	0.34	0.05

Time History * NSI STIMPLAN 3-D Fracture Simulation
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Time (min)	Pen (ft)	Pres (psi)	Rate (_BPM)	Prop (_PPG_)	Sl Vol (MGal)	Eff- ciency	Loss (_BPM)	Hght (ft)	W-Avg (in)
0.9	7	165	5.00	0.0	0.2	0.03	4.7	55	0.01
1.3	7	164	5.00	0.0	0.3	0.03	4.8	56	0.01
1.6	8	172	5.00	0.0	0.3	0.03	5.0	56	0.01
2.0	10	179	5.00	0.0	0.4	0.02	5.0	56	0.01
2.3	11	186	5.00	0.0	0.5	0.02	5.0	56	0.01
2.8	12	194	5.00	0.0	0.6	0.02	5.0	56	0.01
3.1	13	200	5.00	0.0	0.7	0.01	5.0	56	0.01
3.6	14	203	5.00	0.0	0.8	0.01	5.0	56	0.01
4.0	14	204	5.00	0.0	0.8	0.01	5.0	56	0.01
4.4	16	207	5.00	0.0	0.9	0.01	4.9	57	0.01
4.9	16	208	5.00	0.0	1.0	0.01	5.0	57	0.01
5.3	17	212	5.00	0.0	1.1	0.01	4.9	57	0.01
5.7	18	213	5.00	0.0	1.2	0.01	5.0	57	0.01
6.1	18	215	5.00	0.0	1.3	0.01	5.0	57	0.01
6.5	19	218	5.00	0.0	1.4	0.01	4.9	57	0.01
7.2	20	219	5.00	0.0	1.5	0.01	5.0	57	0.01
7.2	21	571	15.00	0.0	1.5	0.02	9.8	57	0.01
7.2	22	598	15.00	0.0	1.5	0.02	8.6	57	0.02
7.3	23	688	15.00	0.0	1.6	0.03	9.2	57	0.03
7.3	25	650	15.00	0.0	1.6	0.03	14.8	57	0.03
7.4	26	636	15.00	0.0	1.6	0.03	14.0	58	0.03
7.4	27	628	15.00	0.0	1.7	0.03	14.0	58	0.03
7.5	28	626	15.00	0.0	1.7	0.03	14.4	61	0.03
7.6	29	608	15.00	0.0	1.8	0.04	13.6	64	0.03
7.8	30	596	15.00	0.0	1.9	0.04	13.9	66	0.03
7.9	31	597	15.00	0.0	2.0	0.04	13.7	69	0.03
8.1	32	585	15.00	0.0	2.1	0.04	13.8	71	0.03
8.3	33	573	15.00	0.0	2.2	0.04	14.3	73	0.03
8.5	34	563	15.00	0.0	2.4	0.04	14.1	76	0.03
8.7	36	557	15.00	0.0	2.5	0.05	14.2	78	0.03
9.0	37	555	15.00	0.0	2.6	0.05	14.3	81	0.03
9.2	38	550	15.00	0.0	2.8	0.05	14.2	83	0.04
9.5	39	547	15.00	0.0	3.0	0.05	14.4	86	0.04
9.8	40	545	15.00	0.0	3.1	0.05	14.4	88	0.04
10.0	41	543	15.00	0.0	3.3	0.05	14.5	90	0.04
10.3	42	517	15.00	0.0	3.5	0.05	14.6	93	0.04
10.6	43	498	15.00	0.0	3.7	0.05	14.6	95	0.04
11.0	44	480	15.00	0.0	3.9	0.05	14.4	98	0.04
11.4	45	466	15.00	0.5	4.2	0.05	14.4	100	0.04
Bridge Stage 3 at 11 min, at 24.4 (ft), Avg Dia/W 0.03/0.04 in									
11.8	47	458	15.00	0.5	4.4	0.05	14.5	100	0.04
Bridge Stage 3 at 12 min, at 24.8 (ft), Avg Dia/W 0.03/0.04 in									
ScreenOut in Stage 3 at Time = 11.8 min at 41 (ft)									
12.3	47	595	15.00	1.0	4.7	0.06	11.7	100	0.05
Bridge Stage 3 at 12 min, at 36.0 (ft), Avg Dia/W 0.03/0.04 in									
12.8	47	789	15.00	2.0	5.0	0.07	10.7	100	0.07
Bridge Stage 3 at 13 min, at 37.8 (ft), Avg Dia/W 0.03/0.05 in									
ScreenOut in Stage 3 at Time = 12.8 min at 39 (ft)									
13.3	47	1020	15.00	2.0	5.4	0.09	10.0	100	0.09
ScreenOut in Stage 4 at Time = 13.3 min at 38 (ft)									
13.8	47	1281	15.00	3.0	5.7	0.10	9.5	100	0.11
14.3	47	1563	15.00	4.0	6.0	0.12	9.0	100	0.14
ScreenOut in Stage 5 at Time = 14.3 min at 36 (ft)									

GEOMETRY SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Dstnce (ft)	Press (psi)	W-Avg (in)	Q (_BPM)	Sh-Rate (1/sec)	------Hght (ft)------- Total	Up	Dn	Prop	Bank Fraction	Prop (PSF)
3	2529	0.27	7.5	36	100	41	4	88	0.01	1.03
6	2529	0.27	6.4	31	100	41	4	88	0.01	1.03
7	2529	0.27	6.2	30	100	41	4	88	0.01	1.04
8	2529	0.27	6.1	29	100	41	4	88	0.01	1.07
9	2529	0.27	5.9	28	100	41	4	88	0.00	1.19
10	2529	0.27	5.7	27	100	41	4	88	0.00	1.19
11	2529	0.27	5.5	26	100	41	4	88	0.00	1.19
12	2529	0.27	5.2	25	100	41	4	88	0.00	1.19
13	2529	0.27	5.0	24	99	40	4	87	0.00	1.18
14	2529	0.27	4.8	24	99	40	4	87	0.00	1.18
15	2529	0.27	4.7	23	98	39	4	86	0.00	1.22
16	2529	0.27	4.5	23	98	39	4	86	0.00	1.23
17	2529	0.26	4.4	22	97	38	4	85	0.00	1.22
18	2529	0.26	4.2	22	96	37	4	85	0.00	1.22
18	2529	0.26	4.1	21	96	37	4	84	0.00	1.22
19	2529	0.26	3.9	21	95	36	4	84	0.00	1.21
20	2529	0.26	3.7	20	94	35	4	83	0.00	1.21
21	2529	0.26	3.6	20	93	35	4	82	0.00	1.20
22	2529	0.26	3.4	19	92	33	3	81	0.00	1.37
23	2529	0.25	3.2	19	90	32	3	80	0.00	1.47
24	2529	0.25	2.9	18	89	31	3	79	0.00	1.45
25	2529	0.25	2.7	17	87	29	3	78	0.00	1.32
26	2529	0.25	2.5	16	86	28	3	76	0.00	1.27
27	2528	0.25	2.3	15	84	26	3	75	0.00	1.54
28	2528	0.25	2.1	14	82	25	3	73	0.00	1.68
30	2528	0.25	1.9	14	80	23	2	71	0.00	1.68
31	2527	0.25	1.7	13	78	21	2	69	0.00	1.46
32	2527	0.25	1.5	12	75	19	2	67	0.00	1.92
33	2526	0.25	1.4	11	73	16	2	65	0.00	2.07
34	2525	0.24	1.2	10	70	14	1	63	0.39	2.27
35	2524	0.24	1.0	9	67	11	1	61	0.86	2.60
36	2188	0.23	0.8	10	64	8	1	59	1.00	2.33
37	1547	0.13	0.7	34	57	2	0	56	1.00	1.28
38	1544	0.15	0.7	30	55	0	0	55	1.00	1.37
39	968	0.10	0.6	68	53	0	0	53	1.00	0.93
41	703	0.11	0.4	96	48	0	0	48	1.00	1.07
42	287	0.03	0.4	1629	35	0	0	35	1.00	0.29
43	259	0.02	0.6	3058	23	0	0	23	1.00	0.23
44	223	0.02	0.5	6044	19	0	0	19	1.00	0.19
45	182	0.02	0.3	6937	18	0	0	18	1.00	0.23
46	142	0.01	0.2	9999	18	0	0	18	1.00	0.08

14.8	47	1872	15.00	5.0	6.3	0.13	8.7	100	0.16
15.3	47	2196	15.00	6.0	6.6	0.15	8.3	100	0.19
ScreenOut in Stage			5 at Time =		15.3 min at		35 (ft)		
15.8	47	2529	15.00	6.0	6.9	0.16	7.9	100	0.22
16.1	47	2276	0.00	0.0	6.9	0.15	8.1	100	0.21
16.4	47	2023	0.00	0.0	6.9	0.14	7.7	100	0.19
16.8	47	1770	0.00	0.0	6.9	0.12	7.5	100	0.17
17.1	47	1517	0.00	0.0	6.9	0.11	7.4	100	0.16
17.5	47	1265	0.00	0.0	6.9	0.10	7.2	100	0.15
17.9	47	1012	0.00	0.0	6.9	0.09	7.1	100	0.14
18.1	47	759	0.00	0.0	6.9	0.09	7.0	100	0.13

9	0	2	1	15	6.0	11.2	3.5	6.2	0.0	143	427	0.01
9	0	2	1	12	6.0	8.6	4.3	6.5	0.0	141	404	0.00
9	0	2	1	4	6.0	7.0	5.2	6.7	0.0	78	391	0.00

FLUID SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Stage No	Gone	Fluid ID	Prop ID	Pos (ft)	Concentration In	Now	Desgn	Fl Vol (MGal)	Ex Tim (min)	Temp (deg_F)	Visc (cp)	Fall Frac
1	1	1	1	47	0.0	0.0	0.0	0.2	0.3	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	0.3	0.3	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	0.3	0.3	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	0.4	0.4	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	0.5	0.4	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	0.6	0.0	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	0.7	0.0	143	4	0.00
1	1	1	1	47	0.0	0.0	0.0	0.8	0.0	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	0.8	0.0	143	4	0.00
1	1	1	1	47	0.0	0.0	0.0	0.9	0.0	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	1.0	0.0	143	4	0.00
1	1	1	1	47	0.0	0.0	0.0	1.1	0.0	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	1.2	0.0	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	1.3	0.0	143	4	0.00
1	1	1	1	47	0.0	0.0	0.0	1.4	0.0	143	3	0.00
1	1	1	1	47	0.0	0.0	0.0	1.5	0.0	143	3	0.00
2	1	2	1	47	0.0	0.0	0.0	1.5	0.0	143	5	0.00
2	1	2	1	47	0.0	0.0	0.0	1.5	0.1	143	7	0.00
2	1	2	1	47	0.0	0.0	0.0	1.5	0.1	143	8	0.00
2	1	2	1	47	0.0	0.0	0.0	1.6	0.1	143	10	0.00
2	1	2	1	47	0.0	0.0	0.0	1.6	0.2	143	10	0.00
2	1	2	1	47	0.0	0.0	0.0	1.6	0.2	143	11	0.00
2	1	2	1	47	0.0	0.0	0.0	1.7	0.2	143	11	0.00
2	1	2	1	47	0.0	0.0	0.0	1.7	0.2	143	11	0.00
2	1	2	1	47	0.0	0.0	0.0	1.8	0.2	143	11	0.00
2	1	2	1	47	0.0	0.0	0.0	1.9	0.2	143	11	0.00
2	1	2	1	47	0.0	0.0	0.0	2.0	0.2	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	2.1	0.2	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	2.2	0.2	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	2.4	0.2	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	2.5	0.2	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	2.6	0.3	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	2.8	0.3	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	3.0	0.3	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	3.1	0.3	143	12	0.00
2	1	2	1	47	0.0	0.0	0.0	3.3	0.3	143	13	0.00
2	1	2	1	47	0.0	0.0	0.0	3.5	0.3	143	13	0.00
2	1	2	1	47	0.0	0.0	0.0	3.7	0.4	143	13	0.00
2	1	2	1	47	0.0	0.0	0.0	3.8	0.8	143	13	0.00
3	1	2	1	47	0.5	45.3	0.0	3.9	0.4	143	16	0.00
3	1	2	1	40	0.5	45.3	0.0	4.2	0.9	143	99	0.00
3	1	2	1	40	0.5	45.3	0.0	4.3	0.9	143	100	0.00
4	1	2	1	39	1.0	45.3	0.0	4.4	1.0	143	164	0.00
4	1	2	1	38	1.0	45.3	0.0	4.7	1.5	143	320	0.00
5	1	2	1	37	2.0	45.3	0.0	4.7	1.5	143	383	0.00
5	1	2	1	36	2.0	45.3	0.0	5.0	2.0	143	606	0.00
5	0	2	1	35	2.0	37.9	0.6	5.1	2.5	143	739	0.00
6	0	2	1	33	3.0	27.8	1.0	5.3	2.0	143	674	0.02
6	0	2	1	31	3.0	13.0	1.6	5.4	2.0	143	621	0.00
7	0	2	1	29	4.0	17.3	1.8	5.6	1.5	143	570	0.02
7	0	2	1	26	4.0	10.7	2.5	5.8	1.0	143	524	0.00
8	0	2	1	23	5.0	13.2	2.6	5.9	1.0	143	490	0.02
8	0	2	1	19	5.0	9.3	3.4	6.2	0.5	143	453	0.00

PROPPANT SUMMARY * At Fracture Closure
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
2.8	1525	0.90
6.2	1522	0.90
7.1	1528	0.90
7.9	1511	0.90
9.0	1516	0.90
10.1	2024	1.10
11.2	2011	1.10
12.3	2010	1.10
13.4	2009	1.10
14.2	1998	1.10
15.0	1995	1.10
15.9	1995	1.10
16.7	2285	1.20
17.5	2244	1.20
18.1	2424	1.30
18.9	2416	1.30
19.8	2412	1.30
20.7	2403	1.30
21.8	2383	1.30
22.9	2839	1.50
24.0	3589	1.80
25.1	2935	1.50
26.2	2770	1.40
27.3	2599	1.40
28.4	3585	1.80
29.5	3546	1.80
30.6	3838	1.90
31.7	4994	2.40
32.8	5066	2.50
33.9	4998	2.40
35.0	5653	2.70
36.1	4759	2.30
37.2	2420	1.30
38.3	2612	1.40
39.4	1622	0.90
40.5	1933	1.10
41.6	209	0.30
42.7	57	0.20
43.8	0	0.20
44.9	56	0.20
46.0	0	0.10

Average Conductivity (md-ft) 2332

PROPPANT SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
2.8	1817	1.00
6.2	1816	1.00
7.1	1820	1.00
7.9	1906	1.10
9.0	2149	1.20
10.1	2154	1.20
11.2	2148	1.20
12.3	2148	1.20
13.4	2143	1.20
14.2	2134	1.20
15.0	2222	1.20
15.9	2253	1.20
16.7	2222	1.20
17.5	2217	1.20
18.1	2213	1.20
18.9	2204	1.20
19.8	2196	1.20
20.7	2186	1.20
21.8	2544	1.40
22.9	2758	1.50
24.0	2730	1.50
25.1	2448	1.30
26.2	2335	1.30
27.3	2922	1.50
28.4	3221	1.70
29.5	3226	1.70
30.6	2756	1.50
31.7	3749	1.90
32.8	4082	2.10
33.9	4517	2.30
35.0	5221	2.60
36.1	4648	2.30
37.2	2364	1.30
38.3	2551	1.40
39.4	1584	0.90
40.5	1888	1.10
41.6	204	0.30
42.7	55	0.20
43.8	0	0.20
44.9	55	0.20
46.0	0	0.10

Average Conductivity (md-ft) 2252

INIT. IN 140 PERFS

Frac Summary * SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN
Filename: EM37PD2.FRK ; Jul 28, 95

Design Data

FLUID LOSS LAYERS:	Top (ft)	Bottom (ft)	Thick (ft)	Loss Coef. (ft/sqrt(min))	Spurt (Gal/100 ft^2)
	4610.0	4643.0	33.0	0.01600	0.50
	4643.0	4690.0	47.0	0.00300	0.00
	4690.0	4745.0	55.0	0.01200	0.40
	4745.0	4900.0	155.0	0.00010	0.00

FORMATION:	Modulus (e6_psi)	5.50
	Perforated Height (ft)	15.0
	Permeability (md)	10.000
TEMPERATURE:	Bottom Hole (deg_F)	143
PRESSURE:	Reservoir Pressure (psi)	1770.0
	Closure Pressure (psi)	3400.0
DEPTH:	Well Depth (ft)	4690.0

FORMATION LAYER DATA - Multi-Layer Height Growth

	-----Depth(ft)------			-Stress (psi)--		Gradient	Modulus	Toughness
	Top	Botm	Thick	Top	Botm	(psi/ft)	(e6_psi)	(psi/in)
120/130	4610.0	4643.0	33.0	2100.0	2100.0	0.000	5.50	3000.0
	4643.0	4675.0	32.0	3850.0	3850.0	0.000	6.50	3000.0
	4675.0	4690.0	15.0	3850.0	3850.0	0.000	6.50	3000.0
	4690.0	4705.0	15.0	3400.0	3400.0	0.000	5.50	3000.0
	4705.0	4709.0	4.0	3600.0	3600.0	0.000	6.00	3000.0
	4709.0	4720.0	11.0	3400.0	3400.0	0.000	5.50	3000.0
	4720.0	4732.0	12.0	3600.0	3600.0	0.000	6.00	3000.0
	4732.0	4745.0	13.0	3400.0	3400.0	0.000	5.50	3000.0
	4745.0			5000.0		0.000	7.50	3000.0

	Fluid Pressure Gradient (psi/ft)	0.450
	Initial Fracture Top (ft)	4690
	Initial Fracture Bottom (ft)	4705
3-D SIMULATOR	Step Size (ft)	1.1
PROGRAM CONTROL	Time Step (min)	0.5

Calculated Results
from 3-D Simulator
STIMPLAN (TM) , NSI , Tulsa,OK
Licensed To: Internal Use - NSI Technologies

1/2 LENGTH:	'Hydraulic' length (ft)	47.8
	Propped length (ft)	47.6
PRESSURE:	Max Net Pressure (psi)	2677.8
	Surface Pres-End of Pad (psi)	3206.7
	Surface Pres-Start of Flush (psi)	6137.7
	Surface Pres-End of Job (psi)	5945.8
	Maximum Hydraulic Horsepower	2302
TIME:	Max Exposure to Form. Temp. (min)	2.1
	Time to Close (min)	1.7
RATE:	Fluid Loss Rate during pad (_BPM)	14.65
EFFICIENCY:	at end of pumping schedule	0.16
PROPPANT:	Average In Situ Conc. (#/sq ft)	1.8
	Average Conductivity (md-ft)	3343
HEIGHT:	Max Fracture Height (ft)	99.6
WIDTH:	Avg width at end of pumping (in)	0.19

StimPlan 2.50 (TM). NSI Technologies, Tulsa, OK
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WELL ID:	SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN	
DEPTH:	Well Depth (ft)	4690
PRESSURE:	Reservoir Pressure (psi)	1770
	Closure Pressure (psi)	3400
TEMPERATURE:	Bottom Hole Temperature (deg_F)	143

**** Pumping Schedule ****

Sl Vol (MGal)	Fl Vol (MGal)	Conc (_PPG_)	Rate (_BPM)	Fluid Type	Prop Type	Cum Prop (MLbs)	Pump Time (min)
1.50	1.50	0.0	5.00	1	1	0.0	7.1
2.25	2.25	0.0	15.00	2	1	0.0	3.6
0.51	0.50	0.5	15.00	2	1	0.3	0.8
0.42	0.40	1.0	15.00	2	1	0.7	0.7
0.44	0.40	2.0	15.00	2	1	1.4	0.7
0.34	0.30	3.0	15.00	2	1	2.4	0.5
0.35	0.30	4.0	15.00	2	1	3.6	0.6
0.49	0.40	5.0	15.00	2	1	5.6	0.8
0.63	0.50	6.0	15.00	2	1	8.6	1.0

Total Slurry ...	6.9	Total Fluid ...	6.6
Total Proppant ...	8.6	Avg. Conc	1.3
Total Pump Time	15.8 min		

Proppant ID No. 1	20- 40 CARBO-LITE				
Specific Gravity	2.72				
'Damage Factor'	0.60				
Proppant Stress (Mpsi)	0	2	4	8	16
KfW @ 2 #/sq ft (md-ft)	10500	9200	7600	3200	500

Fluid ID No. 1	10#_SLICK_WATER					
Specific Gravity	1.04					
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec)	5	5	5	5	5	5
non-Newtonian n'	0.90	0.90	0.90	0.90	0.90	0.90
K(lb·sec/ft^2)x1000	0.17	0.17	0.17	0.17	0.17	0.17

Q (_BPM)	dP/dL (psi/100ft)
5.0	30.0
10.0	32.0
15.0	40.0
20.0	60.0
Measured Depth (ft) ...	4950.0

TABLE A-2

Fluid ID No. 2	BORAGEL_H3595					
Specific Gravity					1.04	
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	325	275	225	175	10	2
non-Newtonian n'	0.38	0.40	0.41	0.42	0.90	0.95
K(lb·sec/ft^2)x1000	160.82	122.80	95.44	70.51	0.34	0.05

Time History * NSI STIMPLAN 3-D Fracture Simulation
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Time (min)	Pen (ft)	Pres (psi)	Rate (_BPM)	Prop (_PPG_)	Sl Vol (MGal)	Eff-ciency	Loss (_BPM)	Hght (ft)	W-Avg (in)
4.3	21	215	5.00	0.0	0.9	0.01	4.8	45	0.01
4.8	21	205	5.00	0.0	1.0	0.02	4.8	45	0.01
5.1	22	219	5.00	0.0	1.1	0.02	5.0	45	0.01
5.4	23	228	5.00	0.0	1.1	0.02	5.1	45	0.01
5.7	23	237	5.00	0.0	1.2	0.01	5.1	45	0.01
6.0	24	241	5.00	0.0	1.3	0.01	5.1	45	0.01
6.3	24	247	5.00	0.0	1.3	0.01	5.0	45	0.01
6.7	25	249	5.00	0.0	1.4	0.01	5.0	45	0.01
7.2	26	253	5.00	0.0	1.5	0.01	5.1	45	0.01
7.2	27	713	15.00	0.0	1.5	0.03	6.7	49	0.01
7.3	28	759	15.00	0.0	1.6	0.03	12.6	61	0.01
7.6	29	620	15.00	0.0	1.8	0.04	13.8	63	0.02
7.7	30	580	15.00	0.0	1.8	0.03	15.1	66	0.02
7.8	31	540	15.00	0.0	1.9	0.03	14.9	68	0.02
8.1	32	505	15.00	0.0	2.1	0.03	14.8	71	0.02
8.3	33	488	15.00	0.0	2.2	0.03	14.3	73	0.02
8.4	34	481	15.00	0.0	2.3	0.03	14.1	75	0.02
8.6	35	475	15.00	0.0	2.4	0.04	14.2	78	0.02
8.8	37	469	15.00	0.0	2.6	0.04	14.1	80	0.02
9.1	38	467	15.00	0.0	2.7	0.04	14.4	83	0.02
9.3	39	464	15.00	0.0	2.9	0.04	14.4	85	0.02
9.6	40	467	15.00	0.0	3.0	0.04	14.4	88	0.02
9.8	41	464	15.00	0.0	3.2	0.04	14.5	90	0.02
10.1	42	465	15.00	0.0	3.3	0.04	14.5	92	0.02
10.3	43	466	15.00	0.0	3.5	0.04	14.5	95	0.02
10.6	44	450	15.00	0.0	3.7	0.04	14.7	96	0.03
10.9	45	438	15.00	0.0	3.9	0.04	14.8	98	0.03
11.2	46	434	15.00	0.5	4.1	0.04	14.6	99	0.03
Bridge Stage 3 at 11 min, at 24.5 (ft), Avg Dia/W 0.03/0.03 in									
11.6	48	435	15.00	0.5	4.3	0.04	14.6	100	0.03
Bridge Stage 3 at 12 min, at 27.4 (ft), Avg Dia/W 0.03/0.02 in									
12.1	48	510	15.00	1.0	4.6	0.04	13.1	100	0.03
Bridge Stage 3 at 12 min, at 31.0 (ft), Avg Dia/W 0.03/0.03 in									
ScreenOut in Stage 3 at Time = 12.1 min at 44 (ft)									
12.6	48	734	15.00	1.0	4.9	0.06	11.4	100	0.06
Bridge Stage 4 at 13 min, at 25.6 (ft), Avg Dia/W 0.03/0.05 in									
13.1	48	951	15.00	2.0	5.2	0.08	10.6	100	0.07
Bridge Stage 4 at 13 min, at 35.1 (ft), Avg Dia/W 0.03/0.06 in									
13.6	48	1205	15.00	3.0	5.5	0.09	9.9	100	0.09
ScreenOut in Stage 4 at Time = 13.6 min at 40 (ft)									
14.1	48	1498	15.00	4.0	5.8	0.10	9.4	100	0.11
14.6	48	1814	15.00	5.0	6.2	0.12	9.0	100	0.13
ScreenOut in Stage 5 at Time = 14.6 min at 37 (ft)									
15.1	48	2161	15.00	5.0	6.5	0.14	8.6	100	0.15
15.8	48	2678	15.00	6.0	6.9	0.16	8.2	100	0.18
ScreenOut in Stage 6 at Time = 15.8 min at 35 (ft)									
16.0	48	2410	0.00	0.0	6.9	0.14	8.1	100	0.18
16.4	48	2142	0.00	0.0	6.9	0.13	7.8	100	0.17
16.7	48	1874	0.00	0.0	6.9	0.12	7.7	100	0.16
17.1	48	1607	0.00	0.0	6.9	0.11	7.5	100	0.15
17.4	48	1339	0.00	0.0	6.9	0.10	7.4	100	0.14

GEOMETRY SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Dstnce (ft)	Press (psi)	W-Avg (in)	Q (_BPM)	Sh-Rate (1/sec)	------Hght (ft)------- Total	Up	Dn	Prop	Bank Fraction	Prop (PSF)
9	2678	0.26	7.5	39	100	36	48	81	0.00	1.17
20	2677	0.24	4.1	26	91	28	48	74	0.00	1.32
21	2677	0.24	3.5	24	89	26	48	72	0.00	1.37
22	2677	0.24	3.5	24	88	26	48	71	0.00	1.37
22	2677	0.24	3.4	23	88	25	48	70	0.00	1.37
23	2677	0.24	3.3	23	87	25	48	70	0.00	1.38
23	2677	0.24	3.2	22	87	24	48	70	0.00	1.38
24	2677	0.24	3.1	22	87	24	48	70	0.00	1.38
24	2676	0.24	3.0	21	87	24	48	70	0.00	1.38
25	2676	0.24	2.9	21	86	23	48	69	0.00	1.51
26	2676	0.24	2.8	21	84	21	48	67	0.00	1.64
27	2676	0.23	2.6	20	82	20	48	65	0.00	1.55
28	2676	0.23	2.4	19	81	19	48	64	0.00	1.55
29	2676	0.23	2.2	18	80	17	47	62	0.00	1.56
30	2675	0.23	2.0	17	78	16	47	61	0.00	1.77
32	2675	0.22	1.8	17	76	15	46	56	0.03	2.16
33	2675	0.22	1.6	16	75	15	45	54	0.03	2.02
34	2674	0.22	1.5	15	75	15	45	53	0.03	2.05
35	2673	0.20	1.3	15	71	15	42	44	0.78	3.17
36	2672	0.19	1.1	17	65	13	37	34	1.00	3.99
37	2671	0.18	0.9	18	59	11	33	28	1.00	4.59
38	1799	0.14	0.8	39	54	10	30	22	1.00	3.29
39	1795	0.14	0.8	42	49	8	25	18	1.00	3.51
40	1793	0.15	0.7	36	45	8	22	18	1.00	3.68
41	1162	0.10	0.6	93	45	8	22	18	1.00	2.40
43	1156	0.10	0.7	78	45	8	22	18	1.00	2.45
44	1153	0.11	0.5	57	45	8	22	18	1.00	2.71
45	309	0.04	0.4	853	45	8	22	18	1.00	0.92
46	234	0.05	0.6	645	45	8	22	18	1.00	1.14
47	147	0.05	0.4	788	45	8	22	18	1.00	1.09
48	126	0.06	0.1	130	45	8	22	18	1.00	1.38

FLUID SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Stage No	Gone	Fluid ID	Prop ID	Pos (ft)	Concentration In	Now	Desgn	Fl Vol (MGal)	Ex Tim (min)	Temp (deg_F)	Visc (cp)	Fall Frac
1	1	1	1	48	0.0	0.0	0.0	0.9	0.7	143	4	0.00
1	1	1	1	48	0.0	0.0	0.0	1.0	0.7	143	4	0.00
1	1	1	1	48	0.0	0.0	0.0	1.1	0.5	143	4	0.00
1	1	1	1	48	0.0	0.0	0.0	1.1	0.3	143	4	0.00
1	1	1	1	48	0.0	0.0	0.0	1.2	0.3	143	4	0.00
1	1	1	1	48	0.0	0.0	0.0	1.3	0.3	143	4	0.00
1	1	1	1	48	0.0	0.0	0.0	1.3	0.3	143	4	0.00
1	1	1	1	48	0.0	0.0	0.0	1.4	0.4	143	3	0.00
1	1	1	1	48	0.0	0.0	0.0	1.5	0.3	143	3	0.00
2	1	2	1	48	0.0	0.0	0.0	1.5	0.3	143	19	0.00
2	1	2	1	48	0.0	0.0	0.0	1.5	0.3	143	18	0.00
2	1	2	1	48	0.0	0.0	0.0	1.6	0.4	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	1.8	0.3	143	26	0.00
2	1	2	1	48	0.0	0.0	0.0	1.8	0.3	143	25	0.00
2	1	2	1	48	0.0	0.0	0.0	1.9	0.4	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	2.1	0.4	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	2.2	0.4	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	2.3	0.4	143	24	0.00
2	1	2	1	48	0.0	0.0	0.0	2.4	0.4	143	24	0.00
2	1	2	1	48	0.0	0.0	0.0	2.6	0.2	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	2.7	0.2	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	2.9	0.3	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	3.0	0.3	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	3.2	0.3	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	3.3	0.3	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	3.5	0.3	143	23	0.00
2	1	2	1	48	0.0	0.0	0.0	3.7	0.3	143	24	0.00
2	1	2	1	48	0.0	0.0	0.0	3.8	0.3	143	24	0.00
3	1	2	1	48	0.5	45.3	0.0	3.9	0.3	143	15	0.00
3	1	2	1	48	0.5	45.3	0.0	4.1	0.4	143	26	0.00
3	1	2	1	44	0.5	45.3	0.0	4.3	0.0	143	39	0.00
4	1	2	1	44	1.0	45.3	0.0	4.3	0.5	143	161	0.00
4	1	2	1	43	1.0	45.3	0.0	4.6	1.0	143	150	0.00
4	1	2	1	40	1.0	45.3	0.0	4.7	1.5	143	250	0.00
5	1	2	1	39	2.0	45.3	0.0	4.9	1.5	143	268	0.00
5	1	2	1	37	2.0	45.3	0.0	5.1	2.1	143	508	0.00
6	1	2	1	35	3.0	45.3	0.0	5.2	1.6	143	537	0.00
6	0	2	1	33	3.0	20.1	1.2	5.4	1.1	143	541	0.00
7	0	2	1	31	4.0	26.7	1.4	5.5	1.1	143	512	0.02
7	0	2	1	28	4.0	13.5	2.1	5.8	0.6	143	483	0.00
8	0	2	1	26	5.0	17.4	2.2	5.8	0.6	143	457	0.02
8	0	2	1	22	5.0	11.0	3.0	6.1	0.0	143	420	0.00
8	0	2	1	17	5.0	8.0	3.8	6.2	0.0	99	356	0.00
9	0	2	1	14	6.0	9.8	3.8	6.3	0.0	88	350	0.01
9	0	2	1	6	6.0	7.7	4.8	6.7	0.0	88	350	0.00

PROPPANT SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
9.0	2051	1.20
19.7	2351	1.30
21.4	2463	1.40
21.7	2468	1.40
22.2	2473	1.40
22.8	2477	1.40
23.3	2483	1.40
23.9	2489	1.40
24.4	2496	1.40
25.1	2765	1.50
26.0	3037	1.60
27.1	2836	1.50
28.2	2849	1.60
29.3	2863	1.60
30.4	3299	1.80
31.5	4140	2.20
32.6	3843	2.00
33.7	3890	2.00
34.8	6254	3.20
35.9	7994	4.00
37.0	9256	4.60
38.1	6519	3.30
39.2	6982	3.50
40.3	7339	3.70
41.4	4637	2.40
42.5	4737	2.40
43.6	5291	2.70
44.7	1509	0.90
45.8	1979	1.10
46.9	1876	1.10
47.6	2477	1.40

Average Conductivity (md-ft) 3270

PROPPANT SUMMARY * At Fracture Closure
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
9.0	1922	1.10
19.7	2170	1.20
21.4	2689	1.50
21.7	2694	1.50
22.2	2697	1.50
22.8	2700	1.50
23.3	2704	1.50
23.9	2709	1.50
24.4	2714	1.50
25.1	2721	1.50
26.0	3596	1.90
27.1	3575	1.90
28.2	3311	1.70
29.3	3321	1.80
30.4	3330	1.80
31.5	4512	2.30
32.6	4526	2.30
33.7	4565	2.30
34.8	6572	3.30
35.9	8112	4.00
37.0	9393	4.60
38.1	6615	3.30
39.2	7086	3.50
40.3	7447	3.70
41.4	4706	2.40
42.5	4807	2.40
43.6	5369	2.70
44.7	1532	0.90
45.8	2009	1.10
46.9	1904	1.10
47.6	2513	1.40

Average Conductivity (md-ft) 3343

INIT. IN 250 PERFS

StimPlan 2.50 (TM). NSI Technologies, Tulsa, OK
Licensed To: Internal Use - NSI Technologies

WELL ID:
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

DEPTH:	Well Depth (ft)	4732
PRESSURE:	Reservoir Pressure (psi)	1770
	Closure Pressure (psi)	3400
TEMPERATURE:	Bottom Hole Temperature (deg_F)	143

** Pumping Schedule **

Sl Vol (MGal)	Fl Vol (MGal)	Conc (_PPG_)	Rate (_BPM)	Fluid Type	Prop Type	Cum Prop (MLbs)	Pump Time (min)
1.50	1.50	0.0	5.00	1	1	0.0	7.1
2.25	2.25	0.0	15.00	2	1	0.0	3.6
0.51	0.50	0.5	15.00	2	1	0.3	0.8
0.42	0.40	1.0	15.00	2	1	0.7	0.7
0.44	0.40	2.0	15.00	2	1	1.4	0.7
0.34	0.30	3.0	15.00	2	1	2.4	0.5
0.35	0.30	4.0	15.00	2	1	3.6	0.6
0.49	0.40	5.0	15.00	2	1	5.6	0.8
0.63	0.50	6.0	15.00	2	1	8.6	1.0

Total Slurry ...	6.9	Total Fluid ...	6.6
Total Proppant ...	8.6	Avg. Conc	1.3
Total Pump Time	15.8 min		

Proppant ID No. 1 — 20- 40 CARBO-LITE

Specific Gravity	2.72				
'Damage Factor'	0.60				
Proppant Stress (Mpsi)	0	2	4	8	16
KfW @ 2 #/sq ft (md-ft)	10500	9200	7600	3200	500

Fluid ID No. 1 — 10#_SLICK_WATER

Specific Gravity 1.04

	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	5	5	5	5	5	5
non-Newtonian n'	0.90	0.90	0.90	0.90	0.90	0.90
K(lb•sec/ft^2)x1000	0.17	0.17	0.17	0.17	0.17	0.17

Q (_BPM)	dP/dL (psi/100ft)
5.0	30.0
10.0	32.0
15.0	40.0
20.0	60.0
Measured Depth (ft) ...	4950.0

Frac Summary * SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN
Filename: EM37PD3.FRK ; Jul 28, 95

Design Data

FLUID LOSS LAYERS:	Top (ft)	Bottom (ft)	Thick (ft)	Loss Coef. (ft/sqrt(min))	Spurt (Gal/100 ft^2)
	4610.0	4643.0	33.0	0.01600	0.50
	4643.0	4690.0	47.0	0.00300	0.00
	4690.0	4745.0	55.0	0.01200	0.40
	4745.0	4900.0	155.0	0.00010	0.00

FORMATION:	Modulus (e6_psi)	5.50
	Perforated Height (ft)	13.0
	Permeability (md)	10.000
TEMPERATURE:	Bottom Hole (deg_F)	143
PRESSURE:	Reservoir Pressure (psi)	1770.0
	Closure Pressure (psi)	3400.0
DEPTH:	Well Depth (ft)	4732.0

FORMATION LAYER DATA - Multi-Layer Height Growth

-----Depth(ft)------ Top	Botm	Thick	-Stress (psi)-- Top	Botm	Gradient (psi/ft)	Modulus (e6_psi)	Toughness (psi/in)
4610.0	4643.0	33.0	2100.0	2100.0	0.000	5.50	3000.0
4643.0	4675.0	32.0	3850.0	3850.0	0.000	6.50	3000.0
4675.0	4690.0	15.0	3850.0	3850.0	0.000	6.50	3000.0
4690.0	4705.0	15.0	3400.0	3400.0	0.000	5.50	3000.0
4705.0	4709.0	4.0	3600.0	3600.0	0.000	6.00	3000.0
4709.0	4720.0	11.0	3400.0	3400.0	0.000	5.50	3000.0
4720.0	4732.0	12.0	3600.0	3600.0	0.000	6.00	3000.0
4732.0	4745.0	13.0	3400.0	3400.0	0.000	5.50	3000.0
4745.0			5000.0		0.000	7.50	3000.0

Fluid Pressure Gradient (psi/ft)		0.450
Initial Fracture Top (ft)		4732
Initial Fracture Bottom (ft)		4745
3-D SIMULATOR	Step Size (ft)	1.1
PROGRAM CONTROL	Time Step (min)	Automatic

Calculated Results
from 3-D Simulator
STIMPLAN (TM) , NSI , Tulsa,OK
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1/2 LENGTH:	'Hydraulic' length (ft)	50.3
	Propped length (ft)	50.3
PRESSURE:	Max Net Pressure (psi)	1815.6
	Surface Pres-End of Pad (psi)	3180.4
	Surface Pres-Start of Flush (psi) .	5250.2
	Surface Pres-End of Job (psi)	5064.7
	Maximum Hydraulic Horsepower	1969
TIME:	Max Exposure to Form. Temp. (min)	1.1
	Time to Close (min)	0.0
RATE:	Fluid Loss Rate during pad (_BPM) ..	14.72
EFFICIENCY:	at end of pumping schedule	0.13
PROPPANT:	Average In Situ Conc. (#/sq ft)	1.0
	Average Conductivity (md-ft)	1810
HEIGHT:	Max Fracture Height (ft)	110.5
WIDTH:	Avg width at end of pumping (in) ...	0.10

TABLE A-3

Fluid ID No. 2	BORAGEL_H3595					
Specific Gravity					1.04	
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	325	275	225	175	10	2
non-Newtonian n'	0.38	0.40	0.41	0.42	0.90	0.95
K(lb·sec/ft^2)x1000	160.82	122.80	95.44	70.51	0.34	0.05

Time History * NSI STIMPLAN 3-D Fracture Simulation
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Time (min)	Pen (ft)	Pres (psi)	Rate (_BPM)	Prop (_PPG_)	Sl Vol (MGal)	Eff- ciency	Loss (_BPM)	Hght (ft)	W-Avg (in)
4.3	21	206	5.00	0.0	0.9	0.01	4.7	44	0.01
5.1	22	215	5.00	0.0	1.1	0.02	4.8	44	0.02
5.6	23	226	5.00	0.0	1.2	0.02	5.0	44	0.02
6.2	24	235	5.00	0.0	1.3	0.02	5.0	44	0.01
6.8	25	242	5.00	0.0	1.4	0.01	5.0	44	0.01
7.2	26	252	5.00	0.0	1.5	0.01	4.6	44	0.01
7.2	27	776	15.00	0.0	1.5	0.03	8.1	49	0.02
7.3	28	765	15.00	0.0	1.6	0.03	12.3	62	0.02
7.6	29	611	15.00	0.0	1.8	0.04	13.7	64	0.02
7.7	30	564	15.00	0.0	1.8	0.04	15.7	67	0.02
7.8	32	520	15.00	0.0	1.9	0.04	14.9	69	0.02
8.0	33	482	15.00	0.0	2.0	0.04	14.6	72	0.02
8.2	34	461	15.00	0.0	2.2	0.04	14.3	74	0.02
8.4	35	448	15.00	0.0	2.3	0.04	14.2	77	0.02
8.6	36	440	15.00	0.0	2.4	0.04	13.9	79	0.02
8.8	37	441	15.00	0.0	2.5	0.04	14.1	81	0.02
8.9	38	444	15.00	0.0	2.6	0.04	14.1	84	0.02
9.2	39	443	15.00	0.0	2.8	0.04	14.3	86	0.02
9.4	40	442	15.00	0.0	2.9	0.04	14.3	89	0.02
9.6	41	442	15.00	0.0	3.1	0.04	14.3	91	0.02
9.9	43	443	15.00	0.0	3.2	0.04	14.4	91	0.02
10.1	44	446	15.00	0.0	3.4	0.04	14.2	93	0.02
10.4	45	435	15.00	0.0	3.5	0.04	14.4	93	0.03
10.6	46	431	15.00	0.0	3.7	0.04	14.5	93	0.03
10.9	47	428	15.00	0.0	3.8	0.04	14.6	93	0.03
11.1	48	426	15.00	0.5	4.0	0.04	14.7	93	0.03
11.4	49	427	15.00	0.5	4.2	0.04	14.6	93	0.03
Bridge Stage 3 at 11 min, at 40.2 (ft), Avg Dia/W 0.03/0.01 in									
12.2	50	578	15.00	0.5	4.7	0.05	12.8	110	0.04
Bridge Stage 3 at 12 min, at 35.5 (ft), Avg Dia/W 0.03/0.03 in									
13.5	50	638	15.00	2.0	5.5	0.07	13.1	110	0.05
ScreenOut in Stage 5 at Time = 13.5 min at 37 (ft)									
14.0	50	796	15.00	4.0	5.8	0.08	10.4	110	0.07
14.4	50	970	15.00	5.0	6.1	0.09	9.9	110	0.08
ScreenOut in Stage 7 at Time = 14.4 min at 24 (ft)									
14.9	50	1257	15.00	5.0	6.4	0.10	9.5	110	0.09
15.3	50	1529	15.00	6.0	6.6	0.12	9.1	110	0.09
15.8	50	1816	15.00	6.0	6.9	0.13	8.6	110	0.10
ScreenOut in Stage 7 at Time = 15.8 min at 22 (ft)									

GEOMETRY SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Dstnce (ft)	Press (psi)	W-Avg (in)	Q (_BPM)	Sh-Rate (1/sec)	Hght (ft) Total	Up	Dn	Prop	Bank Fraction	Prop (PSF)
9	1816	0.23	7.5	48	110	83	15	102	0.01	1.15
19	1816	0.20	3.5	31	94	67	14	85	0.01	1.61
21	1816	0.20	2.9	27	93	66	14	83	1.00	2.12
23	1815	0.20	2.7	26	92	65	14	83	1.00	2.14
24	1815	0.20	2.5	25	91	64	14	82	1.00	2.22
25	967	0.10	2.3	115	90	63	14	81	0.81	0.89
26	966	0.10	3.1	112	89	62	14	80	0.82	0.89
27	964	0.10	3.0	110	88	61	14	79	0.83	0.89
28	962	0.10	2.8	108	87	60	14	78	0.83	0.89
29	959	0.10	2.6	105	85	59	14	76	0.84	0.89
30	956	0.10	2.4	103	84	57	14	75	0.85	0.89
31	953	0.10	2.3	100	82	56	13	73	0.89	0.91
32	950	0.10	2.1	97	81	54	13	72	0.90	0.92
33	946	0.09	1.9	94	79	52	13	70	0.92	0.92
34	943	0.09	1.8	93	77	51	13	68	0.94	0.92
35	940	0.09	1.6	93	75	49	13	66	1.00	0.95
36	938	0.10	1.4	79	72	47	13	63	1.00	1.07
38	598	0.05	1.3	326	70	44	13	60	0.74	0.42
39	588	0.05	1.7	343	66	41	12	56	0.93	0.50
40	574	0.04	1.4	431	54	32	8	47	0.91	0.41
41	552	0.04	1.2	535	51	30	8	45	0.93	0.38
42	523	0.03	1.1	603	47	28	7	42	0.96	0.35
43	489	0.03	0.9	695	45	26	6	40	1.00	0.33
44	448	0.03	0.8	721	44	25	6	39	1.00	0.32
45	402	0.03	0.7	689	44	25	6	39	1.00	0.33
46	347	0.03	0.6	631	44	25	6	39	1.00	0.34
47	290	0.05	0.5	342	44	25	6	39	1.00	0.58
49	232	0.07	0.3	224	44	25	6	39	1.00	0.77
50	145	0.15	0.2	111	44	25	6	39	1.00	1.57
50	121	0.13	0.0	8	44	25	6	39	1.00	1.37

FLUID SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Stage No	Gone	Fluid ID	Prop ID	Pos (ft)	Concentration In	Now	Desgn	Fl Vol (MGal)	Ex Tim (min)	Temp (deg_F)	Visc (cp)	Fall Frac
1	1	1	1	50	0.0	0.0	0.0	0.9	1.0	143	4	0.00
1	1	1	1	50	0.0	0.0	0.0	1.1	0.6	143	4	0.00
1	1	1	1	50	0.0	0.0	0.0	1.2	0.5	143	4	0.00
1	1	1	1	50	0.0	0.0	0.0	1.3	0.6	143	4	0.00
1	1	1	1	50	0.0	0.0	0.0	1.4	0.7	143	3	0.00
1	1	1	1	50	0.0	0.0	0.0	1.5	0.3	143	3	0.00
2	1	2	1	50	0.0	0.0	0.0	1.5	0.3	143	21	0.00
2	1	2	1	50	0.0	0.0	0.0	1.5	0.3	143	18	0.00
2	1	2	1	50	0.0	0.0	0.0	1.6	0.4	143	23	0.00
2	1	2	1	50	0.0	0.0	0.0	1.8	0.4	143	26	0.00
2	1	2	1	50	0.0	0.0	0.0	1.8	0.4	143	26	0.00
2	1	2	1	50	0.0	0.0	0.0	1.9	0.3	143	26	0.00
2	1	2	1	50	0.0	0.0	0.0	2.0	0.4	143	25	0.00
2	1	2	1	50	0.0	0.0	0.0	2.2	0.4	143	24	0.00
2	1	2	1	50	0.0	0.0	0.0	2.3	0.4	143	24	0.00
2	1	2	1	50	0.0	0.0	0.0	2.4	0.2	143	24	0.00
2	1	2	1	50	0.0	0.0	0.0	2.5	0.2	143	25	0.00
2	1	2	1	50	0.0	0.0	0.0	2.6	0.2	143	24	0.00
2	1	2	1	50	0.0	0.0	0.0	2.8	0.2	143	24	0.00
2	1	2	1	50	0.0	0.0	0.0	2.9	0.3	143	23	0.00
2	1	2	1	50	0.0	0.0	0.0	3.1	0.5	143	21	0.00
2	1	2	1	50	0.0	0.0	0.0	3.2	0.5	143	22	0.00
2	1	2	1	50	0.0	0.0	0.0	3.4	0.5	143	23	0.00
2	1	2	1	50	0.0	0.0	0.0	3.5	0.5	143	23	0.00
2	1	2	1	50	0.0	0.0	0.0	3.7	0.5	143	23	0.00
2	1	2	1	50	0.0	0.0	0.0	3.8	0.3	143	32	0.00
3	1	2	1	50	0.5	45.3	0.0	3.8	0.8	143	31	0.00
3	1	2	1	50	0.5	45.3	0.0	4.0	0.6	143	21	0.00
3	1	2	1	50	0.5	45.3	0.0	4.2	1.1	143	39	0.00
3	1	2	1	50	0.5	45.3	0.0	4.3	1.1	143	42	0.00
4	1	2	1	50	1.0	45.3	0.0	4.7	0.0	143	69	0.00
5	1	2	1	50	2.0	45.3	0.0	4.7	0.0	143	90	0.00
5	1	2	1	34	2.0	45.3	0.0	5.1	0.4	143	184	0.00
6	1	2	1	27	3.0	45.3	0.0	5.4	0.0	143	170	0.00
7	1	2	1	24	4.0	45.3	0.0	5.5	0.0	143	161	0.00
7	1	2	1	23	4.0	45.3	0.0	5.8	0.0	143	426	0.00
8	0	2	1	19	5.0	23.0	1.8	6.1	0.0	143	381	0.00
8	0	2	1	15	5.0	13.6	2.5	6.3	0.0	143	333	0.00
9	0	2	1	13	6.0	17.6	2.5	6.3	0.0	143	5	0.02
9	0	2	1	10	6.0	11.1	3.5	6.6	0.0	143	5	0.02
9	0	2	1	4	6.0	7.8	4.7	6.8	0.0	143	5	0.01

PROPPANT SUMMARY * At End of Pumping Schedule
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
8.8	2092	1.20
19.3	3094	1.60
21.5	4210	2.10
22.6	4261	2.10
23.7	4441	2.20
24.8	1507	0.90
25.7	1509	0.90
26.6	1511	0.90
27.7	1510	0.90
28.8	1509	0.90
29.9	1508	0.90
31.0	1560	0.90
32.1	1570	0.90
33.2	1574	0.90
34.3	1576	0.90
35.4	1651	1.00
36.5	1913	1.10
37.6	491	0.40
38.7	660	0.50
39.8	450	0.40
40.9	395	0.40
42.0	330	0.40
43.1	281	0.30
44.2	266	0.30
45.3	282	0.30
46.4	307	0.30
47.5	833	0.60
48.6	1249	0.80
49.7	3002	1.60
50.2	2568	1.40

Average Conductivity (md-ft) 1810

PROPPANT SUMMARY * At Fracture Closure
SANTOS -E.MEREENIE #37 (230/250) PRELIM. FRAC DESIGN

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
8.8	2092	1.20
19.3	3094	1.60
21.5	4210	2.10
22.6	4261	2.10
23.7	4441	2.20
24.8	1507	0.90
25.7	1509	0.90
26.6	1511	0.90
27.7	1510	0.90
28.8	1509	0.90
29.9	1508	0.90
31.0	1560	0.90
32.1	1570	0.90
33.2	1574	0.90
34.3	1576	0.90
35.4	1651	1.00
36.5	1913	1.10
37.6	491	0.40
38.7	660	0.50
39.8	450	0.40
40.9	395	0.40
42.0	330	0.40
43.1	281	0.30
44.2	266	0.30
45.3	282	0.30
46.4	307	0.30
47.5	833	0.60
48.6	1249	0.80
49.7	3002	1.60
50.2	2568	1.40

Average Conductivity (md-ft) 1810

Frac Summary * SANTOS - EM#37 (190/230/250) MINIFRAC EVALUATION
Filename: EM37MF.FRK ; Jul 30, 95

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WELL ID:
SANTOS - EM#37 (190/230/250) MINIFRAC EVALUATION

DEPTH:	Well Depth (ft)	4690
PRESSURE:	Reservoir Pressure (psi)	1770
	Closure Pressure (psi)	3300
TEMPERATURE:	Bottom Hole Temperature (deg_F)	143

Pumping Schedule

Sl Vol (MGal)	Fl Vol (MGal)	Conc (_PPG_)	Rate (_BPM)	Fluid Type	Prop Type	Cum Prop (MLbs)	Pump Time (min)
0.10	0.10	0.0	5.00	3	1	0.0	0.5
0.10	0.10	0.0	9.00	3	1	0.0	0.3
0.10	0.10	0.0	10.00	1	1	0.0	0.2
0.10	0.10	0.0	13.00	1	1	0.0	0.2
0.10	0.10	0.0	14.00	1	1	0.0	0.2
1.50	1.50	0.0	15.00	1	1	0.0	2.4

Total Slurry ...	2.0	Total Fluid ...	2.0
Total Proppant ...	0.0	Avg. Conc	0.0
Total Pump Time	3.7 min		

Proppant ID No. 1 — 20- 40 Un-Defined

Specific Gravity					2.65
'Damage Factor'					0.70
Proppant Stress (Mpsi)	0	2	4	8	16
KfW @ 2 #/sq ft (md-ft)	4800	3850	2750	990	50

Fluid ID No. 3 — BORAGEL

Specific Gravity 1.04

	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	200	150	100	60	10	2
non-Newtonian n'	0.38	0.40	0.41	0.42	0.90	0.95
K(lb·sec/ft^2)x1000	98.97	66.98	42.42	24.18	0.34	0.05

Design Data

FLUID LOSS LAYERS:	Top (ft)	Bottom (ft)	Thick (ft)	Loss Coef. (ft/sqrt(min))	Spurt (Gal/100 ft^2)
	4610.0	4643.0	33.0	0.01000	0.50
	4643.0	4690.0	47.0	0.00010	0.00
	4690.0	4745.0	55.0	0.00500	0.20
	4745.0	4900.0	155.0	0.00010	0.00

FORMATION:	Modulus (e6_psi)	6.63
	Perforated Height (ft)	30.0
	Permeability (md)	10.000
TEMPERATURE:	Bottom Hole (deg_F)	143
PRESSURE:	Reservoir Pressure (psi)	1770.0
	Closure Pressure (psi)	3300.0
DEPTH:	Well Depth (ft)	4690.0

FORMATION LAYER DATA - Multi-Layer Height Growth

Depth(ft) Top	Depth(ft) Botm	Thick	Stress (psi) Top	Stress (psi) Botm	Gradient (psi/ft)	Modulus (e6_psi)	Toughness (psi/in)
4610.0	4643.0	33.0	2100.0	2100.0	0.000	5.50	3000.0
4643.0	4675.0	32.0	4500.0	4500.0	0.000	8.00	3000.0
4675.0	4690.0	15.0	4500.0	4500.0	0.000	8.00	3000.0
4690.0	4705.0	15.0	3300.0	3300.0	0.000	6.50	3000.0
4705.0	4709.0	4.0	4000.0	4000.0	0.000	7.50	3000.0
4709.0	4720.0	11.0	3400.0	3400.0	0.000	6.50	3000.0
4720.0	4732.0	12.0	4050.0	4050.0	0.000	7.50	3000.0
4732.0	4745.0	13.0	3500.0	3500.0	0.000	6.50	3000.0
4745.0			5000.0		0.000	8.00	3000.0

Fluid Pressure Gradient (psi/ft)		0.450
Initial Fracture Top (ft)		4690
Initial Fracture Bottom (ft)		4720
3-D SIMULATOR	Step Size (ft)	2.0
PROGRAM CONTROL	Time Step (min)	Automatic

Calculated Results
from 3-D Simulator
STIMPLAN (TM) , NSI , Tulsa,OK
Licensed To: Internal Use - NSI Technologies

1/2 LENGTH:	'Hydraulic' length (ft)	79.4
	Propped length (ft)	0.0
PRESSURE:	Max Net Pressure (psi)	901.8
TIME:	Max Exposure to Form. Temp. (min)	0.8
	Time to Close (min)	0.7
RATE:	Fluid Loss Rate during pad (_BPM) ..	0.00
EFFICIENCY:	at end of pumping schedule	0.17
PROPPANT:	Average In Situ Conc. (#/sq ft)	0.0
	Average Conductivity (md-ft)	0
HEIGHT:	Max Fracture Height (ft)	82.4
WIDTH:	Avg width at end of pumping (in) ...	0.05

TABLE A-4

Fluid ID No. 1	BORAGEL_H3595					
Specific Gravity					1.04	
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	325	275	225	175	10	2
non-Newtonian n'	0.38	0.40	0.41	0.42	0.90	0.95
K(lb·sec/ft^2)x1000	160.82	122.80	95.44	70.51	0.34	0.05

Time History * NSI STIMPLAN 3-D Fracture Simulation
SANTOS - EM#37 (190/230/250) MINIFRAC EVALUATION

Time (min)	Pen (ft)	Pres (psi)	Rate (_BPM)	Prop (_PPG_)	Sl Vol (MGal)	Eff-ciency	Loss (_BPM)	Hght (ft)	W-Avg (in)
0.2	11	441	5.00	0.0	0.0	0.14	4.2	31	0.01
0.3	13	460	5.00	0.0	0.1	0.16	4.1	31	0.02
0.3	15	513	5.00	0.0	0.1	0.16	4.3	31	0.02
0.4	17	543	5.00	0.0	0.1	0.14	4.7	36	0.02
0.5	18	518	5.00	0.0	0.1	0.12	3.9	37	0.01
0.5	20	615	9.00	0.0	0.1	0.13	7.6	40	0.01
0.6	22	629	9.00	0.0	0.1	0.13	7.4	42	0.01
0.6	24	633	9.00	0.0	0.2	0.13	7.8	43	0.02
0.7	26	644	9.00	0.0	0.2	0.13	7.8	55	0.02
0.8	28	617	9.00	0.0	0.2	0.13	8.0	55	0.02
0.8	30	690	10.00	0.0	0.2	0.13	8.2	57	0.02
1.0	33	734	10.00	0.0	0.3	0.13	8.5	69	0.02
1.1	35	727	13.00	0.0	0.4	0.15	10.3	71	0.02
1.2	37	801	13.00	0.0	0.4	0.16	9.6	73	0.02
1.3	39	810	14.00	0.0	0.5	0.17	11.1	74	0.02
1.4	41	803	14.00	0.0	0.5	0.17	11.3	74	0.02
1.5	43	816	15.00	0.0	0.6	0.17	11.6	75	0.03
1.6	45	821	15.00	0.0	0.6	0.18	11.7	75	0.03
1.7	47	824	15.00	0.0	0.7	0.18	11.9	75	0.03
1.8	49	831	15.00	0.0	0.8	0.18	11.7	75	0.03
1.9	51	836	15.00	0.0	0.8	0.18	12.2	75	0.03
2.0	53	838	15.00	0.0	0.9	0.18	12.3	75	0.03
2.1	55	845	15.00	0.0	0.9	0.18	12.3	76	0.03
2.2	57	850	15.00	0.0	1.0	0.18	12.4	76	0.04
2.3	59	852	15.00	0.0	1.1	0.18	12.3	76	0.04
2.4	61	856	15.00	0.0	1.2	0.18	12.4	77	0.04
2.5	63	861	15.00	0.0	1.2	0.18	12.5	77	0.04
2.7	65	867	15.00	0.0	1.3	0.18	12.6	78	0.04
2.8	67	871	15.00	0.0	1.4	0.18	12.6	78	0.04
2.9	69	875	15.00	0.0	1.5	0.18	12.7	79	0.04
3.1	71	879	15.00	0.0	1.6	0.17	12.7	79	0.04
3.2	73	882	15.00	0.0	1.7	0.17	12.7	80	0.04
3.3	75	886	15.00	0.0	1.8	0.17	12.6	80	0.04
3.5	77	889	15.00	0.0	1.9	0.17	12.7	81	0.04
3.7	79	902	15.00	0.0	2.0	0.17	12.2	82	0.05
3.8	79	812	0.00	0.0	2.0	0.15	18.5	82	0.04
3.8	79	721	0.00	0.0	2.0	0.13	11.4	82	0.04
3.9	79	631	0.00	0.0	2.0	0.12	10.9	82	0.03
4.0	79	541	0.00	0.0	2.0	0.10	10.5	82	0.03
4.1	79	451	0.00	0.0	2.0	0.08	10.1	82	0.02
4.2	79	361	0.00	0.0	2.0	0.07	9.8	82	0.02
4.3	79	271	0.00	0.0	2.0	0.05	9.5	82	0.02
4.4	79	180	0.00	0.0	2.0	0.04	9.2	82	0.02

GEOMETRY SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) MINIFRAC EVALUATION

Dstnce (ft)	Press (psi)	W-Avg (in)	Q (_BPM)	Sh-Rate (1/sec)	Hght (ft) Total	Up	Dn	Prop	Bank Fraction	Prop (PSF)
4	894	0.07	7.4	634	82	20	33	70	0.00	0.00
10	878	0.07	6.8	637	80	18	33	68	0.00	0.00
12	872	0.07	6.7	646	79	17	33	68	0.00	0.00
14	866	0.07	6.6	659	79	16	32	67	0.00	0.00
16	859	0.07	6.4	672	78	15	32	66	0.00	0.00
17	854	0.06	6.3	685	77	15	32	66	0.00	0.00
19	847	0.06	6.2	705	77	14	32	65	0.00	0.00
21	839	0.06	6.1	713	76	14	32	65	0.00	0.00
23	832	0.06	5.9	718	76	13	32	64	0.00	0.00
25	825	0.06	5.8	726	75	13	32	64	0.00	0.00
27	817	0.06	5.6	734	75	13	32	64	0.00	0.00
29	810	0.06	5.5	742	75	13	31	63	0.00	0.00
31	801	0.06	5.3	757	74	13	31	63	0.00	0.00
34	791	0.06	5.1	760	74	13	31	63	0.00	0.00
36	783	0.05	4.9	767	74	13	31	62	0.00	0.00
38	775	0.05	4.8	774	74	13	30	62	0.00	0.00
40	767	0.05	4.6	780	73	13	30	62	0.00	0.00
42	759	0.05	4.5	785	73	13	30	61	0.00	0.00
44	750	0.05	4.3	790	73	13	29	61	0.00	0.00
46	741	0.05	4.1	794	72	13	29	61	0.00	0.00
48	732	0.05	3.9	797	72	13	29	60	0.00	0.00
50	745	0.05	3.7	756	72	13	29	60	0.00	0.00
52	725	0.04	3.4	957	72	13	28	60	0.00	0.00
54	714	0.04	3.2	1046	70	13	27	58	0.00	0.00
56	704	0.04	2.9	1117	67	13	24	54	0.00	0.00
58	693	0.03	2.6	1134	64	12	23	52	0.00	0.00
60	668	0.03	2.3	1906	59	9	19	46	0.00	0.00
62	639	0.02	2.0	2235	58	9	19	45	0.00	0.00
64	615	0.03	1.8	1813	44	4	10	31	0.00	0.00
66	610	0.03	1.6	1801	43	4	9	31	0.00	0.00
68	555	0.02	1.3	2457	39	4	6	31	0.00	0.00
70	561	0.03	1.1	1916	32	2	0	31	0.00	0.00
72	531	0.02	0.8	3899	30	0	0	30	0.00	0.00
74	433	0.01	0.5	9999	25	0	0	25	0.00	0.00
76	359	0.01	0.4	9999	20	0	0	20	0.00	0.00
78	269	0.01	0.2	9999	16	0	0	16	0.00	0.00

FLUID SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) MINIFRAC EVALUATION

Stage No	Gone	Fluid ID	Prop ID	Pos (ft)	Concentration In	Now	Desgn	Fl Vol (MGal)	Ex Tim (min)	Temp (deg_F)	Visc (cp)	Fall Frac
1	1	3	1	79	0.0	0.0	0.0	0.0	0.1	143	7	0.00
1	1	3	1	79	0.0	0.0	0.0	0.1	0.1	143	6	0.00
1	1	3	1	79	0.0	0.0	0.0	0.1	0.2	143	6	0.00
1	1	3	1	79	0.0	0.0	0.0	0.1	0.2	143	6	0.00
1	1	3	1	79	0.0	0.0	0.0	0.1	0.1	143	6	0.00
2	1	3	1	79	0.0	0.0	0.0	0.1	0.1	143	6	0.00
2	1	3	1	79	0.0	0.0	0.0	0.1	0.1	143	7	0.00
2	1	3	1	79	0.0	0.0	0.0	0.1	0.2	143	7	0.00
2	1	3	1	79	0.0	0.0	0.0	0.2	0.2	143	5	0.00
2	1	3	1	79	0.0	0.0	0.0	0.2	0.2	143	6	0.00
2	1	3	1	79	0.0	0.0	0.0	0.2	0.1	143	7	0.00
3	1	1	1	79	0.0	0.0	0.0	0.2	0.1	143	13	0.00
3	1	1	1	79	0.0	0.0	0.0	0.2	0.2	143	12	0.00
3	1	1	1	79	0.0	0.0	0.0	0.3	0.2	143	14	0.00
4	1	1	1	79	0.0	0.0	0.0	0.3	0.3	143	14	0.00
4	1	1	1	79	0.0	0.0	0.0	0.4	0.2	143	13	0.00
4	1	1	1	79	0.0	0.0	0.0	0.4	0.3	143	13	0.00
5	1	1	1	79	0.0	0.0	0.0	0.4	0.3	143	13	0.00
5	1	1	1	79	0.0	0.0	0.0	0.5	0.3	143	12	0.00
5	1	1	1	79	0.0	0.0	0.0	0.5	0.3	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	0.5	0.4	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	0.6	0.4	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	0.6	0.3	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	0.7	0.4	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	0.8	0.4	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	0.8	0.5	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	0.9	0.5	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	0.9	0.5	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	1.0	0.5	143	14	0.00
6	1	1	1	79	0.0	0.0	0.0	1.1	0.5	143	13	0.00
6	1	1	1	79	0.0	0.0	0.0	1.2	0.6	143	14	0.00
6	1	1	1	79	0.0	0.0	0.0	1.2	0.6	143	14	0.00
6	1	1	1	79	0.0	0.0	0.0	1.3	0.8	143	14	0.00
6	1	1	1	79	0.0	0.0	0.0	1.4	0.6	143	15	0.00
6	0	1	1	66	0.0	0.0	0.1	1.5	0.5	143	32	0.00
6	0	1	1	56	0.0	0.0	0.1	1.6	0.3	143	44	0.00
6	0	1	1	46	0.0	0.0	0.2	1.7	0.2	143	52	0.00
6	0	1	1	35	0.0	0.0	0.3	1.8	0.0	143	53	0.00
6	0	1	1	23	0.0	0.0	0.3	1.9	0.0	129	56	0.00
6	0	1	1	8	0.0	0.0	0.3	2.0	0.0	77	64	0.00

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WELL ID:
SANTOS - EM#37 (190/230/250) FINAL FRAC DESIGN

DEPTH:	Well Depth (ft)	4690
PRESSURE:	Reservoir Pressure (psi)	1770
	Closure Pressure (psi)	3300
TEMPERATURE:	Bottom Hole Temperature (deg_F)	143

** Pumping Schedule **

Sl Vol (MGal)	Fl Vol (MGal)	Conc (_PPG_)	Rate (_BPM)	Fluid Type	Prop Type	Cum Prop (MLbs)	Pump Time (min)
1.50	1.50	0.0	5.00	2	1	0.0	7.1
0.25	0.25	0.0	8.00	1	1	0.0	0.7
0.25	0.25	0.0	12.00	1	1	0.0	0.5
1.50	1.50	0.0	15.00	1	1	0.0	2.4
0.61	0.60	0.5	15.00	1	1	0.3	1.0
0.52	0.50	1.0	15.00	1	1	0.8	0.8
0.44	0.40	2.0	15.00	1	1	1.6	0.7
0.45	0.40	3.0	15.00	1	1	2.8	0.7
0.47	0.40	4.0	15.00	1	1	4.4	0.7
0.49	0.40	5.0	15.00	1	1	6.4	0.8
0.51	0.40	6.0	15.00	1	1	8.8	0.8
0.52	0.40	7.0	15.00	1	1	11.6	0.8
0.54	0.40	8.0	15.00	1	1	14.8	0.9

Total Slurry ...	8.1	Total Fluid ...	7.4
Total Proppant ...	14.8	Avg. Conc	2.0
Total Pump Time	18.0 min		

Proppant ID No. 1 — 20- 40 CARBO-LITE

Specific Gravity	2.72				
'Damage Factor'	0.60				
Proppant Stress (Mpsi)	0	2	4	8	16
KfW @ 2 #/sq ft (md-ft)	10500	9200	7600	3200	500

Fluid ID No. 2 — SLICK_WATER

Specific Gravity 1.04

	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	10	10	10	10	10	10
non-Newtonian n'	0.90	0.90	0.90	0.90	0.90	0.90
K(lb·sec/ft^2)x1000	0.34	0.34	0.34	0.34	0.34	0.34

Frac Summary * SANTOS - EM#37 (190/230/250) FINAL FRAC DESIGN
Filename: EM37FD.FRK ; Jul 30, 95

Design Data

FLUID LOSS LAYERS:	Top (ft)	Bottom (ft)	Thick (ft)	Loss Coef. (ft/sqrt(min))	Spurt (Gal/100 ft^2)
	4610.0	4643.0	33.0	0.01000	0.50
	4643.0	4690.0	47.0	0.00010	0.00
	4690.0	4745.0	55.0	0.00500	0.20
	4745.0	4900.0	155.0	0.00010	0.00

FORMATION:	Modulus (e6_psi)	6.63
	Perforated Height (ft)	30.0
	Permeability (md)	10.000
TEMPERATURE:	Bottom Hole (deg_F)	143
PRESSURE:	Reservoir Pressure (psi)	1770.0
	Closure Pressure (psi)	3300.0
DEPTH:	Well Depth (ft)	4690.0

FORMATION LAYER DATA - Multi-Layer Height Growth

Depth(ft) Top	Depth(ft) Botm	Thick	Stress (psi) Top	Stress (psi) Botm	Gradient (psi/ft)	Modulus (e6_psi)	Toughness (psi/in)
4610.0	4643.0	33.0	2100.0	2100.0	0.000	5.50	3000.0
4643.0	4675.0	32.0	4500.0	4500.0	0.000	8.00	3000.0
4675.0	4690.0	15.0	4500.0	4500.0	0.000	8.00	3000.0
4690.0	4705.0	15.0	3300.0	3300.0	0.000	6.50	3000.0
4705.0	4709.0	4.0	4000.0	4000.0	0.000	7.50	3000.0
4709.0	4720.0	11.0	3400.0	3400.0	0.000	6.50	3000.0
4720.0	4732.0	12.0	4050.0	4050.0	0.000	7.50	3000.0
4732.0	4745.0	13.0	3500.0	3500.0	0.000	6.50	3000.0
4745.0			5000.0		0.000	8.00	3000.0

Fluid Pressure Gradient (psi/ft)		0.450
Initial Fracture Top (ft)		4690
Initial Fracture Bottom (ft)		4720
3-D SIMULATOR	Step Size (ft)	3.0
PROGRAM CONTROL	Time Step (min)	1.0

Calculated Results
from 3-D Simulator
STIMPLAN (TM) , NSI , Tulsa,OK
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1/2 LENGTH:	'Hydraulic' length (ft)	117.2
	Propped length (ft)	115.7
PRESSURE:	Max Net Pressure (psi)	2694.5
TIME:	Max Exposure to Form. Temp. (min)	4.6
	Time to Close (min)	6.4
RATE:	Fluid Loss Rate during pad (_BPM) ..	12.87
EFFICIENCY:	at end of pumping schedule	0.27
PROPPANT:	Average In Situ Conc. (#/sq ft)	1.0
	Average Conductivity (md-ft)	1874
HEIGHT:	Max Fracture Height (ft)	123.1
WIDTH:	Avg width at end of pumping (in) ...	0.18

TABLE A-5

Fluid ID No. 1	BORAGEL_H3595					
Specific Gravity					1.04	
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	325	275	225	175	10	2
non-Newtonian n'	0.38	0.40	0.41	0.42	0.90	0.95
K(lb·sec/ft^2)x1000	160.82	122.80	95.44	70.51	0.34	0.05

Time History * NSI STIMPLAN 3-D Fracture Simulation
SANTOS - EM#37 (190/230/250) FINAL FRAC DESIGN

Time (min)	Pen (ft)	Pres (psi)	Rate (_BPM)	Prop (_PPG_)	Sl Vol (MGal)	Eff- ciency	Loss (_BPM)	Hght (ft)	W-Avg (in)
0.3	14	355	5.00	0.0	0.1	0.10	4.4	31	0.01
0.4	17	381	5.00	0.0	0.1	0.11	4.3	32	0.01
0.6	20	408	5.00	0.0	0.1	0.11	4.5	34	0.01
0.7	23	426	5.00	0.0	0.1	0.10	4.7	34	0.01
0.9	26	441	5.00	0.0	0.2	0.09	4.8	35	0.01
1.0	29	455	5.00	0.0	0.2	0.08	4.8	35	0.01
1.3	32	464	5.00	0.0	0.3	0.07	4.8	35	0.01
1.5	35	468	5.00	0.0	0.3	0.07	4.8	36	0.01
1.8	38	476	5.00	0.0	0.4	0.07	4.8	36	0.01
2.1	41	484	5.00	0.0	0.4	0.07	4.8	36	0.02
2.4	44	491	5.00	0.0	0.5	0.06	4.8	36	0.02
2.7	47	498	5.00	0.0	0.6	0.06	4.8	36	0.02
3.1	50	501	5.00	0.0	0.6	0.06	4.8	36	0.02
3.5	53	507	5.00	0.0	0.7	0.06	4.8	37	0.02
3.9	56	513	5.00	0.0	0.8	0.06	4.8	37	0.02
4.3	59	517	5.00	0.0	0.9	0.05	4.8	37	0.02
4.8	62	523	5.00	0.0	1.0	0.05	4.8	38	0.02
5.3	65	530	5.00	0.0	1.1	0.05	4.9	38	0.02
5.9	68	531	5.00	0.0	1.2	0.05	4.8	38	0.02
6.5	71	544	5.00	0.0	1.4	0.05	4.8	39	0.02
7.2	73	537	5.00	0.0	1.5	0.05	4.8	39	0.02
7.4	76	980	8.00	0.0	1.6	0.05	5.9	58	0.02
7.9	79	907	8.00	0.0	1.8	0.06	6.7	75	0.02
8.4	81	957	12.00	0.0	2.0	0.09	8.4	82	0.03
9.3	84	1153	15.00	0.0	2.6	0.13	11.1	123	0.03
10.3	84	938	15.00	0.0	3.2	0.16	11.3	123	0.05
10.5	87	976	15.00	0.0	3.3	0.15	14.2	123	0.05
10.6	90	942	15.00	0.0	3.4	0.15	12.4	123	0.05
10.7	93	922	15.00	0.0	3.5	0.15	12.9	123	0.05
10.9	96	913	15.00	0.0	3.6	0.15	12.6	123	0.05
11.1	99	914	15.00	0.5	3.7	0.15	12.9	123	0.05
11.3	102	915	15.00	0.5	3.8	0.15	12.9	123	0.05
11.6	105	920	15.00	0.5	4.0	0.15	13.0	123	0.05
11.9	108	925	15.00	0.5	4.2	0.15	13.2	123	0.05
12.2	111	932	15.00	1.0	4.4	0.15	13.1	123	0.05
12.5	114	940	15.00	1.0	4.6	0.15	13.1	123	0.05
Bridge Stage 5 at 13 min, at 95.4 (ft), Avg Dia/W 0.03/0.03 in									
13.4	117	1082	15.00	1.0	5.2	0.16	11.3	123	0.06
Bridge Stage 5 at 13 min, at 96.9 (ft), Avg Dia/W 0.03/0.03 in									
ScreenOut in Stage 5 at Time = 13.4 min at 110 (ft)									
14.3	117	1325	15.00	3.0	5.8	0.18	9.3	123	0.09
Bridge Stage 5 at 14 min, at 99.3 (ft), Avg Dia/W 0.03/0.05 in									
ScreenOut in Stage 5 at Time = 14.3 min at 107 (ft)									
15.3	117	1630	15.00	4.0	6.3	0.21	8.4	123	0.11
16.2	117	1960	15.00	5.0	6.9	0.23	7.7	123	0.13
17.1	117	2316	15.00	6.0	7.5	0.25	7.2	123	0.15
ScreenOut in Stage 6 at Time = 17.1 min at 104 (ft)									
18.0	117	2694	15.00	7.0	8.1	0.27	6.8	123	0.18
18.8	117	2425	0.00	0.0	8.1	0.25	6.6	123	0.17
19.7	117	2156	0.00	0.0	8.1	0.22	6.3	123	0.15
20.6	117	1886	0.00	0.0	8.1	0.20	6.0	123	0.14
21.5	117	1617	0.00	0.0	8.1	0.17	5.8	123	0.13
22.5	117	1347	0.00	0.0	8.1	0.15	5.6	123	0.12

23.5	117	1078	0.00	0.0	8.1	0.14	5.4	123	0.11
24.4	117	808	0.00	0.0	8.1	0.13	5.2	123	0.11

GEOMETRY SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) FINAL FRAC DESIGN

Dstnce (ft)	Press (psi)	W-Avg (in)	Q (_BPM)	Sh-Rate (1/sec)	Hght (ft) Total	Up	Dn	Prop	Bank Fraction	Prop (PSF)
5	2694	0.25	7.4	33	123	48	45	105	0.00	1.15
12	2693	0.22	6.4	42	108	36	41	92	0.00	1.03
15	2692	0.22	6.2	41	104	35	39	89	0.00	0.99
18	2691	0.22	5.9	41	101	33	38	86	0.00	1.02
21	2690	0.22	5.7	41	97	32	36	83	0.00	1.02
24	2688	0.22	5.4	41	94	30	34	80	0.00	1.02
27	2687	0.22	5.2	41	91	28	34	78	0.00	1.02
30	2686	0.22	5.0	41	89	25	33	76	0.00	0.99
33	2684	0.22	4.8	41	86	23	33	73	0.00	0.93
36	2683	0.21	4.6	43	82	19	33	70	0.00	1.00
39	2682	0.21	4.4	42	81	18	33	69	0.00	1.00
42	2680	0.21	4.2	40	80	18	33	68	0.00	1.00
45	2679	0.21	4.0	40	78	15	32	66	0.00	0.99
48	2678	0.21	3.8	40	77	15	32	66	0.00	0.95
51	2676	0.20	3.6	39	76	14	32	65	0.00	0.87
54	2675	0.20	3.4	39	76	13	32	64	0.00	0.91
57	2673	0.20	3.2	37	75	13	32	64	0.00	0.97
60	2672	0.20	3.0	36	75	13	31	63	0.00	0.97
63	2670	0.19	2.8	35	74	13	31	63	0.00	0.96
66	2669	0.19	2.6	33	74	13	31	63	0.00	0.89
69	2667	0.19	2.4	32	74	13	30	62	0.00	0.85
72	2666	0.19	2.2	30	73	13	30	62	0.00	0.89
75	2665	0.18	2.0	28	73	13	30	61	0.00	1.04
78	2663	0.18	1.8	26	72	13	29	61	0.00	1.03
80	2662	0.18	1.6	25	72	13	29	60	0.00	0.94
82	2661	0.18	1.5	23	71	13	28	60	0.00	0.93
84	2660	0.18	1.3	20	71	13	28	59	0.00	0.92
86	2660	0.17	1.3	21	71	13	28	59	0.00	0.91
89	2658	0.17	1.1	18	70	13	27	58	0.00	1.15
92	2657	0.16	0.9	18	66	12	24	53	0.00	1.03
95	2655	0.15	0.7	18	57	9	18	45	0.00	1.04
98	2649	0.13	0.5	25	42	4	8	31	0.00	0.91
101	2634	0.13	0.4	27	32	2	0	31	0.15	0.84
104	2626	0.13	0.3	21	32	2	0	31	0.79	1.28
107	2211	0.13	0.2	22	30	0	0	30	1.00	1.21
110	889	0.05	0.2	256	22	0	0	22	1.00	0.51
113	295	0.02	0.2	2676	18	0	0	18	1.00	0.23
116	188	0.04	0.2	1156	17	0	0	17	1.00	0.38

13	0	1	1	7	8.0	8.8	7.3	7.5	0.0	75	387	0.00	

FLUID SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) FINAL FRAC DESIGN

Stage No	Gone	Fluid ID	Prop ID	Pos (ft)	Concentration In	Now	Desgn	Fl Vol (MGal)	Ex Tim (min)	Temp (deg_F)	Visc (cp)	Fall Frac
1	1	2	1	117	0.0	0.0	0.0	0.1	0.1	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.1	0.3	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.1	0.3	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.1	0.2	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.2	0.2	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.2	0.3	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.3	0.3	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.3	0.3	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.4	0.3	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.4	0.3	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.5	0.3	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.6	0.4	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.6	0.4	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.7	0.4	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.8	0.5	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	0.9	0.5	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	1.0	0.5	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	1.1	0.6	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	1.2	0.6	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	1.4	0.4	143	6	0.00
1	1	2	1	117	0.0	0.0	0.0	1.5	0.4	143	6	0.00
2	1	1	1	117	0.0	0.0	0.0	1.5	0.9	143	11	0.00
2	1	1	1	117	0.0	0.0	0.0	1.6	0.5	143	18	0.00
2	1	1	1	117	0.0	0.0	0.0	1.8	0.7	143	22	0.00
3	1	1	1	117	0.0	0.0	0.0	1.8	1.7	143	19	0.00
3	1	1	1	117	0.0	0.0	0.0	2.0	1.0	143	14	0.00
4	1	1	1	117	0.0	0.0	0.0	2.0	1.6	143	26	0.00
4	1	1	1	117	0.0	0.0	0.0	2.6	1.0	143	12	0.00
4	1	1	1	117	0.0	0.0	0.0	3.2	1.1	143	15	0.00
4	1	1	1	117	0.0	0.0	0.0	3.3	1.0	143	15	0.00
4	1	1	1	117	0.0	0.0	0.0	3.4	1.4	143	15	0.00
4	1	1	1	117	0.0	0.0	0.0	3.5	1.1	143	20	0.00
4	1	1	1	117	0.0	0.0	0.0	3.5	1.8	143	20	0.00
5	1	1	1	117	0.5	45.3	0.0	3.6	1.5	143	20	0.00
5	1	1	1	117	0.5	45.3	0.0	3.7	1.5	143	20	0.00
5	1	1	1	109	0.5	45.3	0.0	3.8	2.2	143	86	0.00
5	1	1	1	107	0.5	45.3	0.0	4.0	1.9	143	98	0.00
5	1	1	1	107	0.5	45.3	0.0	4.1	3.4	143	294	0.00
6	1	1	1	107	1.0	45.3	0.0	4.2	3.4	143	278	0.00
6	1	1	1	107	1.0	45.3	0.0	4.4	3.7	143	352	0.00
6	0	1	1	102	1.0	20.8	0.5	4.6	4.6	143	403	0.00
6	0	1	1	98	1.0	8.9	0.9	4.6	4.6	143	408	0.00
7	0	1	1	94	2.0	13.9	1.3	5.0	3.7	143	477	0.00
8	0	1	1	89	3.0	16.2	1.8	5.1	3.7	143	490	0.00
8	0	1	1	83	3.0	10.1	2.5	5.4	2.7	143	435	0.00
9	0	1	1	76	4.0	11.4	3.0	5.7	1.8	143	387	0.00
9	0	1	1	69	4.0	8.4	3.8	5.9	1.8	143	355	0.00
10	0	1	1	60	5.0	9.6	4.3	6.1	0.9	143	327	0.00
10	0	1	1	51	5.0	7.9	5.1	6.3	0.9	143	311	0.00
11	0	1	1	41	6.0	9.0	5.4	6.6	0.0	143	304	0.00
11	0	1	1	32	6.0	7.7	6.2	6.7	0.0	143	303	0.00
12	0	1	1	23	7.0	8.7	6.4	7.1	0.0	103	331	0.00
12	0	1	1	15	7.0	7.8	7.2	7.1	0.0	80	344	0.00

PROPPANT SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) FINAL FRAC DESIGN

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
5.3	2085	1.10
12.0	1831	1.00
15.0	1738	1.00
18.0	1796	1.00
21.0	1803	1.00
24.0	1807	1.00
27.0	1795	1.00
30.0	1736	1.00
33.0	1602	0.90
36.0	1753	1.00
39.0	1749	1.00
42.0	1747	1.00
45.0	1736	1.00
48.0	1645	0.90
51.0	1467	0.90
54.0	1563	0.90
57.0	1702	1.00
60.0	1691	1.00
63.0	1680	1.00
66.0	1505	0.90
69.0	1437	0.90
72.0	1508	0.90
75.0	1836	1.00
77.6	1825	1.00
79.8	1633	0.90
82.5	1595	0.90
84.1	1574	0.90
85.7	1569	0.90
88.7	2088	1.20
91.7	1830	1.00
94.7	1849	1.00
97.7	1549	0.90
100.7	1403	0.80
103.7	2368	1.30
106.7	2207	1.20
109.7	677	0.50
112.7	61	0.20
115.7	392	0.40

Average Conductivity (md-ft) 1656

PROPPANT SUMMARY * At Fracture Closure
SANTOS - EM#37 (190/230/250) FINAL FRAC DESIGN

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
5.3	1419	0.80
12.0	1262	0.70
15.0	1278	0.80
18.0	1291	0.80
21.0	1333	0.80
24.0	1690	0.90
27.0	1688	0.90
30.0	1686	0.90
33.0	1684	0.90
36.0	1682	0.90
39.0	1683	0.90
42.0	1706	0.90
45.0	2080	1.10
48.0	1984	1.10
51.0	1959	1.00
54.0	1936	1.00
57.0	1928	1.00
60.0	1887	1.00
63.0	1988	1.10
66.0	2146	1.10
69.0	2137	1.10
72.0	2136	1.10
75.0	2053	1.10
77.6	2035	1.10
79.8	2505	1.30
82.5	2553	1.30
84.1	2512	1.30
85.7	2428	1.20
88.7	2383	1.20
91.7	3023	1.50
94.7	3069	1.50
97.7	2924	1.50
100.7	2807	1.40
103.7	2742	1.40
106.7	2326	1.20
109.7	714	0.50
112.7	64	0.20
115.7	413	0.40

Average Conductivity (md-ft) 1874

Frac Summary * SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION
Filename: EM37PF1.FRK ; Feb 12, 96

Design Data

FLUID LOSS LAYERS:	Top (ft)	Bottom (ft)	Thick (ft)	Loss Coef. (ft/sqrt(min))	Spurt (Gal/100 ft^2)
	4610.0	4643.0	33.0	0.01000	0.50
	4643.0	4690.0	47.0	0.00010	0.00
	4690.0	4745.0	55.0	0.00440	0.45
	4745.0	4900.0	155.0	0.00010	0.00

FORMATION:	Modulus (e6 psi)	6.63
	Perforated Height (ft)	30.0
	Permeability (md)	10.000
TEMPERATURE:	Bottom Hole (deg_F)	143
PRESSURE:	Reservoir Pressure (psi)	1770.0
	Closure Pressure (psi)	3300.0
DEPTH:	Well Depth (ft)	4690.0

FORMATION LAYER DATA - Multi-Layer Height Growth

Depth(ft) Top	Depth(ft) Botm	Thick	Stress (psi) Top	Stress (psi) Botm	Gradient (psi/ft)	Modulus (e6_psi)	Toughness (psi«in)
4610.0	4643.0	33.0	2100.0	2100.0	0.000	5.50	3000.0
4643.0	4675.0	32.0	4500.0	4500.0	0.000	8.00	3000.0
4675.0	4690.0	15.0	4500.0	4500.0	0.000	8.00	3000.0
4690.0	4705.0	15.0	3300.0	3300.0	0.000	6.50	3000.0
4705.0	4709.0	4.0	4000.0	4000.0	0.000	7.50	3000.0
4709.0	4720.0	11.0	3400.0	3400.0	0.000	6.50	3000.0
4720.0	4732.0	12.0	4050.0	4050.0	0.000	7.00	3000.0
4732.0	4745.0	13.0	3500.0	3500.0	0.000	6.50	3000.0
4745.0			4500.0		0.000	7.50	3000.0

	Fluid Pressure Gradient (psi/ft)	0.450
	Initial Fracture Top (ft)	4690
	Initial Fracture Bottom (ft)	4720
3-D SIMULATOR	Step Size (ft)	3.0
PROGRAM CONTROL	Time Step (min)	1.0

Calculated Results
from 3-D Simulator
STIMPLAN (TM) , NSI , Tulsa,OK
Licensed To: Internal Use - NSI Technologies

1/2 LENGTH:	'Hydraulic' length (ft)	119.3
	Propped length (ft)	117.8
PRESSURE:	Max Net Pressure (psi)	2576.6
TIME:	Max Exposure to Form. Temp. (min)	4.9
	Time to Close (min)	8.6
RATE:	Fluid Loss Rate during pad (_BPM) ..	15.05
EFFICIENCY:	at end of pumping schedule	0.32
PROPPANT:	Average In Situ Conc. (#/sq ft)	0.9
	Average Conductivity (md-ft)	1608
HEIGHT:	Max Fracture Height (ft)	140.7
WIDTH:	Avg width at end of pumping (in) ...	0.17

StimPlan 2.50 (TM). NSI Technologies, Tulsa, OK
Licensed To: Internal Use - NSI Technologies

WELL ID:		
	SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION	
DEPTH:	Well Depth (ft)	4690
PRESSURE:	Reservoir Pressure (psi)	1770
	Closure Pressure (psi)	3300
TEMPERATURE:	Bottom Hole Temperature (deg_F)	143

**** Pumping Schedule ****

Sl Vol (MGal)	Fl Vol (MGal)	Conc (_PPG_)	Rate (_BPM)	Fluid Type	Prop Type	Cum Prop (MLbs)	Pump Time (min)
1.57	1.57	0.0	4.80	2	1	0.0	7.8
0.57	0.57	0.0	8.00	1	1	0.0	1.7
0.57	0.57	0.0	13.75	1	1	0.0	1.0
0.72	0.72	0.0	14.84	1	1	0.0	1.2
0.86	0.83	0.7	15.25	1	1	0.6	1.3
0.49	0.46	1.3	15.21	1	1	1.2	0.8
0.49	0.44	2.4	15.40	1	1	2.2	0.8
0.48	0.41	3.7	15.46	1	1	3.8	0.7
0.70	0.57	5.0	15.29	1	1	6.6	1.1
0.63	0.49	6.3	15.23	1	1	9.7	1.0
0.46	0.34	7.7	16.67	1	1	12.3	0.7
0.36	0.26	8.5	16.10	1	1	14.5	0.5
0.24	0.18	7.4	16.10	1	1	15.8	0.4

Total Slurry ...	8.1	Total Fluid ...	7.4
Total Proppant ...	15.8	Avg. Conc	2.1
Total Pump Time	18.8 min		

Proppant ID No. 1	20- 40 CARBO-LITE				
Specific Gravity	2.72				
'Damage Factor'	0.60				
Proppant Stress (Mpsi)	0	2	4	8	16
KfW @ 2 #/sq ft (md-ft)	10500	9200	7600	3200	500

Fluid ID No. 2	SLICK_WATER					
Specific Gravity	1.04					
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	2	2	2	2	2	2
non-Newtonian n'	0.90	0.90	0.90	0.90	0.90	0.90
K(lb*sec/ft^2)x1000	0.07	0.07	0.07	0.07	0.07	0.07

TABLE A-6

Fluid ID No. 1	BORAGEL_H3595					
Specific Gravity					1.04	
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	400	350	275	175	10	2
non-Newtonian n'	0.38	0.40	0.41	0.42	0.90	0.95
K(lb*sec/ft^2)x1000	197.93	156.29	116.65	70.51	0.34	0.05

Time History * NSI STIMPLAN 3-D Fracture Simulation
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Time (min)	Pen (ft)	Pres (psi)	Rate (_BPM)	Prop (_PPG_)	Sl Vol (MGal)	Eff-ciency	Loss (_BPM)	Hght (ft)	W-Avg (in)
0.3	14	243	4.80	0.0	0.1	0.08	4.3	30	0.01
0.4	17	262	4.80	0.0	0.1	0.10	4.2	30	0.01
0.5	20	285	4.80	0.0	0.1	0.09	4.5	30	0.01
0.6	23	298	4.80	0.0	0.1	0.08	4.6	30	0.01
0.7	26	305	4.80	0.0	0.2	0.07	4.6	30	0.01
0.9	29	313	4.80	0.0	0.2	0.07	4.6	30	0.01
1.1	32	320	4.80	0.0	0.2	0.06	4.7	31	0.01
1.3	35	325	4.80	0.0	0.3	0.06	4.6	31	0.01
1.5	38	330	4.80	0.0	0.3	0.06	4.6	32	0.01
1.7	41	335	4.80	0.0	0.3	0.06	4.6	32	0.01
1.9	44	340	4.80	0.0	0.4	0.05	4.6	32	0.01
2.2	47	344	4.80	0.0	0.4	0.05	4.6	32	0.01
2.4	50	349	4.80	0.0	0.5	0.05	4.7	33	0.01
2.7	53	353	4.80	0.0	0.6	0.05	4.7	33	0.01
3.0	56	357	4.80	0.0	0.6	0.05	4.7	33	0.01
3.4	59	362	4.80	0.0	0.7	0.05	4.6	33	0.01
3.7	62	363	4.80	0.0	0.8	0.05	4.7	34	0.01
4.1	65	367	4.80	0.0	0.8	0.05	4.7	34	0.01
4.4	68	372	4.80	0.0	0.9	0.04	4.7	34	0.01
4.8	71	375	4.80	0.0	1.0	0.04	4.7	34	0.01
5.3	74	376	4.80	0.0	1.1	0.04	4.7	34	0.01
5.8	77	381	4.80	0.0	1.2	0.04	4.7	34	0.01
6.3	80	383	4.80	0.0	1.3	0.04	4.7	34	0.02
6.8	83	385	4.80	0.0	1.4	0.04	4.7	34	0.02
7.4	86	392	4.80	0.0	1.5	0.04	4.7	34	0.02
7.8	88	393	4.80	0.0	1.6	0.04	4.6	34	0.02
8.0	91	1249	8.00	0.0	1.6	0.05	5.8	51	0.02
8.9	94	1387	8.00	0.0	1.9	0.08	5.7	77	0.02
9.5	94	815	8.00	0.0	2.1	0.09	6.8	91	0.02
11.1	94	1162	13.75	0.0	3.1	0.13	10.5	136	0.03
12.1	95	1023	14.84	0.0	3.7	0.17	9.3	140	0.05
12.3	95	1012	15.25	0.7	3.8	0.17	15.1	141	0.05
12.4	98	999	15.25	0.7	3.8	0.17	8.9	141	0.05
12.6	101	1008	15.25	0.7	4.0	0.17	11.1	141	0.05
12.8	104	973	15.25	0.7	4.2	0.17	12.3	141	0.05
13.0	107	976	15.25	0.7	4.3	0.18	11.1	141	0.05
13.3	110	979	15.21	1.3	4.4	0.18	12.0	141	0.05
13.5	113	981	15.21	1.3	4.6	0.18	11.8	141	0.05
13.8	116	991	15.21	1.3	4.8	0.18	11.3	141	0.05
Bridge Stage 5 at 14 min, at 89.2 (ft), Avg Dia/W 0.03/0.03 in									
14.1	119	1004	15.40	2.4	5.0	0.19	11.4	141	0.06
Bridge Stage 5 at 14 min, at 92.2 (ft), Avg Dia/W 0.03/0.04 in									
ScreenOut in Stage 5 at Time = 14.1 min at 106 (ft)									
15.0	119	1227	15.40	2.4	5.6	0.21	8.8	141	0.08
Bridge Stage 5 at 15 min, at 100.9 (ft), Avg Dia/W 0.03/0.05 in									
16.0	119	1516	15.46	3.7	6.2	0.24	7.7	141	0.10
16.9	119	1831	15.29	5.0	6.8	0.27	7.0	141	0.12
17.9	119	2167	15.23	6.3	7.4	0.29	6.5	141	0.14
18.8	119	2577	16.67	7.7	8.1	0.32	6.1	141	0.17
19.9	119	2319	0.00	0.0	8.1	0.29	5.9	141	0.16
21.0	119	2061	0.00	0.0	8.1	0.26	5.5	141	0.14
22.3	119	1804	0.00	0.0	8.1	0.23	5.2	141	0.13
23.6	119	1546	0.00	0.0	8.1	0.20	5.0	141	0.12

25.0	119	1288	0.00	0.0	8.1	0.17	4.8	141	0.10
26.4	119	1031	0.00	0.0	8.1	0.14	4.6	141	0.10
27.5	119	773	0.00	0.0	8.1	0.14	4.4	141	0.09

GEOMETRY SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Dstnce (ft)	Press (psi)	W-Avg (in)	Q (_BPM)	Sh-Rate (1/sec)	Hght (ft) Total	Up	Dn	Prop	Bank Fraction	Prop (PSF)
5	2576	0.23	8.3	40	141	43	68	124	0.00	0.98
12	2575	0.21	7.2	43	128	38	60	108	0.00	1.03
15	2574	0.21	6.9	42	125	37	58	105	0.00	1.01
18	2572	0.21	6.6	42	123	36	57	103	0.00	1.02
21	2571	0.21	6.4	42	121	35	56	100	0.00	1.03
24	2569	0.21	6.1	41	118	34	54	98	0.00	1.03
27	2568	0.21	5.8	41	116	33	53	95	0.00	0.98
30	2567	0.21	5.6	40	113	32	51	93	0.00	0.90
33	2565	0.20	5.3	40	112	31	50	91	0.00	0.91
36	2564	0.20	5.1	39	110	30	50	90	0.00	0.98
39	2562	0.20	4.9	38	108	30	49	88	0.00	0.98
42	2561	0.20	4.6	37	107	29	48	87	0.00	0.97
45	2560	0.20	4.4	36	105	28	47	85	0.00	0.92
48	2558	0.20	4.2	35	103	27	46	84	0.00	0.82
51	2557	0.20	3.9	35	101	26	45	82	0.00	0.84
54	2556	0.20	3.7	34	99	25	43	80	0.00	0.93
57	2554	0.19	3.5	33	96	24	42	79	0.00	0.93
60	2553	0.19	3.2	32	95	23	41	77	0.00	0.92
63	2551	0.19	3.0	31	93	23	40	76	0.00	0.92
66	2550	0.19	2.8	29	91	22	39	74	0.00	0.82
69	2549	0.19	2.6	28	89	21	39	73	0.00	0.80
72	2547	0.19	2.4	27	88	20	38	71	0.00	0.89
75	2546	0.19	2.2	25	86	19	37	70	0.00	0.88
78	2545	0.18	1.9	24	83	18	36	68	0.00	0.79
81	2543	0.18	1.7	22	81	16	35	66	0.00	0.65
84	2542	0.18	1.5	21	79	15	34	64	0.00	0.67
87	2541	0.18	1.3	19	77	14	33	63	0.00	0.75
89	2540	0.18	1.2	17	76	13	32	62	0.00	0.69
92	2539	0.17	1.0	16	74	13	31	60	0.00	0.52
94	2538	0.15	0.8	19	65	12	23	52	0.00	0.53
94	2538	0.15	0.8	19	64	12	23	52	0.00	0.53
95	2537	0.15	0.7	19	63	11	22	51	0.00	0.53
97	2536	0.14	0.7	19	60	10	20	47	0.00	0.64
100	2532	0.13	0.5	21	48	5	13	35	0.00	0.73
103	2517	0.12	0.3	28	32	2	0	31	0.37	0.85
106	2507	0.13	0.3	20	30	0	0	30	1.00	1.38
109	532	0.03	0.2	1486	26	0	0	26	1.00	0.28
112	452	0.02	0.6	2255	18	0	0	18	1.00	0.20
115	351	0.02	0.4	4124	16	0	0	16	1.00	0.22
118	215	0.03	0.2	2285	15	0	0	15	1.00	0.29

FLUID SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Stage No	Gone	Fluid ID	Prop ID	Pos (ft)	Concentration In	Now	Desgn	Fl Vol (MGal)	Ex Tim (min)	Temp (deg_F)	Visc (cp)	Fall Frac
1	1	2	1	119	0.0	0.0	0.0	0.1	0.1	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.1	0.2	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.1	0.2	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.1	0.1	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.2	0.2	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.2	0.2	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.2	0.2	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.3	0.2	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.3	0.2	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.3	0.2	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.4	0.3	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.4	0.3	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.5	0.3	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.6	0.3	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.6	0.3	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.7	0.3	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.8	0.4	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.8	0.4	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	0.9	0.4	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	1.0	0.5	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	1.1	0.5	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	1.2	0.5	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	1.3	0.5	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	1.4	0.5	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	1.5	0.3	143	1	0.00
1	1	2	1	119	0.0	0.0	0.0	1.6	0.5	143	1	0.00
2	1	1	1	119	0.0	0.0	0.0	1.6	0.5	143	21	0.00
2	1	1	1	119	0.0	0.0	0.0	1.6	0.7	143	131	0.00
2	1	1	1	119	0.0	0.0	0.0	1.9	2.4	143	28	0.00
2	1	1	1	119	0.0	0.0	0.0	2.1	1.9	143	13	0.00
3	1	1	1	119	0.0	0.0	0.0	2.1	2.0	143	13	0.00
3	1	1	1	119	0.0	0.0	0.0	2.7	0.9	143	16	0.00
4	1	1	1	119	0.0	0.0	0.0	3.1	1.3	143	15	0.00
4	1	1	1	119	0.0	0.0	0.0	3.4	1.5	143	20	0.00
5	1	1	1	119	0.7	45.3	0.0	3.7	1.2	143	31	0.00
5	1	1	1	107	0.7	45.3	0.0	3.8	2.8	143	208	0.00
5	1	1	1	107	0.7	45.3	0.0	3.8	3.5	143	311	0.00
5	1	1	1	107	0.7	45.3	0.0	4.0	4.2	143	395	0.00
5	0	1	1	105	0.7	39.1	0.3	4.1	4.9	143	510	0.00
5	0	1	1	101	0.7	7.6	0.8	4.2	4.7	143	550	0.00
6	0	1	1	100	1.3	12.2	1.0	4.3	4.7	143	569	0.00
6	0	1	1	98	1.3	8.3	1.3	4.4	4.4	143	591	0.00
6	0	1	1	94	1.3	5.8	1.8	4.6	3.8	143	639	0.00
6	0	1	1	91	1.3	4.5	2.2	4.7	3.8	143	667	0.00
7	0	1	1	90	2.4	8.4	2.4	4.7	3.8	143	642	0.00
7	0	1	1	87	2.4	7.3	2.7	4.9	3.8	143	614	0.00
7	0	1	1	82	2.4	6.0	3.2	5.1	2.8	143	554	0.00
8	0	1	1	74	3.7	8.6	3.7	5.4	2.8	143	505	0.00
8	0	1	1	68	3.7	6.6	4.6	5.5	1.9	143	478	0.00
9	0	1	1	59	5.0	8.6	4.9	5.9	0.9	143	447	0.00
9	0	1	1	49	5.0	7.1	5.9	6.1	0.9	143	423	0.00
10	0	1	1	40	6.3	8.8	6.1	6.4	0.0	143	408	0.00
10	0	1	1	31	6.3	7.7	6.9	6.6	0.0	143	392	0.00
11	0	1	1	22	7.7	9.3	7.1	6.9	0.0	94	416	0.00
11	0	1	1	16	7.7	8.4	7.8	6.9	0.0	81	419	0.00
12	0	1	1	11	8.5	9.2	7.8	7.2	0.0	76	429	0.00
13	0	1	1	3	7.4	8.0	7.9	7.4	0.0	74	440	0.00

PROPPANT SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
5.3	1738	1.00
12.0	1853	1.00
15.0	1802	1.00
18.0	1833	1.00
21.0	1851	1.00
24.0	1851	1.00
27.0	1733	1.00
30.0	1555	0.90
33.0	1580	0.90
36.0	1741	1.00
39.0	1732	1.00
42.0	1724	1.00
45.0	1611	0.90
48.0	1380	0.80
51.0	1437	0.80
54.0	1632	0.90
57.0	1622	0.90
60.0	1615	0.90
63.0	1605	0.90
66.0	1375	0.80
69.0	1333	0.80
72.0	1532	0.90
75.0	1524	0.90
78.0	1325	0.80
81.0	1014	0.70
84.0	1056	0.70
86.7	1229	0.80
89.4	1086	0.70
92.4	719	0.50
94.0	737	0.50
94.3	744	0.50
94.9	742	0.50
96.8	991	0.60
99.8	1189	0.70
102.8	1454	0.90
105.8	2642	1.40
108.8	169	0.30
111.8	7	0.20
114.8	44	0.20
117.8	209	0.30

Average Conductivity (md-ft) 1389

PROPPANT SUMMARY * At Fracture Closure
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
5.3	1073	0.70
12.0	1332	0.80
15.0	1337	0.80
18.0	1349	0.80
21.0	1356	0.80
24.0	1438	0.80
27.0	1555	0.90
30.0	1565	0.90
33.0	1569	0.90
36.0	1566	0.90
39.0	1401	0.80
42.0	1396	0.80
45.0	1747	0.90
48.0	2018	1.10
51.0	1671	0.90
54.0	1674	0.90
57.0	1637	0.90
60.0	1513	0.80
63.0	1517	0.90
66.0	2014	1.10
69.0	2011	1.10
72.0	2011	1.10
75.0	2014	1.10
78.0	1855	1.00
81.0	2393	1.20
84.0	2153	1.10
86.7	2158	1.10
89.4	1725	0.90
92.4	2330	1.20
94.0	2584	1.30
94.3	2082	1.10
94.9	2468	1.30
96.8	2716	1.40
99.8	3235	1.60
102.8	2473	1.30
105.8	2351	1.20
108.8	177	0.30
111.8	8	0.20
114.8	46	0.20
117.8	219	0.30

Average Conductivity (md-ft) 1608

Frac Summary * SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION
Filename: EM37PF1.FRK ; Feb 12, 96

Design Data

FLUID LOSS LAYERS:	Top (ft)	Bottom (ft)	Thick (ft)	Loss Coef. (ft/sqrt(min))	Spurt (Gal/100 ft^2)
	4610.0	4643.0	33.0	0.01000	0.50
	4643.0	4690.0	47.0	0.00010	0.00
	4690.0	4745.0	55.0	0.00340	0.25
	4745.0	4900.0	155.0	0.00010	0.00

FORMATION:	Modulus (e6_psi)	6.63
	Perforated Height (ft)	30.0
	Permeability (md)	10.000
TEMPERATURE:	Bottom Hole (deg_F)	143
PRESSURE:	Reservoir Pressure (psi)	1770.0
	Closure Pressure (psi)	3300.0
DEPTH:	Well Depth (ft)	4690.0

FORMATION LAYER DATA - Multi-Layer Height Growth

-----Depth(ft)------ Top	Botm	Thick	-Stress (psi)-- Top	Botm	Gradient (psi/ft)	Modulus (e6_psi)	Toughness (psi«in)
4610.0	4643.0	33.0	2100.0	2100.0	0.000	5.50	3000.0
4643.0	4675.0	32.0	4500.0	4500.0	0.000	8.00	3000.0
4675.0	4690.0	15.0	4500.0	4500.0	0.000	8.00	3000.0
4690.0	4705.0	15.0	3300.0	3300.0	0.000	6.50	3000.0
4705.0	4709.0	4.0	4000.0	4000.0	0.000	7.50	3000.0
4709.0	4720.0	11.0	3400.0	3400.0	0.000	6.50	3000.0
4720.0	4732.0	12.0	4050.0	4050.0	0.000	7.00	3000.0
4732.0	4745.0	13.0	3500.0	3500.0	0.000	6.50	3000.0
4745.0			4500.0		0.000	7.50	3000.0

	Fluid Pressure Gradient (psi/ft)	0.450
	Initial Fracture Top (ft)	4690
	Initial Fracture Bottom (ft)	4720
3-D SIMULATOR	Step Size (ft)	3.0
PROGRAM CONTROL	Time Step (min)	1.0

Calculated Results
from 3-D Simulator
STIMPLAN (TM) , NSI , Tulsa,OK
Licensed To: Internal Use - NSI Technologies

1/2 LENGTH:	'Hydraulic' length (ft)	119.4
	Propped length (ft)	117.9
PRESSURE:	Max Net Pressure (psi)	2539.9
TIME:	Max Exposure to Form. Temp. (min)	5.3
	Time to Close (min)	10.5
RATE:	Fluid Loss Rate during pad (_BPM) ..	9.97
EFFICIENCY:	at end of pumping schedule	0.42
PROPPANT:	Average In Situ Conc. (#/sq ft)	0.9
	Average Conductivity (md-ft)	1519
HEIGHT:	Max Fracture Height (ft)	134.8
WIDTH:	Avg width at end of pumping (in) ...	0.18

StimPlan 2.50 (TM). NSI Technologies, Tulsa, OK
Licensed To: Internal Use - NSI Technologies

WELL ID:	SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION	
DEPTH:	Well Depth (ft)	4690
PRESSURE:	Reservoir Pressure (psi)	1770
	Closure Pressure (psi)	3300
TEMPERATURE:	Bottom Hole Temperature (deg_F)	143

**** Pumping Schedule ****

Sl Vol (MGal)	Fl Vol (MGal)	Conc (_PPG_)	Rate (_BPM)	Fluid Type	Prop Type	Cum Prop (MLbs)	Pump Time (min)
0.53	0.53	0.0	8.00	1	1	0.0	1.6
0.57	0.57	0.0	13.75	1	1	0.0	1.0
0.72	0.72	0.0	14.84	1	1	0.0	1.2
0.86	0.83	0.7	15.25	1	1	0.6	1.3
0.49	0.46	1.3	15.21	1	1	1.2	0.8
0.49	0.44	2.4	15.40	1	1	2.2	0.8
0.48	0.41	3.7	15.46	1	1	3.8	0.7
0.70	0.57	5.0	15.29	1	1	6.6	1.1
0.63	0.49	6.3	15.23	1	1	9.7	1.0
0.46	0.34	7.7	16.67	1	1	12.3	0.7
0.36	0.26	8.5	16.10	1	1	14.5	0.5
0.24	0.18	7.4	16.10	1	1	15.8	0.4

Total Slurry ...	6.5		Total Fluid ...	5.8
Total Proppant ...	15.8		Avg. Conc	2.7
Total Pump Time	10.9	min		

Proppant ID No. 1	20- 40 CARBO-LITE				
Specific Gravity	2.72				
'Damage Factor'	0.60				
Proppant Stress (Mpsi)	0	2	4	8	16
KfW @ 2 #/sq ft (md-ft)	10500	9200	7600	3200	500

Fluid ID No. 1	BORAGEL_H3595					
Specific Gravity	1.04					
	@Welbor	@FormTmp	@1Hr	@2Hr	@4Hr	@8Hr
vis (cp @ 170 1/sec) .	500	450	375	175	10	2
non-Newtonian n'	0.38	0.40	0.41	0.42	0.90	0.95
K(lb*sec/ft^2)x1000	247.42	200.94	159.07	70.51	0.34	0.05

TABLE A-7

Time History * NSI STIMPLAN 3-D Fracture Simulation
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Time (min)	Pen (ft)	Pres (psi)	Rate (_BPM)	Prop (_PPG_)	Sl Vol (MGal)	Eff-ciency	Loss (_BPM)	Hght (ft)	W-Avg (in)
0.1	14	790	8.00	0.0	0.0	0.34	5.3	31	0.02
0.2	17	791	8.00	0.0	0.1	0.36	5.0	36	0.03
0.2	20	853	8.00	0.0	0.1	0.34	5.6	43	0.03
0.3	23	859	8.00	0.0	0.1	0.32	6.2	50	0.03
0.4	26	888	8.00	0.0	0.1	0.29	6.3	56	0.02
0.5	29	892	8.00	0.0	0.2	0.27	6.6	63	0.02
0.7	32	882	8.00	0.0	0.2	0.24	6.9	69	0.02
1.0	35	870	8.00	0.0	0.3	0.22	6.6	76	0.02
1.2	38	866	8.00	0.0	0.4	0.23	6.2	83	0.03
1.6	41	884	8.00	0.0	0.5	0.23	6.0	90	0.03
1.7	44	924	13.75	0.0	0.6	0.25	7.7	93	0.03
1.8	47	956	13.75	0.0	0.7	0.27	8.0	95	0.04
1.9	50	967	13.75	0.0	0.7	0.28	8.5	98	0.04
2.0	53	968	13.75	0.0	0.8	0.28	9.2	100	0.04
2.2	56	966	13.75	0.0	0.9	0.29	9.3	102	0.04
2.3	59	967	13.75	0.0	1.0	0.29	9.4	105	0.04
2.5	62	969	13.75	0.0	1.0	0.29	9.4	106	0.04
2.6	65	973	13.75	0.0	1.1	0.29	9.5	108	0.04
2.8	68	986	14.84	0.0	1.2	0.30	9.8	110	0.05
3.0	71	991	14.84	0.0	1.3	0.30	9.9	112	0.05
3.1	74	996	14.84	0.0	1.4	0.30	10.1	113	0.05
3.3	77	1001	14.84	0.0	1.5	0.30	10.2	115	0.05
3.5	80	1002	14.84	0.0	1.6	0.30	10.3	117	0.05
3.6	83	1008	14.84	0.0	1.8	0.30	10.3	118	0.05
3.8	86	1010	14.84	0.0	1.9	0.30	10.3	120	0.05
4.0	89	1028	15.25	0.7	2.0	0.31	10.0	121	0.05
4.2	92	1028	15.25	0.7	2.1	0.31	10.7	123	0.05
4.4	95	1032	15.25	0.7	2.3	0.30	10.7	125	0.06
4.6	98	1033	15.25	0.7	2.4	0.30	10.6	126	0.06
4.8	101	1040	15.25	0.7	2.5	0.30	10.4	127	0.06
5.1	104	1047	15.25	0.7	2.7	0.30	10.9	129	0.06
5.3	107	1050	15.21	1.3	2.8	0.30	10.9	130	0.06
5.5	110	1052	15.21	1.3	3.0	0.30	10.8	132	0.06
5.8	113	1059	15.21	1.3	3.1	0.30	10.6	133	0.06
Bridge Stage 4 at 6 min, at 92.7 (ft), Avg Dia/W 0.03/0.04 in									
6.0	116	1065	15.21	1.3	3.3	0.30	10.8	135	0.06
Bridge Stage 4 at 6 min, at 104.0 (ft), Avg Dia/W 0.03/0.03 in									
6.8	119	1167	15.40	2.4	3.8	0.31	9.4	135	0.07
Bridge Stage 4 at 7 min, at 100.5 (ft), Avg Dia/W 0.03/0.04 in									
ScreenOut in Stage 4 at Time = 6.8 min at 112 (ft)									
7.6	119	1389	15.46	3.7	4.3	0.34	7.7	135	0.09
Bridge Stage 4 at 8 min, at 107.6 (ft), Avg Dia/W 0.03/0.05 in									
8.4	119	1642	15.29	5.0	4.8	0.36	6.9	135	0.11
9.2	119	1917	15.23	6.3	5.4	0.38	6.3	135	0.13
10.1	119	2208	15.23	6.3	5.9	0.40	5.9	135	0.15
10.9	119	2540	16.10	8.5	6.5	0.42	5.5	135	0.18
12.1	119	2286	0.00	0.0	6.5	0.38	5.2	135	0.16
13.6	119	2032	0.00	0.0	6.5	0.34	4.8	135	0.15
15.1	119	1778	0.00	0.0	6.5	0.30	4.5	135	0.13
16.7	119	1524	0.00	0.0	6.5	0.26	4.2	135	0.11
18.4	119	1270	0.00	0.0	6.5	0.22	4.0	135	0.10
20.1	119	1016	0.00	0.0	6.5	0.18	3.7	135	0.09
21.4	119	762	0.00	0.0	6.5	0.17	3.6	135	0.09

GEOMETRY SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Dstnce (ft)	Press (psi)	W-Avg (in)	Q (_BPM)	Sh-Rate (1/sec)	------Hght (ft)------- Total	Up	Dn	Prop	Bank Fraction	Prop (PSF)
5	2539	0.22	8.0	43	135	41	64	116	0.00	0.96
12	2537	0.21	7.0	40	131	39	62	111	0.00	1.02
15	2535	0.21	6.8	40	129	38	60	109	0.00	1.03
18	2534	0.21	6.5	39	127	38	59	107	0.00	1.00
21	2532	0.21	6.3	38	126	37	59	106	0.00	1.00
24	2530	0.21	6.0	38	124	36	57	104	0.00	1.00
27	2528	0.21	5.8	37	122	36	56	102	0.00	0.93
30	2526	0.21	5.5	36	120	35	55	100	0.00	0.90
33	2525	0.21	5.3	36	119	34	54	98	0.00	0.92
36	2523	0.21	5.0	35	117	33	53	96	0.00	0.92
39	2521	0.21	4.8	34	115	32	52	94	0.00	0.93
43	2519	0.20	4.5	33	113	32	51	92	0.00	0.93
46	2517	0.20	4.2	32	111	31	50	90	0.00	0.86
49	2516	0.20	4.0	31	109	30	49	89	0.00	0.85
52	2514	0.20	3.8	30	107	29	48	87	0.00	0.84
55	2512	0.20	3.5	29	105	28	47	86	0.00	0.84
58	2511	0.20	3.3	28	103	27	46	84	0.00	0.85
61	2509	0.20	3.1	27	101	26	45	82	0.00	0.94
64	2507	0.20	2.9	26	99	25	44	81	0.00	0.83
67	2506	0.19	2.7	25	97	24	42	79	0.00	0.74
70	2504	0.19	2.4	24	95	23	41	77	0.00	0.74
73	2503	0.19	2.2	23	93	22	40	75	0.00	0.77
76	2501	0.19	2.0	22	89	21	39	73	0.00	0.78
79	2499	0.19	1.8	21	87	19	37	71	0.00	0.60
82	2498	0.18	1.6	20	84	18	36	69	0.00	0.60
85	2496	0.18	1.4	19	82	17	35	67	0.00	0.61
88	2495	0.18	1.3	18	77	14	33	63	0.00	0.65
91	2493	0.17	1.1	18	73	13	30	60	0.00	0.41
94	2491	0.15	0.9	19	69	13	26	57	0.00	0.42
97	2489	0.15	0.7	19	63	11	22	51	0.00	0.46
100	2487	0.14	0.6	19	55	8	17	42	0.00	0.55
103	2484	0.13	0.4	18	49	6	13	36	0.00	0.44
106	2479	0.12	0.3	19	40	4	6	31	0.00	0.46
109	2463	0.12	0.2	19	32	2	0	31	0.07	0.59
112	2451	0.12	0.2	13	30	0	0	30	1.00	1.30
115	369	0.02	0.1	1470	24	0	0	24	1.00	0.21
118	207	0.04	0.2	644	22	0	0	22	1.00	0.36

FLUID SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Stage No	Gone	Fluid ID	Prop ID	Pos (ft)	Concentration In	Now	Desgn	Fl Vol (MGal)	Ex Tim (min)	Temp (deg_F)	Visc (cp)	Fall Frac
1	1	1	1	119	0.0	0.0	0.0	0.0	0.2	143	29	0.00
1	1	1	1	119	0.0	0.0	0.0	0.1	0.3	143	33	0.00
1	1	1	1	119	0.0	0.0	0.0	0.1	0.4	143	33	0.00
1	1	1	1	119	0.0	0.0	0.0	0.1	0.4	143	35	0.00
1	1	1	1	119	0.0	0.0	0.0	0.1	0.2	143	36	0.00
1	1	1	1	119	0.0	0.0	0.0	0.2	0.5	143	34	0.00
1	1	1	1	119	0.0	0.0	0.0	0.2	0.6	143	33	0.00
1	1	1	1	119	0.0	0.0	0.0	0.3	0.7	143	29	0.00
1	1	1	1	119	0.0	0.0	0.0	0.4	0.6	143	32	0.00
1	1	1	1	119	0.0	0.0	0.0	0.5	0.6	143	32	0.00
2	1	1	1	119	0.0	0.0	0.0	0.5	0.6	143	32	0.00
2	1	1	1	119	0.0	0.0	0.0	0.6	0.7	143	33	0.00
2	1	1	1	119	0.0	0.0	0.0	0.7	0.7	143	33	0.00
2	1	1	1	119	0.0	0.0	0.0	0.7	0.9	143	33	0.00
2	1	1	1	119	0.0	0.0	0.0	0.8	0.9	143	34	0.00
2	1	1	1	119	0.0	0.0	0.0	0.9	1.0	143	34	0.00
2	1	1	1	119	0.0	0.0	0.0	1.0	1.2	143	34	0.00
2	1	1	1	119	0.0	0.0	0.0	1.0	1.2	143	34	0.00
2	1	1	1	119	0.0	0.0	0.0	1.1	1.3	143	34	0.00
3	1	1	1	119	0.0	0.0	0.0	1.1	1.3	143	34	0.00
3	1	1	1	119	0.0	0.0	0.0	1.2	1.3	143	34	0.00
3	1	1	1	119	0.0	0.0	0.0	1.3	1.4	143	35	0.00
3	1	1	1	119	0.0	0.0	0.0	1.4	1.4	143	35	0.00
3	1	1	1	119	0.0	0.0	0.0	1.5	1.6	143	35	0.00
3	1	1	1	119	0.0	0.0	0.0	1.6	1.7	143	37	0.00
3	1	1	1	119	0.0	0.0	0.0	1.8	1.8	143	47	0.00
3	1	1	1	119	0.0	0.0	0.0	1.8	2.3	143	47	0.00
4	1	1	1	119	0.7	45.3	0.0	1.9	2.1	143	47	0.00
4	1	1	1	119	0.7	45.3	0.0	2.0	1.9	143	64	0.00
4	1	1	1	113	0.7	45.3	0.0	2.1	3.3	143	419	0.00
4	1	1	1	113	0.7	45.3	0.0	2.3	4.7	143	749	0.00
4	0	1	1	111	0.7	22.5	0.4	2.4	5.3	143	831	0.00
4	0	1	1	107	0.7	6.8	0.8	2.5	5.1	143	776	0.00
4	0	1	1	104	0.7	4.3	1.2	2.7	4.8	143	802	0.00
5	0	1	1	102	1.3	8.0	1.4	2.7	4.8	143	811	0.00
5	0	1	1	100	1.3	6.3	1.7	2.8	4.6	143	783	0.00
5	0	1	1	96	1.3	4.7	2.1	2.9	4.1	143	785	0.00
5	0	1	1	92	1.3	3.8	2.6	3.1	4.1	143	802	0.00
5	0	1	1	90	1.3	3.3	2.9	3.1	4.1	143	811	0.00
6	0	1	1	87	2.4	6.3	3.1	3.2	3.3	143	808	0.00
6	0	1	1	81	2.4	5.2	3.7	3.5	3.3	143	754	0.00
7	0	1	1	75	3.7	7.8	4.0	3.6	2.5	143	710	0.00
7	0	1	1	69	3.7	6.5	4.7	3.9	2.5	143	672	0.00
8	0	1	1	61	5.0	8.6	5.0	4.1	1.7	143	637	0.00
8	0	1	1	52	5.0	7.2	5.8	4.5	0.8	143	598	0.00
9	0	1	1	44	6.3	9.1	5.9	4.5	0.8	143	573	0.00
9	0	1	1	37	6.3	8.0	6.7	4.9	0.0	143	552	0.00
9	0	1	1	28	6.3	7.3	7.3	5.0	0.0	109	555	0.00
10	0	1	1	21	7.7	8.9	7.4	5.3	0.0	84	557	0.00
11	0	1	1	15	8.5	9.8	7.4	5.3	0.0	80	547	0.00
11	0	1	1	11	8.5	9.1	8.0	5.5	0.0	76	534	0.00
12	0	1	1	3	7.4	7.8	8.0	5.7	0.0	73	526	0.00

PROPPANT SUMMARY * At End of Pumping Schedule
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
5.3	1693	1.00
12.0	1821	1.00
15.0	1848	1.00
18.0	1780	1.00
21.0	1778	1.00
24.0	1779	1.00
27.0	1640	0.90
30.0	1569	0.90
33.0	1612	0.90
36.0	1615	0.90
39.5	1618	0.90
42.9	1638	0.90
45.9	1469	0.90
48.9	1440	0.80
51.9	1432	0.80
54.9	1423	0.80
57.9	1451	0.90
60.9	1641	0.90
63.9	1412	0.80
66.9	1215	0.70
69.9	1208	0.70
72.9	1266	0.80
75.9	1296	0.80
78.9	894	0.60
81.9	885	0.60
84.9	920	0.60
87.9	1013	0.70
90.9	459	0.40
93.9	486	0.40
96.9	579	0.50
99.9	784	0.60
102.9	539	0.40
105.9	573	0.50
108.9	872	0.60
111.9	2459	1.30
114.9	26	0.20
117.9	357	0.40

Average Conductivity (md-ft) 1287

PROPPANT SUMMARY * At Fracture Closure
SANTOS - EM#37 (190/230/250) POST-FRAC EVALUATION

Lb/Sq-Ft Lost to Embedment 0.200

Distance (ft)	KfW (md-ft)	Prop Concentration(Total lb/sq foot) Prop ID--> 1
5.3	1004	0.60
12.0	1192	0.70
15.0	1198	0.70
18.0	1205	0.70
21.0	1225	0.70
24.0	1302	0.80
27.0	1284	0.70
30.0	1290	0.80
33.0	1295	0.80
36.0	1301	0.80
39.5	1876	1.00
42.9	1941	1.00
45.9	1907	1.00
48.9	1903	1.00
51.9	1900	1.00
54.9	1917	1.00
57.9	1512	0.80
60.9	1510	0.80
63.9	1508	0.80
66.9	1507	0.80
69.9	1535	0.90
72.9	1949	1.00
75.9	1810	1.00
78.9	1644	0.90
81.9	1643	0.90
84.9	2180	1.10
87.9	1589	0.90
90.9	1377	0.80
93.9	1297	0.80
96.9	1912	1.00
99.9	1651	0.90
102.9	2539	1.30
105.9	1804	1.00
108.9	2001	1.10
111.9	2281	1.20
114.9	27	0.20
117.9	374	0.40

Average Conductivity (md-ft) 1519

APPENDIX B

Svc. Co. Treatment Job Log