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DETERMINATION OF THE OPTIMUM MASSIVE HYDRAULIC
FRACTURING DESIGN FOR THE STIMULATION OF THE WASATCH
AND MESA VERDE FORMATIONS

Annual Report

By
Robert G. Merrill

July 1978

Work Performed Under Contract No. EY-76-C-08-0681

Gas Producing Enterprises, Inc./
CIG Exploration, Inc.
Denver, Colorado

U. S. DEPARTMENT OF ENERGY

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Robert G. Merrill

Gas Producing Enterprises, Inc./
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P. O. Box 749
Denver, Colorado 80201

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PREPARED FOR

U. S. DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE

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ANNUAL REPORT

Abstract

The MHF project in the Natural Buttes Unit, Bitter Creek Field, Utah has progressed through five of the eight phases of the scheduled program. The last three phases of the program are in progress. Two of the three remaining phases should be finished by 10-1-78, with the testing of CIGE 21-15-10-22 to continue until approximately 1-1-79. Results from this project indicate that MHF stimulations of low permeability sands such as the Mesa Verde-Wasatch are economically high risk. The technology necessary to perform an MHF is adequate, however the results anticipated must be carefully evaluated with respect to economics.

Introduction

The experiment started in the Natural Buttes Unit with the stimulation of Natural Buttes Unit No. 18 as Phase I of the DOE (formerly ERDA) project. Fracture treatment of Natural Buttes Unit No. 19 completed Phase II. An old existing well, Natural Buttes Unit No. 14, in the field was fractured in Phase III. Natural Buttes Unit No. 20 was treated using limited entry placement for Phase IV. Phase V is in progress; six zones are scheduled for testing and if gas bearing, additional zones will be selected for MHF. Phase VI was comprised of two wells, Natural Buttes Unit No. 22 and Natural Buttes Unit No. 9. Both No. 22 and No. 9 were stimulated successfully. Phase VII is in progress, and will comprise of two separate MHF stages. By separating the stages of the treatment we hope to be able to evaluate the logging data more accurately. The last phase is also in progress with an MHF scheduled for the third quarter of 1978, fourth quarter of the DOE fiscal year.

Discussion

Phase I - Natural Buttes Unit No. 18

The well was fraced with 9000 gallons of 15% HCl, 695,000 gallons of Versagel, 100,000 pounds of 40-60 sand and 1,380,000 pounds of 20-40 sand. The treatment was pumped in nine stages separated by ball sealers use as diverting agents. The well was placed on production on September 30, 1976 and made a total of 455 MMCF since the date of first sales, and is now producing at an average rate of 910 MCFD.

Frac fluid was a low residue guar gum derivative which has been cross linked to give the viscosity desired to hold the proppant in suspension. This suspension allows the proppant to be placed into the fracture in a vertical column and held there until the fracture closes thus trapping the sand grains. After a predetermined period of time, the gel breaks and may then be flowed back to the wellbore, leaving the sand distributed in a vertical column.

Phase II - Natural Buttes Unit No. 19

Gas production from this well has totaled 16.2 MMCF since it was treated by MHF. It is now producing at an average rate of 52 MCFD and is the only well that has been treated in two separate sections. The first section consisted of the lower nine zones treated with 363,000 pounds of 40-60 sand, 61,000 pounds of 100 mesh sand, 274,846 gallons of guar gum gel, 5000 gallons of 15% HCl and 485,000 SCF nitrogen. Please see text of the September, 1976 Monthly Report for details of this work.

The upper section from 7224' - 8676' was perforated and treated with the following: 6500 gallons of 15% HCl, 358,302 gallons of fluid, 72,000 pounds of 100 mesh sand, 712,000 pounds of 40-60 sand and 555,000 SCF of nitrogen. Please see text of the September, 1976 Monthly Report for details of this work.

The thin fluid used on this well was designed to create a fracture and then fill this fracture with sand using a technique known as the equilibrium bank method. This method has been used successfully in other areas and other formations and quite extensively throughout the industry. The purpose of using this method was to try to determine the ability of these fluids to obtain long frac wings and stay within the sand boundaries.

Phase III - Natural Buttes Unit No. 14

Since many old wells exist in the Rocky Mountain Basins that are completed in low permeability reservoirs, but which are only low volume producers, it was desirable to attempt an MHF on one of these types of wells to determine the feasibility of using this technique on other such wells. Natural Buttes Unit No. 14 was treated with 1,053,000 pounds of 20-40 sand, 40,000 pounds of 40-60 sand, 544,000 gallons of low residue cross linked gelled fluid, 32,000 gallons of prepad and 8,000 gallons of 15% non-emulsifying acid. Natural Buttes Unit No. 14 was placed on initial production in October, 1974 and was fraced on March 15, 1977. Total production before fracing was 51 MMCF. The well has made 265 MMCF since the treatment.

Sandia Laboratories studied the MHF and took data by electrical potential methods.

Results from the frac treatment of Natural Buttes Unit No. 14 are so encouraging that another old well has been added to the program.

Phase IV - Natural Buttes Unit No. 20

MHF using the limited entry technique was performed on June 22, 1977 on Natural Buttes Unit No. 20 using the following materials: 2,600 gallons 7½% HCl, 10,000 gallons 2% KCl, 309,000 gallons YF4 PSD, 56,000 pounds 100 mesh sand, 745,000 pounds 40-60 sand and 25,000 pounds 20-40 glass beads and radioactive tracer sand. A Gamma-ray log was run and covered seven of the eight zones treated. All seven of the zones showed traces of radioactive sand indicating that the zones took fluid during the MHF treatment. Natural Buttes Unit No. 20 was placed on production in July, 1977. Cumulative production as of 8-1-78 was 244 MMCF.

Phase V - Natural Buttes Unit No. 21

Reservoir and production testing was initiated on this well by perforating zones at 8509' - 8513'. Core studies are being performed by Terra Tek.

Phase VIa - Natural Buttes Unit No. 22

A TDT log was run and perfs have been picked. A CBL log was also run on this well and showed top of cement at 5500'. Natural Buttes Unit No. 22 was fractured with the following:

3500 gallons 7½% HCl, 12,000 gallons 2% KCl water pad, 478,758 gallons YF4 PSD, plus 25,000 pounds 20-40 glass beads, 60,000 pounds 100 mesh and 1,066,000 pounds 40-10 mesh Ottawa sand on 11-21-77. ISIP - 2700 psig, 5 minutes SIP 2400 psig, 10 minutes SIP 2300 psig, 15 minutes SIP 2300 psig. Average frac pump rate - 45 barrels per minute. Average treating pressure 4900 psi. Maximum treating pressure 7100 psig. Maximum rate 55 barrels per minute. See Appendix D for treatment report.

Since stimulation this well has produced a total of 37 MMCF.

Phase VIb - Natural Buttes Unit No. 9

Natural Buttes Unit No. 9 was treated with the following:

7000 gallons of 7½% HCl, 35,000 gallons 2% KCl water pad slicked with 10#/1000 gallons of fluid with guar gum, 56,000 gallons 2% KCl water base with 60# guar gum/1000 gallons of fluid, 258,000 gallons of 40# gel, 28,000 pounds 100 mesh Ottawa sand, 525,000 pounds 40-60 mesh Ottawa sand, 2,200 pounds 50/50 Unibeads, 174 - 7/8" RCN balls of 1.4⁺ specific gravity and 110 tons of CO₂ on April 1, 1978.

Since treatment this well has made 36,017 MCF.

Phase VII - Natural Buttes Unit No. 2 (CIGE #2-29-10-21)

Perforating will be performed in two stages on this well as will the actual stimulation work. By treating this well in separate stages, we hope to gain some information that will help to evaluate logs over the Wasatch-Mesa Verde formations throughout the Uintah Basin.

Phase VIII - Natural Buttes Unit No. 23 (CIGE #23-7-10-22)

Logs are being studied and an MHF design is being prepared.

Summary

The experiment is progressing satisfactorily. The economics of drilling and fracturing tight, low permeability sands such as the Mesa Verde do not appear attractive at this time.

Some of the factors that detract from the economics are high drilling costs, extremely high fracturing costs, water production, and the high risk associated with the drilling and fracturing.

Forecast of Work During the Third Year of the DOE Contract

Phase V - Natural Buttes Unit No. 21

Test six zones, perform core analysis, and evaluate for MHF. If an MHF is not recommended, then the phase will be considered terminated.

Phase VII - Natural Buttes Unit No. 2 (CIGE #2-29-10-21)

Perform MHF in two stages.

Phase VIII - Natural Buttes Unit No. 23 (CIGE #23-7-10-22)

Perform MHF on best zones only, using information particularly from Phase VII.

Introduction

During August, 1977, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 20,531 MCF in 31 days for an average flow rate of 662 MCFD.
- II Natural Buttes Unit No. 19 produced at an average rate of 63 MCFD for 31 days.
- III Natural Buttes Unit No. 14 produced at an average rate of 603 MCFD for 31 days.
- IV Natural Buttes Unit No. 20 produced at an average rate of 1085 MCFD for 31 days.
- V Natural Buttes Unit No. 21 is waiting on rotary tools. Anderson Rig #5 is finishing up another well in the Natural Buttes Unit and will be moving to this well during September.
- VIa Natural Buttes Unit No. 22 was drilled to 8622' and 4½" N-80, 13.5# 8rd R-3 casing was run and set at 8622'. PBD is 8605'. Ran TDT and CBL log. Perfs have been picked and we are presently designing a frac job.
- VIb Natural Buttes Unit No. 9 is being cleaned out and prepared for fracing.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced well for 31 days. See attached production graph.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 31 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 31 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 31 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Making preparations to move rotary tools.

VI Phase VIa - Natural Buttes Unit No. 22

A TDT log was run and perfs have been picked. A CBL log was also run on this well and showed top of cement at 5500'.

Phase VIb - Natural Buttes Unit No. 9

Moved in a workover rig and cleaned out to 8959'. Attempt to run a casing inspection log failed and preparations are being made to go in hole with packer and tubing to approximately 5500'.

Introduction

During September, 1977, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 18,382 MCF in 30 days for an average flow rate of 613 MCFD.
- II Natural Buttes Unit No. 19 produced at an average rate of 40 MCFD for 30 days.
- III Natural Buttes Unit No. 14 produced at an average rate of 584 MCFD for 30 days.
- IV Natural Buttes Unit No. 20 produced at an average rate of 1039 MCFD for 30 days.
- V Natural Buttes Unit No. 21 is preparing to cut core #1 at 4389'.
- VIA Natural Buttes Unit No. 22 was drilled to 8622' and 4½" N-80, 13.5# 8rd R-3 casing was run and set at 8622'. PBTD is 8605'. Ran TDT and CBL log. Perfs have been picked, a MHF treatment designed and submitted to ERDA for approval of the design and service company contracts.
- VIB Natural Buttes Unit No. 9 was cleaned out to 8959 PBTD and tubing and packer were run and set at 5492'.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced well for 30 days. See attached production graph.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 30 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 30 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 30 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Drilled to 4389' and preparing to cut core #1. Will attempt to obtain oriented core.

VI Phase VIa - Natural Buttes Unit No. 22

A TDT log was run and perfs have been picked. A CBL log was also run on this well and showed top of cement at 5500'. MHF design and service company contracts have been submitted to ERDA for approval.

Phase VIb - Natural Buttes Unit No. 9

Moved in a workover rig and cleaned out to 8959'. An attempt to run a casing inspection log failed. Went in hole with packer and tubing to 5492'. MHF is being redesigned to allow treatment to be pumped down tubing only. This design should be completed in late October or early November.

Introduction

During October, 1977, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 17,497 MCF in 28 days for an average flow rate of 625' MCFD.
- II Natural Buttes Unit No. 19 produced at an average rate of 33 MCFD for 28 days.
- III Natural Buttes Unit No. 14 produced at an average rate of 529 MCFD for 31 days.
- IV Natural Buttes Unit No. 20 produced at an average rate of 668 MCFD for 31 days.
- V Natural Buttes Unit No. 21 is coring at 8435'.
- VIA Natural Buttes Unit No. 22 was drilled to 8622' and 4½" N-80, 13.5# 8rd R-3 casing was run and set at 8622'. PBTD is 8605'. Ran TDT and CBL log. NBU No. 22 was perforated and is waiting to be fraced.
- VIB Natural Buttes Unit No. 9 was cleaned out to 8959 PBTD and tubing and packer were run and set at 5492'. MHF was designed and is waiting to be fraced.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced well for 28 days. See attached production graph.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 28 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 31 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 31 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Drilled to 8435' and we are cutting core #11. See Appendix A for daily reports. See Appendix B for core descriptions CIGE #21. See Appendix C for mud log daily reports CIGE #21.

VI Phase VIa - Natural Buttes Unit No. 22

A TDT log was run and perfs have been picked. A CBL log was also run on this well and showed top of cement at 5500'. MHF design and service company contracts have been submitted to ERDA for approval. Well was perforated and is now waiting frac treatment.

Phase VIb - Natural Buttes Unit No. 9

Moved in a workover rig and cleaned out to 8959'. An attempt to run a casing inspection log failed. Went in hole with packer and tubing to 5492'. MHF was redesigned to allow treatment to be pumped down tubing only. This design will be sent out to obtain bids for proposed work, and this well should be treated by late November or early December.

Introduction

During November, 1977, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 18,092 MCF in 30 days for an average flow rate of 603 MCFD.
- II Natural Buttes Unit No. 19 produced at an average rate of 17 MCFD for 17 days.
- III Natural Buttes Unit No. 14 produced at an average rate of 562 MCFD for 30 days.
- IV Natural Buttes Unit No. 20 produced at an average rate of 653 MCFD for 18 days.
- V Natural Buttes Unit No. 21 is shut in, waiting on cased hole logging.
- VIa Natural Buttes Unit No. 22 was fraced on November 21, 1977.
- VIb Natural Buttes Unit No. 9 was cleaned out to 8959 PBTD and tubing and packer were run and set at 5492'. MHF was designed and is waiting to be fraced. Bids were received and are being evaluated.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced well for 30 days. See attached production graph.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 17 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 30 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 18 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Drilled to TD of 8788'. See Appendix A for daily drilling reports. See Appendix B for core descriptions. See Appendix C for mud log daily reports. 5½" casing, 20 pound, N-80, 8rd casing was run and set at 8788'. 5½" casing was cemented with 15 barrels of CW-100, 2000 sacks 50+50 poz with 6% gel, plus 18% Salt plus 0.5% D-45 TIC, plus 5 pounds per sack Gilsonite.

Displaced plug with 2% KCl water. Pumped plug with 4,000 psi at 2:00 p.m. November 16, 1977. Cut off casing. Nipple down Blow Out Preventers and install tubing head. Clean mud tanks and release rig at 6:00 a.m. November 17, 1977.

VI Phase VIa - Natural Buttes Unit No. 22

A TDT log was run and perfs have been picked. A CBL log was also run on this well and showed top of cement at 5500'. Natural Buttes Unit No. 22 was fraced with the following:

3500 gallons 7½% HCl, 12,000 gallons 2% KCl water pad, 478,758 gallons YF4-PSD, plus 25,000 pounds 20-40 glass beads, 60,000 pounds 100 mesh and 1,066,000 pounds 40-10 mesh Ottawa sand on 11-21-77. ISIP - 2700 psig, 5 minutes SIP 2400 psig, 10 minutes SIP 2300 psig, 15 minutes SIP 2300 psig. Average frac pump rate - 45 barrels per minute. Average treating pressure 4900 psi. Maximum treating pressure 7100 psig. Maximum rate 55 barrels per minute. See Appendix D for treatment report.

Phase VIb - Natural Buttes Unit No. 9

Moved in a workover rig and cleaned out to 8959'. An attempt to run a casing inspection log failed. Went in hole with packer and tubing to 5492'. MHF was redesigned to allow treatment to be pumped down tubing only. Bids are being evaluated and recommendations will be submitted to DOE (ERDA) in the near future.

Introduction

During December, 1977, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 17,060 MCF in 31 days for an average flow rate of 550 MCFD.
- II Natural Buttes Unit No. 19 produced at an average rate of 12 MCFD for 31 days.
- III Natural Buttes Unit No. 14 produced at an average rate of 578 MCFD for 31 days.
- IV Natural Buttes Unit No. 20 produced at an average rate of 593 MCFD for 31 days.
- V Natural Buttes Unit No. 21 is shut in, waiting on completion.
- VIa Natural Buttes Unit No. 22 is flowing to pit cleaning up after frac.
- VIb Natural Buttes Unit No. 9 was cleaned out to 8959 PBTD and tubing and packer were run and set at 5492'. MHF was designed and is waiting to be fraced. Bids were received. MHF will be re-bid due to time factor.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced well for 31 days. See attached production graph.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 31 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 31 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 31 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Waiting on completion. Ray TDT, CN., Experimental Long Spaced Sonic on December 13, 1977. See Appendix A for daily drilling reports. See Appendix B for core descriptions.

VI Phase VIa - Natural Buttes Unit No. 22

A TDT log was run and perfs have been picked. A CBL log was also run on this well and showed top of cement at 5500'. Natural Buttes Unit No. 22 was fraced with the following:

3500 gallons 7½% HCl, 12,000 gallons 2% KCl water pad, 478,758 gallons YF4-PSD, plus 25,000 pounds 40-60 Ottawa Sand, 60,000 pounds 100 mesh sand, flushed with 125 barrels slick 2% KCl. ISIP - 2700 psig, 5 minutes SIP 2400 psig, 10 minutes SIP 2300 psig, 15 minutes SIP 2300 psig. Average frac pump rate - 45 barrels per minute. Average treating pressure 4900 psi. Maximum treating pressure 7100 psig. Maximum rate 55 barrels per minute. See Appendix C for treatment report.

Well is not flowing to pit to clean up. A gamma tool was run. Tubing was run in the hole and cleaned out to 8500'. See Appendix D for daily reports.

Phase VIb - Natural Buttes Unit No. 9

Moved in a workover rig and cleaned out to 8959'. An attempt to run a casing inspection log failed. Went in hole with packer and tubing to 5492'. MHF was redesigned to allow treatment to be pumped down tubing only. MHF is being re-bid and recommendations will be submitted to DOE (ERDA) in the near future.

Introduction

During January, 1978, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 17,359 MCF in 31 days for an average flow rate of 560 MCFD.
- II Natural Buttes Unit No. 19 produced a total of 409 MCF at an average rate of 13 MCFD for 31 days.
- III Natural Buttes Unit No. 14 produced a total of 16,361 MCF at an average rate of 528 MCFD for 31 days.
- IV Natural Buttes Unit No. 20 produced a total of 9877 MCF at an average rate of 319 MCFD for 31 days.
- V Natural Buttes Unit No. 21 is shut in, waiting on completion.
- VIa Natural Buttes Unit No. 22 is being cleaned out to PBTD and flowing to pit to unload frac fluids.
- VIb Natural Buttes Unit No. 9 was cleaned out to 8959' PBTD and tubing and packer were run and set at 5492'. MHF was designed and is waiting to be fraced. Rebids were received.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced well for 31 days. See attached production graph.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 31 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 31 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 31 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Waiting on completion.
- VI Phase VIa - Natural Buttes Unit No. 22
Well is now flowing to pit to clean up.

Phase VIb - Natural Buttes Unit No. 9

Subcontractor was recommended to DOE for proposed stimulation treatment. Now waiting on DOE approval.

VII Phase VII - CIGE #2-29-10-21

Well was drilled to 9895'. 4½", 13.5#, N-80, 8rd, R-3 casing was run to 9895' and cemented in place w/1950 sx 50:50 poz 1/8% gel + 18% salt + 0.5% TIC + 5# /sx Gilsonite + 1150 sx RFC cement w/5#/sx Gilsonite. Logs run in the open hole were DIL, CNL-FDC and GR-BHC Sonic. Logs are being studied to pick perfs and prepare an MHF design.

VIII Phase VIII - CIGE #23-7-10-22

The well was drilled to 9560' and 4½", 13.5#, N-80, 8rd, R-3 casing was run to bottom. The 4½" casing was cemented in place w/1960 sx 50:50 poz + 6% gel + 10% salt + 0.5% D-45 + 0.2% D-13 + 5#/sx Gilsonite. Tail slurry: 1510 sx 10.0 RFC + 10% D-53 + 0.2% D-74 + 5#/sx Gilsonite. PD 11:30 p.m., 12-31-77. Logs are being studied and MHF design is being prepared.

Forecast of Work for February, 1978

I Phase I - Natural Buttes Unit No. 18

Continue flowing well to sales.

II Phase II - Natural Buttes Unit No. 19

Study for workover or plug and abandon.

III Phase III - Natural Buttes Unit No. 14

Continue flowing well to sales.

IV Phase IV - Natural Buttes Unit No. 20

Continue flowing well to sales.

V Phase V - Natural Buttes Unit No. 21

Analyze cores and logs.

VI Phase VIa - Natural Buttes Unit No. 22

Flow well to clean up.

Phase VIb - Natural Buttes Unit No. 9

MHF is being re-bid and recommendations will be prepared and submitted to DOE (ERDA) for approval.

VII Phase VII - CIGE #2-29-10-21

Study logs for perfs and prepare MHF design. Obtain bids and submit to DOE for approval.

VIII Phase VIII - CIGE #23-7-10-22

Study logs for zones of interest and prepare MHF design. Solicit bids and submit above for DOE approval.

Introduction

During February, 1978, the following work was accomplished:

- I Natural Buttes No. 18 produced a total of 13,195 MCF in 28 days for an average flow rate of 471 MCFD.
- II Natural Buttes Unit No. 19 produced a total of 564 MCF at an average rate of 20 MCFD for 28 days.
- III Natural Buttes Unit No. 14 produced a total of 14,461 MCF at an average rate of 516 MCFD for 28 days.
- IV Natural Buttes Unit No. 20 produced a total of 1,398 MCF at an average rate of 50 MCFD for 28 days.
- V Natural Buttes Unit No. 21 is shut in, waiting on completion.
- VIa Natural Buttes Unit No. 22 is flowing to pit to unload frac fluids.
- VIb Natural Buttes Unit No. 9 waiting on DOE approval.
- VII Natural Buttes Unit No. 2 (CIGE #2-29-10-21) is shut in waiting on DOE approval of proposed program.
- VIII Natural Buttes Unit No. 23 (CIGE #23-7-10-22) is shut in waiting on completion.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced well for 28 days. See attached production graph.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 28 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 28 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 28 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Waiting on completion

VI Phase VIa - Natural Buttes Unit No. 22

Well is flowing to pit to clean up.

Phase VIb - Natural Buttes Unit No. 9

Subcontractor was recommended to DOE for proposed stimulation treatment. Now waiting on DOE approval.

VII Phase VII - CIGE #2-29-10-21

Well was drilled to 9895'. 4½", 13.5#, N-80, 8rd, R-3 casing was run to 9895' and cemented in place w/1950 sx 50:50 poz 1/8% gel + 18% salt + 0.5% TIC + 5#/sx Gilsonite + 1150 sx RFC cement w/5#/sx Gilsonite. Logs run in the open hole were DIL, CNL-FDC and GR-BHC Sonic. A completion program was recommended to DOE. Now waiting on DOE approval.

VIII Phase VIII - CIGE #23-7-10-22

The well was drilled to 9560' and 4½", 13.5#, N-80, 8rd, R-3 casing was run to bottom. The 4½" casing was cemented in place w/1960 sx 50:50 poz + 6% gel + 10% salt + 0.5% D-45 + 0.2% D-13 + 5#/sx Gilsonite. Tail slurry: 1510 sx 10.0 RFC + 10% D-53 + 0.2% D-74 + 5#/sx Gilsonite. PD 11:30 p.m., 12-31-77. Logs are being studied and MHF design is being prepared. This completion depends on results of lower part of CIGE #2-29-10-21 completion.

Forecast of Work for March, 1978

I Phase I - Natural Buttes Unit No. 18

Continue flowing well to sales.

II Phase II - Natural Buttes Unit No. 19

Study for workover or plug and abandon.

III Phase III - Natural Buttes Unit No. 14

Continue flowing well to sales.

IV Phase IV - Natural Buttes Unit No. 20

Continue flowing well to sales.

V Phase V - Natural Buttes Unit No. 21

Analyze cores and logs. Begin production testing of isolated zones.

VI Phase VIa - Natural Buttes Unit No. 22

Flow well to clean up.

Phase VIb - Natural Buttes Unit No. 9

Expect to perform MHF as soon as DOE approval is received.

VII Phase VII - CIGE #2-29-10-21

When DOE approves procedure we will obtain bids and submit to DOE for approval.

VIII Phase VIII - CIGE #23-7-10-22

Study logs for zones of interest and prepare MHF design.
Solicit bids and submit above for DOE approval.

Introduction

During March, 1978, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 14,453 MCF in 28 days for an average flow rate of 516 MCFD.
- II Natural Buttes Unit No. 19 produced a total of 322 MCF at an average rate of 10 MCFD for 31 days.
- III Natural Buttes Unit No. 14 produced a total of 15,421 MCF at an average rate of 497 MCFD for 31 days.
- IV Natural Buttes Unit No. 20 produced a total of 25,584 MCF at an average rate of 825 MCFD for 31 days.
- V Natural Buttes Unit No. 21 is shut in, waiting on completion.
- VIa Natural Buttes Unit No. 22 is flowing to pit to unload frac fluids.
- VIIb Natural Buttes Unit No. 9 was fraced and is now flowing to pit for clean up.
- VII Natural Buttes Unit No. 2 (CIGE #2-29-10-21) is shut in waiting on DOE approval of proposed program.
- VIII Natural Buttes Unit No. 23 (CIGE #23-7-10-22) is shut in waiting on completion.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced well for 28 days. See attached production graph.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 31 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 31 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 31 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Is waiting on completion.

VI Phase VIa - Natural Buttes Unit No. 22

Produced well for 28 days. First production: February 1, 1978.
Actual February production: 10,285 MCF.

Phase VIb - Natural Buttes Unit No. 9

Was treated with 7000 gallons of 7½% HCl acid, 35,000 gallons 2% KCl pads w/10#/1000 gallons guar gum, 56,000 gallons 2% KCl w/60#/1000 gallons guar gum gel, 258,000 gallons 2% KCl water w/40#/1000 gallons guar gum gel, 28,000# 100 mesh Ottawa Sand, 525,000# 40-60 mesh Ottawa Sand, 2200# 50/50 Unibeads, 174 - 7/8" RCN balls of 1.4+ specific gravity, and 110 tons of CO₂. (See attached treatment report for additional details.)

Well was shut in overnight and opened up to return frac fluids to the pit at 10:00 a.m. April 2, 1978.

VII Phase VII - CIGE #2-29-10-21

Was drilled to 9895'. 4½", 13.5#, N-80, 8rd, R-3 casing was run to 9895' and cemented in place w/1950 sx 50:50 poz 1/8% gel + 18% salt + 0.5% TIC + 5#/sx Gilsonite + 1150 sx RFC cement w/5#/sx Gilsonite. Logs run in the open hole were DIL, CNL-FDC and GR-BHC Sonic. A completion program was recommended to DOE. Now waiting on DOE approval.

VIII Phase VIII - CIGE #23-7-10-22

Was drilled to 9560' and 4½", 13.5#, N-80, 8rd, R-3 casing was run to bottom. The 4½" casing was cemented in place w/1960 sx 50:50 poz + 6% gel + 10% salt + 0.5% D-45 + 0.2% D-13 + 5#/sx Gilsonite. Tail slurry: 1510 sx 10.0 RFC + 10% D-53 + 0.2% D-74 + 5#/sx Gilsonite. PD 11:30 p.m., 12-31-77. Logs are being studied and MHF design is being prepared. This completion depends on results of lower part of CIGE #2-29-10-21 completion.

Forecast of Work for April, 1978

I Phase I - Natural Buttes Unit No. 18

We plan to add additional perfs in the Wasatch. This is not a part of the DOE Program.

II Phase II - Natural Buttes Unit No. 19

Study for workover or plug and abandon.

III Phase III - Natural Buttes Unit No. 14

Continue flowing well to sales.

IV Phase IV - Natural Buttes Unit No. 20

Continue flowing well to sales.

V Phase V - Natural Buttes Unit No. 21

Analyze cores and logs. Begin production testing of isolated zones.

VI Phase VIa - Natural Buttes Unit No. 22

Continue flowing well to sales.

Phase VIb - Natural Buttes Unit No. 9

Flow to pit to clean up and evaluate frac.

Introduction

During April, 1978, the following work was accomplished:

- I Natural Buttes Unit No. 18 was shut in for workover.
- II Natural Buttes Unit No. 19 produced a total of 776 MCF at an average rate of 43 MCFD for 18 days.
- III Natural Buttes Unit No. 14 produced a total of 12,557 MCF at an average rate of 419 MCF for 30 days.
- IV Natural Buttes Unit No. 20 produced a total of 21,075 MCF at an average rate of 703 MCFD for 30 days.
- V Natural Buttes Unit No. 21 is shut in, waiting on completion.
- VIA Natural Buttes Unit No. 22 produced a total of 7043 MCF at an average rate of 235 MCFD for 30 days.
- VIB Natural Buttes Unit No. 9 is flowing to pit for clean up.
- VII Natural Buttes Unit No. 2 (CIGE 2-29-10-21) was perforated and acidized.
- VIII Natural Buttes Unit No. 23 (CIGE 23-7-10-22) is shut in waiting on completion.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Was shut in for workover.
- II Phase II - Natural Buttes Unit No. 19
Produced well for 18 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced well for 30 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced well for 30 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Waiting on completion

VI Phase VIa - Natural Buttes Unit No. 22

Produced well for 30 days. See attached production graph.

Phase VIb - Natural Buttes Unit No. 9

Flowing to pit to clean up.

VII Phase VII - CIGE 2-29-10-21

Was perforated and acidized. Perforation depths are:

9237'	9396'	9525'
9239'	9397'	9574'
9279'	9427'	9576'
9281'	9429'	9606'
9300'	9488'	9608'
9302'	9490'	9650'
9343'	9523'	9653'
9345'		

1 SPF - Total 22 shots

The well was acidized with 3000 gallons 15% MSR acid at a rate of 7.5 BPM. Well balled out and pressure increased to 5000 psig. Bids were obtained from service companies for the MHF work. The Work Order and Service Contract have been prepared and are being executed.

VIII Phase VIII - CIGE 23-8-10-22

Was drilled to 9560' and 4½", 13.5#, N-80, 8rd, R-3 casing was run to bottom. The 4½' casing was cemented in place w/1960 sx 50:50 poz + 6% gel + 10% salt + 0.5% D-45 + 0.2% D-13 + 5#/sx Gilsonite. Tail Slurry: 1510. sx 10.0 RFC + 10% D-53 + 0.2% D-74 + 5#/sx Gilsonite. PD 11:30 p.m., 12-31-77. Logs are being studied and MHF design is being prepared. This completion depends on results of lower part of CIGE 2-29-10-21 completion.

Forecast of Work for May, 1978

I Phase I - Natural Buttes Unit No. 18

We plan to return this well to production.

II Phase II - Natural Buttes Unit No. 19

Study for workover.

III Phase III - Natural Buttes Unit No. 14

Continue flowing well to sales.

IV Phase IV - Natural Buttes Unit No. 20

Continue flowing well to sales.

V Phase V - Natural Buttes Unit No. 21

Analyze cores and logs. Begin production testing of isolated zones.

VI Phase VIa - Natural Buttes Unit No. 22

Continue flowing well to sales.

Phase VIb - Natural Buttes Unit No. 9

Flow to pit to clean up and evaluate frac.

VII Phase VII - CIGE 2-29-10-21

Submit bids for DOE approval.

VIII Phase VIII - CIGE 23-7-10-22

Study logs for zones of interest and prepare MHF design. Solicit bids and submit above for DOE approval.

Introduction

During May, 1978, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 30,251 MCF at an average rate of 1043 MCFD for 29 days.
- II Natural Buttes Unit No. 19 produced a total of 541 MCF at an average rate of 38 MCFD for 14 days.
- III Natural Buttes Unit No. 14 produced a total of 16,111 MCF at an average rate of 520 MCFD for 31 days.
- IV Natural Buttes Unit No. 20 produced a total of 19,663 MCF at an average rate of 634 MCFD for 31 days.
- V Natural Buttes Unit No. 21 is shut in, waiting on completion.
- VIa Natural Buttes Unit No. 22 produced a total of 4223 MCF at an average rate of 136 MCFD for 31 days.
- VIIb Natural Buttes Unit No. 9 produced a total of 3327 MCF at an average rate of 264 MCFD for 15 days.
- VII Natural Buttes Unit No. 2 (CIGE 2-29-10-21) was perforated and acidized; presently waiting on MHF approval from DOE.
- VIII Natural Buttes Unit No. 23 (CIGE 23-7-10-22) is shut in, waiting on completion.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18

Produced for 29 days. See attached production graph. NOTE:
Production now includes additional zones that were not included in the original MHF job.
- II Phase II - Natural Buttes Unit No. 19

Produced for 14 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14

Produced for 31 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20

Produced for 31 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21

Waiting on completion.

VI Phase VIa - Natural Buttes Unit No. 22

Produced for 31 days. See attached production graph.

Phase VIb - Natural Buttes Unit No. 9

Produced for 14 days. See attached production graph.

VII Phase VII - Natural Buttes Unit No. 2 (CIGE 2-29-10-21)

Was perforated and acidized. Perforation depths are:

9237'	9396'	9525'
9339'	9397'	9574'
9279'	9427'	9576'
9281'	9429'	9606'
9300'	9488'	9608'
9302'	9490'	9650'
9343'	9523'	9653'
9345'		

1 SPF - Total 22 shots

The well was acidized with 3000 gallons 15% MSR acid at a rate of 7.5 BPM. Well balled out and pressure increased to 5000 psig. Bids were obtained from service companies for the MHF work. The Work Order and Service Contract has been executed, and we are now waiting on DOE approval.

VIII Phase VIII - Natural Buttes Unit No. 23 (CIGE 23-8-10-22)

Was drilled to 9560' and 4½", 13.5#, N 80, 8rd, R-3 casing was run to bottom. The 4½" casing was cemented in place w/1960 sx 50:50 poz + 6% gel + 10% salt + 0.5% D-45 + 0.2% D-13 + 5#/sx Gilsonite. Tail Slurry: 1510 sx 10.0 RFC + 10% D-53 + 0.2% D-74 + 5#/sx Gilsonite. PD 11:30 p.m., 12-31-77. Logs are being studied and MHF design is being prepared. This completion depends on results of lower part of CIGE 2-29-10-21 completion.

Forecast of Work for June, 1978

I Phase I - Natural Buttes Unit No. 18

Continue flowing to sales.

II Phase II - Natural Buttes Unit No. 19

Study for workover.

III Phase III - Natural Buttes Unit No. 14

Continue flowing well to sales.

IV Phase IV - Natural Buttes Unit No. 20

Continue flowing well to sales.

V Phase V - Natural Buttes Unit No. 21

Analyze cores and logs. Begin production testing of isolated zones.

VI Phase VIa - Natural Buttes Unit No. 22

Continue flowing well to sales.

Phase VIb - Natural Buttes Unit No. 9

Flow to sales.

VII Phase VII - Natural Buttes Unit No. 2 (CIGE 2-29-10-21)

Perform MHF.

VIII Phase VIII - Natural Buttes Unit No. 23 (CIGE 23-7-10-23)

Study logs for zones of interest and prepare MHF design. Solicit bids and submit same for DOE approval.

Introduction

During June, 1978, the following work was accomplished:

- I Natural Buttes Unit No. 18 produced a total of 10,463 MCF at an average rate of 1162 MCFD for 9 days.
- II Natural Buttes Unit No. 19 produced a total of 44 MCF at an average rate of 22 MCFD for 2 days.
- III Natural Buttes Unit No. 14 produced a total of 8,439 MCF at an average rate of 402 MCFD for 21 days.
- IV Natural Buttes Unit No. 20 produced a total of 13,554 MCF at an average rate of 616 MCFD for 22 days.
- V Natural Buttes Unit No. 21 is flowing to pit.
- VIA Natural Buttes Unit No. 22 produced a total of 3,112 MCF at an average rate of 164 MCFD for 19 days.
- VIB Natural Buttes Unit No. 9 produced a total of 11,280 MCF at an average rate of 537 MCFD for 21 days.
- VII Natural Buttes Unit No. 2 (CIGE 2-29-10-21) was acidized and fraced.
- VIII Natural Buttes Unit No. 23 (CIGE 23-7-10-22) is shut in, waiting on completion.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Produced for 9 days. See attached production graph. NOTE: Production now includes additional zones that were not included in the original MHF job.
- II Phase II - Natural Buttes Unit No. 19
Produced for 2 days. See attached production graph.
- III Phase III - Natural Buttes Unit No. 14
Produced for 21 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced for 22 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Is flowing to pit. Well was perforated at 8509', 8510', 8511', 8512' and 8513' (Schlumberger CBL Depths). Perforations were

broken down with 3% KCl water and ball sealers. Well balled out to 6030 psig. Perfs have made 100 barrels of water per day since break down and no measurable amount of gas. The decision to abandon these perfs and test the next set of perfs will be studied early in July.

VI Phase VIa - Natural Buttes Unit No. 22

Produced for 19 days. See attached production graph.

Phase VIb - Natural Buttes Unit No. 9

Produced for 21 days. See attached production graph.

VII Phase VII - Natural Buttes Unit No. 2 (CIGE 2-29-10-21)

Was perforated and acidized. Perforation depths are:

9237'	9396'	9525'
9239'	9397'	9574'
9279'	9427'	9576'
9281'	9429'	9606'
9300'	9488'	9608'
9302'	9490'	9650'
9343'	9523'	9653'
9345'		

1 SPF - Total 22 shots

The well was acidized with 3000 gallons 15% MSR acid at a rate of 7.5 BPM. Well balled out and pressure increased to 5000 psig. Well was fraced 6-22-78 (see attached treatment report).

VIII Phase VIII - Natural Buttes Unit No. 23 (CIGE 23-7-10-22)

Was drilled to 9560' and 4½", 13.5#, N-80, 8rd, R-3 casing was run to bottom. The 4½" casing was cemented in place w/1960 sx 50:50 poz + 6% gel + 10% salt + 0.5% D-45 + 0.2% D-13 + 5#/sx Gilsonite. Tail Slurry: 1510 sx 10.0 RFC + 10% D-53 + 0.2% D-74 + 5#/sx Gilsonite. PD 11:30 p.m., 12-31-77. Logs are being studied and MHF design is being prepared. This completion depends on results of lower part of CIGE 2-29-10-21 completion.

Forecast of Work for July, 1978

I Phase I - Natural Buttes Unit No. 18

Continue flowing to sales.

II Phase II - Natural Buttes Unit No. 19

Study for workover.

III Phase III - Natural Buttes Unit No. 14

Continue flowing to sales.

IV Phase IV - Natural Buttes Unit No. 20

Continue flowing to sales.

V Phase V - Natural Buttes Unit No. 21

Analyze cores and logs. Continue production testing of open perfs at 8509' - 8513'. If perfs produce only water, then we will set a CIBP and move up hole to next set of perfs.

VI Phase VIa - Natural Buttes Unit No. 22

Continue flowing to sales.

Phase VIb - Natural Buttes Unit No. 9

Flow to sales.

VII Phase VII - Natural Buttes Unit No. 2 (CIGE 2-29-10-21)

Flow well and evaluate stage one.

VIII Phase VIII - Natural Buttes Unit No. 23 (CIGE 23-7-10-22)

Study logs for zones of interest and prepare MHF design. Solicit bids and submit same for DOE approval.

Introduction

During July, 1978, the following work was accomplished:

- I Natural Buttes Unit No. 18 is shut in due to field proration.
- II Natural Buttes Unit No. 19 is shut in due to field proration.
- III Natural Buttes Unit No. 14 produced a total of 10,627 MCF at an average rate of 343 MCFD for 31 days.
- IV Natural Buttes Unit No. 20 produced a total of 19,560 MCF at an average rate of 631 MCFD for 31 days.
- V Natural Buttes Unit No. 21 is flowing to pit.
- VIa Natural Buttes Unit No. 22 produced a total of 4,000 MCF at an average rate of 129 MCFD for 31 days.
- VIb Natural Buttes Unit No. 9 produced a total of 19,703 MCF at an average rate of 636 MCFD for 31 days.
- VII Natural Buttes Unit No. 2 (CIGE 2-29-10-21) was flow tested and cleaned up.
- VIII Natural Buttes Unit No. 23 (CIGE 23-8-10-22) is shut in, waiting on completion.

Discussion of Work Performed

- I Phase I - Natural Buttes Unit No. 18
Is shut in due to field proration.
- II Phase II - Natural Buttes Unit No. 19
Is shut in due to field proration.
- III Phase III - Natural Buttes Unit No. 14
Produced for 31 days. See attached production graph.
- IV Phase IV - Natural Buttes Unit No. 20
Produced for 31 days. See attached production graph.
- V Phase V - Natural Buttes Unit No. 21
Is flowing to pit. Well was perforated at 8474', 8476', 8478', 8480' and 8482' (Schlumberger CBL Depths). Perforations were broken down with 3% KCl water. Please see appendix for chronological reports.

VI Phase VIa - Natural Buttes Unit No. 22

Produced for 31 days. See attached production graph.

Phase VIb - Natural Buttes Unit No. 9

Produced for 31 days. See attached production graph.

VII Phase VII - Natural Buttes Unit No. 2 (CIGE 2-29-10-21)

Was perforated and acidized. Perforation depths are:

7251'	7795'	8642'
7253"	8169'	8662'
7296'	8170'	8661'
7297'	8440'	8718'
7310'	8445'	8725'
7370'	8535'	8738'
7702'	8541'	8768'
7714'	8638'	8774'

1 SPF - Total 24 shots

See appendix for daily reports to July 31, 1978.

VIII Phase VIII - Natural Buttes Unit No. 23 (CIGE 23-7-10-21)

Was drilled to 9560' and 4½", 13.5#, N-80, 8rd, R-3 casing was run to bottom. The 4½" casing was cemented in place w/1960 sx 50:50 poz + 6% gel + 10% salt + 0.5% D-45 + 0.2% D-13 + 5#/sx Gilsonite. Tail Slurry: 1510 sx 10.0 RFC + 10% D-53 + 0.2% D-74 + 5#/sx Gilsonite. PD 11:30 p.m., 12-31-77. Bids are being obtained for proposed Massive Hydraulic Frac.

Forecast of Work for August, 1978

I Phase I - Natural Buttes Unit No. 18

Shut in due to field proration.

II Phase II - Natural Buttes Unit No. 19

Shut in due to field proration.

III Phase III - Natural Buttes Unit No. 14

Continue flowing to sales.

IV Phase IV - Natural Buttes Unit No. 20

Continue flowing to sales.

V Phase V - Natural Buttes Unit No. 21

Analyze cores and logs. Continue production testing of open perfs at 8474' - 8482'. If perfs produce only water, then we will set a CIBP and move up hole to next set of perfs at 8201' - 8205'.

VI Phase VIa - Natural Buttes Unit No. 22

Continue flowing to sales.

Phase VIb - Natural Buttes Unit No. 9

Flow to sales.

VII Phase VII - Natural Buttes Unit No. 2 (CIGE 2-29-10-21)

Flow well and evaluate stage one. Perform second stage of MHF on 8-8-78.

VIII Phase VIII - Natural Buttes Unit No. 23 (CIGE 23-7-10-21)

Solicit bids and submit same for DOE approval.

Table 1 Summary of MHF Treatments											
Well	No. of Zones Perf.	Net Ft. of Pay	Average Frac Job Size							Calc. Frac Length Ft.	Est. 1st Yr. Avg. Prod. Rate MCFD
			Net Ft. Per Zone	Ø	SW	% Sd	Type of Fluid	Gals of Gel	Pounds of Proppant		
NATURAL BUTTES #18	18	224	12.5	10	48	88	VERSA FRAC	695,000	1,480,000	882	1200
NATURAL BUTTES #19	19	194	10.2	9.5	47	87	40# GUAR GUM	655,000	1,237,000	950	60
NATURAL BUTTES #14	15	271	18.0	9.9	49	65	YF4-PSD	544,000	1,082,000	879	600
NATURAL BUTTES #20	8	65	8.1	9.9	44	88.5	YF4-PSD	309,000	826,000	1150	800
NATURAL BUTTES #22	24	196	8.1	12.0	45	85.0	YF4-PSD	478,758	1,091,000	---	---
NATURAL BUTTES #9	(35)	779*	22*	Unk.	Unk.	Unk.	10#, 40# & 60# guar gum	349,000	553,000	---	---
CIGE 2-29-10-21	26	275	10.5	10	47	85	MY-T-GEL III	917,000	2,126,500	---	---
CIGE 23-7-10-22	10	---	---	--	--	--	MY-T-GEL III	240,000	470,000	---	---

*Using GR as only indication of net sand which more closely equals gross sand.

NATURAL BUTTES NO. 14

NATURAL BUTTES NO. 18

4 1/2" @ 9140

2 3/8" @ 8,968'

PERFS: 4490-8954 (18 zones)

FRAC: 695,000 GAL Versagel &

1,480,000# SD

Fract Length = 950'

10,000

MCF/mo

1,000

100

NATURAL BUTTES NO. 19

NATURAL BUTTES NO. 20

NATURAL BUTTES NO. 22

NATURAL BUTTES NO.9

Table 1 Summary of HRF Treatments											
Well	No. of Zones Perf.	Net Ft. of Pay	Average			Frac Job Size			Calc. Frac Length Ft.	Est. 1st Yr. Avg. Prod. Rate MCFD	
			Net Ft. Per Zone	Ø	SN	S Sd	Type of Fluid	Gals of Gel			Pounds of Proppant
NATURAL BUTTES # 18 DOE	10	224	12.5	10	48	88	VERSA FRAC	695,000	1,480,000	882	1200
NATURAL BUTTES # 19 DOE	19	194	10.2	9.5	47	87	40# GUAR GUM	655,000	1,237,000	950	60
NATURAL BUTTES #14 DOE	15	271	18.0	9.9	49	65	VF4-PSD	544,000	1,082,000	879	600
NATURAL BUTTES #20	8	65	8.1	9.9	44	58.5	VF4-PSD	309,000	826,000	1150	800
NATURAL BUTTES #22	24	196	8.1	12.0	45	85.0	VF4-PSD	478,758	1,091,000		
NATURAL BUTTES #9	(35)	779*	22*	Unk.	Unk.	Unk.					
CIGE 2-29-10-21											
CIGE 23-7-10-22											

*Using GR as only indication of net sand which more closely equals gross sand.

TABLE 2
FUTURE WELL TREATMENT PROGRAM

FISCAL YEAR 1978 ----- QUARTER	WELL NUMBER	JOB SIZE	COST	FLUID	FRAC LENGTH	AVERAGE LOWE QUALITY AND NET PAY (From Sorehead)	REMARKS
4TH	WBU 21	750,000 gals. 1,500,000 lbs.	\$450,000	Final Charges Based on Previous Results	To Be Determined	Ø = 9.0 Sw = 50% h = 100'	Comparison of log data and core data to help determine zones to be per- forated. Testing of cored intervals
4TH	WBU 23	400,000 gals. 700,000 lbs.	\$150,000	Final Charges Based on Previous Results	To Be Determined	9.0 - Ø Sw = 50% h = 100'	Design depends on success of lower frac of WBU 2
3RD	WBU 2	1,003,000 gals.** 2,000,000**	\$400,000**	Cross linked 25% salt	To Be Determined	Sw = 45% Ø = h = 200'	Frac in 2 parts to TEST log interpretation as well as larger frac and high number of zones

* First part only

** Total Cost of Both Parts

TABLE 3 - EFFECT OF SAND SIZE ON STABILIZED PRODUCTION RATE

WELL NAME	SAND PROPPANT			FROM SALES DATE: FIRST MONTH PRODUCTION RATE (MCF/MO.)	FROM SALES DATE: THIRD MONTH PRODUCTION RATE (MCF/MO.)	FROM SALES DATE: END OF 1 YEAR PRODUCTION RATE (MCF/MO.)
	100-20-40 ----- (IN THOUSANDS)	100-40-60 ----- (IN THOUSANDS)	100-100 Mesh ----- (IN THOUSANDS)			
WBU #18	1380	100	0	27,000	21,000	18,300
WBU #19	0	1075	133	380	3,400 **	300
WBU #14	1053	40	0	23,000	17,800	13,540
WBU #20	20 *	745	56	36,029	27,000	25,500 ***
WBU #22	25 *	1066	60	10,500	N/A	N/A
WBU #9	0	525	28	N/A	N/A	N/A

* Glass beads

** This well was damaged due to extensive fishing job performed to recover coil tubing.

*** Only 8 months are available at this time

FIGURE 3 - MILESTONE CHART

FISCAL YEAR	YEARS BY QUARTERS							
	1976 - T	1977-1st.	1977-2nd.	1977-3rd.	1977-4th.	1978-1st.	1978-2nd.	1978-3rd.
CALENDAR YEAR	1976 - 3rd	1976-4th	1977-1st.	1977-2nd.	1977-3rd.	1977-4th.	1978-1st.	1978-2nd.
ACTIVITY	<div> <div>Firm</div> <div>Program</div> <div>Optional</div> <div>Program</div> </div>							
DRILLING NEW WELL			20	21	22 2	21	23	
PRE FRAC PRODUCTION TEST	18 19	14	20	21	22		9	2 21 23
MASSIVE FRAC	* 18 * 19	* 14	* 20		* 22	* ?	? 9	2 21 23
POST FRAC PRODUCTION TEST AND BHP BUILDUP		18 19	14	20	22			? 9 2 23 21
FRACTURE ORIENTATION TEST		14	20			22		

APPENDIX A

CHRONOLOGICAL REPORTS

NATURAL BUTTES UNIT NO. 2 (CIGE 2-29-10-21)

July 1, 1978 to July 31, 1978

CIGE 2-29-10-21 (NBU)
Bitter Creek Field
Uintah County, Utah
AFE: 19430 WI: 100%
ATD: 9200' SD: 3-4-77
CIGE, Inc., Oper
Anderson Drilling, Contr.
13-3/8" @ 90'; 9-5/8" @
2500'; 4 1/2" @ 9896'
Gross Perf Int: 9237' - 9653'
(22 holes)

TD: 9896'
7-1-78 Flowing to pit. FCP 0#, on 2" ck. No gas or wtr.
7-2-78 No Report.
7-3-78 FCP 0#. Flowing to pit on 3/4" ck. Completely dead, no wtr. or gas.
7-4-78 Well open to pit on 3/4" ck. Well dead.
7-5-78 Prep to run 2-3/8" tbg. Open to pit on 3/4" ck. Well dead.
7-6-78 Running 2-3/8" tbg. in hole. Unloaded 322 jts. 2-3/8", J-55 tbg.; ND tree, NU BOP; PU & strap 2-3/8" tbg. & TIH to 6660'; SDFN w/well open to pit on 20/64" ck; Well dead.
7-7-78 Swabbing. PU & run tbg. to 9124'; RU swab & swabbed 72 BW; FL @ 1300'; Left csg. open to pit; SDFN.
7-8-78 Swabbing. NU tree; Swabbing; FL 3200'; TP 0, SICP 400 psi; 150 BW w/small amt. of gas after each swab run; Left open to pit overnite on 16/64" ck; No flow.
7-9-78 Open to pit on 16/64" ck. Swabbed 140 BW w/20 runs w/FL @ 3500'; SICP 900 psi; Small Show of gas w/each swab pull; Left well open to pit overnite on 16/64" ck; SD for Sunday.
7-10-78 Open to pit. FTP 0, SICP 1200#, on 16/64" ck. Swabbed 7-8-78, 140 BW. SD for Sunday.
7-11-78 Prep to resume swabbing.
7-12-78 Prep to swab. RU Benco Swabbing Service. Swabbed 27 BW in 7 hrs. FL drpd from 2975' to 3171'. No gas. SICP 1400#. Left well open to pit overnite.

CIGE 2-29-10-21 (NBU)
Bitter Creek Field
Uintah County, Utah
AFE: 19430 WI: 100%
ATD: 9200' SD: 3-4-77
CIGE, Inc., Oper
Anderson Drilling, Contr.
13-3/8" @ 90'; 9-5/8" @
2500'; 4 1/2" @ 9896'
Gross Perf Int: 9237' - 9653'
(22 holes)

7-13-78 Prep to swab. Swabbed 128 BW in 9 hrs. FL 2660' to 4305'. Well heading w/gas after 6 1/2 hrs. SICP 1400#. Left tbg. open to pit on 18/64" ck overnite.

7-14-78 Swabbing - prep to release Swab Unit & pull 2-3/8" tbg.; Swabbed 136 bbls from 1750' FL to 2800' FL w/no show of gas; SICP 1450#.

7-15-78 Prep to pull tbg. Swab 32 BW. SICP 1600#; RD Swab Unit. MI & RU WO unit to pull tbg.

7-16-78 Prep to set CIBP. LD tbg. - prep to set CIBP, perf & frac new interval.

7-17-78 WO Frac of Wasatch & upper Mesa Verde. FCP 0, open to pit - Well dead.

TD: 9896' Last report was 7-17-78.

7-20-78 Prep to press test well hd & csg. BP & perf. RU GOI WL Service; Set CIBP @ 9000'; Spot 10' cmt on top of plug & RD.

7-21-78 RU to perf.

7-22-78 Flowing to pit. Perf w/GOI w/1 SPF @ 7251', 7253', 7296', 7297', 7310', 7370', 7702', 7714', 7795', 8169', 8170', 8440', 8445', 8535', 8541', 8638', 8642', 8662', 8666', 8718', 8725', 8738', 8768', 8774'; Acidized w/4500 gals 7 1/2% HCl w/Admix, used 45 RCN ball sealers 7/8"; ARO 14.6 BPM @ 3900 psi; Balled out to 7100 psi; Drp balls off after 30 min; Displaced remaining acid; ISIP 3400#; Open on 32/64" ck; FCP 0, w/2" stream acid wtr. to pit.

7-23-78 Flowing to pit on 32/64" ck. FCP 50#, 50 MCFD, 35 BWPD.

7-24-78 Flowing to pit. FCP 50 psi, on 32/64" ck. Gas - TSTM, 50 BWPD.

7-25-78 Flowing to pit. FCP 50 psi, on 32/64" ck. Flowing approx 50 DWPD w/gas TSTM.

CIGE 2-29-10-21 (NBU)
Bitter Creek Field
Uintah County, Utah
AFE: 19430 WI: 100%
ATD: 9200' SD: 3-4-77
CIGE, Inc., Oper
Anderson Drilling, Contr.
13-3/8" @ 90'; 9-5/8" @
2500'; 4½" @ 9896'
Gross Perf Int: 9237' - 9653'
(22 holes)

<u>7-26-78</u>	Flowing to pit. FCP 50 psi, on 32/64" ck. Gas - 20 to 25 MCFD, WTR - 25 to 50 BWPD.
<u>7-27-78</u>	Flow to pit. FCP 50#, on 1/2" ck, 50 BWPD, 30 MCFD.
<u>7-28-78</u>	Flowing to pit. FCP 50 psi, on 32/64" ck. Flowing est 20 MCFD w/50 BWPD.
<u>7-29-78</u>	FCP 50# to the pit on 32/64" ck. Flowing est 45 BWPD, 25 MCFD.
<u>7-30-78</u>	No Report.
<u>7-31-78</u>	Flowing to pit on ½" ck. FCP 50#, Gas & wtr TSTM.

APPENDIX B

CHRONOLOGICAL REPORTS

NATURAL BUTTES UNIT NO. 21 (CIGE 21-15-10-22)

July 1, 1978 to July 31, 1978

CIGE 21-15-10-22 (NBU)
Bitter Creek Field
Uintah County, Utah
AFE: 19355 WI: 100%
ATD: 8800' SD: 4-9-77
CIGE, Inc., Oper.
Anderson Drilling, Contr.
13-3/8" @ 89'; 9-5/8" @ 2531';
5 1/2" @ 8788'
Perfs: 8509' - 8513'
(5 shots)

TD: 8788'
PBTD: 8757'

<u>7-1-78</u>	Flow to pit. FCP 50#, on 20/64" ck. 50 - 75 BWPD, Gas - TSTM.
<u>7-2-78</u>	Flow to pit on 20/64" ck. FCP 50#, 50 BWPD, Gas - TSTM.
<u>7-3-78</u>	Flowing to pit. FTP 50#, on 20/64" ck. Flowing est 50 - 75 BW & Gas - TSTM.
<u>7-4-78</u>	Flowing to pit. FTP 0, SICP 0, on 20/64" ck. Gas - TSTM. Est 25 to 50 BWPD w/1/2" stream of wtr. Prep to set test tank.
<u>7-5-78</u>	Flowing to pit. FTP 0, SICP 0, on 20/64" ck. Gas - TSTM w/1/2" stream of wtr. Prep to set test tank.
<u>7-6-78</u>	Flowing into test tank. FTP 0 psi, on 20/64" ck. 11 BWPD w/no gas.
<u>7-7-78</u>	FTP 0 to pit. Est 40 - 50 BWPD, 25 - 50 MCFD.
<u>7-8-78</u>	Flowing to test tank. Set vert. separator; 3 hr. test indicates 40 BWPD w/gas - TSTM.
<u>7-9-78</u>	Flowing to test tank. FTP 50 psi. 100 BWPD (24 hr. tank gauge) w/gas - TSTM.
<u>7-10-78</u>	FTP 40#, on 16/64" ck. 97 BW, Gas - TSTM.
<u>7-11-78</u>	Flow to test tank on 16/64" ck; FTP 40#; Gas TSTM; 110 BWPD.
<u>7-12-78</u>	Flowing thru separator to test tank. FTP 40 psi on 30/64" ck. Gas - TSTM, 100 BWPD.

CIGE 21-15-10-22 (NBU)
Bitter Creek Field
Uintah County, Utah
AFE: 19355 WI: 100%
ATD: 8800' SD: 4-9-77
CIGE, Inc., Oper.
Anderson Drilling, Contr.
13-3/8" @ 89'; 9-5/8" @ 2531';
5 1/2" @ 8788'
Perfs: 8509' - 8513'
(5 shots)

7-13-78 Flowing thru test equipment. FTP 50 psi, on 18/64" ck. 106 BW, Gas - TSTM. Water Analysis taken 7-7-78 results.

Gravity	1.013	Magnesium	29 ppm
PH	7.1	Chloride	8924 ppm
Iron	52 ppm	Sulfate	334 ppm
Potassium	103 ppm	Carbonate	NIL
Sodium	5450 ppm	Bi-carbonate	1159 ppm
Calcium	176 ppm	Rw	0.43 ohm @ 77° F

7-14-78 Flowing to pit. FTP 40 psi, SICP 0, w/pkr, on 18/64" ck. 87 BWPD (Tank gauge), Gas - TSTM.

7-15-78 Flowing well to pit. FTP 40#. Flowing thru test separator. Gas - TSTM, 190 BWPD.

7-16-78 Flowing well to pit. FTP 40#. Gas - TSTM, 95 BWPD on 18/64" ck.

7-17-78 MI & RU Gamache WO Rig. Flow thru test separator on 30/64" ck. FTP 40#, SICP 0. Gas - TSTM, w/96 BWPD.

7-18-78 MI & RU WO Rig. (Gamache Well Service). Prep to re-set BP & pkr for recompletion.

7-19-78 Prep to finish pulling BP & pkr. ND tree, NU BOP; Circ hole w/3% KCl wtr & reversed out RCN ball sealers; GIH & release BP & pull & re-set BP @ 8500'; Press tested BP w/2800 psi - BP didn't hole - pumped in 1 BPM; Working pkr thru tite spot @ 8400'; TOOH w/2-7/8" tbg. w/BP & pkr - pulled 40 stds (80 jts) & SDFN; Left open on 30/64" ck.

7-20-78 Prep to TIH w/Retrievable BP & pkr. RU Halliburton pump truck; Kill well w/100 bbls 10% brine wtr; TOOH w/2-7/8" tbg. & MR pkr; Lost BP @ 4010'; TIH; Sit on plug & release; Circ hole w/10% brine wtr; POOH w/BP; RU GOI WL; TIH w/5 1/2" BP & set @ 8500'; Press test to 1500# - held OK; Well open to pit overnite.

CIGE 21-15-10-22 (NBU)
Bitter Creek Field
Uintah County, Utah
AFE: 19355 WI: 100%
ATD: 8800' SD: 4-9-77
CIGE, Inc., Oper.
Anderson Drilling, Contr.
13-3/8" @ 89'; 9-5/8" @ 2531';
5½" @ 8788'
Perfs: 8509' - 8513'
(5 shots)

<u>7-21-78</u>	WO BP. TIH w/2-7/8" tbg., Baker RBP & Model R double grip pkr. Set plug @ 8494'; POOH to 8037'; ND BOP's; Land tbg. in hanger; Swab well down to 4500'.
<u>7-22-78</u>	Flow to test tank on 16/64" ck. RU OWP; Ran strip log; Perf 8474', 8476', 8478' 8480', 8482'. Set pkr @ 8450'; Test backside to 2000#. RU Howco; Brk dwn perfs w/3% KCl wtr @ 8900# @ 3½ BPM; ISI 8000#.
<u>7-23-78</u>	Flowing thru test equipment. FTP 50 psi, on 18/64" ck. Gas - TSTM, 72 BWPD.
<u>7-24-78</u>	Flowing thru test equipment. FTP 50 psi, on 18/64" ck. Gas - TSTM, 72 BWPD.
<u>7-25-78</u>	Flowing thru test separator on 18/64" ck. FTP 50 psi, w/pkr. Gas - TSTM, 70 BWPD (test tank).
<u>7-26-78</u>	Flowing thru test equipment. FTP 40 psi, w/pkr, on 18/64" ck; Flowing 85 BWPD w/gas TSTM.
<u>7-27-78</u>	Flow to test tank. SICP 0, FTP 45#, on 18/64" ck. Flowing est 80 BWPD w/gas TSTM.
<u>7-28-78</u>	Flowing thru test separator. FTP 50 psi, w/pkr, on 18/64" ck. Gas - TSTM w/24 BWPD.
<u>7-29-78</u>	FTP 50# to test separator. SICP 0, on 18/64" ck. 30 BWPD w/gas TSTM.
<u>7-30-78</u>	No Report
<u>7-31-78</u>	Flowing thru test separator to pit. FTP 50#, SICP 0#, w/pkr, on 18/64" ck. Gas - TSTM w/20 BW.

HALLIBURTON SERVICES JOB SUMMARY

FORM 1012 N-1

HALLIBURTON DIVISION Denver

HALLIBURTON LOCATION Vernal

BILLED ON 245281
TICKET NO.

FIELD		SEC.		TWP.		RND.		COUNTY		STATE	
<u>So. Ouray</u>		<u>29</u>		<u>10</u>		<u>21</u>		<u>Uintah</u>		<u>Utah</u>	
FORMATION NAME		TYPE		FROM		TO		CASING		NEW USED	
FORMATION THICKNESS		FROM		TO				U		13.5	
INITIAL PROD. OIL		BPD, WATER		BPD, GAS		MCFD		LINER			
PRESENT PROD. OIL		BPD, WATER		BPD, GAS		MCFD		TUBING			
COMPLETION DATE		MUD TYPE		MUD WT.				OPEN HOLE			
PACKER TYPE		SET AT						PERFORATIONS		9237 9653 22	
BOTTOM HOLE TEMP.		PRESSURE						PERFORATIONS			
MISC. DATA		TOTAL DEPTH						PERFORATIONS			

TOOLS AND ACCESSORIES

TYPE AND SIZE	QTY.	MAKE
FLOAT COLLAR		
FLOAT SHOE		
GUIDE SHOE		
CENTRALIZERS		
BOTTOM PLUG		
TOP PLUG		
HEAD		
PACKER		
OTHER		

MATERIALS

TREAT. FLUID MY -T-Gel 111 DENSITY LB/GAL API
 DISPL. FLUID H2O DENSITY 2%KCL LB/GAL API
 PROP. TYPE Sand SIZE 100 Mesh LB 30,000
 PROP. TYPE Sand SIZE 40/60 LB 140,500
 ACID TYPE GAL %
 ACID TYPE GAL %
 ACID TYPE GAL %
 SURFACTANT TYPE Tri-S GAL 193 W 1/K
 WET AGENT TYPE GAL IN
 FLUID LOSS ADD. TYPE GAL-LB IN
 GELLING AGENT TYPE Myf-1 GAL-LB 6440 IN @ 30&40/k
 FRIC. RED. AGENT TYPE GAL-LB IN
 BREAKER TYPE GBW - 3&AP GAL-LB 150&100 @ .1 to .5/k
 BLOCKING AGENT TYPE GAL-LB
 PERFFAC BALLS TYPE QTY.
 OTHER HYG-3, K34 483 lbs each
 OTHER KCL 33193 @ 2% RA- Sand
350 Units @ .6/1000# Sand

JOB DATA

DATE	ON LOCATION	JOB STARTED	JOB COMPLETED
06-22-78	06-22-78	06-22-78	06-22-78
TIME 05:00am	TIME 07:00	TIME 09:58	TIME 11:58

PERSONNEL AND SERVICE UNITS

NAME	UNIT NO. & TYPE	LOCATION
Jenne - Morris		
Lane	5393 M100	Vernal
Robinson	4077 HT	"
Case - Amos	8774 HT	"
Rowe	8539 HT	"
Barney	9453 HT	"
Jenkins	3693 HT	"
Bassett	3349 HT	"
Yourdan	2532 HT	"
Bills	4960 HT	"
White - Ussery	5623 Gel	"
Curtis - Casey	9922 Matl.	"
Robison - Kalcich	3853-0554	"
Hall - Hatch	Mechanics	"

DEPARTMENT

DESCRIPTION OF JOB

JOB DONE THRU: TUBING ☐ CASING ☒ ANNULUS ☐ TSG./ANN. ☐

CUSTOMER REPRESENTATIVE

HALLIBURTON OPERATOR

COPIES REQUESTED

CEMENT DATA

STAGE	NUMBER OF BAGS	TYPE	API CLASS	BRAND	BULK SACKED	ADDITIVES	YIELD CU.FT./SK.	MIXED LBS./GAL.

PRESSURES IN PSI

SUMMARY

VOLUMES

CIRCULATING DISPLACEMENT PREFLUSH: BBL-GAL TYPE
 BREAKDOWN MAXIMUM 7100 LOAD & SHDN: BBL-GAL PAD: BBL-GAL 33,000
 AVERAGE 6800 FRACTURE GRADIENT TREATMENT: BBL-GAL 162,000 DISPL: BBL-GAL 8,000
 BRUIN: INSTANT 3350 15-MIN. 3250 1-HR. 3200 CEMENT SLURRY: BBL-GAL
 HYDRAULIC HORSEPOWER 8000 TOTAL VOLUME: BBL-GAL 203,000
 ORDERED AVAILABLE USED 7330 REMARKS
 AVERAGE RATES IN BPM
 TREATING 44 DISPL. 45 OVERALL 44
 CEMENT LEFT IN PIPE

HALLIBURTON SERVICES JOB LOG

WELL NO. 2-29-10-21 LEASE Natural Buttes TICKET NO. 245281

CUSTOMER CIGE

PAGE NO. 1 of 1

JOB TYPE MY-T Gel III

DATE 06-22-78

FORM 1013 R-2

CHART NO.	TIME	RATE (BPM)	VOLUME (BBL) (GAL)	PUMPS		PRESSURE (PSI)		DESCRIPTION OF OPERATION AND MATERIALS
				T	C	TUBING	CASING	
								Safety Meeting
								Prime and test lines
1	09:58	-	-				1890	Start Pad
2	10:08	23	5790				4600	@ Perfs
3	10:25	37	30,000				6400	Start 1# 100 Mesh
4	10:29	42	36,630				6700	@ Perfs
5	10:43	42	60,000				7000	Start Spacer
6	10:45	43	63,000				7000	Start 1# 40/60
7	10:49	43	69,630				6780	@ Perfs
8	11:01	98	93,000				6820	Start 2# 40/60
8A	11:02	48	95,000				6500	Start 1# 40/60
9	11:04	49	99,630				6150	2# @ Perfs
10	11:06	49	101,630				6500	@ Perfs
11	11:08	48	106,000				6550	Start 1 1/2# 40/60
12	11:08	50	108,000				5750	Start 1# 40/60
13	11:10	50	112,630				5800	1 1/2 @ Perfs
14	11:12	50	114,500				5850	Start 1 1/2 40/60
15	11:14	50	121,130				5750	@ Perfs
16	11:17	48	126,000				6500	Start 1# 40/60
17	11:21	49	132,630				6100	@ Perfs
17A	11:22	49	136,000				6700	Start 40# Gel
18	11:38	45	165,000				6100	Start 1 1/2# 40/60
19	11:39	45	167,000				6050	Start 1# 40/60
20	11:42	46	171,630				5850	1 1/2# @ Perfs
21	11:43	46	175,000				5850	Start 1 1/2# 40/60
22	11:47	46	181,630				5850	@ Perfs
23	11:48	46	183,000				5800	Start 2# 40/60
24	11:51	46	189,630				5900	@ Perfs
25	11:54	45	195,000				5900	Start Flush
26	11:58	42	203,000				6100	End Flush
							3350	Instant shut-in pressure
							3250	5 Min.
							3220	10 Min.
							3200	15 Min.
							- 56 -	