15262
Report

**USE OF SLIMHOLE DRILLING TO REDUCE WELL COSTS 30-50%: ARNIM
PROSPECT**

ARNIM #5 & #6 – FAYETTE COUNTY, TEXAS

FINAL REPORT

**FEBRUARY 6, 2002 THRU
FEBRUARY 12, 2002**

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June 13, 2002

DE-FG26-00BC15262

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ABSTRACT

This report highlights the drilling of two shallow oil wells in Fayette County, Texas. The operator of these two wells was Stanton Mineral Development, Inc. The aim of this project was to successfully complete the two (2) wells, emphasizing tight oversight of the technological aspects, neglect of which are the primary causes of failure in this mature producing region as well as unnecessarily expensive wells.

Discussions contained here within are not limited to just the execution of the project itself, but a historical and technical analysis which forms a basis for the decisions made both during drilling and completion. Additionally, there is substantial dialogue covering the financial benefits associated with the findings of this project.

INTRODUCTION

The Arnim Lease prospect is located in southwestern portion of Fayette County, Texas. Production from the sands in this region, between depths of 1200 – 2500', is found in a narrow trend running southwest to northeast from an area in Wilson County, south of San Antonio, into deep East Texas.

Shallow development of oil and gas reserves from Carrizo/Reklaw aged sands in Fayette County has been on going since as early as 1930. The Southwest Muldoon Field contains 71 wells which have produced from the Arnim Sand at a depth of approximately 2100'. Reported production for these wells since 1970 is 3,577,305 barrels of oil. Production figures prior to 1970 are not easily available. Only 15 of the 71 wells located in the SW Muldoon Field were completed after 1970, so accurate total production for the field is not readily available. Even so, the reported production averages per well, using only production reported since 1970, are in excess of 50,300 barrels per well.

Log and core analysis of wells in the area show an oil productive column in the 3rd Cockrill Sand with a lowest known oil level not shallower than -1679', providing a minimum 27' oil column in the two proposed locations.

However, several wells in the area which produced substantial amounts of water had cores similar to wells which were good oil producers. This would tend to indicate the likelihood of a poor cement bond across the 3rd Cockrill interval.

EXECUTIVE SUMMARY

The use of slimhole technology has a significant impact on the reduction of producing well costs, lower risks for independents, and improved US onshore oil production.

As this is a mature producing region, geologic concerns are minimal. Typically, wells in this field produce an average of 25,000 bbls of oil at best. Numbers like these are not attractive to the majors and large independents, but with efficient and economic technology the region could once again be opened up to commercial exploration.

To investigate this hypothesis, a three step program will be implemented. First, slimhole drilling and wellbore configuration will be applied. Next, the implementation and maintenance of a quality drilling mud program will be undertaken. Finally, working closely with the cementing company, design and implement a superior cementing program.

Wells in this region are typically drilled to depths of about 2500'. The shallow depth obviously means lower overall costs but quite a few operators try to economize further by selecting the cheapest cementing proposal, with disappointing results.

Both wells were successfully drilled and completed in February of 2002.

PROPOSED SOLUTION

Stanton Mineral Development, Inc. (SMDI) is proposing the drilling of two wells, the Arnim #5 and Arnim #6. These locations should both encounter the 3rd Cockrill Sand at a depth of 2077' (-1651'). The two wells are proposed to TD no deeper than the top of the underlying Arnim "A" sand at 2130' (-1704').

In order to address the critical cement bonding issue, additional steps will be taken to avoid channeling of water. A better controlled mud program is to be implemented and the cement chemistry altered to likely improve bonding in this fresh water environment. These items, which are modeled after Conoco's successful program method in the field, should insure the successful completion of both wells.

Additionally, by implementing the above costs will be reduced substantially including the unlikely scenario of a failed completion. This in turn will reduce the amount of recoverable oil necessary to pay out the wells.

TECHNOLOGICAL TESTING

Close attention was paid to the condition of the mud. The mud pits were lined with heavy gauge plastic to prevent contamination. Additionally, the mud engineers took samples at regular intervals to assure quality. Throughout the drilling of both wells, all samples taken registered within required limits.

SMDI worked closely with Schlumberger and its sales/engineering staff on the cementing program. Schlumberger has a long history of working in this area, with good success. By altering the cement chemistry based upon the mud encountered while drilling, we anticipated a superior bond which would permit the perforating of multiple pay zones. Without a good cement job, if multiple zones are perforated there is the risk of water channeling from the over and under lying zones.

DRILLING ACTIVITY

The Arnim #6 was drilled first. Progress Drilling Company spud the well on February 6, 2002. TD was reached on February 7, 2002. Schlumberger cemented the well on February 8, 2002. The Arnim #5 was spud on February 11, 2002 and reached TD on February 12. The Arnim #5 was cemented on February 12, 2002.

Both wells were drilled to approximate depths of 2115' with a hole sizes of 7 7/8" diameter. Each then had 4 1/2" casing run and cemented back to the surface. By running 4 1/2" casing, instead of 5 1/2", SMDI was able to use 2 3/8" tubing, an economic advantage over 2 7/8" tubing which will not drift inside 4 1/2" casing.

The drilling aspect of the program was uneventful. With respect to any difficulties encounter, SMDI did have to contend with heavy rains which made movement on the location complicated.

RESULTS

Both wells were successfully completed and put on line in late February. Initially the Arnim #5 experienced sand problems which caused our downhole pump to stick. This was addressed by circulating the well for several hours until clean. The Arnim #6 has been pumping steadily since it first went online.

To date, the production on the two wells has been disappointing. The oil cut on both wells is just under 1%. We are currently trying to determine why we are not seeing better production numbers. According to computer models run, the wells are producing the amount of fluid expected based upon stroke length, pump size, and strokes per minute (spm). However, the oil cut we were expecting, 25-50%, has not materialized.

ANALYSIS OF PROJECT

Development of shallow oil bearing sands of the Carrizo/ Recklaw formations has had several problems facing it that have nearly completely halted any development in the trend. These sands, which possess extremely high porosity/high permeability and contain fresh water, have historically been very difficult to complete. Additionally, the shallow depth has primarily attracted the operators who do not have access to good engineering to solve the completion problems.

Estimated drilling and completion costs for conventional wells of approximately \$139,000, along with an approximate 50% failure rate of completion due to poor cementing practices, has required the average well to produce nearly 15,000 bbls of oil at today's high prices to pay out the investment. Additionally, the limited capital resources of the many small operators who have pursued this trend do not allow for the drilling of replacement wells or for failed completions. With recoverable reserves of only 15,000 – 25,000 bbls average per well, large independents and majors with access to good technology cannot justify participating in the trend as the reserves are too small.

The major cause of wells being noncommercial is this region result from poor completion. These wells are inexpensive to drill to these shallow depths. Many operators choose to further cut costs by using small time cementers, which although less expensive, do not have the expertise or science behind them companies such as Schlumberger possess.

All indications point to a successful cement job.

CAPITAL INVESTMENT

Attached to this report as Exhibits "A" and "B", are the AFE and cost data for both wells, broken down into tangible and intangible costs.

On both wells, each came in under a typical drilling budget by more than 40%. The savings would have been greater except for the poor weather which required extra expense to keep both locations accessible to men and materials.

ONGOING BENEFITS

These types of wells are relatively inexpensive to operate. Thus they are not as susceptible to volatile fluctuations of commodity prices. Obviously, \$30 oil is preferable to \$12 oil but low operating costs allow commercial viability in both scenarios. These costs will be addressed further under lease operating cost analysis.

Additionally, in a mature producing region like the Southwest Muldoon Field there is extensive history and information available. This significantly reduces the risk of drilling non-commercial wells. One of the benefits of low-risk drilling is that it allows several wells to be drilled consecutively without fear of a "dry-hole". By drilling several wells back-to-back, the operator has leverage when negotiating with potential vendors, hence lower costs.

LEASE OPERATING COST ANALYSIS

The wells are relatively inexpensive to operate on a monthly basis. There are three fixed costs; overhead/administration, pumper, and electricity. Overhead and administration covers expenses incurred by SMDI including office expenses, accounting, etc. The other two fixed costs, pumper and electricity, are \$150/month and approximately \$180/month respectively.

When the wells have to be pulled, i.e. remove the tubing, rods, and pump to perform maintenance, the cost is roughly \$2500 which includes the price of a new downhole pump. This is done on an as needed basis and usually occurs every nine months.

Water disposal, a substantial operating cost on most other wells, is not an issue as water from these wells is relatively "fresh". SMDI has a surface discharge permit with the Texas Railroad Commission which allows the operator to dispose of all water produced upon the ground.

CONCLUSION

The attention paid to the completion portion of both wells appears to have paid off. Not only were the completions successful, but the project came in some 40% under a typical drilling and completion budget for these types of wells.

Though not an application in all drilling circumstances, in this region the tight control and use of superior technology should definitely enhance the probability of success.

Stanton Mineral Development, Inc.
Project Summary
Arnim Lease, Fayette County, Texas

Summary

The Arnim Lease prospect is located in southwest Fayette County, Texas in the shallow Carrizo/Recklaw producing trend of the Texas Gulf Coast. Production from these sands, between depths of 1200-2500' is found in a narrow trend running southwest to northeast from south of San Antonio in Wilson County into deep east Texas. Oil production from these sands was first established shortly after the turn of the century at the town of Muldoon in southwest Fayette County. Although hundreds of existing locations are known, production from these high quality, fresh water sands has been historically difficult to establish for the many small operators working in the trend and has basically caused abandonment of the producing trend to any recent development. Stanton Mineral Development, Inc. intends to show that through application of technology and basic engineering, that the trend can prove to be prolific for producers as well as add substantially to the state's reserve base.

History

Development of shallow oil bearing sands of the Carrizo/Recklaw formations has had several problems facing it that have nearly completely halted any development in the trend. These sands, which are extremely high porosity/high permeability and contain fresh water have historically been very difficult to complete. Additionally, the shallow depth has attracted primarily the operators who do not have access to good engineering to solve the completion problems. Failure of producers to successfully cement their wells, as well as the relative high cost of these shallow wells has made the economics of these producers marginal even in times of high oil prices. Estimated drilling and completion costs for conventional wells of approximately \$139,000, along with an approximate 50% failure rate of completion due to poor cementing practices, has required the average well to produce nearly 15,000 bbls of oil at today's high prices to pay out the investment. Additionally, the limited capital resources of the many small operators who have pursued this trend do not allow for the drilling of replacement wells or for failed completions. With recoverable reserves of only 15,000-25,000 bbls average per well, large independents and majors with access to good technology cannot justify participating in the trend as the reserves are too small. Stanton Mineral Development, Inc. believes that through application of slim hole drilling to reduce costs, as well as implementation of solid engineering to assure completion, the trend should be reopened to developemnt and prove to add substantial reserves.

Procedure

Geologic concerns are limited on the Arnim lease as the two locations selected are known to be within the limits of the SW Muldoon Field. Eliminating geologic concern and focusing solely on the cost and tehnology issues should allow SMDI to prove its ability to

successfully complete these wells at reduced cost. Plans for successful implementation include the following:

1. Application of slim hole drilling and wellbore configuration
2. Implementation and maintenance of a quality drilling mud program
3. Design and implementation of better cementing procedure

Implementation of the above should not only reduce costs by an estimated 41%, but substantially reduce the possibility of a failed completion. This should reduce the amount of oil recovery on a per well basis by 60% to some 6,000 bbls in order to pay out the investment.

Conclusion

Implementation and application of simple technology should serve to reduce cost and risk in this producing region and thereby reopen an entire trend to additional activity.

Comparison of Slimhole and Conventional Well Costs
Arnim Prospect
Fayette County, Texas

Conventional Drilling and Completion Program, Arnim #1	\$ 138,715
Slimhole Drilling and Completion Program, Arnim #1	<u>98,454</u>
Potential Cost Savings	<u>\$ 40,261</u>
Cost Savings as a Percent of Slimhole Well Costs	<u>41%</u>

Note: Costs exclude special prospect development, project engineering, and technology transfer costs associated with this project.

Slimhole Drilling and Completion Program
Stanton Mineral Development, Inc.
Estimated Well Costs, Arnim #1
Fayette County, Texas

INTANGIBLE DEVELOPMENT COSTS PER WELL				
Description	Price (per ft)	Dry Hole	Completion	Total
Casing Crew		\$0	\$1,500	\$1,500
Cementing and Cementing Services		\$0	\$7,000	\$7,000
Company Supervision (\$500/day)		\$1,000	\$500	\$1,500
Contract Drilling - Footage	\$7	\$15,400	\$0	\$15,400
Contract Drilling - Hourly Rate (\$180/hr)		\$0	\$5,400	\$5,400
Completion Rig		\$0	\$1,700	\$1,700
Engineering Consultant		\$1,000	\$1,000	\$2,000
Equipment Rental		\$1,000	\$1,000	\$2,000
Land and Site Reclamation		\$1,500	\$1,500	\$3,000
Legal and Curative		\$1,500	\$0	\$1,500
Logging (open and cased hole)		\$5,600	\$2,500	\$8,100
Miscellaneous		\$1,000	\$2,000	\$3,000
Mud		\$2,500	\$0	\$2,500
Trucking and Hauling		\$1,000	\$1,000	\$2,000
Water		\$1,500	\$0	\$1,500
Cementing/Squeeze/Reperforate		\$0	\$0	\$0
Contingencies (10%)		\$3,300	\$2,510	\$5,810
TOTAL INTAGIBLE DRILLING COSTS		\$36,300	\$27,610	\$63,910

DEPTH

2,200

TANGIBLE DRILLING COST PER WELL				
Description	Price (per ft)	Dry Hole	Completion	Total
Downhole Pump		\$0	\$875	\$875
Mud Anchor		\$0	\$750	\$750
Polish Rod		\$0	\$1,100	\$1,100
Production Casing (4 1/2" 10.5# J-55)	\$3.33	\$0	\$7,326	\$7,326
Pumping Unit (Size 160)		\$0	\$3,000	\$3,000
Rods (7/8" Grade "D")	\$1.00	\$0	\$2,200	\$2,200
Tank Battery		\$0	\$8,000	\$8,000
Tubing Anchor (2 3/8" x 4 1/2")		\$0	\$500	\$500
Tubing (2 3/8" 4.7# J-55)	\$2.28	\$0	\$4,900	\$4,900
Wellhead Assembly		\$0	\$3,000	\$3,000
Contingencies (10%)		\$0	\$2,893	\$2,893
TOTAL TANGIBLE DRILLING COSTS		\$0	\$34,544	\$34,544

TOTAL AFE AMOUNT

\$36,300

\$62,154

\$98,454

Slimhole Drilling and Completion Program
Stanton Mineral Development, Inc.
Estimated Well Costs, Arnim #2
Fayette County, Texas

INTANGIBLE DEVELOPMENT COSTS PER WELL				
Description	Price (per ft)	Dry Hole	Completion	Total
Casing Crew		\$0	\$1,500	\$1,500
Cementing and Cementing Services		\$0	\$7,000	\$7,000
Company Supervision (\$500/day)		\$1,000	\$500	\$1,500
Contract Drilling - Footage	\$7	\$15,400	\$0	\$15,400
Contract Drilling - Hourly Rate (\$180/hr)		\$0	\$5,400	\$5,400
Completion Rig		\$0	\$1,700	\$1,700
Engineering Consultant		\$1,000	\$1,000	\$2,000
Equipment Rental		\$1,000	\$1,000	\$2,000
Land and Site Reclamation		\$1,500	\$1,500	\$3,000
Legal and Curative		\$0	\$0	\$0
Logging (open and cased hole)		\$5,600	\$2,500	\$8,100
Miscellaneous		\$1,000	\$2,000	\$3,000
Mud		\$2,500	\$0	\$2,500
Trucking and Hauling		\$1,000	\$1,000	\$2,000
Water		\$1,500	\$0	\$1,500
Cementing/Squeeze/Reperforate		\$0	\$0	\$0
Contingencies (10%)		\$3,150	\$2,510	\$5,660
TOTAL INTAGIBLE DRILLING COSTS		\$34,650	\$27,610	\$62,260

DEPTH
2,200

TANGIBLE DRILLING COST PER WELL				
Description	Price (per ft)	Dry Hole	Completion	Total
Downhole Pump		\$0	\$875	\$875
Mud Anchor		\$0	\$750	\$750
Polish Rod		\$0	\$1,100	\$1,100
Production Casing (4 1/2" 10.5# J-55)	\$3.33	\$0	\$7,326	\$7,326
Pumping Unit (Size 160)		\$0	\$3,000	\$3,000
Rods (7/8" Grade "D")	\$1.00	\$0	\$2,200	\$2,200
Tank Battery		\$0	\$0	\$0
Tubing Anchor (2 3/8" x 4 1/2")		\$0	\$500	\$500
Tubing (2 3/8" 4.7# J-55)	\$2.28	\$0	\$4,900	\$4,900
Wellhead Assembly		\$0	\$3,000	\$3,000
Contingencies (10%)		\$0	\$2,093	\$2,093
TOTAL TANGIBLE DRILLING COSTS		\$0	\$25,744	\$25,744

TOTAL AFE AMOUNT	\$34,650	\$53,354	\$88,004
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Note: The Arnim #2 cost is slightly less than the #1 because of the elimination of one-time land and lease costs and the use of a common tank battery.

Conventional Drilling and Completion Program
Stanton Mineral Development, Inc.
Estimated Well Costs, Arnim #1
Fayette County, Texas

INTANGIBLE DEVELOPMENT COSTS PER WELL				
Description	Price (per ft)	Dry Hole	Completion	Total
Casing Crew		\$0	\$1,750	\$1,750
Cementing and Cementing Services		\$0	\$9,000	\$9,000
Company Supervision (\$500/day)		\$1,000	\$500	\$1,500
Contract Drilling - Footage	\$9	\$18,700	\$0	\$18,700
Contract Drilling - Hourly Rate (\$180/hr)		\$0	\$5,400	\$5,400
Completion Rig		\$0	\$1,700	\$1,700
Engineering Consultant		\$1,000	\$1,000	\$2,000
Equipment Rental		\$1,000	\$1,000	\$2,000
Land and Site Reclamation		\$1,500	\$1,500	\$3,000
Legal and Curative		\$1,500	\$0	\$1,500
Logging (open and cased hole)		\$6,500	\$2,500	\$9,000
Miscellaneous		\$1,000	\$2,000	\$3,000
Mud		\$3,500	\$0	\$3,500
Trucking and Hauling		\$1,000	\$1,000	\$2,000
Water		\$2,000	\$0	\$2,000
Cementing/Squeeze/Reperforate ⁽¹⁾		\$0	\$20,000	\$20,000
Contingencies (10%)		\$3,870	\$4,735	\$8,605
TOTAL INTAGIBLE DRILLING COSTS		\$42,570	\$52,085	\$94,655

DEPTH
2,200

TANGIBLE DRILLING COST PER WELL				
Description	Price (per ft)	Dry Hole	Completion	Total
Downhole Pump		\$0	\$875	\$875
Mud Anchor		\$0	\$1,000	\$1,000
Polish Rod		\$0	\$1,100	\$1,100
Production Casing (5 1/2" 15.5# J-55)	\$5.00	\$0	\$11,000	\$11,000
Pumping Unit (Size 160)		\$0	\$6,000	\$6,000
Rods (7/8" Grade "D")	\$1.00	\$0	\$2,200	\$2,200
Tank Battery		\$0	\$8,000	\$8,000
Tubing Anchor (2 3/8" x 5 1/2")		\$0	\$750	\$750
Tubing (2 3/8" 4.7# J-55)	\$2.28	\$0	\$4,900	\$4,900
Wellhead Assembly		\$0	\$4,500	\$4,500
Contingencies (10%)		\$0	\$3,735	\$3,735
TOTAL TANGIBLE DRILLING COSTS		\$0	\$44,060	\$44,060

TOTAL AFE AMOUNT	\$42,570	\$96,145	\$138,715
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(1) Anticipate a minimum of one cement squeeze on a conventional well.