Report Title/Type:	Eighth Quarterly Technical Progress Report for project entitled "Establishment of an Industry-Driven Consortium Focused on Improving the Production Performance of Domestic Stripper Wells"
Reporting Period:	February 1, 2006 – April 30, 2006
Principal Authors:	Joel L. Morrison and Sharon L. Elder
Report Issue Date:	May 1, 2006
DOE Award Number:	DE-FC26-04NT42098
Submitting Organization:	The Pennsylvania State University The Energy Institute C-211 Coal Utilization Laboratory University Park, Pennsylvania 16802-2323

DISCLAIMER

ABSTRACT

The Pennsylvania State University, under contract to the U.S. Department of Energy (DOE), National Energy Technology Laboratory (NETL) established a national industry-driven Stripper Well Consortium (SWC) that is focused on improving the production performance of domestic petroleum and/or natural gas stripper wells. The consortium creates a partnership with the U.S. petroleum and natural gas industries and trade associations, state funding agencies, academia, and the National Energy Technology Laboratory.

This report serves as the eighth quarterly technical progress report for the SWC. Key activities for this reporting period include:

- Organize and host the 2006 Spring Meeting in State College, PA to review and select projects for SWC co-funding;
- Participation in the 2006 PA CleanEnergy Expo Energy Theatre to air the DVD on “Independent Oil: Rediscovering American’s Forgotten Wells”;
- New member additions;
- Improving communications; and
- Planning of the fall technology meetings.

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania State University, under contract to the U.S. Department of Energy (DOE), National Energy Technology Laboratory (NETL), has established an industry-driven stripper well consortium that is focused on improving the production performance of domestic petroleum and/or natural gas stripper wells. Industry-driven consortia provide a cost-efficient vehicle for developing, transferring, and deploying new technologies into the private sector. The Stripper Well Consortium (SWC) creates a partnership with the U.S. petroleum and natural gas industries and trade associations, state funding agencies, academia, the National Energy Technology Laboratory, and the National Petroleum Technology Office.

Consortium technology development research is conducted in the areas of reservoir remediation, wellbore clean up, and surface system optimization. Consortium members elect an Executive Council that is charged with reviewing projects for consortium co-funding. Proposals must address improving the production performance of stripper wells and must provide significant cost share. The process of having industry develop, review, and select projects for funding ensures that the consortium conducts research that is relevant and timely to industry. Co-funding of projects using external sources of funding is sought to ensure that consortium funds are highly leveraged.

2.0 EXPERIMENTAL

A description of experimental methods is required by the DOE for all quarterly technical progress reports. In this program, Penn State is responsible for establishing and managing an industry-driven stripper well consortium. Technology development research awards are made on a competitive basis. Therefore, this section is not applicable to the Penn State contracted activities. Technical reports from the individual researchers are required to contain an experimental discussion section and are submitted to consortium members and DOE for their review.

3.0 RESULTS AND DISCUSSION

This report addresses the activities for the reporting period from February 1, 2006 through April 30, 2006. During this time period efforts were directed toward the following activities:

- Organizing and hosting the 2006 Spring Meeting in State College, PA to review and select projects for SWC co-funding;
- Participation in the 2006 PA CleanEnergy Expo Energy Theatre with the showing of the DVD on "Independent Oil: Rediscovering American's Forgotten Wells";
- New member additions;
- Planning of the fall technology meetings; and
- Improving communication efforts.

3.1 SWC Spring Meeting

The SWC organized and hosted its spring proposal meeting on April 18-19, 2006 in State College, PA. Over 50 representatives from industry, academia, trade associations and the federal government participated. The agenda for this meeting is provided as Appendix A. The meeting was dedicated to reviewing the proposals that were submitted to the SWC for co-funding. In addition, delegates from Interstate Oil & Gas Compact Commission (IOGCC), Independent Petroleum Association of America (IPAA), and the National Stripper Well Association (NSWA) participated in a technical panel discussion on issues such as the needs and trends of the SW industry, promotion of appropriate technology for the SW industry, and how the SWC can address these issues. The Principal Investigators of the proposed projects provided a 20-minute presentation, followed by a question and answer session. Of the 18 proposals submitted, the Executive Council recommended 9 proposals for SWC co-funding for a total of $1,241,430. Table 1 summarizes these projects. Appendix B contains a one page Executive Summary for these projects. The breakdown for the approved projects is as follows:

- Committed funding from SWC $1,241,430
- Funding commitment from applicant $1,366,158
- Total project funds: $2,607,588

TABLE 1: PROJECT SUMMARY

Title	Company City, State	Project Cost Summary			
		Total	SWC	Applicant	Committed Funding
Best Practices Guide to Optimizing Multizone Coalbed Natural Gas Well Completions	WellDog, Inc. Laramie, WY	$1,070,806	$200,000	$870,806	$200,000
Liquid Lifting from Deviated and Horizontal Tight-Shale Gas Wells	Colorado School of Mines Golden, CO	$115,311	$68,024	$47,287	$68,024
Pumper/Well Tender PDA Program for Small Producing Companies	OK Marginal Well Commission Oklahoma City, OK	$121,674	$93,076	$28,597	$103,076
Novel Single Stage Water Mitigation Treatment	Impact Technologies Tulsa, OK	$224,950	$152,966	$71,984	$152,966
Reducing Water Production in Mississippian Reservoirs Using Gelled Polymer Systems	University of Kansas Lawrence, KS	$335,688	$234,982	$100,706	$234,982
Advanced ASJ Drilling System	Impact Tech. Tulsa, OK	$225,840	$153,571	$72,269	$153,571
Foam Control System for Natural Gas	Composite Engineers Oklahoma City, OK	$75,797	$44,567	$31,230	$44,567
Increased Pumping Capacity and Depth for Airlift System	Airlift Services International Anderson, IN	$178,403	$126,324	$52,079	$126,324
Modify and Extend Casing Plunger Technology to Tubing	PAAL, LLV Brownwood, TX	$249,120	$157,920	$91,200	$157,920
	Grand Total	$2,597,588	$1,231,430	$1,366,158	$1,241,430

3.2 2006 PA Clean Energy Expo

The SWC participated in the 2006 PA CleanEnergy Expo Energy Theatre with the showing of the DVD on "Independent Oil: Rediscovering American's Forgotten Wells" at the Bryce Jordan Center, University Park, PA on March 31 – April 1, 2006. This thirty-minute video was periodically shown throughout the expo as part of six energy related programs presented by the Penn State Public Broadcasting network (WPSU). The two-day event was well received and drew over 15,000 visitors. The initial order of 3,500 DVDs has been distributed and an additional 2,500 have been ordered.

3.3 New Members

The SWC membership continues to grow and broaden in its diversity. During this quarter, 7 new members were added. Recruiting additional members throughout 2006 will continue.

• Cook Contracting, WV • Double "K" Oil, Inc., KS • EarthSonics, Inc., IL • Motorbyte, VA	• New Mexico Tech, NM • WellDog, Inc., WY • WellSonic, LC, CA

3.4 Upcoming Meetings

The SWC is in the preliminary planning stage to organize two fall technology transfer meetings in 2006.

Oklahoma City, OK. The first technology transfer event will be held in the southern US at the Oklahoma State Fair Grounds Travel and Transportation Building, Oklahoma City, OK in conjunction with the OK Oil and Gas Trade Expo, OK Marginal Well Commission on October 26, 2006. The meeting is still in the planning stage and will be organized to showcase selected SWC research projects.

Pittsburgh, PA. The second technology transfer event will be held in the northeastern US in Pittsburgh, PA at the Embassy Suites Pittsburgh International Airport on November 9, 2006. The meeting will be in conjunction with the Pipeline Research Council International (PRCI) Underground Storage Technical Planning Committee

meeting and the Gas Storage Technology Consortium (GSTC) transfer meetings. The PRCI meeting will be on November 7, 2006. The GSTC technology transfer session will be held on November 8, 2006, immediately following the PRCI meeting. The SWC technology transfer session will follow on November 9, 2006. The scheduling of back-to-back meetings will fit with the SWC's plan to strengthen the interactions between SWC, GSTC, and PRCI. This will expand the cross-fertilization of the two consortiums and allow delegates to conveniently attend all meetings. The meeting is still in the planning stage and will be organized to showcase selected SWC research projects.

3.5 Communications

The SWC website continues to be updated and redesigned (http://www.energy.psu.edu/swc). The first electronic newsletter announcing the new project awards and upcoming events has been drafted. The newsletter will improve communication between the spring and fall meetings. It is anticipated this newsletter will be distributed 3-5 times per year, in addition to being available on the website.

3.6 Upcoming Activities

During the next quarter the SWC will:

- Work towards getting the subaward contracts in place for the 9 new projects,
- Finalize the 2006 calendar,
- Continue planning for the fall technology transfer meetings, and
- Continue web redesign and updates.

4.0 CONCLUSIONS

During this reporting period, the SWC provided $1,241,430 to co-fund 9 projects. These projects build upon 62 other projects that the Consortium has co-funded in previous funding cycles. Since the inception of the SWC, the Consortium has now provided $6.84M to co-fund a total of 71 projects. The SWC is preparing for two regional technology transfer meetings, one in the southwest (Oklahoma region) and one in the northeast (Pennsylvania region) in the October/November time frame. The SWC has laid

a solid foundation for continued membership growth and industrial-relevant technology transfer.

5.0 REFERENCES

A listing of referenced materials is required by the DOE for each quarterly technical progress report. This technical progress report for the SWC did not utilize any reference material.

6.0 APPENDICES

Appendix A: Spring Meeting Agenda
Appendix B: Proposal Executive Summaries

APPENDIX A:
Spring Meeting Agenda

MEETING AGENDA

Nittany Lion Inn, State College, PA

April 17, 2006 – Penn State Room	
6:00-8:00 PM	**Evening Reception and hors d'oeuvres – Penn State Room**

April 18, 2006	
7:30-8:30 AM	**Breakfast Buffet – Boardroom 1**
8:30 – 9:00	Registration
9:00 – 9:20	**Introductions, Welcoming Comments, State of the SWC – Ballroom AB**
9:20– 9:45	Well-Bore Clean-UP Using Sonication and Petromax Chemistry *Presenter: EarthSonics, LLC*
9:50 – 10:15	New 3D Seismic Attribute Analysis, Improved Wireline Saturation Modeling, and Integrated Reservoir Modeling to Rejuvenate Projection from a Mature Midcontinent Oomoldic Field *Presenter: University of Kansas Center for Research*
10:15-10:45	**Break**
10:45 – 11:10	Best Practices Guide to Optimizing Multizone Coalbed Natural Gas Well Completions *Presenter: WellDog, Inc.*
11:15 – 11:40	15 Well Acoustic Fluid Level Monitor Case Study *Presenter: WellSonic, Inc.*
11:45 – 12:10	Liquid Lifting from Deviated and Horizontal Tight-Shale Gas Wells *Presenter: Colorado School of Mines*
12:15 – 1:00PM	**Lunch – Boardroom 1**
1:00 – 2:00	Technical Discussion: Industry Needs and Trends – Gerry Baker, IOGCC, Dewey Bartlett, SWA, and Suzanne Whitehurst, IPAA
	Proposal Continuations
2:00 – 2:25	Design, Develop and Bench Test a Canister-less Actuator for the GOAL PetroPump to Afford for Quicker Descent of Tool Through More Viscous Fluids, Reduce Potential for Entrapment of Sand and Other Particles Which Restrict Tool Operation in Dirty Wells and Improve Seal Alignment *Presenter: Brandywine Energy and Development Company*

2:25 –2:50	Pumper/Well Tender PDA Program for Small Producing Companies *Presenter: Oklahoma Marginal Well Commission*
2:50- 3:15	Arbuckle Water Remediation-Polymer Gel Technology *Presenter: Double "K" Oil*
3:20 – 3:45	Increased Pumping Capacity and Depth for Airlift System *Presenter: Airlift Services International*
3:45 – 4:00	**Break – Ballroom**
4:00 – 4:25	Development of Low-Cost Hybrid Horizontal Drilling Technology *Presenter: Hydroslotter Corp.*
4:30 – 4:55	Novel Single Stage Water Mitigation Treatment *Presenter: Impact Technologies*
5:00 – 5:25	Long Range Ultrasonic Guided Waves for Inspection of Stripper Well Components *Presenter: Pennsylvania State University*
6:00PM	**Dinner – Boardroom 1**

April 19, 2006	
7:30 – 8:30AM	**Breakfast Buffet - Ballroom C Meeting Ballroom AB**
8:30 – 8:55	Reducing Water Production in Mississippian Reservoirs Using Gelled Polymer Systems *Presenter: University of Kansas Research Center*
9:00 - 9:25	Advanced ASJ Drilling System *Presenter: Impact Technologies*
9:30 – 9:55	A New Intelligent Systems'-Based Methodology for Revitalization of Mature Fields *Presenter: West Virginia Research Corp.*
9:55 – 10:15	**Break**
10:15 – 10:40	Foam Control System for Natural Gas *Presenter: Composite Engineers*
10:45 – 11:10	Gas Well Disposal Water Pumping Into Lower Formation *Presenter: Airlift Services International*
11:15 – 11:40	Modify and Extend Casing Plunger Technology to Tubing *Presenter: PAAL, Inc.*
11:40 – 12:00	**Closing Comments/Meeting Adjourned**
12:00	SWC Executive Council Meeting and Working Lunch Lunch in Writing Room 2AB. Meeting Mt. Nittany Room

APPENDIX B:
Proposal Executive Summaries

Best Practices Guide to Optimizing Multizone Coalbed Natural Gas Well Completions

Bret Noecker, Principal Investigator, WellDog Inc; Dr. John Pope, Principal Lead, WellDog, Inc.

Executive Summary

The purpose of this study is to provide assistance with multizone completions by using spectroscopic analysis of coalbed reservoir geochemistry to measure critical desorption pressure (CDP), gas content (GC) and percent saturation in coalbed natural gas (CBNG) wells from existing leases in the Powder River Basin **(T52N R77W, Sec. 20, Johnson County, Wyoming)**. Results for these key reservoir parameters will be economically feasible and available in less than one week, rather than several months using conventional coring techniques, allowing the producer the ability to directly compare and predict each seam's performance prior to substantial water production. The study objectives are:

- Use WellDog's proprietary technology to measure CDP, GC, and percent saturation in up to 27 seams, from twelve wells with both single zone and multizone completions.
- Use CDP, GC, and percent saturation to evaluate the production potential of several seams in nine wells. Having the ability to identify a seam with low GC, CDP and high potential for water contribution, a producer can choose to isolate such a seam and reduce water production without sacrificing economic gas production.
- Compare the gas and water production of off-set wells, completed by the PRB industry standard practice of single zone, under-reamed completion method, to the gas and water production of the wells with multizone completion to determine effectiveness in providing enhanced gas production.

Of the 17,000 CBNG wells in the PRB, over 9,600 produce less than 30 mcf/day. While multizone completions should enhance economic gas production, reservoir variability in the PRB have not allowed for broad success. In order to induce increased production from these wells, it is necessary to employ WellDog's technology and identify re-entry zones that contain economic gas.

EXECUTIVE SUMMARY: Liquid Lifting from Deviated and Horizontal Tight-Shale Gas Wells

Objectives. Measure and correlate (1) critical flow rates for lifting liquids from deviated and horizontal gas wells, and (2) extent of production impairment by water blocks in very low permeability formations.

Motivation. Deviated and horizontal wells with induced fractures are used increasingly for exploiting gas from very low permeability formations where much of U.S. gas reserves reside. To efficiently produce from these gas-bearing formations, accumulations of water and hydrocarbon liquids in wells must be avoided or minimized because accumulated liquid decreases productivity by increasing bottom-hole pressure and by blocking flow of gas from the formations – water blocks can be severe for very low permeability formations.

Specific Directions. The three tasks proposed below describe briefly the specific directions for this study.

1. *Quantify Critical Flow Rates.* Use the flow loop in the High Bay Lab at CSM to measure critical flow rates for tubing orientations from vertical to horizontal. Compare measured critical flow rates to existing correlations. Modify or develop new correlations as needed to describe data.
2. *Quantify Water Blocks*. Use the Relative Permeability Apparatus at TerraTek in Salt Lake City to measure the extent of production impairment by water blocks in very low permeability media. Correlate results with other rock properties.
3. *Liquid-Lifting Short Course.* Continue one-day short courses on lifting liquids from gas wells using the CSM Flow Loop for hands-on demonstrations. Add demonstrations for deviated wells and water blocks.

EXECUTIVE SUMMARY
For
PUMPER/WELL TENDER PDA PROGRAM

This project is taking a very simple and fundamental concept, putting software behind it, then presenting it to people and teaching them how to use it.

The goal of this project is to create a simple, user-friendly software system to support field operations for oil and gas production. The software will be created to work in the field on Personal Digital Assistance (PDAs). The data that is gathered in the field will be transferred to a computer in the office. Data can be created on the office computer for use in the field. The software will be capable of performing some common calculations such as meter flow rates and tank gauges.

Smaller companies often operate marginal or stripper wells. The expense of Implementing a software system such as the one being proposed may be cost Prohibitive. The programming, setup and training of any system would require a large amount of time and expense. This expense as well as the technology expertise needed to implement the system would deter the majority of small operators.

The program will be available free of charge in the form of CD's and on a web-Site. The training seminars will be held to display the software to companies. Additionally, a technical support website and telephone tech support will be created.

The program will take into account the various practices and equipment used throughout the country. It will be capable of meeting the needs of a broad range of operations. At the same time it will present the field user with the simplest interface possible.

The overall objective is to improve the efficiency of the operation and add value by increasing the knowledge base of the resources.

Impact Technologies LLC
2006 Proposal to the
Stripper Well Consortium

Novel Single Stage Water Mitigation Treatment

PUBLIC EXECUTIVE SUMMARY

A new silicate (liquid glass) chemistry formulation, now called SPI Technology, has been identified that can provide a low cost silicate system to be mixed on the surface and pumped downhole for delayed formation of strong, resilient "green" gels. This new formulation appears more favorable than the current chromium based systems or even the original Glass system, although it has similar environmentally friendly and low cost chemicals, but it provides a more resilient gel, controlled delayed gelation, simpler surface mixing and less labor to monitor and treat. Such well treatments will allow deep treatments of stripper wells for long term diversion of formation waters. This will reduce excess and unwanted water production from oil and gas wells resulting in operational cost savings and increased recoverable oil and gas reserves. Stiffer gel from this same basic formulation can also be prepared for casing repairs, preventing these damaged wells from being plugged and abandoned prematurely. Due to the low treatment cost and environmental friendly chemicals, it will be very cost effective for stripper well operators to utilize.

Laboratory tests will be conducted to outline the testing matrix of the SPI chemical concentrations and other variables. Further testing will be done to characterize the gel properties in the identified 'sweet spot' of the SPI formulation. Specific lab testing will evaluate the gels with different brines and specific multivalent ions. Laboratory physical modeling will be done (optional) with sand packs and simulated casing leaks. Well information and waters will be obtained from selected wells for possible field treatments and laboratory tests will be made to determine the optimal treatment plans. Six (6) field treatments will be made out of this selection. The results will be monitored for performance and benefits obtained.

EXECUTIVE SUMMARY

A two-well field test is proposed to determine if the gelled polymer technology that has been applied successfully in Arbuckle reservoirs in Central Kansas can be extended to Mississippian reservoirs. The Mississippian reservoirs in Kansas are a major source of oil production, accounting for about 18%(6.13 million barrels in 2004) of the total annual production. Cumulative production from Mississippian reservoirs in Kansas exceeds 1 billion barrels. The Mississippian reservoirs are heterogeneous and produce under a strong water drive. High water cuts and low recovery factors are typical of these reservoirs. The perceived risk of trying the new technology used successfully in the Arbuckle formation has prevented the evaluation of the new gelled polymer technology in Mississippian reservoirs

The proposed field test will be conducted in the Schaben Field in Central Kansas. This field, studied in a DOE Class 2 demonstration project in 1994-1997, has regions containing high mobile oil saturations that may be potentially recoverable if water production can be reduced and the water influx diverted to matrix rock to displace mobile oil. Water production rate following treatment of a well using a gelled polymer system can be reduced by a process in which the gel that has formed in situ is dehydrated following placement by slow injection of oil. Three results are anticipated: 1) substantial reduction of water production rates after treatment, 2) increased incremental oil production caused by creation of new displacement paths for the water moving to the wellbore and 3) longer interval between gel treatments because the dehydrated gel is stronger than the original gel because the polymer concentration increases in the gel that is dehydrated. The field test is a cooperative field demonstration program between the Kansas University Energy Research Center, American Warrior Inc. and Pickrell Drilling Co. Inc. independent oil producers in Kansas.

Impact Technologies LLC

2006 Proposal to the

Stripper Well Consortium

Advanced ASJ Drilling System

PUBLIC EXECUTIVE SUMMARY

A new drilling system is proposed for faster and lower cost drilling of vertical wells, for finding new reserves, and for the installation of multiple micro-sized lateral drain holes, or extended perforations, for significant improvement in production from stripper wells. Lateral drain holes can provide stimulation of existing zones by providing a conduit for flow from tight formations, bypass of damaged zones and reduced water production due to coning. This system can also clean-out solids, scales and metals from wellbores and can recomplete stripper wells into new zones by cutting the steel casing for lateral installations. This proposal includes the development of a new patent-pending high pressure abrasive slurry pump; development of a new patent (pending) downhole hydraulic motor in a new configuration; deployment of a new abrasive nozzle and several other downhole tools for control of the new drilling process. Bench testing of the individual components and (optional) shallow vertical and directional field tests are included in this project.

If the cost savings from this new system were applied to only 5000 wells drilled per year, where the drilling cost is $90,000, this would result in savings to the stripper well operators of about $150 million each year. For 5 years is would be $750,million in savings. This does not take into account the environmental benefits of smaller unit, the savings from less water production due to avoidance of water coning due to lateral drainholes installed or the increase in oil and gas production due to new wells drilled and lateral drainholes installed.

EXECUTIVE SUMMARY
For
Foam Control System

As our domestic natural gas wells decline, more and more efforts are being made to get more and more needed gas to the surface. The projected natural gas needs for the United States will be several times current production in the coming years.

Of the wells being discovered and produced today, most produce varying amounts of water. As more and more water comes into the wellbore of these wells, stronger and more reactive foaming agents are required to get the water to the surface.

There is a new family of foaming agents available that work in high temperature wells, high chloride concentrations and in the sizeable presence of hydrocarbons.

While these foaming agents are very effective, in many applications they are so effective, the foam they produce survives the separation process at the surface and continue on into the gas measurement piping and down the sales lines. Where compressors are onsite, these foams have been blamed for aggravated corrosion problems and compressor damage. The gas purchasers have recognized this problem and have shut in wells in some areas.

The purpose of the proposed research is based on two approaches.

The first one is to research, study, test and identify a chemical compound that is capable of "breaking" a new family of foaming agents being distributed by all major oilfield chemical companies.

The second is to design an injection system that maximizes effect and minimizes volumes.

This system is currently needed and will be applied upon availability.

Executive Summary

Airlift Services International (ASI), a Division of Energy, Inc., is an Indiana-based oil service company. ASI, still in the initial start-up phase, is the first company to successfully and economically pump oil and other fluids using compressed air. The Airlift Oil Pumping System (Airlift) is designed to increase profits for owners of marginal or stripper wells by increasing well production through the reduction of maintenance costs and increase of uptime and efficiency.

Since 1993, America's marginal well producers have plugged and abandoned approximately 150,000 marginal wells and 150,000,000 bbls of crude oil. The pump jack system requires regular maintenance to replace worn out components and broken parts. Current technology offered by ASI has proven effective in opening many of these wells. The systems offered by ASI are capable of pumping up to 70 barrels per day of fluid from wells to a depth of 2000 feet.

ASI proposed the re-engineering of its innovative and proven pumping technology to improve the pumping capacity and increase the pumping depth. ASI proposed to develop computer modeling that will evaluate the current six stage, 1500 foot pumping system. This system will be modeled and optimized for fluid flow.

If ASI is able to re-engineer the system through computer modeling and develop a system with the ability to pump at depths of 3000 feet and 50 BPD, there will be a major increase in the number of now idle wells that can be put back online. The objectives of this grant proposal include:

1. Objective 1 – To increase the number of stripper wells currently in production.
2. Objective 2 – To validate the capability of computer simulation to predict fluid flow capacity in future wells.

PAAL, LLC 2006 PROJECT PROPOSAL
MODIFY AND EXTEND CASING PLUNGER TECHNOLOGY TO TUBING

Executive Summary

This proposal offers to evaluate the recently patented advances in casing plunger applications in larger diameter casing for the feasibility of extending the proven technology in casing to stripper well gas production in 2-3/8 inch and 2-7/8 inch tubing applications. The technology, while similar, will require substantial modifications in the design concept and material selections to successfully extend the benefits of larger diameters of casing to the smaller diameters of tubing

Many applications exist in which 2-7/8 inch tubing was cemented in the hole in what has been called tubing-less or casing-less completions. Multiple strings could produce multiple zones quite economically during the flush production of the reservoir. Other applications exist in older, depleted wells which have experienced a casing leak and economics and well bore pressure did not warrant traditional repair procedures. In many cases, the 2-3/8 inch or 2-7/8 inch tubing was run back in the hole with a packer that isolated the casing leak. Such temporary repair procedures further complicate the production in stripper wells and reduce the feasibility of a successful casing leak repair. In all these applications, no tubing/casing annulus exists for gas pressure build up to act as an energy storage chamber to assist conventional tubing plungers.

As reservoir pressures declined over the years, traditional artificial lift remedies were curtailed in so-called tubing-less completions. Although rod pumps, siphon strings and tubing plungers extended production in many applications for a while, further depletion now severely limit these methods as economical solutions for extending the productive life of stripper wells.

Unrepaired casing leaks isolated by a frequent “quick-fix” method of running the tubing with a packer, offers some immediate resolution. However, as reservoir pressure further declines, two serious conditions occur. First, conventional tubing plunger or siphon string production becomes less effective and more costly to maintain. Rod pump installation may be hindered, or even impossible if the packer cannot be released and the tubing repositioned for effective rod pump operation. Second, and of greater concern, the inevitable fluid invasion into the depleted producing zone that will result in drilling out the packer or repairing the casing leak greatly increases the risk of flooding out the producing zones, thus increasing the risk of the loss of all production.

If a tubing plunger can be designed that employs the principles and technology of successful casing plungers, then daily production and future recovery can be substantially increased for many stripper wells.

This proposal covers the design, drafting, and manufacture of tubing prototypes, including the tooling required to lab test and field test both design concepts and tool prototypes.