GREENSBURG OIL, LLC

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A cost effective system for desalination of produced water is proposed. Produced water represents 98% of waste in the oil and gas industry. Many times the profitability of a field depends upon the effective management of this water. While Underground Injection through EPA Class II injections wells is the most common method for dealing with produced water, lack of injection capacity as well as challenging geology, can drive the need for an alternative. The Greensburg Oil Pool is one such example.

The Greensburg Oil Pool located in South Central Kentucky produced 22 million barrels of oil through primary recovery methods during a seven year span in the 1960's. During this period, produced water was simply discarded into surface streams without treatment. After state and federal agencies stopped this, local operators were forced to shut down due to an inability to deal with the water issue. There are no alternative zones for disposal and the technology did not exist for treatment of the water to make it acceptable for surface discharge.

The goal of this exercise will be to not only prove the technology for treatment of the water but to also prove the economics of deploying such a system.

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Two-Phase Flow Impairment in Gas Gathering Systems: Problems, Detection and Solutions for Stripper Well Systems

PUBLIC EXECUTIVE SUMMARY

The optimum operation of the surface production system is one of the key elements needed for the successful operation of gas stripper well facilities. Unwarranted losses in the surface gathering system invariably lead to inability to produce stripper wells at their full potential, when at all possible. Therefore, optimizing conditions at the surface production system becomes an important goal and challenge for operators. One of the major stumbling blocks in this pursuit is the detrimental effect of liquids on gas production performance. Liquids, water in special, are the major culprits of excessive losses not only in the wellbore but throughout the surface production system. In surface gathering systems handling production from gas stripper wells, the presence of liquids such as water can reduce gas deliverability below economic limits and kill production from wells feeding the gathering system. The most insidious feature about the water problem is that, even after successful removal of free water at wellhead conditions, natural gases entering the surface gathering system are water-saturated and thus liquids tend to reappear at different locations of the surface network system. Early detection and removal of this water can become a real challenge for operators. This work will focus primarily on developing, testing, deploying and demonstrating an analytical tool that would serve the primary purpose of increasing throughput capacity and improving operational reliability of natural gas gathering network infrastructure. This will be done by developing a comprehensive model for single-phase gas and multiphase (gas and liquid water) movement in the gas pipeline system anchored on good fluid dynamics science. This model will have the capability to answer some fundamental questions about gas deliverability and two-phase flow impairment or water interference, to which there is lack of accurate answers that have severely limited the industry operator's ability to control the fate of the gas delivery system, which is central to economic outlook as well as profitability of operation. The answers to these questions have direct and significant impact on deliverability and operational efficiency of the pipeline system, and the integrity of the salient peripheral equipment. The proposed water-tracking research effort aims at utilizing fundamental thermodynamic and transport phenomena principles for the mapping of pressure, temperature, and fluid distribution inside a gas gathering networks and the definition of how liquid drop-out defines new preferential flow paths for the gas and liquid phases.

Public Executive Summary

A new, effective and tested dewatering pumping system based on proven hydraulically operated diaphragm pump technology has been developed and patented. Pumps have been deployed on concentric steel coil tubing for major operators in the San Juan and are planned for East Texas operating regions. In these installations, the pumping system has proven to be reliable and effective in dewatering gas wells. As favorable as these results are, these pumps are not economic for lower productivity wells due mostly to the high cost of concentric coil tubing, installation, and the cost of bringing in power.

The goal of this project is to develop and demonstrate in the field lower cost deployment and operating methods based on this pump. Cost will be reduced by 1) The use of low cost thermoplastic tubing, 2) the use of low cost spoolers in place of coil tubing rigs and 3) the use of solar, wind and other independent, non polluting power systems to power the pump.

When this project is completed, a low cost, tested, insertable pump, deployed on flexible plastic hydraulic lines with low cost spoolers will be available to the stripper well community nationwide.

Another goal of the project is to demonstrate the operation of the pump using small scale solar or wind power systems, and/or the use of a truck mounted power source to eliminate the need for power lines or internal combustion engines on site. This system is one of the few that has the option to be operated using small scale alternative energy systems.

EXECUTIVE SUMMARY: OPTIMIZING STRIPPER WELL PRODUCTION WITH JLS GAS DRIVE FLUID LIFTING SYSTEM

Jet Lifting Systems International is a California based Oil Services Company, which is a division of JLS, Inc. (hereinafter "JLS"). JLS is developing a lifting process that significantly reduces operator costs and improves the environmental footprint of stripper well operations. The heart of the process is JLS's patented GAS DRIVE FLUID LIFTING SYSTEM. JLS is the assignee of a patent (Patent Number US 7,331,397 B1) that was granted on February 19, 2008.

It is being proposed that a development test series be conducted with the objective of demonstrating significantly reduced operator costs and improvements in the environmental footprint employing closed system operations with zero emissions. Relative ease of installation down-hole, ease of operation, reliability, lack of maintenance requirements, the self cleaning feature, the liquid level prompt control system and ease of removal at the end of the test period will be demonstrated. Another important objective is to obtain operating data to lead to system improvement and optimization. For example, just how soon can the gas being sent down-hole be cut off and still maintain full production per cycle?

Essentially, the JLS process for lifting fluid, from a well bore, is a closed loop passive collection and pneumatic lifting system located in a well consisting of (1) a pneumatic tube, (2) a fluid tube mounted within the pneumatic tube creating an annulus, and (3) a jet barrel chamber formed between the pneumatic tube and fluid tube, in fluid communication at the zone to be recovered. Just as important is the steel ball that is located in the jet barrel. This is the only moving part in the JLS system. Once fluid fills the jet barrel chamber, a compressor on the surface is triggered, whereupon pressurized gas or air is sent down-hole in the annular space between the chamber wall and fluid tube. When the applied gas pressure reaches the jet barrel, it forces the ball to seat at the bottom of the jet barrel chamber and the fluid is forced to the surface, where a gas-oil separator then separates and transports the fluid to a holding tank and the recovered gas to a (low) pressure vessel on the suction side of the compressor.

The JLS process is specific to stripper wells. Whereas, the traditional pump jack has numerous moveable parts, including a lifting plunger piston for lifting the oil to the surface, the JLS system has only one moving part that is cleaned each time pressurized gas reaches the jet barrel chamber and the JLS lifting method is this pressurized gas. Therefore, unlike the pump jack, there is no up and down movement in the JLS process, which results in a significant cost savings over the pump jack. In essence, JLS eliminates the expensive operational costs associated with the moveable parts of the pump jack that have to be replaced over time. For example, the sucker rods, cones and seals within the pump jack configuration are especially subject to wear because of the constant up and down motion. But, by using the JLS Lifting System, the producer can eliminate all of this wear and tear, which means less maintenance costs and more profits. .

Also, where the pump jack is designed for continuous operation for periods of time, the JLS process is designed for cyclical periods. This is another savings. As operators know, the operating and maintenance costs can destroy the commercial value of stripper wells. Also, it is foreseeable that using the JLS System is a friendlier alternative because of the simplicity of design. Potential accidents will be averted and there will be less environmental impact.

EXECUTIVE SUMMARY

This proposal will combine the improved efficiencies of solar powered motors with the standard pump jack installations common to the stripper well industry.

Many stripper wells exist in isolated areas in which electrical service is currently unavailable as a viable source of power for stripper wells, especially in the Texas and Oklahoma panhandles with which the applicant is familiar. Many of these wells were originally completed as flowing gas wells. As production has declined over the years with the depletion of reservoir pressure, most producers have routinely utilized two primary methods of artificial lift to remove well-bore fluids. The accumulation of well-bore fluids, even if marketable, restrict gas production.

The preferred method for capital asset outlay is the conventional tubing plunger which eventually loses efficiency and cost effectiveness with continued decline. In the absence of sufficient gas pressure for tubing plungers, the second, more costly method is familiar pump jack. Currently, only two power sources exist for pump jacks, electricity and natural gas. Since many stripper wells exist in isolated areas in which electrical service is not available and cost prohibitive to construct, the only option is to use lease natural gas fired motors to power pump jacks. While the industry is well acquainted with typical natural gas motor maintenance, the recent rapid price increases of natural gas have made the fuel consumption of such motors a significant loss of revenue.

This proposal will combine the improved efficiencies of solar powered motors with the standard pump jack installations common to the stripper well industry.

Not only is this proposal an application for isolated gas wells with fluid loading, this proposal offers any low volume oil producer the option of replacing the natural gas fired motor with an environmental friendly and attractive power source. Not only will exhaust gases be eliminated from the atmosphere, but in many oil wells casinghead gas is a valuable source of revenue. Fuel gas can then be converted into additional natural gas sales revenues. Typical fuel consumption of 5 MCF/day becomes and additional natural gas sales volume of 150 MCF/ month. For many stripper wells, that will represent an increase of over 100 % in natural gas sales per month. And in every case, such a volume at current prices is significant.

This proposal will combine the improved efficiencies of solar powered motors with the standard pump jack installations common to the stripper well industry.

Thomas Karg

Oil Well Sentry, Inc

Public Executive Summary

"*Can a simple control produce more oil?"*

Yes, 1 to 20% more! *How?* By making more oil available to pump that is <u>already available</u> in the formation. *Just pump more often!* By keeping the rising fluid column in the bore low, the hydrostatic pressures that develop when the fluid column rises will never get to the point of opposing the formation pressure. This allows a continuous flow of crude oil and brine migrating to the well bore. Otherwise, the absence of pumping lets the column rise until it reaches equilibrium and all flow stops. For the most part, nothing happens until the pumping resumes. Then as the pressure against the formation drops, the flow slowly starts to the well bore, and then on to your stock tanks. More constant flow=more crude!

By adding a 8" x 8" x 4" box to your normal pump controls, the "Oil Well Sentry" a PrePump-Off Control, eliminates the problem of pumping **after** pump-off or pumping "dry". When this common worry is eliminated, many great economical and energy saving are possible. The system works by *monitoring each pump stroke* for the <u>**normal level of fluid refilling the Working Barrel**</u> at the bottom of the well. When the **normal level decreases** because pump-*off* is a*pproaching*, the motor or engine stops the cycle in 2-3 pump strokes

Pump-Off is defined as "a condition in which <u>all</u> the available fluids have been pumped." The "Oil Well Sentry" terminates the cycle just before <u>all</u> the fluids have pumped. This protects the seals and moving parts from excessive wear and tear, and reduces energy consumption by 30%. Also, crude oil production may be increased by 0 to 6 barrels a week.

This request is to develop methods to 1) optimize the frequency of pumping for increased production; 2) refine, develop and test additional sensors and controls to monitor pump strokes to lower energy requirements and wear and tear. The existing bridle mounted sensor works effectively to 2,800 feet, but will it work at 5,000'? The inline sensors work at 5,000' but there is a problems at 2,200'.

The objective is to produce very efficient low cost controls and highly effective production methods. This will let the Producer achieve maximum production, lowest energy usage, long equipment life, and minimum labor requirements.

<u>Executive Summary</u>

The objective of this Project is to demonstrate a new, advanced completion / stimulation method named Directed Slotting-Fracturing (DSF) technology. DSF technology combines hydroslotting, the patented and proprietary excavation technology that cuts two 180^{o}-phased slots through the casing, cement, and <u>deep</u> into the formation, with hydraulic fracturing. This demonstration will show that the orientation and long-distance direction of a hydraulic fracture can be controlled by the orientation and design characteristics of the actuating hydroslot if aligned with the maximum in-situ formation stresses. In other words, the hydroslot will cause the fracture to propagate along a pre-determined course for several tens to hundreds of feet, by altering the near-wellbore geology with properly oriented man-made stress regimes that exceed the maximum in-situ stresses in the near-wellbore zone, and follow the maximum stresses in the formation that are present naturally.

Directed Slotting-Fracturing, or DSF technology, introduces a new paradigm to the well-known rule that hydraulic fractures tend to propagate according to naturally-occurring path(s) of maximum and minimum stresses (usually perpendicular to the least principal strain). The new paradigm is that the hydroslotting component alters those naturally-occurring stress regimes in a well's near-wellbore zone, and this enables a hydraulic fracture to follow along a new path of (pre-planned) artificial stresses. If the hydroslot is oriented and designed properly, then this Project should be able to demonstrate how DSF can take into account the existing layout of local gas well activity, and expose the best gas characteristics of the local geology.

This demonstration will be implemented on a Medina gas well owned by Chautauqua Energy, Inc. and evaluation assistance will be provided by Earth Energy Consultants. Letters of in-kind support have been attached. Results of the demonstration will be compared to those of known hydro-fractures that have been set off through standard shot holes, notches, or other types of perforations.

Preliminary research comparing some of Chautauqua Energy's stripper wells to its best performers has revealed that, notwithstanding the poor performances of the stripper wells over the last twenty years, in fact, many have extensive reserves that have never been accessed due to near-wellbore damage and/or insufficient drainage, and also contain significant by-passed pay in lower porosity intervals (4-6%) that have never even been touched, which are <u>only</u> accessible with hydroslotting (altogether exceeding 600 MMCF for a small sample area of 200 acres). The upside potential of using DSF on all Medina stripper wells, based on the research of the small sample area, makes this Project commercially sound.

If the proposed technical approach is successful, it could lead to an important shift in the way old wells are re-stimulated, new wells are completed, and spud locations are chosen. The encouraging cost-benefit analysis gives independent operators a lower-cost alternative to drilling a new well, with practically equal performance results. When widely applied, DSF can add significant reserves to the energy resources of NY State, and ultimately, from similar gas fields across the nation.

Public Executive Summary

Validation of incremental oil production via single well and reservoir field trials involving *in situ* stimulation of indigenous microorganisms

Lead Organization: RAM Biochemicals, Inc.
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SWC Funding: $99,975

Microbial populations can and do exist in virtually all oil bearing formations seemingly regardless of depth, temperature, or formation geology. It is suggested that these organisms are not naturally occurring, but rather the result of contamination from initial drilling operations, water-flooding or infiltration from aquifers underlying the oil bearing formation. Regardless of their origin, these down-hole populations derive metabolic energy through processes utilizing existing carbon sources and water-born nutrients. For the purpose of this proposal they are all considered to be indigenous organisms.

Traditional Microbial Enhanced Oil Recovery [MEOR] treatment methods for stimulating oil production in single wells and reservoirs involves repetitive [cyclic] or continual injection of non-indigenous microorganisms plus substantial quantities of nutrient medium, usually molasses. These methods have proven to stimulate oil production which results from the production of biochemicals beneficial to oil recovery plus carbon dioxide that provides a gas drive mechanism. However, there are major drawbacks to this MEOR approach: 1) selection, culturing, and preparation of the requisite microorganisms to be injected requires specialized skills, 2) nutrient and shipping cost; 3) microorganisms can be filtered out at or near the formation face, resulting in severe flow restriction and little penetration into the formation, or even plugging; 4) failure of the injected microorganisms to become established and thrive in the down-hole environment.

This project seeks to validate the results of a novel approach to MEOR first undertaken by the applicant in 1988 which produces incremental oil by stimulating indigenous organisms in the formation *[in situ]* using low volumes of treatment fluid produced from brewing industry waste streams. Field trials to validate oil stimulation will be conducted on a number of single stripper well candidates in various oil-bearing strata. Single wells will be treated with low-volume slugs of treatment fluid via cyclic injection methods. Additionally, one or more enhanced water-flood projects involving mature fields will also be undertaken. Letters of Support from two oil producers have been received. They have agreed to assist the applicant in identifying candidate oil wells and one or more waterflood projects, and provide verifiable pre- and post-treatment data in exchange for stimulation fluid and technical assistance. Memoranda of Agreement to this effect will be executed upon receipt of grant funding.

The applicant seeks SWC co-funding to: 1) screen and select candidate wells and active water-floods; 2) manufacture and ship sufficient product to meet the needs of multiple single well field trials, and one or more enhanced water-flood projects; 3) analyze pre- and post-treatment data, and 4) generate a report of findings.