

RMOTC

Rocky Mountain Oilfield Testing Center

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KLAEGER OIL RETRIEVAL SYSTEM

Field Test Project Report

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PREPARED FOR THE U.S. DEPARTMENT OF ENERGY

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Klaeger Oil Retrieval System

Introduction

The Rocky Mountain Oilfield Testing Center (RMOTC) participated in a field demonstration project of the Klaeger Oil Retrieval System (KORS). The Rocky Mountain Oilfield Testing Center (RMOTC) was established in 1994 by the U.S. Department of Energy (DOE) as an industry-driven endeavor to help strengthen the domestic energy industry by field testing new petroleum and environmental technologies in an operating oil field. The Klaeger system was used to produce marginal wells over a 12-month period at the Teapot Dome oil field - also known as the Naval Petroleum Reserve 3 (NPR-3).

Alternative Technology

The Klaeger Oil Retrieval System is unique to the oil industry. The Klaeger was invented approximately 12 years ago in Texas in an effort to reduce operating costs and increase revenue.

The concept revolves around using a mobile casing swab to retrieve oil from marginal wells. The original swab unit was mounted on a farm tractor, which in fact is still in use today. The design has evolved to the point where the swab unit can now be mounted on a regular truck that increases mobility and allows more wells to be swabbed in a given time frame, thus increasing the profit margin. Because the Klaeger is patented and is designed for a very specific type of producing operation, other manufacturers have not been licensed to produce the system.

Field Data and Results

The Teapot Dome oil field had approximately 500 producing wells and another 500 wells that were in a dormant status, shut-in due to low oil production, had mechanical problems, had no production equipment, or were unused injection wells. The Klaeger was used mainly on the 650 wells completed in the Shannon formation at a depth of 300' to 1200'. The Klaeger was also used on approximately 20 Second Wall Creek wells at a depth of 2500' and 10 Muddy wells at a depth of 4000'.

The Klaeger has proven to be a valuable tool at NPR-3. It allows marginal wells to be economically produced instead of being plugged and abandoned. At NPR-3, it turns out that 75% of all wells tested can be returned to production instead of being plugged. Oil price is, of course, a major factor, but it turns out that the Klaeger "stimulates" every well it is used on. Paraffin and fines plugging are major causes of reduced production at NPR-3. The Klaeger creates enough "suction" across the perforations to actually clean the perforations and, in effect, stimulate the well. Several wells upon initial swabbing did not make any fluid. After five to ten days of swabbing, rates have reached as high as 4 BFPD, which on Shannon wells, is usually all oil. Almost every well has shown the effects of stimulation, however, not all the increased production is oil and, in those cases, the well may not be economical to return to pump, even though production is higher.

On a "normal" day at NPR-3, the Klaeger will swab 14 to 20 wells, recovering 35 to 55 BFPD. Of the total fluid recovered, the oil rate can reach as high as 85 to 90% if the wells are all Shannon formation (300' to 1200'). When swabbing other zones, such as the Muddy and Second Wall Creek,

the rates can reach as high as 80 to 100 BFPD but might only be 20% oil from 10 wells swabbed. The Klaeger at NPR-3 has 6000' of 9/16" wire rope so all seven oil zones at NPR-3 could theoretically be swabbed. The NPR-3 Klaeger has a 4 1/2", a 5 1/2", and a 7" mandrel, so those three size casings can be swabbed.

A Shannon well can be produced with the Klaeger in about 15 minutes from the time the unit pulls onto location until it drives off. Because of the time required to drive between the wells and to occasionally unload during the day, only 20 wells can be produced with the Klaeger during a normal 10 hour day. The Klaeger has a 40 barrel tank, but about 30 to 35 barrels is all that should be carried. The produced fluid is transported by truck to a tank battery for separation and sales. Transporting the fluid to a tank battery can be time-consuming, depending on the location of the wells. Also, weather conditions play a big role in how much fluid is recovered each day. During wet weather, not much work can be done. Cold weather slows down the operation. If an operator had enough wells, the Klaeger could be run 24 hours per day which would improve the economics of the unit considerably. Production varies from day to day depending on weather, wells, and manpower.

The purchase price of the NPR-3's truck-mounted unit was \$200,000. Operating costs for labor, fuel, and materials have averaged \$8500/month. During oil prices of \$12/bbl, the Klaeger was uneconomic to operate but did aid in identifying profitable wells. However, now that the price is near \$30/bbl, operation of the Klaeger is profitable.

One of the major benefits of the Klaeger to an independent operator is the fact that the operator could in fact sell all the pumping equipment, i.e., the pumping unit, the prime mover, the rods, and the tubing from each of his wells. Operators in Texas have in fact done this and used the revenue to pay for the Klaeger immediately. Training for new operators was minimal. The major cost is the labor to run the Klaeger, fuel, and the cost of swab cups. There are no electrical costs or rig costs to fix parted rods, holes in the tubing, or bad pumps. Maintenance savings varied from well to well. The Klaeger would work best for an operator with a large number of closely spaced wells with easy access to a treating facility.

Since the Klaeger was brought into the field during April 1999, 49 wells have been returned to production instead of being plugged and abandoned as probably would have happened. In older oil fields, where many wells are marginal or shut in because of economics, the Klaeger can be a very valuable tool. It allows well bores to remain open in hopes of higher oil prices or new developments in technology.