

Polymer treatments produce outstanding results in Kansas



Running a treatment in North Texas.

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Although polymer treatments have been around since the late 1960s, recent advances in technology, coupled with experience gained in the application of earlier treatments, have resulted in dramatic increases in both the success rate and long-term benefits resulting from a typical polymer treatment. Since early 2003, Polymer Services has pumped more than 800,000 barrels of polymer gel into nearly 400 individual wells for treatment. A conservative estimate of incremental oil resulting from the treatments is around 1.5 million barrels of additional oil. These numbers can largely be verified on third party production tracking sites on the Internet, such as IHS Energy Data or the Kansas Geological Survey website. Using an average oil price of \$50/bbl, the treatments have potentially yielded as much as \$75 million in additional oil revenues.

What types of wells can benefit from a polymer treatment? The most successful applications have been mature oil wells producing at a high water cut.

These wells typically have been in strong water-driven carbonate formations such as dolomite and limestone. Other successful applications include new wells which have channeled to an underlying water zone, and blocking direct channels in a water-flood situation, which typically results in one well “watering out” prematurely. In this case, the injection well can often benefit from a polymer gel injection to block a direct channel to an offset producing well, without limiting injectivity. Gas wells have also been successfully treated.

Candidate selection

A number of factors should be examined to determine if a well is a viable candidate for polymer treatment. These factors include: (1) wells that show significant original-oil-in-place, (2) wells located in a field or on a lease with high cumulative (historical) oil production. This indicates a significant amount of additional oil is likely to be recovered as a result of a polymer treatment. Other important factors include



Randy Prater consults with a customer while a treatment is in progress.



Jeremy Makings, field technician supervisor, performs follow up testing after a successful treatment.

wells that are moving a lot of fluid, typically 200 BPD or greater, with a high producing fluid level, and wells that cannot be pumped off with existing equipment. Many successful candidates were producing 1 percent oil or less on several hundred to several thousand barrels of total fluid per day. A good candidate well should also be relatively high on structure, and above the oil/water contact for the field.

Designing the treatment

Each polymer treatment is optimized to fit the conditions of the subject well, in order to yield the best possible outcome. Key factors in designing the treatment include: (1) the type of polymer and associated chemicals that will be used, (2) the volume of the treatment, and (3) a detailed treatment procedure, including alternative procedures if well conditions are different than anticipated, once the treatment has commenced.

Treatment design information

Important details should be reviewed to help determine the optimum treatment strategy for a candidate well. This includes basic wellbore data, such as tubing size and depth, casing size and depth, and whether the well is completed open hole or if it is cased through the target zone and perforated. Other important factors include: (1) current total fluid rate and oil percentage, (2) pumping fluid levels and static fluid levels, if possible, to help determine the amount of fluid movement required to pump the well off, (3) any geological information, such as well logs, core analysis reports, geological reports, driller's reports. These and related observations are extremely helpful. If this information is not available for the subject well, similar information on other wells in the field or area can still serve as a useful tool.

Preparation is important

Proper cleanup and preparation of the well for treatment is critical to a successful outcome! All wells should be sand-pumped or otherwise cleaned out to the original TD. On carbonate formations, such as

limestone or dolomite, an aggressive acid cleanup treatment should be performed to insure polymer injectivity into the water zone and also to facilitate the flow of oil or gas into the wellbore after the polymer treatment has been performed. An acceptable water source must be identified, which will be used to mix the polymer and chemicals. A packer should normally be run into the well on tubing, and set to isolate the target zone for polymer injection. This eliminates any concerns if other zones are also open or if there are concerns about casing integrity, since the treatment sometimes requires significant injection pressure during placement.

During the treatment

A specially designed polymer unit and trained crew will hookup to the tubing and water supply, (usually one or more frac tanks) and take an injectivity test with treated water which also helps the polymer adsorb to the rock surfaces in the formation. Once injectivity has been established, polymer injection will commence according to the treatment design. Care is taken to make sure the calculated fracture pressure for the target formation is not exceeded and also to insure the well is not "locked up." Some pressure increase during the treatment is desirable, to assure all fractures and high-permeability streaks likely to be conducting water to the wellbore are selectively blocked off. Bottom-hole pressure is often monitored in real time to facilitate proper placement of the treatment, without invading the oil or gas saturated matrix, which is where "bypassed" oil saturation often exists. The goal is to effectively change the drainage pattern to the wellbore, and make it easier for oil and gas, which had been previously "overrun" by water, to be produced as a result of the treatment. When the optimum treatment volume has been pumped, the wellbore is flushed, usually with clean lease crude, and the well is shut in for 5 to 10 days, to allow the polymer to develop maximum gel strength before the well is returned to production.

A case study

On July 2, 2003, a 10-well project was commenced in the Bemis-Shutts field of northwest Kansas for White Eagle Resources Corp, of Denver, Colorado. Prior to treatment, the subject wells produced a combined average of 47 BOPD and 12,000 BWPD. Treatment sizes ranged from 1,100 barrels of polymer gel to 5,100 barrels of polymer gel. Individual well production immediately after treatment ranged from 16 BOPD to 145 BOPD on an average of no more than 150 BWPD. Peak production occurred in early October, at just over 500 BOPD. Current production ranges from 180-200 BOPD, and all wells are producing less than 150 BWPD. White Eagle estimates the Net Present Reserve Value of the wells has increased from approximately \$1,000,000 to approximately \$4,000,000 as a result of the treatments. Incremental oil production to date is estimated to be at least 81,000 additional barrels of oil.

Conclusion

Polymer gel treatment can be an effective solution in oil and gas wells affected by excessive water production. Polymer is also an effective tool in controlling early water break through in waterfloods.

Significant increases in oil production and total incremental oil recoveries have been demonstrated as a result of polymer gel treatment programs. Although expensive, workovers involving polymer gel treatments often pay out in less than 60 days, and continue paying benefits for years. A polymer gel treatment program will often significantly increase the reserve value of an oil property. 🏠

About the Author: Randy Prater is owner of Polymer Services, LLC, and has been active in the field application of polymer gel treatments and other enhanced oil recovery technologies since 1989. Prater has applied polymer technology in many parts of the U.S., as well as Canada, Mexico and Argentina. He has personally designed and administered the application of more than 2,000 polymer gel treatments during his career. Prior to his entry into the polymer industry, Prater was a cementing/stimulation specialist with Halliburton Services in Ness City, Kansas, where he also acquired extensive testing and downhole tool experience. Prater entered into the oil industry with Great Guns Logging and Perforating in 1977. For more information, visit www.polymergel.com.