Analysis of EEOR Using Greenzyme® for Prue Ranch (Anacacho) Oilfield, Hitzfelder #3 Lease

Prue Ranch (Anacacho) Oilfield. Frio County, Texas. RRC District 1

By: John L. Gray
Jumpstart Energy Services, LLC (Houston, TX)
May 30, 2007

BACKGROUND

Enzyme Enhanced Oil Recovery (EEOR) utilizes non-living enzymes that are protein based and effectively release hydrocarbon compounds from solid surfaces. Greenzyme® is a unique oil well unclogging agent developed by Apollo Separation Technologies, Inc. To date, most applications of this product have been overseas in China, Indonesia and Venezuela. Greenzyme® 280 enzyme fluid is presently used in a variety of downhole applications to remove blockage, release additional oil and improve mobility of crude. Jumpstart Energy Services is actively involved in developing applications for enzyme fluid technology primarily in the U.S. and Canada.

WELL HISTORY

The Hitzfelder #3 Lease on the Prue Ranch (Anacacho) Oilfield in Frio County, Texas is owned and operated by Property Development Group, Inc. (Austin, TX). This well was originally drilled by Property Development Group in 1997 and has cumulative production (thru 3-31-07) of 108,411 bbls of oil (34° API gravity). The well has historically produced some gas, but wasn't tabulated per this test. The formation is a detrital zone that formed at the interface of the Anacacho limestone and the Serpentine formation and didn't require fracturing. The detrital zone had natural fractures that were opened by acidizing. The well's drive is a combination of dissolved gas and water. The well was completed for the Anacacho formation at the end of 1997 with 8,522 bbls of oil produced during the last two months. In 1998, the first full year of production and the peek production year, Hitzfelder #3 produced 36,751 bbls or ~101 BOPD. Production has declined since then with more rapid decline beginning in 2001. Hitzfelder #3 averaged about 3.7 BOPD in 2005. An acid job was completed on 2-11-06. The well was shut down with no pressure, and then put on pump after 4 hours. This helped restore production. The average for 9 days prior production before treating with Greenzyme® on 5-31-06 was 4.34 BOPD.

BASIC WELL DATA

- First production 1997
- Peak annual prod. – 36,751 bbls
- Total depth – 3218 ft.
- Perfs at 2991 – 3001 ft.
- API gravity of oil = 34°
- SN at 2886 ft.
- Plug back 3182 ft.
- Hole size 7 7/8″ (with 4 1/2″ casing set to 3182 ft.)
- Hole size 12 ¼″ (with 8 5/8″ casing set to 354 ft.)
- Tubing size 2 3/8″ to 3017 ft.
- Water cut = 3-4 bbls water per day
- Porosity = zero (fractures only)
- Perm. = zero (fractures only)

TREATMENT WITH ENZYME FLUID

Jumpstart Energy Services was on-site with Property Development Group on 5-31-06 to treat Hitzfelder #3. Jumpstart delivered four 55-gallon drums of Greenzyme® 280 enzyme concentrate to a local pumper the previous day. The four drums were diluted to 7% by volume in a 2% KCl water solution in one truck or 3,142 gallons total fluid. Another truck had an equivalent volume (3,142 gallons of 2% KCl water (no enzyme fluid). Pumping was to be staged between the two trucks per the following: 1,571 gallons of 7% enzyme fluid in 2% KCl water, then 1,571 gallons of 2% KCl water only. This procedure would then be repeated.

Operator oversees alternating treatment procedure with pumper.

Due to the geology and fractures associated with this well versus more traditional matrix sandstone treatments, the operator indicated pumping wouldn't take that long nor did they expect significant resistance to pumping or build up in pressure due the high permeability of the fractures. The operator worked with the pumper with these considerations in mind.

PUMPING SEQUENCE AND TIMING

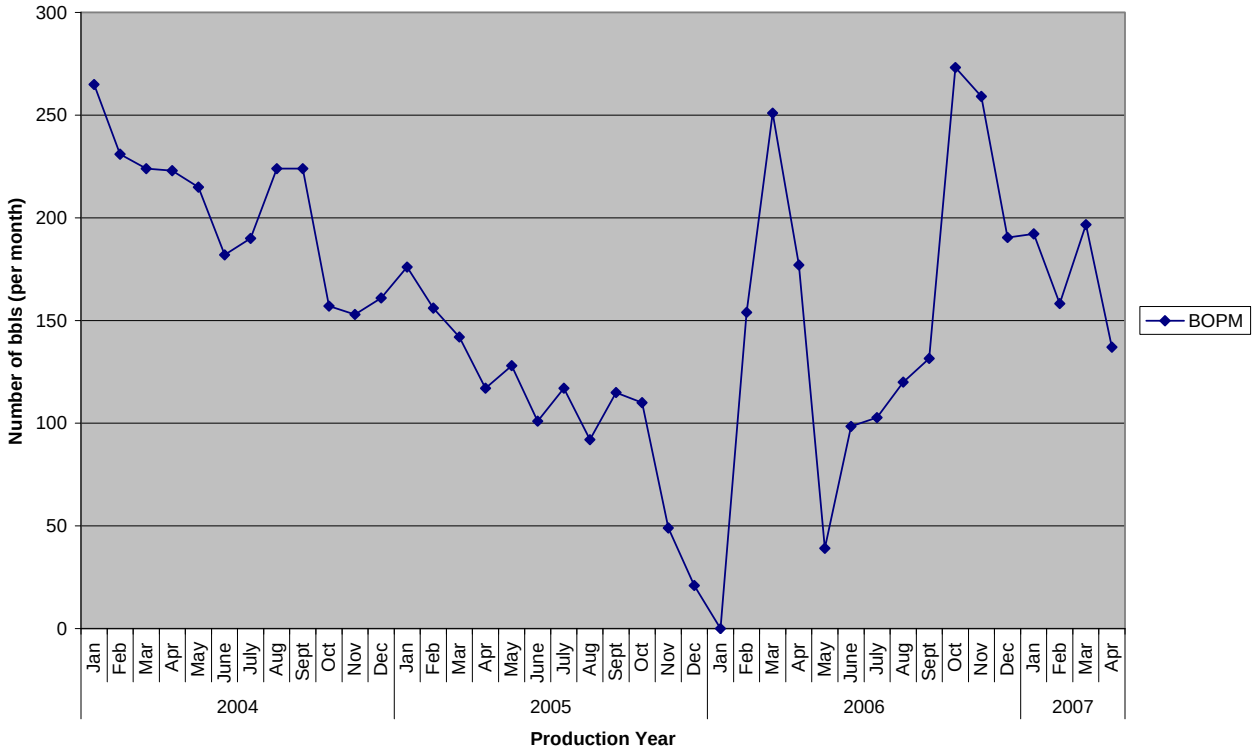
- 7:58 AM commenced pumping with 7% dilute enzyme solution in 2% KCl water. Rate = 4.2 bbls per minute [BPM]; Pressure = 100 lbs psi.
- 8:11 AM. 13 minutes pumping. Rate = 3.2 to 3.1 BPM. Rate dropped down to 3.0 BPM.
- 8:17 AM. 19 minutes pumping. Rate = 2.5 BPM. Roughly 17 bbls of enzyme solution have been pumped. Note: I don't have pressure readings, but I believe these stayed fairly constant. We weren't trying to pump too fast.
- 8:34 AM. 36 minutes pumping. Rate = 1.9 BPM.
- 8:45 AM. 47 minutes pumping. Rate = 3.2 BPM to 4.1 bbls BPM. Pressure ~ 100 psi. 30 seconds later rate = 4.9 BPM with pressure = 50 lbs.
- 8:46 AM. 48 minutes pumping. Rate = 4.5 BPM. Increased pressure to 600 psi. Rate declined to 4.3 BPM. Overcoming well capability to accept fluid to create near wellbore turbulence.
- 8:47:26 AM 49 minutes 26 seconds pumping. Rate declined to 4.1 BPM. Pressure at 650 psi.
- 8:48 AM 50 minutes pumping. Pressure maintained at 600 psi. 3.8 - 3.9 BPM.
- 8:49 AM 51 minutes pumping. Reduced pressure to slow pumping rate. Alternated between enzyme solution and water. Pumped 21 bbls of enzyme solution, then 17 bbls of water slowed to 1.9 - 2.0 BPM. Pumped 20 bbls of enzyme fluid at 1.9 BPM, followed by 20 bbls of water.
- Well is treated and capped in less than 1 hour.

OIL PRODUCTION AFTER ENZYME FLUID TREATMENT

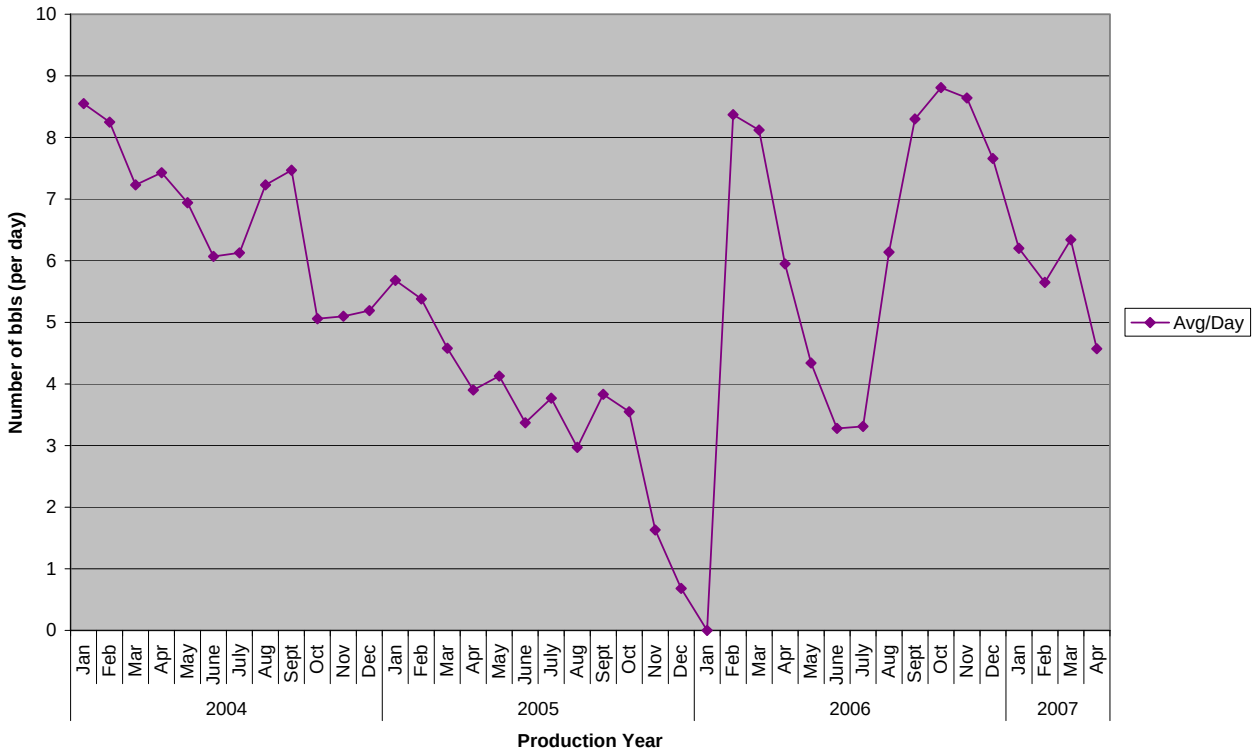
Hitzfelder #3 had declined (2004 thru 2005) to ~3 BOPD. Early in 2006 prior to treating with enzyme fluid, the well was shut in for 45 days. The production history on page 3 shows an increase in production after the well was acidized and returned to production. This is accompanied by a fairly precipitous decline. As indicated, the well averaged 4.34 BOPD for 9 days prior to enzyme fluid treatment.

Hitzfelder #3 was shut-in for 5 days after treatment with enzyme fluid on 5-31-06. Production was resumed on 6-6-06. Property Development Group had the well gauged daily. The gauger reports summarize monthly production in total bbls and calculate the average monthly BOPD for the well. This data provides a timeline of results for the well post-treatment.

Hitzfelder #3 Production (BOPM)



Hitzfelder #3 Production (Avg/Day)



POST-TREATMENT TIMELINE

- June 2006 – Production is resumed and increases to 10 BOPD as accumulated near wellbore oil is produced. This level is short-lived. Note: well was shut-in the first 5 days. Average monthly production = **3.28 BOPD**.
- July 2006 – Production doesn't show much effect. Note: well was shut-in end of month (6-28 thru 6-30) for repairs. Average monthly production **= 3.31 BOPD**.
- August 2006 – Well increases to 10 BOPD briefly, but begins to show more sustained production that increases towards the end of the month. Average monthly production = **6.14 BOPD**.
- September 2006 – Daily production shows nice increases including some days with 11 – 13 BOPD levels. The enzyme treatment shows a clear positive impact on production. Average monthly production = **8.30 BOPD**.
- October 2006 – Daily production is sustained at higher levels. Increased production continues to be sustained. Average monthly production = **8.81 BOPD**.
- November 2006 – Well produces some days in 10 BOPD range. Average monthly production = **8.64 BOPD**.
- December 2006 – Production tapers slightly. Average monthly production = **7.86 BOPD**.
- January 2007 – Production declines, but still has elevated levels. Average monthly production = **6.20 BOPD**.
- February 2007 – Productions slips. The well has mechanical problems on 2-12 which are fixed. Well was shut-in 2.5 days while repairs are completed. Average monthly production = **5.65 BOPD**.
- March 2007 – Total oil produced increases ~40 bbls over February. Production is sustained at higher levels 9 months after initial treatment with enzyme fluid. Average monthly production = **6.34 BOPD**.
- April 2007 – Production begins strong, but starts to taper. Well experiences broken belts on 4-8 that reduce one day of production (and probably a ½ day before and after). Average monthly production = **4.57 BOPD**.
- May 2007 – Production data is incomplete for this month. Estimated range = **5-6 BOPD**.

CONCLUSIONS

Property Development Group's Hitzfelder #3 showed a clear and sustained increase in production after treatment with Greenzyme®. Peak average monthly production of 8.81 BOPD in October 2006 was double the average production of 4.34 BOPD prior to treatment. Additional oil produced in 2006 and 2007 showed a good increase over pre-enzyme treatment levels. Earlier production levels in 2005 make additional oil produced even higher.

Treating Hitzfelder #3 was a departure from a more typical "matrix squeeze" application of enzyme fluid in a sandstone formation. There was very little pressure build-up on the well when pumping downhole. The permeable fractures readily accepted the enzyme fluid. Property Development Group was careful not to push fluid too far from the wellbore. When the well began to show signs of increased production, the operator commented, "It's possible that a longer delay time could be expected from fractured reservoirs versus matrix type reservoirs." The results from this treatment also show that the enzyme fluid can be effective for higher API gravity oil (ie. 34° API gravity).

In reviewing almost 12 months production data for Hitzfelder #3, Property Development Group observed there was "significant improvement that provided added revenue. It did show that the enzymes had a positive effect." The operator added, "Given that the results were on only one well, the cumulative effect over 10 or more wells could prove very significant to the cash flow" and suggested the enzyme fluid "needs to be tested in a waterflood environment, where greater results might be achieved over a larger population of wells." Note: Jumpstart's independent data from PTS Labs confirms an increase in post-waterflood recovery of OOIP using enzyme fluid.