

Schlobohm Oil Operations
 Microbial Enhanced Oil Recovery Project
 Final Results

Summary of Results through 7/31/2010

Lease Name	Pre-MEOR BOPD	Post-MEOR BOPD
Crissman 'A'	9.09 ±0.28	10.24 ±0.34
Schruben	2.44 ±0.06	3.33 ±0.09
Dumler	1.24 ±0.07	1.18 ±0.10
Art Karst	1.31 ±0.03	1.31 ±0.04
*Boxberger	1.78 ±0.03	1.43 ±0.10
Bemis-Shutts (Waterflood)	0.44 ±0.03	0.47 ±0.05
Morgenstern (Waterflood)	6.13 ±0.18	6.51 ±0.06

Table 1

* Control – Well treated by same treatment method without MEOR Fluid

PROJECT OVERVIEW

This microbial enhanced oil recovery (MEOR) project was conducted to validate the production of additional oil in stripper wells by stimulating native microbial populations present in the critical production matrix and surrounding oil-bearing strata. Schlobohm Oil's part of the project consisted of 11 stripper wells, one 3-well lease and four 1-well leases plus two permitted waterflood, each with one injection well and two production wells. The treatment regimen for single wells called for three MEOR treatments at regular 30 to 45 day intervals. Enhanced waterflooding treatments were made by injecting larger slugs of MEOR fluid through the existing injection system followed by post-treatment monitoring of total fluid production for 60 to 90 days. Single well re-treatment volumes, rates, and schedules were based upon the initial treatment results. Routine mechanical maintenance activities continued throughout the project, but no chemical or acid treatments were done. Hot oil treatments for paraffin build-up were not needed since the project wells do not exhibit significant paraffin problems.

IMPLEMENTATION

The project was initially started on 09/16/2009 by fluid squeeze treatment of all three Crissman 'A' Lease wells. Well bore fluids were pumped off before injecting the treatment fluids through the annulus. Two wells were treated by injecting 20 gallons of off-road diesel, a 50-gallon slug of MEOR fluid, followed by 10 BBLs of produced oil, and a 2-day shut-in. The third well was treated with 20 gallons of diesel, a 15-gallon slug of MEOR fluid, 5 BBLs of lease water, and 2-day shut-in. No other Schlobohm wells were treated in 2009. On 12/28/2009 the pump on the No. 2 well was changed out due to mechanical problems. On 01/11/2010 the No. 1 well was worked over and then acidized on 01/14/2010. The No. 4 well was worked over on 01/15/2010.

Schlobohm Oil restarted their MEOR project in on 14/04/2010 with treatment services provided by Evans Tank Service, Russell, Kansas. Between 14/04/2010 and 07/08/2010 all single wells, with the exception of the Boxberger control well, were treated three times with MEOR fluid. The two enhanced waterfloods were treated once. The Boxberger well was used for project control to help determine the effect of the treatment methodology alone without MEOR. Its initial treatment used with the same methodology, but lease water was substituted for MEOR treatment fluid. Daily production reports noted all maintenance activities, pump changes, down days, and days when the production was pumped into the gun barrel. No chemical treatments or acidizing work was done after the project was restarted. Daily gauge reports from 01/01/2008 through 07/31/2010 were available for review and analysis.

Individual Lease Details

Crissman 'A'

The Crissman 'A' is a 3-well lease in the Gorham Field, Russell County, Kansas. All three wells in this lease produce from the Lansing-Kansas City and Gorham groups and pump into a common tank battery with two stock tanks. Production shows a gradual downward trend from 2008 through 2009. The 348 production days in 2008 show an average of 6.61 gauge inches or 11.04 BOPD. The 338 production days in 2009 show an average of 5.74 gauge inches or 9.59 BOPD. The lower production levels is due in part to pump problems on the No. 2 well.

In late December mechanical problems on the #2 well required a pump change which was completed on 12/28/2009. At that time the producer also made a decision to acid treat two wells on the lease. On 01/11/2010 the #1 well's rods and pump were pulled, steamed and tested. The No. 1 well acidized on 01/14/2010. On 1/14/2010 the No. 4 well's rods and pump were pulled and worked over and the well was acidized. Pump replacement, workovers, and acid treatments on the Crissman 'A' lease call its post-MEOR treatment results into question. Although these results are reported, more weight is given to the post-MEOR treatment results after the project was restarted three months later on 04/14/2010. After restart the treatment regimen for all single wells consisted of 25 gallons of off-road diesel, a 50-gallon slug of MEOR fluid followed by another 25 gallons diesel, and a 2 to 3 day shut-in.

It is impossible to determine what percentage of the production shown is due to the initial MEOR treatment vs. the acid treatments, well workovers and pump change. Regardless of how much weight is placed on each of these activities, a comparison of the 218 day pre-acidizing average shows 9.09 BOPD vs. 9.91 BOPD for the 85 day post-acidizing average up to 4/14/2010 when project was restarted. For 104 production days after the project was restarted the Crissman 'A' lease averaged 10.24 BOPD, a further increase above the acidizing results of 0.33 BOPD. This strongly suggests that MEOR treatments on the Crissman 'A' Lease were at least as effective as the acidizing treatments. No maintenance activities and one down day are noted for this 104 day period.

Crissman 'A' Lease
Comparison of Pre-acidizing vs. Post-acidizing vs. MEOR Treatment

Pre-acidizing BOPD Average in Inches = 5.44"		1" = 1.67 BBLs		
6/1/09 to 1/07/10 221	Total Inches 1187.00	No of Days 218	Inches / Day 5.44	BOPD 9.09
	DOWN Days	3		± 0.28
Post acidizing BOPD Average in Inches = 5.93"				
1/18/10 to 4/14/10 96	Total Inches 504.25	No of Days 85	Inches / Day 5.93	BOPD 9.91
	DOWN Days	11		± 0.34
Post MEOR BOPD Average in Inches = 6.13"				
4/18/10 to 7/31/10 105	Total Inches 638.00	No of Days 104	Inches / Day 6.13	BOPD 10.24
	DOWN Days	1		± 0.36
BOPD Increase		0.34 ± 0.70		
Percent Increase		3% ± 7%		

Table 2

Schruben Lease

The Schruben is a 1-well lease in the Galatia Field in Barton County, Kansas pumping into a with a single stock tank. The well was initially treated on 4/14/2010, a second MEOR treatment was made on 6/02/2010 and a third on 7/08/2010. Production data from 7/01/2009 to 7/31/2010 was analyzed. Production averaged 2.44 BOPD for 271 pre-treatment production days with 17 down days during this period, and 3.33 BOPD for 99 post-treatment days with 9 down days.

Schruben Lease		1" = 1.67 BBLS		
7/01/2009 to 4/15/2010	Total Inches	No of Days	Inches / Day	BOPD
Pre-treatment Production	396.0	271	1.46	2.44
288	DOWN Days	17		± 0.06
4/18/2010 to 7/31/2010				
Post Treatment Production	197.3	99	1.99	3.33
108	DOWN days	9		± 0.09
BOPD Increase		0.89 ±0.15		
Percent Increase		27% ±5%		

NOTE: Schruben Lease – results of three MEOR treatments after project was restarted on 4/15/2010.

Table 3

Dumler Lease

The Dumler is a 1-well low producing lease in the Galatia North Field, Barton County, Kansas. It produces from the Lansing-Kansas City group and pumps into a single stock tank. The well was treated initially on 4/17/2010, second treatment on 6/02/2010, and third on 7/07/2010. Daily gauging is shown in whole inches. Some days show zero inches of production even though the well was pumped that day. Consequently, statistical analysis was not applied and the cumulative analysis was used which counted zero days as production days unless the well was noted as down on the daily reports.

Dumler Lease		1" = 2.75 BBLS		
7/01/2009 to 4/15/2010	Total Inches	No of Days	Inches / Day	BOPD
Pre-treatment Production	84	187	0.45	1.24
288	DOWN Days	101		±0.07
4/18/2010 to 6/30/2010				
Post Treatment Production	44.75	104	0.43	1.18
105	DOWN Days	1		±0.10
BOPD Decrease/Increase		-0.05 ±0.17		
Percent Decrease/Increase		-4.2% ±13.4%		

NOTE: Dumler Lease – results of three MEOR treatments after project was restarted on 4/15/2010.

Table 4

Pre-treatment production from 7/01/2009 to 4/15/2010 averaged 1.24 BOPD. There were 187 production days during this period and 84 down days. Post-treatment production from 4/18/2010 to 7/31/2010 shows 1.18 BOPD for 104 production days with one down day during this period, a slight decrease in production.

Art Karst Lease

The Art Karst is a 1-well low producing lease in the Karst Field, Barton County, Kansas. It produces from the Lansing-Kansas City and Arbuckle groups and pumps into a single stock tank. The well was treated initially on 4/17/2010, a second MEOR treatment was made on 6/02/2010, and a third on 7/08/2010. Daily gauging is shown in whole inches. Even though the Art Karst was pumped daily unless noted otherwise some days show zero gauge inches of production. Consequently, statistical analysis was not applied and the cumulative analysis was used which counted zero days as production days unless the well was noted as down. The 422 pre-treatment production days show an average BOPD of 1.31 with 47 down days. Post-treatment shows unchanged at 1.31 BOPD for 106 production days with no down days noted.

Art Karst Lease		1" = 1.67 BBLS		
1/01/2009 to 4/15/2010	Total Inches	No of Days	Inches / Day	BOPD
Pre-treatment production	331.25	422	0.78	1.31
469	DOWN Days	47		±0.03
4/17/2010 to 7/31/2010				
Post treatment production	82.97	106	0.78	1.31
106	DOWN Days	0		±0.04
BOPD Increased Production		0.00 ±0.07		
Percent Increase		0% ±5%		

NOTE: Art Karst Lease – results of three MEOR treatments after project was restarted on 4/15/2010. Production remains unchanged at 1.31 BOPD.

Table 5

Boxberger Lease

The Boxberger is a 1-well low producing lease in the Gorham Field, Russell County, Kansas. It pumps into two 200 BBL stock tanks. This well was used for project control by using the same treatment methodology and substituting lease water for MEOR fluid. The purpose of the control is to differentiate between treatments made with and without MEOR fluid, and determine the effect on production of the treatment methodology alone. The Boxberger received its initial MEOR treatment on 6/02/2010, and second treatment on 7/08/2010.

Control Treatment on 4/14/2010 – No MEOR Fluid Injected				
			1" = 1.67 BBLS	
7/01/2009 to 4/14/2010	Total Inches	No of Days	Inches / Day	BOPD
Pre-control treat production	293.85	275	1.07	1.78
277	DOWN Days	2		
4/16/2010 to 6/02/2010				
Post control treat production	40.25	47	0.86	1.43
47	DOWN Days	0		
BOPD Decrease		-0.35		
Percent Decrease		-19.86%		

NOTE: Boxberger was used for control, lease water was substituted for MEOR treatment fluid and the well was treated using the same treatment methodology. The Boxberger averaged 1.77 BOPD for 277 production days before the control treatment on 4/15/2010 and 1.43 BOPD for 47 production days thereafter until the initial MEOR treatment on 6/02/2010.

Table 6

For 275 days before the control treatment Table 7 shows the Boxberger averaged 1.78 BOPD with two down days noted, and 1.43 BOPD for 47 production days after the control treatment until the first MEOR treatment on 6/02/2010. This indicates that the treatment methodology alone is not a likely contributing factor for any increases shown.

First MEOR treatment on 6/02/2010				
			1" = 1.67 BBLS	
7/01/2009 to 6/01/2010	Total Inches	No of Days	Inches / Day	BOPD
Pre-treatment production	335.1	323	1.04	1.73
325	DOWN Days	2		
6/02/2010 to 7/31/2010				
Post MEOR production	60	60	1.00	1.67
60	DOWN Days	0		
BOPD Decrease		-0.06		
Percent Decrease		-3.61%		

NOTE 1: The Boxberger averaged 1.73 BOPD from 7/01/2009 until the first MEOR treatment on 6/02/2010 (323 production days). A second MEOR treatment was made on 7/08/2010. Production has averaged 1.67 BOPD for 60 production days following the first MEOR treatment on 6/02/2010 reflecting a slight decrease in production.

NOTE 2: The Boxberger was used for control. Production averaged 1.43 BOPD for 47 production days following the control treatment on 4/15/2010 up to the first MEOR treatment on 6/02/2010. The 60 day post MEOR production is 1.67 BOPD; still slightly below the 323 pre-treatment average of 1.73 BOPD, but back up from the 1.43 BOPD average for 47 production days after the control treatment until the first MEOR treatment..

Table 7

The post-control interval from 4/14/2010 to the initial MEOR treatment on 6/02/2010 is included in the pre-treatment average of 1.73 BOPD for 323 production days. Post-treatment production has averaged 1.67 BOPD for 60 production days; still below the pre-treatment average, but back up from the post-control average of 1.43 BOPD.

Bemis-Shutts Lease - Enhanced Waterflood

The Bemis-Shutts is a 3-well lease in the Bemis-Shutts Field, Ellis County, Kansas. It has 1 injection well permitted for EOR and 2 stripper wells producing from the Lansing-Kansas City formation. Waterflooding was enhanced on 4/15/2010 by injecting an initial 50-gallon slug of MEOR fluid through the existing injection system (well API 15-051-05183-0004). A second 100-gallon slug was injected on 4/20/2010 and a third on 4/23/2010. Injection rates were monitored and no problems were encountered. Enhanced waterfloods may require 60 to 90 days or more of post-treatment production data before a production trend can be established and a re-treatment regimen recommended.

Bemis-Shutts Lease		1" = 1.67 BBLS		
1/02/2009 to 4/14/2010	Total Inches	No of Days	Inches / Day	BOPD
Pre-treatment production	115.34	438	0.26	0.44
469	DOWN Days	31		± 0.03
3/01/2010 to 7/01/2010				
Post treatment production	21.41	76	0.28	0.47
76	DOWN Days	0		± 0.05
BOPD Increase / Decrease		0.03 ± 0.08		
Percent Increase / Decrease		12% ± 25%		

NOTE 1: Bemis-Shutts is an enhanced waterflood project that averaged 0.44 BOPD from 2 Jan 2009 to 15 April 2010 with 31 down days. MEOR fluid was injected on 4/14, 4/20, and 4/23/2010. Production is often pumped into the gun barrel and the the 78.50 BBLS pushed over into the stock tank on 6/27/2010 and 6/28/2010 was prorated; 43.58 BBLS to pre-treatment production and 34.92 BBLS to post-treatment. Production has been pumping into the gun barrel since 7/01/2010. Pre-treatment production averaged 0.44 BOPD vs. 0.47 BOPD post-treatment from 4/16/2010 to 7/01/2010 with no down days. Enhanced waterfloods can take 60 to 90 days or more before a production trend is established and validated. Awaiting August 2010 data to update this analysis.

Table 8

Morgenstern North Lease - Enhanced Waterflood

The Morgenstern North is a 3-well lease in the Boxberger West Field, Russell County, County, Kansas. It has 1 injection well permitted for EOR and 2 stripper wells producing from the Lansing-Kansas City formation. Waterflooding was enhanced on 4/15/2010 by injecting an initial 50-gallon slug of MEOR fluid through the existing injection system (well API 15-167-00561-0001). A second 100-gallon slug was injected on 4/20/2010 and a third on 4/23/2010. Injection rates were monitored and no problems were encountered. Injection rates and pressures will to be monitored for 60 to 90 days and total fluid production gauged.

Morgenstern North Lease		1" = 1.67 BBLs		
1/01/2009 to 4/23/2010	Total Inches	No of Days	Inches / Day	BOPD
Pre-treatment production	1478.70	403	3.67	6.13
478	DOWN Days	75		± 0.18
4/24/2010 to 7/31/2010				
Post-treatment production	276.75	71	3.90	6.51
98	DOWN Days	27		± 0.06
BOPD Increase			0.38 ± 0.24	
Percent Increase			6% ± 4%	

NOTE: Morgenstern North is an enhanced waterflood project with one injection well and two producers. MEOR fluid was injected in three slugs; 50 gallons on 4/14, and 100 gallons on 4/20 and 4/23/2010. Enhanced waterfloods typically take 60 to 90 days or more of post-treatment data before a meaningful analysis can be performed. The Morgenstern lease averaged 6.13 BOPD for 403 pre-treatment production days and has averaged 6.51 BOPD for 71 production days since the last MEOR fluid injection on 4/23/2010 through 7/31/2010. Enhanced waterflood may take 60 to 90 days or longer before a trend is established and validated.

Table 9

The Morgenstern North Lease averaged 6.13 BOPD for 403 production days from 1/01/2009 to 4/23/2010 with 75 down days over this date range. Following MEOR treatment the well has averaged 6.51 BOPD for 71 production days with 27 down days from 4/24/2010 to 7/31/2010.

FINDINGS – Schlobohm Oil Operations

Post-treatment data from Schlobohm Oil shows sufficient positive results from the Crissman 'A', Schruben, Bemis-Shutts, and Morgenstern North to warrant consideration for continued MEOR treatments. The Boxberger regained production after its control treatment, but it is not yet above its pre-treatment average production level. However, its upward production trend indicates that it should also be considered for further MEOR treatments and evaluation. The Dumler and Art Karst leases may show a positive response to another MEOR approach that injects viable microbes and nutrients, further treatments with this MEOR fluid should be suspended.

Project Economics

Project economics were evaluated for Schlobohm Oil and are reported as a low and high range due to accumulations from the mean ± error. The aggregated oil increase of all leases from 4/15/2010 to 7/31/2010 ranges between 147 BBLs to 256 BBLs (201 BBLs ± 54 BBLs). Validation of the actual incremental oil production will be shown through cumulative sales tickets.

At pilot plant scale the MEOR fluid cost ≈ \$8.00 per gallon to produce and ship FOB to Russell, Kansas including the cost of the non-returnable 250 gallon totes. Third party

treatment services were priced at \$50 / hour with a one hour minimum. Treatments took an average of 30 minutes per well and combined they required one thousand gallons of off road diesel at \$2.80 per gallon, and one thousand two hundred and fifty gallons of MEOR treatment fluid.

From April through July 2010 Schlobohm Oil sold oil at an average Kansas Common plus bonus price of \$68.25 per barrel. Total treatment costs for the project to 07/31/2010 are \$15,300. Proceeds from oil sales at the low range of error measurement (148 additional barrels) are \$10,101, and \$17,472 at the high range (256 additional barrels). Given this range in measurement error, Schlobohm Oil's project has realized somewhere between a net loss of \$5,199 to a net gain of \$2,200. The mean between low and high range is 202 additional barrels for a net loss of \$1,514. However, the longer these production increases hold without additional MEOR treatments, the closer the project comes to producing net positive income.

Conclusion

All Schlobohm wells were judged to be viable candidates by screening with the modified treatability matrix. Yet three of the single wells showed no measurable response outside of the calculated measurement error to three treatments over a 90 day period. This was not surprising as it is indicative of past results using this benchmark MEOR fluid and treatment methodologies. Positive results are not insured even though a screened well may appear to be an ideal candidate for this MEOR technology. For a 'shotgun approach' to be economically viable a success rate of 50% to 60% should be achieved after preliminary screening. Treatment costs must to be kept low and the volume of additional oil produced from wells showing a sufficient positive response to realize a net gain after sales.

Under normal operating circumstances a stripper well producer would have dropped the unresponsive wells from the program after the second treatment. The economics of Schlobohm Oil's MEOR project look better under this real world scenario. After the project was restarted in April 2010, a practical application of the 'shotgun approach' would have dropped the unresponsive wells from the program. This practical approach lowers the total treatment cost to \$12,420 and yields a range from a net loss of approximately \$2,400 to a net gain of \$5,050 through 07/31/2010.