CRYSTAL MODIFIER PROJECT

Jim Campbell, Unichem
Pat Carter and Tina Flowers, Texaco

ABSTRACT

The Midway FMT is a Spraberry waterflood located in Dawson County about 10 miles southeast of Lamesa, Texas that has a history of paraffin problems. The severity of problems range from having to abandon flowlines that plugged with paraffin, to back pressure on flowlines, to reduced production rates, to having to hot oil or hot water flowlines, to injecting paraffin solvents and paraffin inhibitors and / or combinations of the above. Paraffin build-ups in tubing can result in decreased tlow rates, expense and delayed production due to field or contract wireline cutting and steaming the tubing.

The goal of the Midway FMT is to maximize production while investigating ways to reduce controllable expenses through chemicals and associated costs. This paper describes a method to help control paraffin using a chemical program developed by Unichem called the Crystal Modifier Project. The objective of this program is to reduce failures and costs associated with paraffin.

INTRODUCTION

In 1998 the Midway FMT began to investigate ways to reduce controllable expenses. The field's lifting cost was $4.20/ BOE NWI in with a failure rate of .81. The following chart illustrates the high cost associated with paraffin related failures.

During a typical paraffin failure it is very difficult to pull the rods and pump. When the pump is sticking sometimes hot water or hot oil is dumped down the casing to loosen the pump. Other times a paraffin knife or scraper is used as an attempt to cut the paraffin from the tubing. When the rods and tubing are retrieved without pulling too hard, because they may part, the tubing usually has to be steamed clean. This failure process can be very time consuming and expensive.

UNICHEM'S FINDINGS

Unichem performed three laboratory tests to investigate which solvents and surfactants would be best for dissolving the paraffin found from the Midway FMT's wells: the solvent/surfactant test, the pour point test, and the cold finger test.

The Solvent/Surfactant Test

This is a simple test used to determine which solvent or surfactant effectively solvates the test sample. **A** four to five gram sample of compacted paraffin was placed in various solvents and surfactants to observe the speed of disruption and the carrying capacity of the chemicals. TS-163 was determined to be an excellent solvent for dissolving the paraffin samples.

The Pour Point Test

Pour point testing is among the most dependable methods of monitoring oil field fluid behavior. Several crystal modifiers were added to the crude samples and the modified crudes were subjected to the standard ASTM D-97 Pour Point Test. It was determined that the addition of the crystal modifiers reduced the pour point of the Shafer and WSU crude from 18" F to -20" F. The pour point of the Jeter crude was reduced from 8" F to -20" F. Pour point testing is an essential method used to measure the chemical effectiveness on the oil.

The Cold Finger Test

Cold finger testing is a common procedure used for determining paraffin deposit tendencies. Modified crude samples were heated to reservoir temperature (105° F). Cylinders (cold fingers) cooled to 20" F were placed in each sample and monitored for paraffin deposits. It was determined that RNB 81008 and TH 538 were the most effective in reducing paraffin deposits.

Unichem made a commitment to use new technology in treating Midway's paraffin problems. They committed to checking and maintaining the chemical pumps on a weekly basis. The lab involvement was increased to help monitor the progress of the project. Paraffin expert, Dr. J R Becker analyzed crude samples to determine if the treatment was effective and efficient. Unichem also promised to collect the data from testing and track the different treatment methods: batch treating, truck treating, and continuous treatment.

PHASE ONE - 1999

There were three initial goals of the Crystal Modifier Project in 1999. The first was to reduce hot watering and hot oiling. This is acceptable treatment for flowlines and tank bottoms, but it could be detrimental to wellbores and tubulars. The second objective was to clean up the wells with a solvent/dispersant treatment (TS-163). The third purpose of the project was to use the crystal modifier (RNB-8 1008) in addition to or in place of hot watering and hot oiling. These goals are considered phase one of the project.

The phase one pilot project included five of Midway's worst paraffin producers:
Robison 7, WSU 508, Jeter 4, Shafer 26, and SDU 622. These wells were treated with crystal modifier on a continuous treatment via a slipstream down the annulus. In addition to these five wells, eleven other wells were added to the project in 1999. The following chart illustrates savings of $41,811 in 1999 from the crystal modifier program.

PHASE TWO - 2000

During the second phase of the crystal modifier project there were goals to continue to reduce failure rates and increase the mean time between failures. The team also continued to work to reduce chemical costs. Another objective was to evaluate the treatment methods: what worked and what didn't work, how much did it cost, and are there other treatment methods (i.e., truck treating). One step in working toward this target was to reduce the use of TS-163 by 50%, from a 3% makeup of TS-163 to 1.7% makeup of TS-163 on continuous, batch, and truck treatments. Unichem continued to tweak the treatment methods and recommended treatment volumes.

JETER #4 CASE STUDY

The Jeter #4 has a long history of well failures related to paraffin. Hot oiling and hot watering were used in an attempt to remove the paraffin. This was not an efficient method of paraffin control. Unichem began treating the well with crystal modifier in December 1998. The well was pulled in March 1999 for treatment review. There was light paraffin on the rods, but a significant improvement from before. The crystal modifier proved to be an effective method in preventing paraffin accumulation.

CONCLUSION

The Crystal Modifier Project had savings of $41,811 in 1999 that lead to an expansion of the project to include a total of 26 wells. In 2000 another $131,294 was documented as savings from the reduction in failure costs and chemical vs. hot watering costs. The following graph illustrates the reduction in failure rates on rod pumped wells. Failure rates dropped significantly from 1.05 to .44 in two years. This increased the mean time between failures and helped reduce the FMT's lifting cost from $4.20/BOE NWI to $3.79/BOE NWI. The accomplishments of the Midway FMT are largely due to the effectiveness of the crystal modifiers in preventing paraffin accumulation. The success of the Crystal Modifier Project is being shared and duplicated with other fields throughout the Permian Basin.

REFERENCES

1. Becker, Harold JR, "Paraffin Waxes in the Oil Field", southwestern Petroleum ShortCourse 2001 Conference, April 25-26, Lubbock, Texas.

Table 1
Midway's Top Five Paraffin Producers and Related Failure Costs

WELL	No. of Paraffin Related Failures	Total Cost for Paraffin Related Failures	Avg. No. of Paraffin Related Failures per yr.	Avg. Cost of Paraffin Related Failures
Robison 7	5	$23,294	1.00	$4,659
WSU 508	3	$14,300	.60	$4,767
Jeter 4	4	$19,579	.50	$4,895
Shafer 26	4	$14,630	.57	$3,658
SDU 622	1	$4,015	.33	$4,015

Table 2
1999 Savings from the Crystal Modifier Program

WELL	Crystal Modifier Treatment Cost	Hot Water Treatment Cost	Savings Chemical vs. Hot Water	Savings Reducing Reducing	Total Savings	Installation Cost
Jeter 4	$2,063	$10,317	$8,254	$2,447	$10,701	$1,429
WSU 508	$1,987	$9,937	$7,950	$2,860	$10,810	$2,638
Robison 7	$1,987	$6,625	$4,637	$4,649	$9,286	$2,044
Shafer 26	$1,982	$6,607	$4,625	$2,085	$6,710	$2,716
SDU 622	$1,993	$3,321	$1,329	$1,325	$2,654	$1,361
Stanfield 7	$1,347	$9,619	$8,272	$1,135	$9,407	$3,069
Robison 5	$1,309	$4,362	$3,053	$275	$3,328	$3,154
Robison 18	$1,943	$6,489	$4,546	$1,196	$5,742	$3,235
SDU 623	$1,292	$4,308	$3,015	$1,789	$4,804	$3,389
Shafer 23	$1,935	$4,308	$2,373	$0	$2,373	$3,332
Shafer 24	$1,265	$4,217	$2,952	$300	$3,252	$3,332
Shafer 27	$1,265	$4,217	$2,952	$756	$3,708	$3,332
Shafer 29	$1,238	$4,127	$2,889	$2,353	$5,242	$3,332
Shafer 30	$1,238	$4,127	$2,889	$0	$2,889	$3,332
Shafer 31	$1,276	$4,254	$2,977	$1,310	$4,287	$3,332
Shafer 32	$1,276	$4,254	$2,977	$0	$2,977	$3,332
TOTAL					**$88,170**	**$46,359**

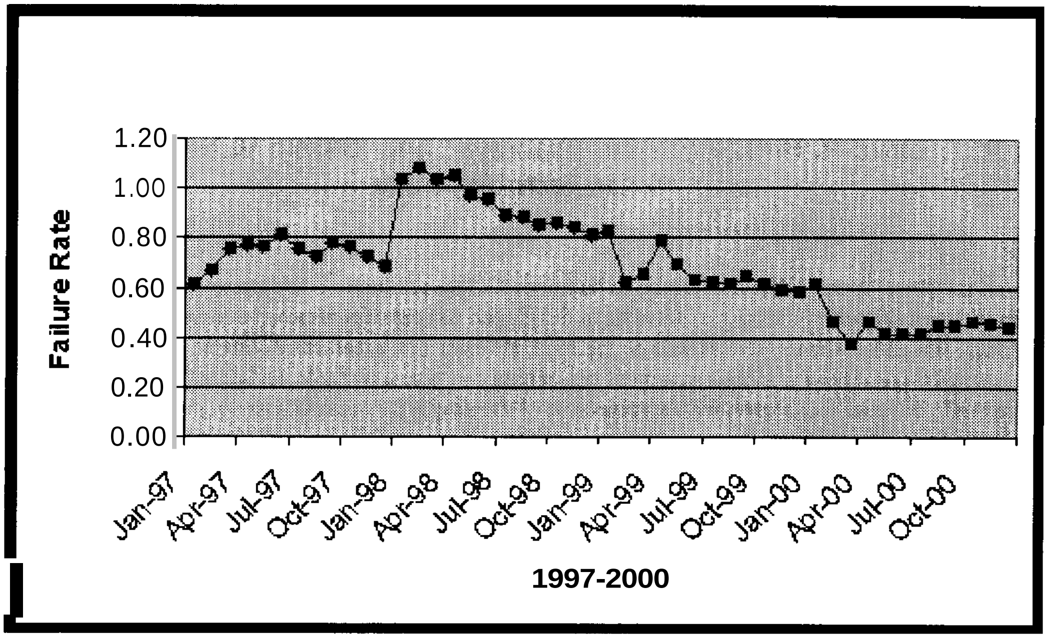

Figure 1 - Midway Failure Rate for Rod Pumped Wells