OPTIMIZING THE COST OF PARAFFIN TREATMENTS IN THE SPRABERRY

Albert S. Garza, Rowland Ramos, David Snapp and Robert Hillger
Pioneer Natural Resources, USA
Jeffrey J. DaCunha, Spirit Global Energy Solutions

ABSTRACT
Paraffin wax treatment in the Spraberry has been around since development began in the 50's. For many years, hot oiling and hot watering have been the method of choice to reduce and/or eliminate paraffin buildup in the tubing string. Chemical treatment and a combination of chemical with hot oil or water have also been alternate methods. The purpose of this paper is not to determine the best method or methods, but to attempt to define and extend the frequency of the treatment necessary to control the paraffin wax. Current treating schedules are 30, 45, 60 and 90 day. Ten wells from the Spraberry were selected for this project for monitoring via a SCADA system to establish an optimized scheduling program. A new method to determine where paraffin has accumulated in the wellbore will also be introduced.

INTRODUCTION
Paraffin wax treatment frequency in the Spraberry is usually performed by a time frame and not by downhole conditions. These time frames are usually performed in 30 day intervals and can have a large impact on the bottom line. Paraffin build in the tubing string will be the focus on this paper. In addition, a novel method will be outlined which will enable an operator to not only identify when paraffin is present downhole, but to accurately determine its location along the rod string.

Paraffin is a hydrocarbon with the general composition C_nH_{2n+2}. The heavier paraffin's ($20<n<40$) crystallize into solids when temperature or pressure drops in the oil production process, which forms a waxy substance that can block the flow of oil and cause failures in the pump[2].
After paraffin wax has formed, it can be found in all stages of the production process, causing downhole failures and further operational problems in the surface equipment.

NATURE OF THE STUDY
- Select 10 wells from XSPOC for the project
- Review the possibilities of extending 30 day Hot Oil/Hot Water paraffin treatment schedules by 30 day increments
- Select well operating parameters to monitor
- Review project after 6 months
- Report observations and conclusions

SUBJECT WELLS:
Midkiff Unit 2211
Midkiff Unit 4004
SDU 1051A
SDU 1077A
SDU 1512A
SSU 2707A
SSU 4107A
Tippett D # 12
Tippett D # 16
XBC Giddings 401

Average Operating Conditions:

- SPM - 8.53
- Stroke Length - 81.5”
- Pump bore - 1.25”
- Runtime - 13.61 Hrs
- S/N - 7,181’
- Casing - 4” & 5” I.D.
- Wells where on 30 day Hot Oil/Water treatment schedule
- Corrosion truck treatment continued
- All wells U/L Spraberry & Dean except for XBC Giddings 4014 U/L, Dean and Wolf Camp

Parameters Selected:

- Polished Rod Hp
- Maximum Loads
- Minimum Loads
- Runtime

An interesting, yet rarely used feature of diagnosing rod pumped wells can be employed to give an accurate answer to where paraffin has accumulated in the wellbore. It is well known from pump dynagraph interpretation techniques that drag friction causes distortion of the down hole dynagraph. By distortion, we mean that the pump card takes on a leftward lean, indicating some sort of interference in the way the stress waves are transmitted along the rod string from the downhole pump to the polished rod.

An interested fact that can be used to determine the location of the drag friction is described in the following statement. The higher up the rod string that the drag friction occurs, the more distorted the pump card will appear. The lower the drag friction occurs, the less distorted the pump card will appear—however, the pump card will appear abnormally tall. In this case, the fluid load that is obtained from measuring the height of the pump card will often yield a pump intake pressure that is extremely low or even negative in some cases. This is of course incorrect.

Given a surface and pump dynagraph pair that is exhibiting the presence of extreme downhole friction, in particular due to paraffin, we can employ the following methodology to determine where the paraffin is accumulating. The wave equation technique that is employed by all diagnostic software programs is designed to yield the load and positions of the bottom of the last rod taper. By definition[3], this is the pump dynagraph. In order to determine the behavior of the rod string at any point, the programs are simply manipulated to show the load and position at a certain depth of the rod string by inputting the correct rod string design up to the depth of interest.

We will illustrate this with the following example. It is obvious that the following well is exhibiting severe drag friction and due to the history of the well and the fact that this drag friction has just become visible, the culprit is paraffin. Cutting into the rod string a different depths, by trial and error we find the depth where the “down hole” card is square. Any depth beyond this depth indicates distortion (leftward lean) which indicates that there is some sort of drag friction and/or interference in wave transmission at this point. Any calculated cards below this point will be inaccurate and the accuracy will decline the deeper one goes in obtaining down hole cards.

Observe, in Figure 10, the pump card is extremely distorted due to paraffin interference.

MIDKIFF UNIT 2211 Production

Before:	15.83 Oil /	28.91 Gas /	50.00 Wtr
After :	17.46 Oil /	36.02 Gas /	49.33 Wtr
	1.63	7.11	(0.67)

MIDKIFF UNIT 4004 Production

Before:	5.10 Oil /	20.03 Gas /	41.85 Wtr
After :	3.39 Oil /	16.95 Gas /	21.81 Wtr
	(1.71)	(3.08)	(20.04)

SDU 1051A Production

Before: 5.95 Oil/ 28.55 Gas / 11.09 Wtr

After : 5.97 Oil/ 27.78 Gas / 14.54 Wtr

SDU 1077A Production
Before: 3.07 Oil / 18.97 Gas / 13.79 Wtr
After : 2.26 Oil / 13.83 Gas / 9.22 Wtr
(0.81) (5.14) (4.57)

SDU 1512A Production
Before: 4.13 Oil / 12.38 Gas / 11.13 Wtr
After : 3.81 Oil / 14.06 Gas / 10.61 Wtr
(0.32) 1.68 (0.52)

SSU 2707A Production
Before: 9.11 Oil / 24.05 Gas / 185.98 Wtr
After : 8.47 Oil / 21.61 Gas / 192.17 Wtr
(0.64) (2.44) 6.20

SSU 4107A Production
Before: 2.88 Oil / 41.81 Gas / 201.05 Wtr
After : 3.18 Oil / 40.40 Gas / 191.18 Wtr
.93 (1.41) (10.32)
TIPPET D 12 Production
Before: 16.57 Oil / 9.48 Gas / 81.47 Wtr
After : 23.04 Oil / 15.26 Gas / 89.20 Wtr
6.47 5.78 7.73
TIPPETT D 16 Production
Before: 4.53 Oil / 4.39 Gas / 10.07 Wtr
After : 3.19 Oil / 6.15 Gas / 14.02 Wtr
(1.34) 1.76 3.95

XBC GIDDINGS Production
Before: 114.65 Oil / 145.37 Gas / 110.86 Wtr
After : 120.95 Oil / 142.97 Gas / 95.91 Wtr
6.30 (2.40) (14.95)

SUMMARY

During the time frame of March through September 4 wells encountered a failure, 3 rod parts and 1 (one) tubing leak.

Midkiff Unit 2211, 4004 had rod parts and where hot oil during well servicing.

SDU 1512A was hot oiled 7/14/09 by mistake due to a lack of communications with the vendor.

The SSU 2707A and SSU 4017 both experienced a rod part, but were not hot oil.

The Tippett D 12 and XBC Giddings 4014 experienced well service events for equipment changes, but only the XBC Giddings 4014 was hot oil during the event.

CONCLUSION

No well conditions suggest hot oil or hot water treatment was needed as of 9/29/2009 or ~198 days.
Four wells were hot oiled during a well event but not due an exceeded "parameter." Continue to monitor project well for 6 more months. Install flowline pressure transducers

The degree of paraffin content terminology needs to be better quantified i.e.,

- Negligible

- Light
- Moderate
- Heavy
- Severe

RECOMMENDATIONS

- Review project wells to increase paraffin treatment schedule from 30 days 60

REFERENCES

1. ELC Group, Organic Remediation, accessed on March 5, 2010, http://www.eclgroup.com/HomeICTC/Oilfield_chemicals/Stimulation_Solvents/Organic_Remediation.aspx
2. McCain, William D. The Properties of Petroleum Fluids, Second Edition
3. W.E. Gilbert, An oil-well pump dynagraph, *API Drilling and Production Practice* (1936), 94—115.

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Jamie Castagno PNR 2010 Engineering Intern

Figure 1 - Paraffin Sample[1]

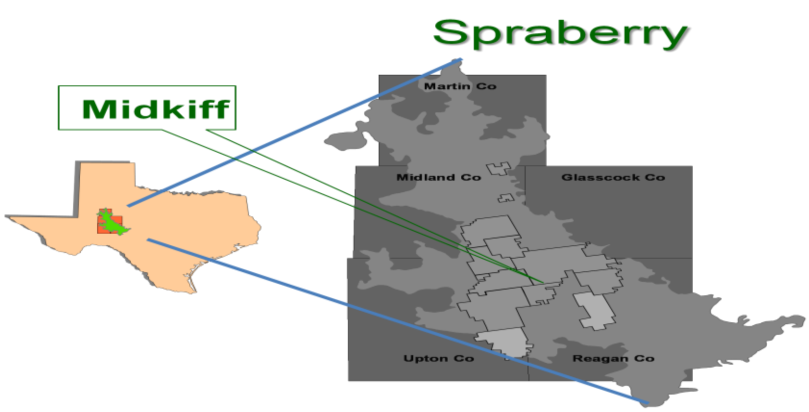

Figure 2

Paraffin Card Examples

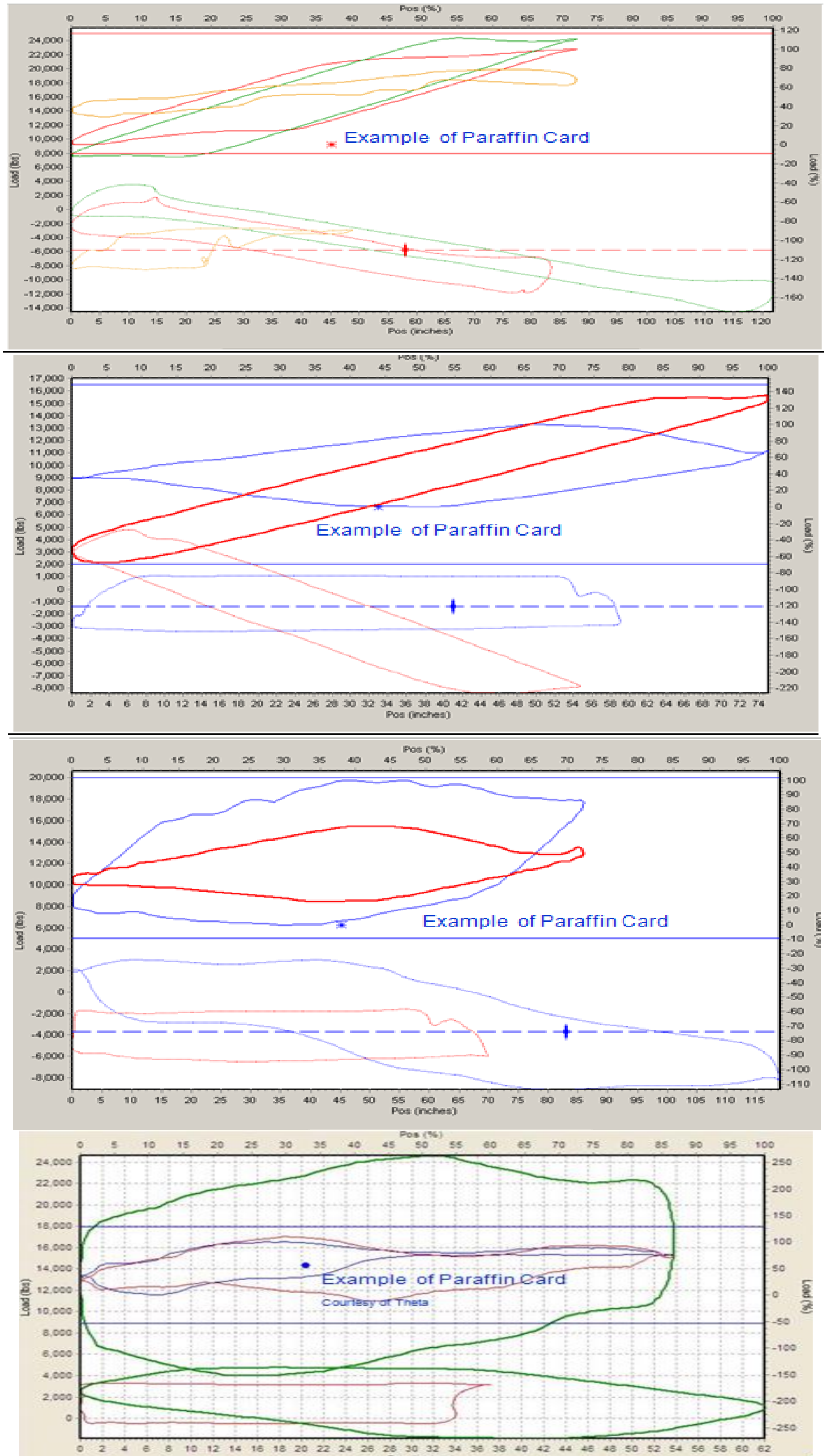

Figure 3

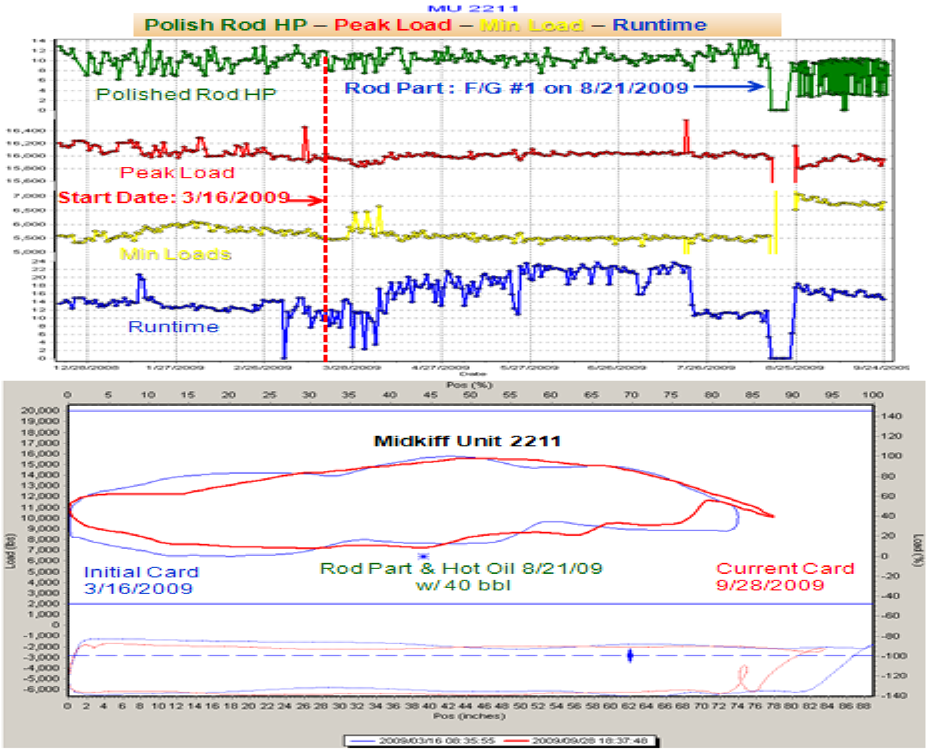

Figure 4

Figure 5

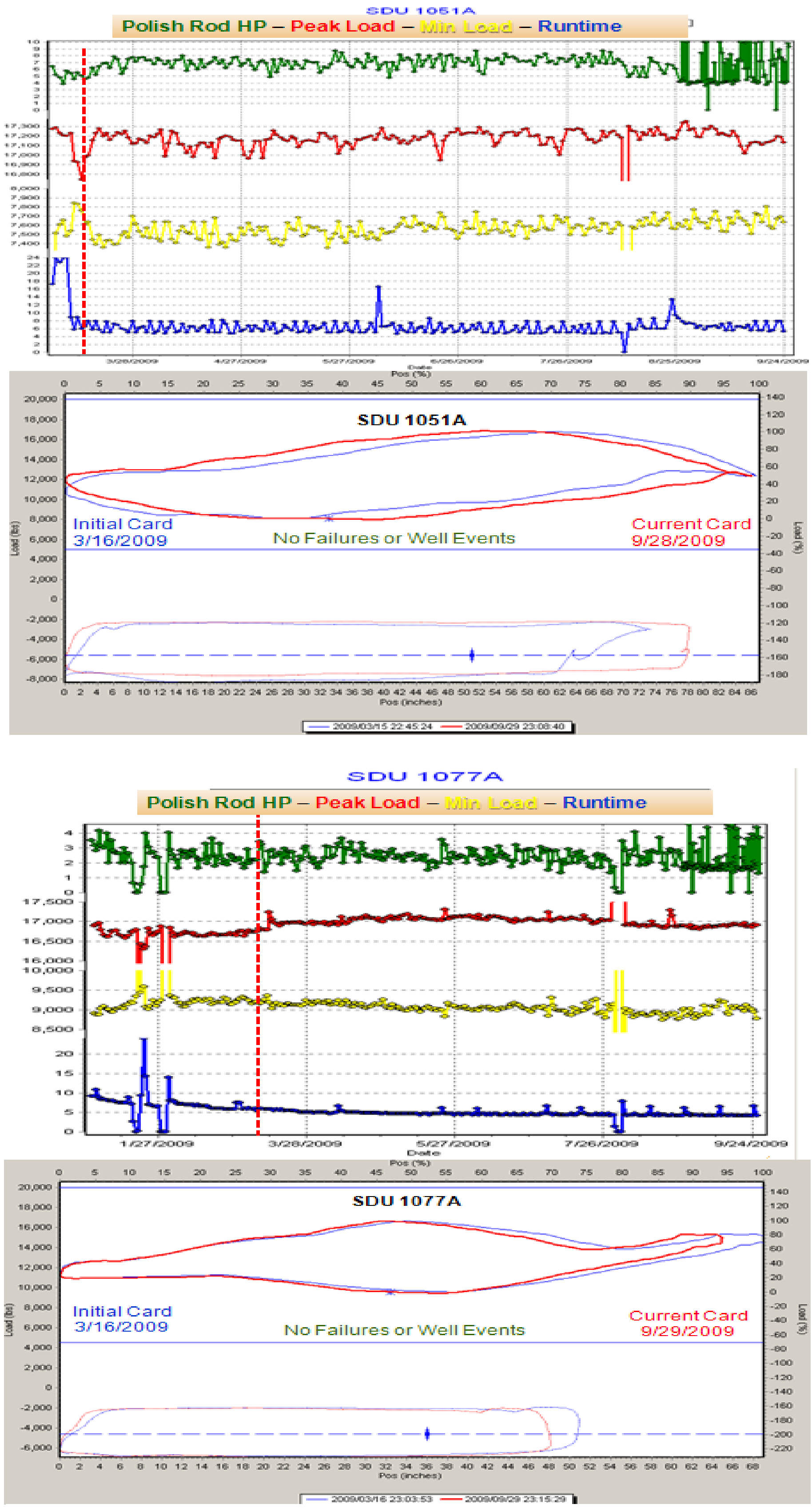
SDU 1051A
Polish Rod HP – Peak Load – Min Load – Runtime
Date
Pos (%)
SDU 1051A
Initial Card
3/16/2009
No Failures or Well Events
Current Card
9/28/2009
Load (lbs)
Load (%)
Pos (inches)
SDU 1077A
Polish Rod HP – Peak Load – Min Load – Runtime
1/27/2009
3/28/2009
5/27/2009
7/26/2009
9/24/2009
Date
Pos (%)
SDU 1077A
Initial Card
3/16/2009
No Failures or Well Events
Current Card
9/29/2009
Load (lbs)
Load (%)
Pos (inches)

Figure 6

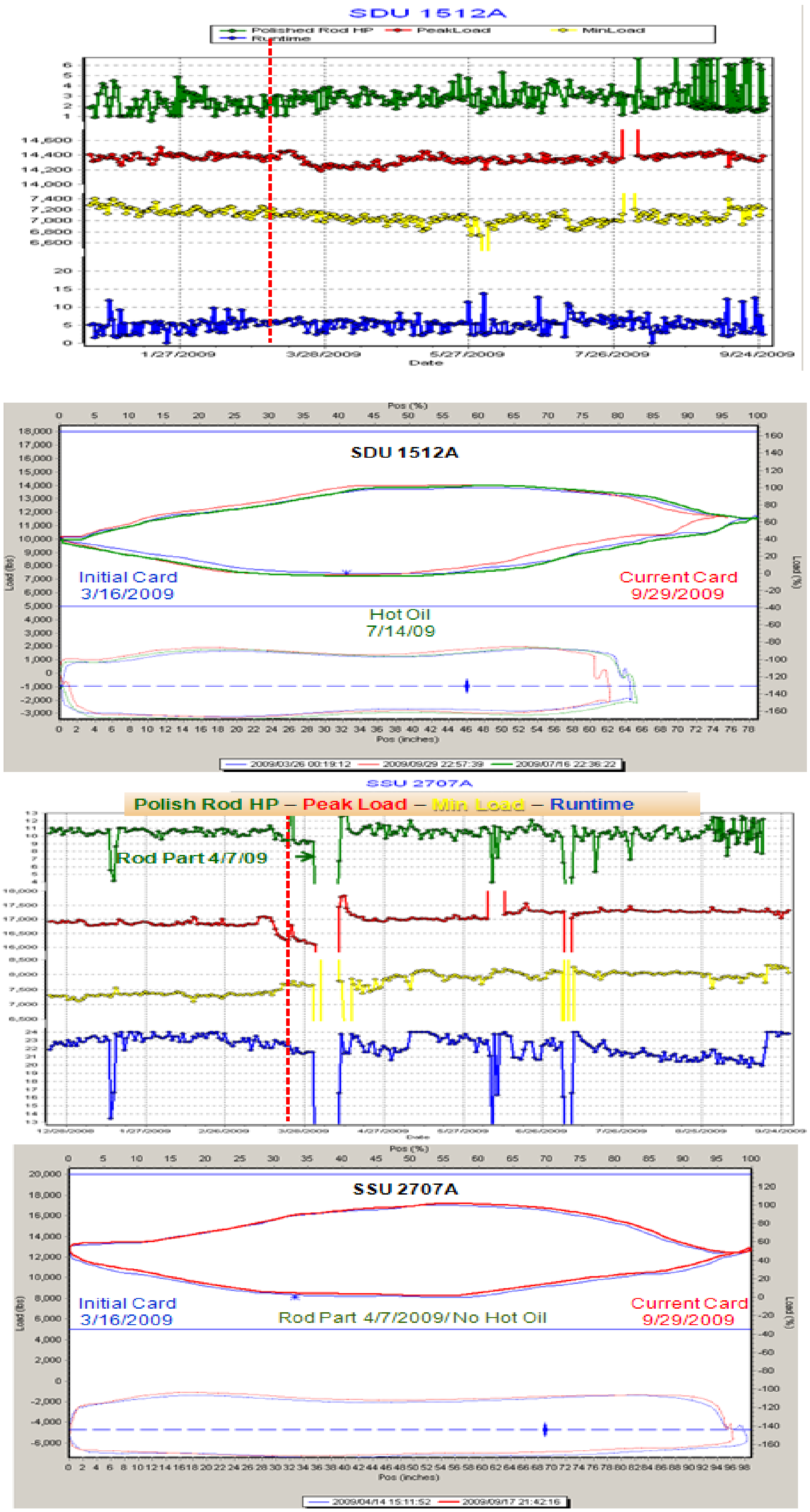
SDU 1512A
Polished Rod HP
PeakLoad
MinLoad
Runtime
1/27/2009
3/28/2009
5/27/2009
7/26/2009
9/24/2009
Date
Pos (%)
SDU 1512A
Load (lbs)
Initial Card
3/16/2009
Current Card
9/29/2009
Hot Oil
7/14/09
Pos (inches)
SSU 2707A
Polish Rod HP – Peak Load – Min Load – Runtime
Rod Part 4/7/09
Date
Pos (%)
SSU 2707A
Initial Card
3/16/2009
Rod Part 4/7/2009/No Hot Oil
Current Card
9/29/2009
Pos (inches)

Figure 7

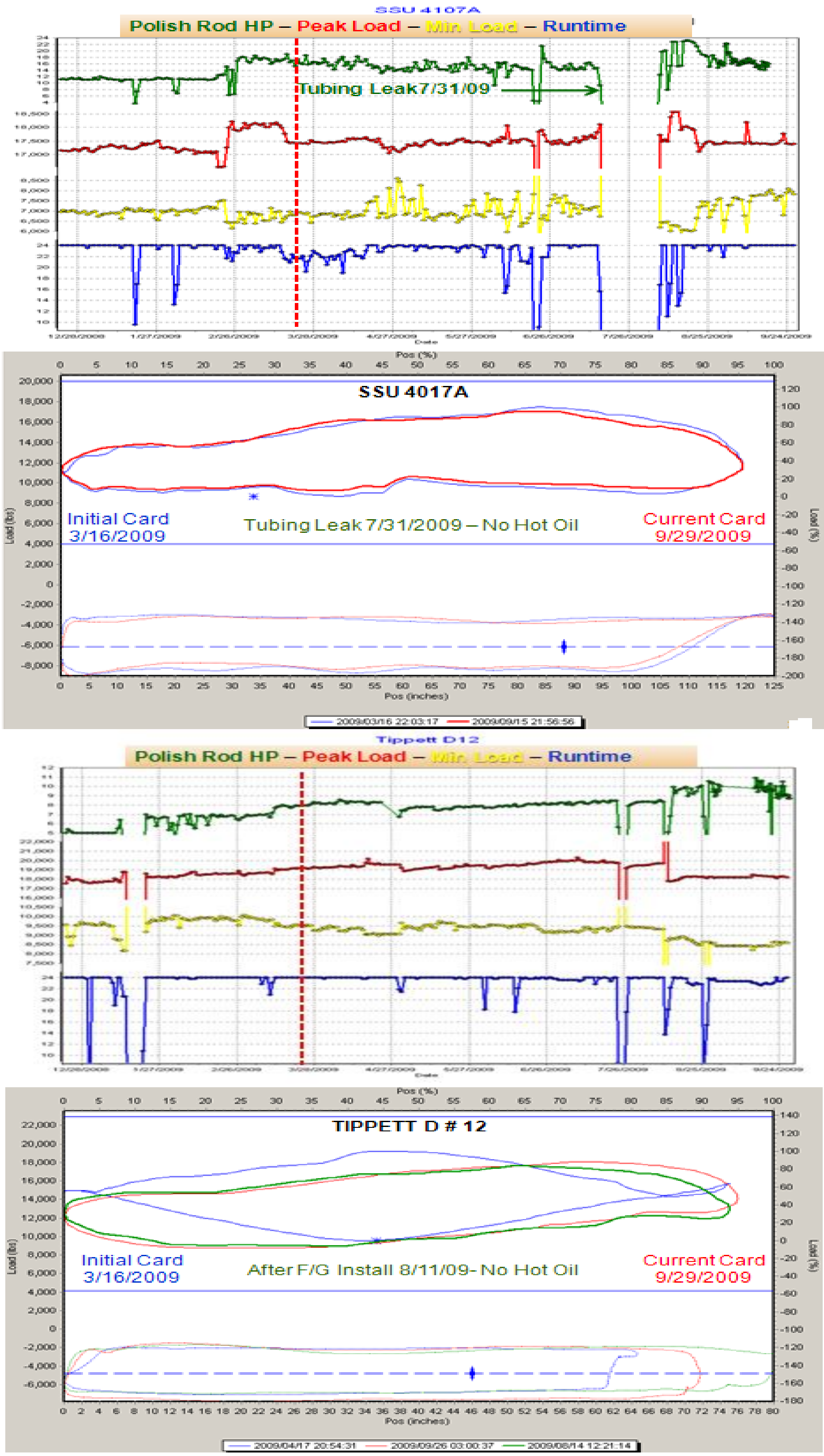
SSU 4107A
Polish Rod HP – Peak Load – Min Load – Runtime
Tubing Leak7/31/09
Date
Pos (%)
SSU 4017A
Initial Card
3/16/2009
Tubing Leak 7/31/2009 – No Hot Oil
Current Card
9/29/2009
Load (lbs)
Load (%)
Pos (inches)
Tippett D12
Polish Rod HP – Peak Load – Min Load – Runtime
TIPPETT D # 12
Initial Card
3/16/2009
After F/G Install 8/11/09- No Hot Oil
Current Card
9/29/2009

Figure 8

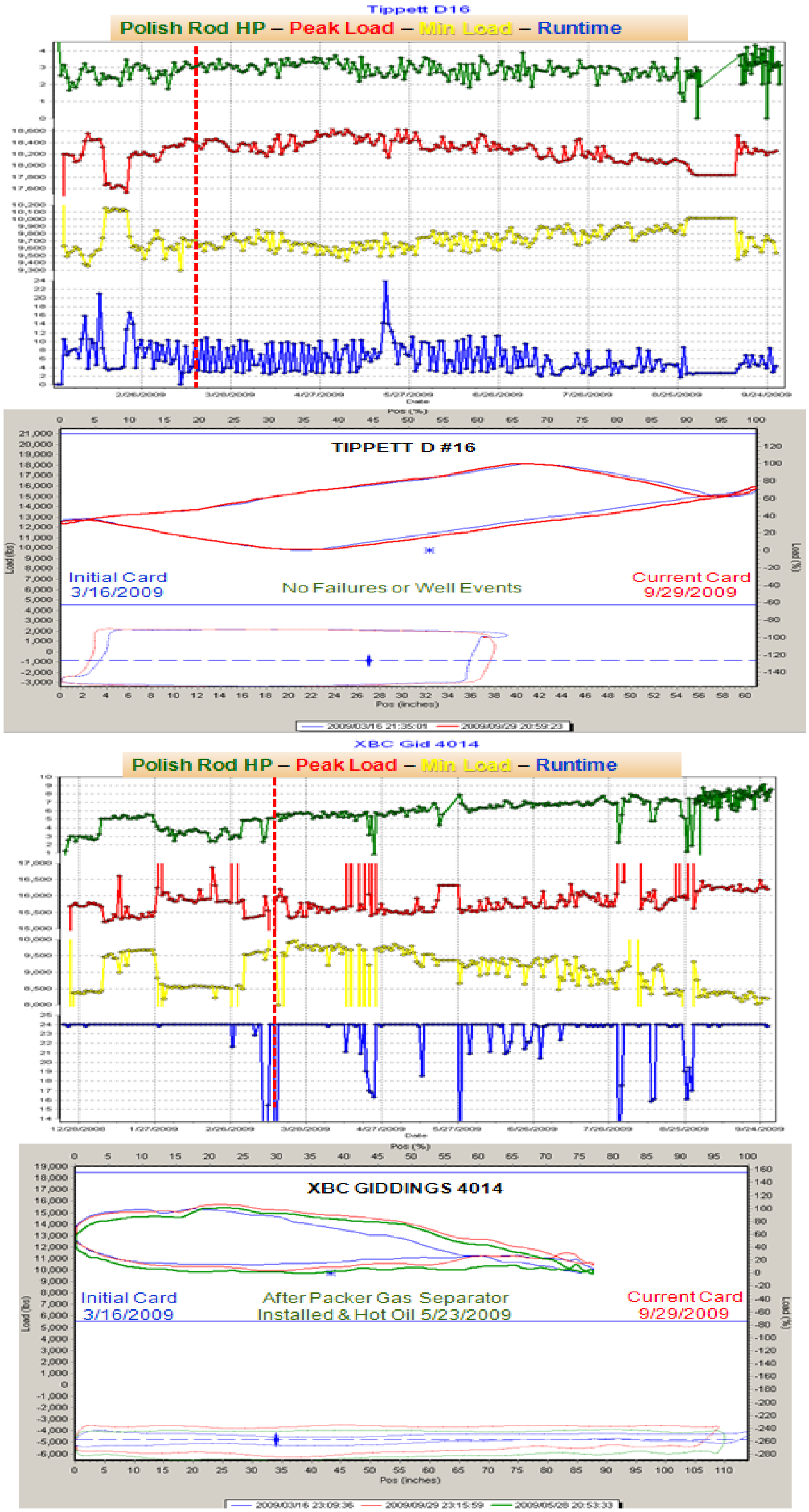
Tippett D16
Polish Rod HP – Peak Load – Min Load – Runtime
TIPPETT D #16
Initial Card
3/16/2009
No Failures or Well Events
Current Card
9/29/2009
XBC Gid 4014
Polish Rod HP – Peak Load – Min Load – Runtime
XBC GIDDINGS 4014
Initial Card
3/16/2009
After Packer Gas Separator
Installed & Hot Oil 5/23/2009
Current Card
9/29/2009

Figure 9

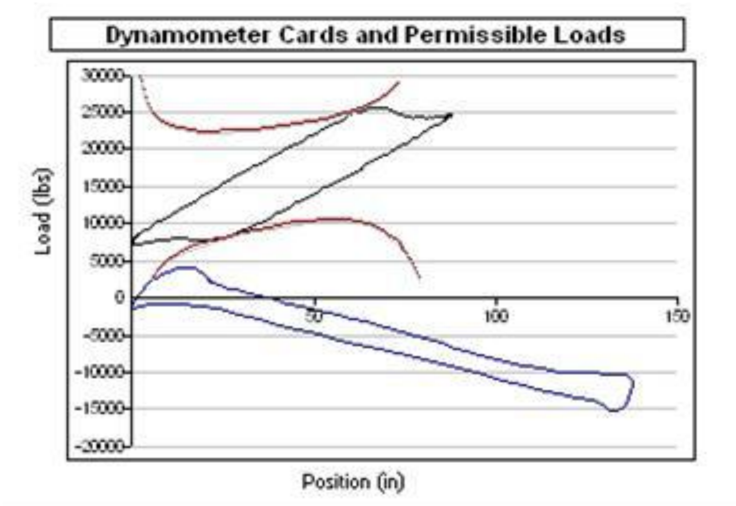

Figure 10 - The down hole card at 1300 feet.
Have not yet reached the depth of the source of distortion.

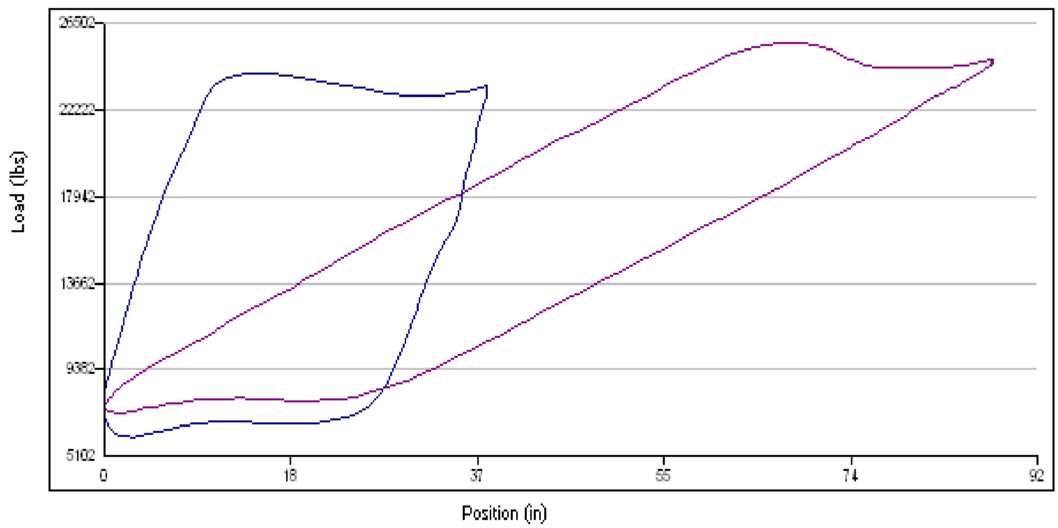

Figure 11 - The down hole card at 1300 feet.
This is showing a correctly represented downhole card at 1300 ft. before the paraffin has accumulated.

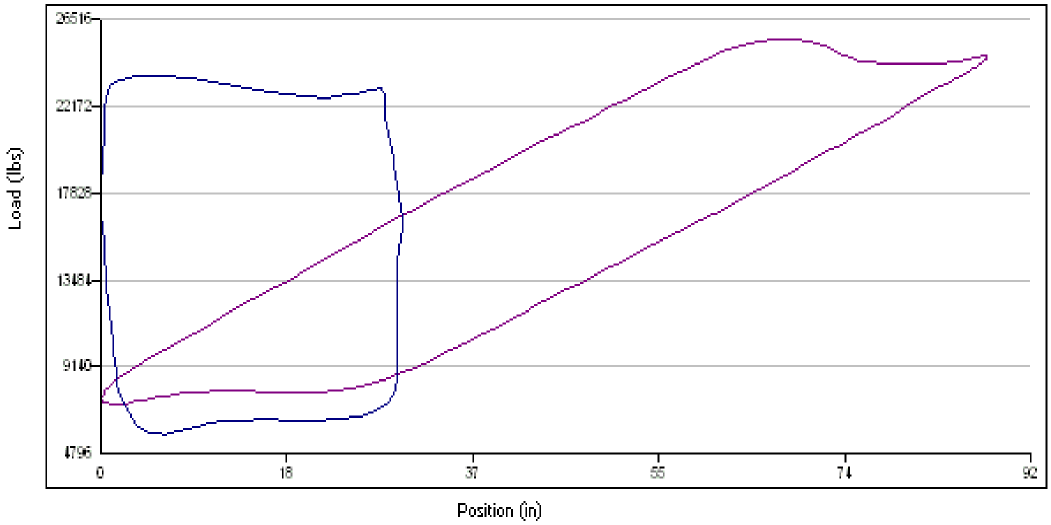

Figure 12 - The down hole card at 1700 feet.
This is where the paraffin has most likely accumulated.

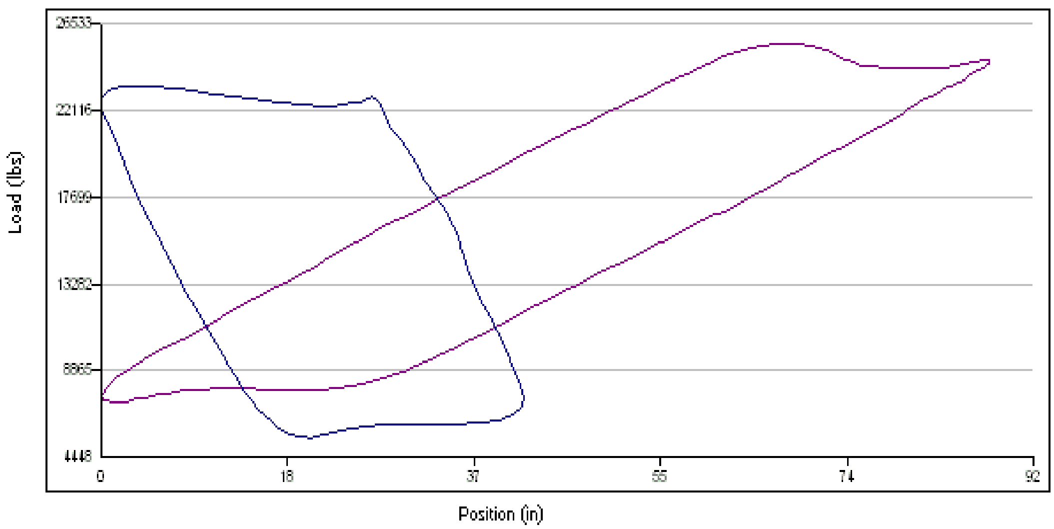

Figure 13 - The down hole card at 2100 feet.
Distortion due to the fact that the drag friction or interference has occurred above this depth in the rod string.

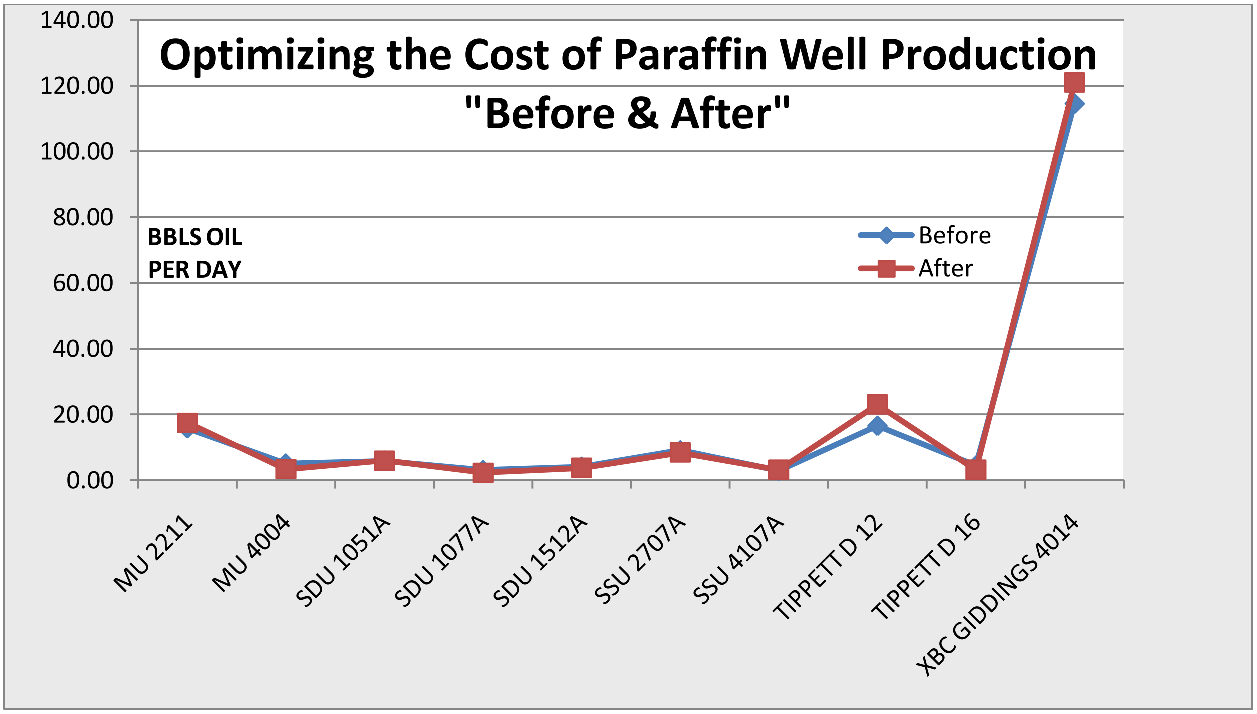
Optimizing the Cost of Paraffin Well Production
"Before & After"
BBLS OIL
PER DAY
Before
After
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
MU 2211
MU 4004
SDU 1051A
SDU 1077A
SDU 1512A
SSU 2707A
SSU 4107A
TIPPETT D 12
TIPPETT D 16
XBC GIDDINGS 4014

Figure 14