TITLE PAGE

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In Stripper Gas Wells

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Abstract

The goal of this research program is to develop and deliver a procedure guide of low cost methodologies to analyze and correct problems with stripper wells experiencing abnormal production declines.

A study group of wells will provide data to determine the historic frequency of the problem of abnormal production declines in stripper gas wells and the historic frequency of the causes of the production problems. Once the most frequently occurring causes of the production problems are determined, data collection forms and decision trees will be designed to cost-effectively diagnose these problems and suggest corrective action. Finally, economic techniques to solve the most frequently occurring problems will be researched and implemented. These systematic methodologies and techniques will increase the efficiency of problem assessment and implementation of solutions for stripper gas wells.

This second quarterly technical report describes the data reduction and methodology to develop data collection forms of pertinent information to assist in analysis of problem wells. The report also describes the procedures to categorize individual well problems. Finally, the report summarizes the frequency of individual well problems.

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Introduction

The goal of this research program is to develop and deliver a procedure guide of low cost methodologies to analyze and correct problems with stripper wells experiencing abnormal production declines.

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The following is the second quarterly technical report which addresses the data reduction methods and conclusions for each of the following tasks: 1) Develop Diagnostic Tools to Evaluate the Cause of Declines in Problem Wells, 2) Categorize Individual Well Problems, and 3) Summarize the Frequency of Individual Well Problems.

Executive Summary

The goal of this research program is to develop and deliver a procedure guide of low-cost methodologies to analyze and correct problems with stripper wells experiencing abnormal production declines.

A study group of wells will provide data to determine the historic frequency of the problem of abnormal production declines in stripper gas wells and the historic frequency of the causes of the production problems. Once the most frequently occurring causes of the production problems are determined, data collection forms and decision trees will be designed to cost-effectively diagnose these problems and suggest corrective action. Finally, economic techniques to solve the most frequently occurring problems will be researched and implemented. These systematic methodologies and techniques will increase the efficiency of problem assessment and implementation of solutions for stripper gas wells.

This second quarterly technical report describes the results of the following three tasks: 1) Develop Diagnostic Tools to Evaluate the Cause of Declines in Problem Wells, 2) Categorize Individual Well Problems, and 3) Summarize the Frequency of Individual Well Problems.

The first task was to develop diagnostic tools to evaluate the cause of declines in problem wells which required identifying the current responsibilities of production management, the current methods of monitoring production, and the basis for determining the productive potential of stripper gas wells. Finally, a triage form was developed to identify the most common production problems.

After identifying individual well problems, the source of the problems were categorized as follows: reservoir damage, reservoir depletion, fluid accumulation problems, precipitate plugging, mechanical failure of casing, tubing, plungers, rods, or pumps, gathering system restrictions, metering inaccuracies, and unknown.

Of the 376 wells reviewed, 270 wells or 71.8% were identified as having experienced abnormal production decline within the past five years. The source of the problem was then assigned one of the above-mentioned categories. The main problems were fluid accumulation problems that accounted for 45.9% of all the problems, while gathering system restrictions accounted for 24.0% and mechanical failures accounted for 22.6 %.

In summary, the above analysis indicates that many stripper gas wells do not experience abnormal production due to reservoir damage, precipitate plugging or reservoir depletion, but rather from failing to reduce the flowing bottom hole producing pressure as required to maximize production.

Experimental

No experimental methods, materials, or equipment were used in this phase of the research.

Results and Discussion

According to the timeline provided by James Engineering, Inc. to the National Energy Technical Laboratory, James Engineering, Inc. was to accomplish the following tasks by March 31, 2000:

- 1.) Develop Diagnostic Tools to Evaluate the Cause of Declines in Problem Wells
- 2.) Categorize Individual Well Problems
- 3.) Summarize the Frequency of Individual Well Problems

Each task identified above will be reviewed in detail and describe the methodologies utilized.

Task 1 – Develop Diagnostic Tools to Evaluate the Cause of Declines in Problems Wells

“Develop diagnostic forms of pertinent information to assist in the analysis of problem wells. Well equipment will be analyzed for mechanical failure. Shut-in and producing pressure information will be gathered to analyze bottom hole producing pressures. Fluid levels and other information will be collected to determine the effects of fluid on bottom hole pressure. Fluid production histories will be confirmed to determine what effect gas/liquid ratios have on stripper gas well performance. Pressure drops from producing formation to the gas sales point will be analyzed.

Data Reduction and Methodology

In the process of developing new diagnostic tools to assist in the analysis of problem wells, it was necessary to identify the current responsibilities of production management, the current methods of monitoring production, and the basis for determining the productive potential of stripper gas wells. Finally, a triage form was developed to identify the most common production problems.

Well Production Responsibility

The responsibility of achieving and maintaining maximum production volumes falls to the production manager and the well pumper. Development of the diagnostic tools to evaluate the cause of abnormal declines in problem wells assists both the manager and the pumper to react when maximum production is not achieved. A pumper has many responsibilities but primary must maximize production of each well. The pumper, in most cases, is more familiar with the productive characteristics of the stripper wells and with general guidance from the production manager, makes adjustments that affect the daily production from each well. The pumper has the ability to observe first hand the

changes in well performance through changes he makes, such as changing production cycles, by observing pressure and production trends. Through the consistent collection and analysis of data, the pumper can develop the skill and knowledge to keep many stripper wells that are close to being uneconomic from becoming “problem wells”.

The production manager needs to minimize the number of problem wells in the day to day operations. The production manager also has many other responsibilities in addition to maximizing well production. Environmental, governmental, land duties, supervisory responsibilities, and budgetary restrictions limit the amount of time and resources to address optimizing production. It is critical that the production manager and the pumper spends as little time possible assembling and analyzing the causes of abnormal well declines in stripper gas wells.

Current Production Monitoring Reports

The three primary reports currently used by Artex Oil Company to assist in maintaining optimum production include weekly pumper production reports, monthly gas production chart integration statements, and monthly “Priority” production monitoring reports.

The “Priority” production monitoring report that was developed to allow operators to set production and monitor gas production volumes from their wells. James Engineering, Inc. was involved in a cost-sharing venture with BDM-Oklahoma under the requirement entitled “Research and Development by Small Independent Operators to Provide Solutions towards Production Problems.” Through that cost-sharing venture, a computer program called “Priority” was developed to help users quickly identify opportunities to maximize field profitability.

“Priority” is a MS® Excel based program designed to accept imported actual and forecasted production information from an ARIES® database. The report generated from “Priority” assists production managers as follows: “By comparing actual oil and gas production volumes to forecasted producing rates for a specific period, the program generates a discrepancy report which can rank the wells in order of the greatest production deficiency to identify wells that require attention.” A sample of the “Priority” report is included in Appendix 1.

Simple weekly production reports are completed by well pumpers and are designed to provide a list of active wells and to monitor weekly gas, oil, and water production volumes. In addition, fluid volumes shipped from location, orifice plate changes, and a comment section allow pumpers to note significant changes in lease operations. The production manager and pumper review their production reports at a weekly meeting where they discuss and resolve many issues. A sample of the weekly production report can be seen in Appendix 2.

Monthly gas chart integration statements are another tool utilized by the production manager to identify potential gas production problems from the stripper wells. The integrated volumes produced are entered and tracked in the Landmark ARIES® database

and used to prepare the “Priority “ reports. The produced integration volumes are not the same as the gas sales volumes because they do not account for line loss. However, they are effective in reflecting the production trends and any abnormal production declines.

Many problems are identified by the above system and routinely taken care of by the pumper or the production manager. It has been said “what gets measured gets done”. The “Priority” production monitoring report utilized by Artex Oil Company sets a production goal and then compares it to actual production. The production goal allows the pumper to measure well performance to maintain optimum production volumes.

Determining the Productive Potential of Stripper Gas Wells

James Engineering, Inc. begins determining a stripper well gas production with the premise that a well’s productive potential is inversely proportional to the ratio of the flowing bottom hole pressure to the shut in bottom hole pressure.

James Engineering, Inc. refers to the work completed by J.V. Vogel whereby fluid flow in a reservoir is caused by movement of fluid from a high pressure area to a low pressure area and that fluid flow increases as the differential pressure increases. Vogel presents an Inflow Performance Relationship, or IPR curve for determining producing rate efficiency based upon the ratio of the well bore pressure to the reservoir pressure. Vogel’s IPR is based upon the following formula:

$$Q/Q_m = 1.0 - 0.2*(P_{fbh}/P_{sibh}) - 0.8*(P_{fbh}/P_{sibh})^2$$

Where

Q = Flow rate in mcf/d at the current flowing bottom hole pressure.

Q_m = Maximum flow rate in mcf/d at minimum flowing bottom hole pressure.

P_{fbh} = Flowing Bottom Hole Pressure.

P_{sibh} = Shut in Bottom Hole Pressure.

The Flowing Bottom hole pressure, or P_{fbh}, equals the summation of P_{wh} + P_{gc} + P_{oc} + P_{wc}, where

P_{wh} = Casing or tubing well head pressure

P_{gc} = Pressure exerted by gas column

P_{oc} = Pressure exerted by oil column

P_{wc} = Pressure exerted by water column

The total fluid column can be identified from an acoustic liquid level instrument, while the percentage of the oil and water portions are assumed to be equivalent to previous production rates of the respective reservoir. That is, if a well had averaged 1 barrel of water per day and 1 barrel of oil per day and a 200 ft fluid column was identified, then 100 ft would be accounted for by oil and 100 ft by water.

A graphical representation of the formula showing the relationship of the ratio of

Pfbh/Psibh to the percentage of the maximum producing rate, Q/Q_m is provided as Appendix No. 3. Note that graph indicates that's approximately 90% of the reservoir's maximum flow rate will be achieved when the flowing bottom hole pressure is 25% of the shut in reservoir pressure.

It should be noted that Vogel assumed that the reservoir is a solution gas drive and that there is no reservoir skin damage in the development of his IPR. James Engineering, Inc.'s experience indicates these assumptions are valid when determining the folds of increases expected by optimizing the pressure drop at the bottom of the hole.

To illustrate the effect of the Inflow Performance Relation, the following example of a Clinton Sand formation well is presented. The current flow rate at a calculated flowing bottom hole pressure of 400 psi is 50 mcf/d and the shut in bottom hole pressure is 1000 psi, the Clinton oil API = 60, and the Clinton brine has a specific gravity = 1.1. With a Pfbh/Psibh ratio = 0.25, entering the graph from the y axis then following it across to the performance curve, then down to the x axis indicates the well is producing at 90% of its maximum productive potential. If the current producing rate is 10 mcf/d at 500 psi, then the maximum productive rate would be $50 \text{ mcf/d} / 0.90$, or 55.5 mcf/d. Therefore, if the Pfbh was reduced to 0 psi then an approximate 10 % increase in production could be achieved.

However, consider if later in the life of the well that was previously able to effectively remove fluids from the well bore without any assistance from artificial lift, now has a Psibh of 500 psi. The 4,500' well has an abnormal decline in production and now has a flow rate of 20 mcf/d with a sales line pressure of 100 psi. The producing formation at 4,400' now has an effective fluid column comprised of 100' of oil and 100' of salt water.

Oil gradient in psi/ft = $61.3 / (\text{API} + 131.5)$, or $61.3 / (60 + 131.5) = 0.32 \text{ psi/ft}$.

Water gradient, psi/ft = $.433 * \text{Specific Gravity}$, or $.433 * 1.1 = 0.476 \text{ psi/ft}$.

Therefore,

Casing or tubing well head pressure: $P_{wh} = 100 \text{ psi}$

Pressure exerted by gas column: $P_{gc} = 4,200 \text{ ft} * 100 \text{ psi} / 30,000 = 14 \text{ psi}$

Pressure exerted by oil column: $P_{oc} = 100 \text{ ft} * .300 \text{ psi/ft} = 30 \text{ psi}$

Pressure exerted by water column: $P_{wc} = 100 \text{ ft} * (.433 * 1.1) \text{ psi/ft} = 48 \text{ psi}$

Therefore, the Flowing Bottom Hole Pressure, FBHP, = $P_{wh} + P_{gc} + P_{oc} + P_{wc}$

$100 \text{ psi} + 14 \text{ psi} + 30 \text{ psi} + 48 \text{ psi} = 192 \text{ psi}$.

The Pfbh/Psibh ratio now equals .384 with a corresponding percentage of maximum producing rate = 80%. Therefore, $Q_m = 10 \text{ mcf/d} / 0.80 = 12.5 \text{ mcf/d}$, or a potential increase of approximately 25% if the Pfbh were reduced to 0 psi.

This would require the installation of a pumping unit or compression facility to achieve a Pfbh of 10 to 25 psi resulting in less than a production increase of only 1 - 2 mcf/d.

Triage Form Development

A triage sheet was developed that could quickly and easily identify the most common production problems. This form focuses on identification of the factors that would affect the flowing bottom hole pressure. The overall philosophy is that to begin with the simplest analysis to eliminate the most common problems, and then expand the analysis as the problem requires.

Once a well has been identified as having abnormal production decline from the decline curves or “Priority” production monitoring report, the production manager collects the necessary information with the Stripper Gas Well Abnormal Production Decline Triage Sheet as seen in Appendix 4.

Phase 1 is to “Identify the Problem”. Step 1 restates that the problem as identified by the “Priority” production monitoring report. Step 2 is to review the production decline curve plot and associated production forecast to ensure that the data and the forecast are correct. Step 3 then verifies with the pumper that the problem has not already been corrected. Step 4 verifies that the gas meter and chart integration were performed correctly. Step 5 then insures that there are no problems with the gas gathering system and that the problem is at the well.

Phase 2 is to “Measure the Problem”. Step 6 checks for anything that would adversely affect well performance by increasing the flowing bottom hole pressure. Step 7 checks for increased fluid production that would affect production, also by increasing the flowing bottom hole pressure. Step 8 compares current flowing bottom hole pressure to previous pressure reading. This can be verified with an acoustic liquid level instrument to identify any fluid level. The flowing bottom hole pressure is the sum of the casing or tubing pressure, the gas column pressure, and the liquid column pressure.

Step 9 checks the performance of the well to compare actual production to its potential production. Step 10 determines if the well is producing at its maximum economic production rate. Step 11 establishes if the well is on artificial lift.

Phase 3 is to “Solve the Problem”. If the well is not producing at its maximum economic production rate as identified through the IPR analysis, then steps 12 through 17 allow for detailed analysis of the effectiveness of the type of artificial lift currently being used on the well. It is always possible that the well was producing at or near its economic limit and that any further expenditure would not be economically justified. The well may also have a problem requiring shut in bottom hole pressure analysis for precipitate or other formation damage requiring stimulation typically too expensive for most stripper gas well applications.

Step 12 instructs the user to go to the Swabbing Sheet. The Swabbing Sheet is used to analyze a well with no artificial lift. Step 13 instructs the user to go the Compression Determination Sheet to assist the user determine compression needs and economic justification for wells with very little fluid problems where compression can enhance or continue production. Step 14 instructs the user to go to one of the detailed analysis sheets for tubing plunger, TPL, casing plunger, CPL, or pumping unit, PJ. A sample of a detailed analysis sheet for a tubing plunger is provided in Appendix 5.

Should the well have no artificial lift, and artificial lift installation be suggested from Swabbing analysis, then Step 15 would direct the user to an Artificial Lift Determination Sheet. If compression or artificial lift do not correct an abnormal production decline, then further analysis of the bottom hole producing pressure may be required as directed through Step 16. Finally, Step 17 would instruct the user that additional action might be required or justified. The final step is to shut the well in to sell or plug and abandon.

In summary, the methodology to “Develop Diagnostic Tools to Evaluate the Cause of Declines in Problem Wells” was as follows:

1. Identify responsible parties and their responsibilities for achieving and maintaining optimum well production.
2. Review sources of data collection and processing.
 - A. Weekly production report
 - B. Monthly Gas Chart Integration Statement
 - C. “Priority” Production Monitoring Report
3. Identify criteria for wells to be identified as problem wells.
 - A. Producing gas well.
 - B. Historic production data in ARIES® database.
 - C. Production forecast assigned.
 - D. Updated monthly gas production data entered into database.
 - E. Updated “Priority” production report.
 - F. Actual well production has departed from forecasted decline
 - G. Highlighted to top of Priority report.
 - H. Determined by production manager to be reviewed.
4. Develop triage sheet for initial analysis of possible problems
 - A. Identify problem through existing data.
 - B. Measure the problem with pressure data and Vogel IPR curve.
 - C. Solve the problem through detailed well analysis.
5. Complete detailed analysis sheet according to well type
6. Prepare Abnormal Production Decline Triage Sheet.
7. Go to appropriate detailed well analysis sheet as necessary.
8. Shut in the well for bottom hole pressure analysis.
9. Shut in the well to Sell or Plug and Abandon.

Task 2 – Categorize Individual Well Problems

“Producing problems can occur at any point from the producing formation to the custody transfer point and be manifested in many different ways. Examples may include 1) Reservoir damage, 2) Reservoir depletion, 3) Fluid accumulation problems, 4) Precipitate plugging, 5) Mechanical failure of casing, tubing, plungers, rods or pumps, 6) Gathering system restrictions, and 7) Metering inaccuracies. There may be other problems, but in our experience, these are believed to be the major occurrences. A primary cause will be assigned to each.”

Data Reduction and Methodology

While often the entire production history was available, any knowledge about abnormal production decline prior to 1995 was very limited or unavailable. Therefore, all abnormal declines analysis will be limited to the period of 1995 through 1999.

The potential well problems were categorized as originally presented with the addition of the “Unknown” category. The categories of individual well problems are as follows:

- 1.) Reservoir damage
- 2.) Reservoir depletion
- 3.) Fluid accumulation problems
- 4.) Precipitate plugging
- 5.) Mechanical failure of casing, tubing, plungers, rods, or pumps
- 6.) Gathering system restrictions
- 7.) Metering inaccuracies
- 8.) Unknown

Further, for the purposes of this study,

Reservoir damage is defined as reservoir permeability damage caused by drilling, stimulation, or injection of foreign fluids into the reservoir.

Reservoir depletion is defined as pressure depletion of the producing reservoir drainage area sufficient to cause abnormal production decline due to interference or production of offset wells.

Fluid accumulation problems are defined as build up of fluid (oil or water) due to ineffective artificial lift methods or primary production mechanism no longer capable of effectively lifting fluid from well while maintaining optimum production. Ineffective artificial lift methods can be further defined as swabbing programs, cycle changes for increased plunger runs. When the primary production mechanism was no longer able to lift fluids from the well, the well then required the installation of artificial lift mechanism or installation of tubing, or casing plunger, or tubing and tubing plunger to maintain optimum production.

Precipitate plugging is defined as plugging of perforations or immediate well bore area with paraffin or other precipitate materials.

Mechanical failures of casing, tubing, plungers, rods, or pumps are defined as casing leaks, tubing leaks, plungers sticking or wearing out, rods parting, tubing parting, or pumps failing due to wearing out or getting stuck.

Gathering system restrictions are defined as increased sales line pressure, fluid build up in the gas lines, or gas line failure.

Metering inaccuracies are defined as either gas meter problems leading to inaccurate chart readings or improper chart integration leading to invalid integration values.

Unknown was a classification utilized when there no other indication as to the most likely cause for the abnormal production decline.

After evaluation of each decline curve, and determination that the well had experienced abnormal production decline, a primary cause for the decline was assigned. The primary cause was defined as one that resulted in the majority of the abnormal production decline. Each well may have experienced more than one period of abnormal decline in the five years analyzed. The primary cause assigned was the one that affected the majority of the abnormal decline periods.

For example, a well with a gathering system restriction could also have a casing leak. If the casing leak is not repaired the well could not be produced. Therefore, a mechanical failure due to a casing leak would be the primary cause for the abnormal production decline.

In summary, the methodology to “Categorize Individual Well Problems” is as follows:

1. Review individual well production plots.
2. Overlay producing formation production type decline curve.
3. Determine wells with abnormal production decline.
4. Perform diagnostic of wells with abnormal declines to determine primary cause from all available data sources.
5. Assign primary cause of abnormal production decline.

Task 3 – Summarize the Frequency of Individual Well Problems

“A statistical analysis will be prepared for the different causes of abnormal production decline identified in the problem wells. Knowing the most likely source of problem and symptoms of the problems should help stripper well operators diagnose and correct problems as they occur.”

Data Reduction and Methodology

Each well with an abnormal production decline was assigned a primary category according to the information available. This information was available either from well file data, first hand information, or through diagnostic information collected. It is important to note that while there may have been two or more contributing causes for the abnormal production decline, only one primary cause was assigned.

Of the 376 wells reviewed, 270 wells or 71.8% were identified as having experienced abnormal production decline within the past five years. Of the 270 wells identified as having experienced abnormal production decline, the frequency of the source of the individual well problems were summarized in Table No. 1.

Table No. 1 Summary of the Frequency of Individual Well Problems

Category	Number of Occurrences	% of the Total Number of Occurrences
Fluid Accumulation Problems	124	45.9
Gathering System Restrictions	65	24.0
Mechanical Failure	61	22.6
Reservoir Depletion	10	3.7
Metering Inaccuracies	5	1.9
Unknown	4	1.5
Reservoir Damage	1	0.3
Precipitate Plugging	0	0.0
Total	270	100.0 %

As can be seen from summary Table No. 1, the majority of abnormal well declines observed in the database were a result of fluid accumulation in the well as a result of the need for artificial lift or ineffective artificial lift.

The above analysis indicates that many stripper gas wells do not experience abnormal production due to reservoir damage or precipitate plugging, but rather from failing to reduce the flowing bottom hole producing pressure as required to maximize production.

Conclusion

The goal of this research program is to develop and deliver a procedure guide of low cost methodologies to analyze and correct problems with stripper wells experiencing abnormal production declines.

The second quarterly technical report describes the data reduction and methodology to develop data collection forms of pertinent information to assist in analysis of problem wells. The report also describes the procedures to categorize individual well problems. Finally, the report summarizes the frequency of individual well problems.

A triage sheet was developed that could quickly and easily identify the most common production problems. This form focuses on identification of the factors that would affect the flowing bottom hole pressure. The overall philosophy is that to begin with the simplest analysis to eliminate the most common problems, and then expand the analysis as the problem requires. By starting with the triage sheet, the user is then led to additional detailed analysis sheets by lift mechanism for further analysis.

The causes of abnormal well declines were then categorized into the following categories; reservoir damage, reservoir depletion, fluid accumulation problems, precipitate plugging, mechanical failure of casing, tubing, plungers, rods, or pumps, gathering system restrictions, metering inaccuracies, and unknown.

Of the 376 wells reviewed, 270 wells or 71.8% were identified as having experienced abnormal production decline within the past five years. A statistical analysis of the 270 abnormal production declines identified indicated fluid accumulation problems accounted for 45.9%, gathering system restrictions accounted for 24.0%, and mechanical failures accounted for 22.6%. The total of these three categories accounted for over 92% of the abnormal production declines.

The above analysis indicates that many stripper gas wells do not experience abnormal production declines due to reservoir damage or precipitate plugging but rather from failing to reduce the flowing bottom hole producing pressure as required to maximize production. This is typically attributable to a misapplication of artificial lift or a failure in mechanical integrity. Proof of this has been found through production increases predicted by Vogel IPR analysis and then verified through correct application of artificial lift methods to minimize the flowing bottom hole pressure.

Further work under this project will utilize the preliminary triage and detailed well analysis sheets in field applications to finalize the necessary information required for individual well abnormal production decline identification, analysis, and correction.

References:

Not applicable.

Bibliography:

SPE Paper 39416 “Increasing Production and Profitability by use of a Computer Monitoring Program” by Jerry James, SPE, and Gene Huck, SPE, James Engineering, Inc.

SPE Paper 1476 “Inflow Performance Relationships for Solution Gas Drive Wells” by J.V. Vogel

SPE Paper “Analyzing Well Performance XV” by J.N. McCoy, Echometer Company; A.L. Podio, University of Texas; K.L. Huddleston, Echometer Company

List of Acronyms and Abbreviations:

Not applicable.

Appendices:

Appendix 1	Sample “Priority” Production Monitoring Report
Appendix 2	Sample Weekly Production Pumper Reporting Sheet
Appendix 3	Vogel’s Inflow Performance Relationship Curve
Appendix 4	Abnormal Production Decline Triage Sheet
Appendix 5	Detailed Analysis Sheet: Tubing Plunger

Guy Steward		Artex Oil Company				231 Third Street, Marietta, OH 45750 740-373-3313					
Beg	End	MCFW Gas	MCFW Gas	Oil Prod.	Water Prod.	DOL	Oil Shipped	Tank	Tank	Meter	Meter
Prod	Prod	Prod	Prod	(BBLs)	(BBLs)	Prod	(BBLs)	Beg. Gauge	End Gauge	SZ/From	To
Well Name							Date				Comments
Bonnell, W. #1											
Bradfield #1											
Bertine, M. #2											
Bertine #3											
Big Brother Unit #1											
Big Brother #1											
Bonnet, R. #1											
Bowen, R. #1											
Cox, G. #1											
Daugherty, G. #1											
Eck #1											
Eck #2											
Fassinger #1											
Fordyce #1											
Getz, M. #1											
Glass, A. #1											
Gray, A.R. #1											
Greenwall, S. #1											
Mitchell, F. 31											
Orr, P. #1											
Peterson #1											
Patterson, R. #1											
Peterson Unit #1											
Tedrick, V. #1											
Tedrick, V. #2											
Slimbosky #1											
Steward #1											
Steward #2											
Vincenzo #1											
Warnock, R. #1											
Young, R. #1											
MASTER METERS											
A305											

Vogel's Inflow Performance Relationship Curve

**Stripper Gas Well
Abnormal Production Decline
Triage Sheet**

Date of Analysis _____

Lease _____

Well Identification Number _____

Artificial Lift Mechanism _____

Step Phase 1: Identify the Problem Well

	Yes	No	Then
1 Identify Abnormal Production Decline from Priority Report	_____	_____	Go to step 2
2 Review Production Decline Curve and Forecast	_____	_____	Go to step 3
3 Check with Pumper to verify problem still exists	_____	_____	Go to step 4
4 Check for Metering Inaccuracy	_____	_____	Go to step 5
5 Check for Integrity of Gas Gathering System	_____	_____	Go to step 6

Phase 2: Measure the Problem

6 Check for change in Sales Line Pressure	_____	_____	Go to 7
7 Check for change in Fluid Production	_____	_____	Go to 8
8 Check for Flowing Bottom Hole Pressure	_____	_____	Go to 9
9 Check Flow Performance Chart: Vogel IPR Curve	_____	_____	Go to 10
10 Is well producing at maximum desired production rate?	_____	_____	If yes, go to 13, if no go to 11
11 Is well on artificial lift?	_____	_____	If yes, go to 16, if no go to 12

Phase 3: Solve the Problem

12 Go to Swabbing Sheet	_____
13 Go to Compression Determination Sheet	_____
14 Go to Artificial Lift Detail Sheet: TPL, CPL, or PJ	_____
15 Go to Artificial Lift Determination Sheet	_____
16 Shut in for Bottom Hole Pressure Analysis	_____
17 Shut in to Sell or Plug and Abandon	_____

Stripper Gas Well**Data Collection Form for Problem Well Analysis****Tubing Plunger, TPL****General Information**

Date of Analysis	_____	
Lease Name	_____	Enter
Well Identification Number	_____	Enter
Lift Mechanism	TPL	Enter
Depth of Well	_____ Feet	Enter
Perforated Interval	_____	Enter
Depth of Tubing	_____ Feet	Enter
Tubing Size	_____ Inches	Enter
Domestic Gas Usage	_____	Enter
Sales Line Size	_____ Inches	Enter
Distance from Well to Sales Meter	_____ Feet	Enter
Gas Gathering System on Compression	_____	Enter

Lift Mechanism Cycles

Cycles per Day	_____	Enter
Minutes per Cycle	_____ Minutes	Enter
Manual or Automatic	_____	Enter
Last date plunger replaced	_____	Enter

Current Monthly Production Rate

Oil	_____ BOPM	Enter
Gas	_____ MCFM	Enter
Water	_____ BWPM	Enter
Compare to Previous Months		

Current Pressure Information

Tubing	_____ PSIG	Enter
Annulus	_____ PSIG	Enter
Sales Line	_____ PSIG	Enter
Separator	_____ PSIG	Enter
Flowing Bottom Hole Pressure (FBHP)	_____ PSIG	Enter
Compare to Previous Months		

Echo Meter Shot Information

Date	_____	Enter
Fluid Level	_____	Enter

Last Shut In Pressure

Shut In Bottom Hole Pressure (SIBHP)	_____	Enter
Date	_____	Enter

Vogel Chart Analysis

FBHP/SIBHP	_____
% of Production	_____

Category of Well Problem

Reservoir Damage	_____
Reservoir Depletion	_____
Fluid Accumulation Problem	_____
Precipitate Plugging	_____
Mechanical Failure of Casing, Tubing, or Plungers	_____
Gathering System Restriction	_____
Metering Inaccuracy	_____
Other	_____