Increasing Production and Profitability by Use of a Computer Monitoring Program

SPE 39416

Jerry James (jameseng@ee.net; 740-373-9521)
Gene Huck (740-373-9521)
James Engineering, Inc.
231 Third Street
Marietta, OH 45750

Abstract

Profitability is normally maximized from oil and gas properties when maximum production rates are consistently obtained. The computer program discussed in this paper has been developed to help small operators realize that goal with a minimal time investment.

Introduction

This paper describes a software application that enables users to increase field profitability by analyzing monthly oil and gas production rates. Profitability is almost always increased from oil and gas properties when maximum production is obtained from every well. However, many managers charged with maximizing well performance do not have time to properly monitor each well to ensure production is maximized at all times. This project addresses this problem with the development of a user-friendly computer program that compares actual production volumes to forecasted production rates and alerts the user to wells that fall short of forecasted rates. The case study is comprised of 250 wells located in the State of Ohio. This group contains examples of wells that have under-produced at various times because of failure to detect and respond to decreases in production.

This program, called *Priority*, helps users quickly identify opportunities to maximize field profitability. By comparing actual oil and gas production volumes to forecasted producing rates for a specific production 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. The program utilizes production forecast information imported from commercially available reserve/evaluation software, but can also be utilized by companies that have access to spreadsheet software only.

This project was specifically developed for small operators in a cost sharing venture between James Engineering, Inc. and BDM-Oklahoma under the requirement entitled, "Research and Development by Small, Independent Petroleum Operators to Provide solutions towards Production Problems." BDM-Oklahoma is the management and operating contractor for DOE's National Oil and Related Programs under prime contract DE-AC22-94PC91008. The program

will be available on the National Petroleum Technology Office (NPTO) Website (www.npto.doe.gov); the DOE program is under the supervision of Dr. Betty Felber.

Historical Monitoring Methods

After years of performing reserve evaluations on thousands of wells for numerous operators, experience indicates that operators often struggle to maintain maximum well production rates. Many operators monitor well performance but fail to achieve maximum production rates consistently. Current monitoring methods and their deficiencies are reviewed below.

The simplest method relies on the pumper to report decreases in production. This method often fails because bumpers are burdened with day-to-day activities and have insufficient information to develop a long-term production perspective. Therefore, many times gradual declines in production are not observed.

A second method consists of a tabular comparison of current monthly production to the previous month's production. This type of monitoring employs too short a time period and does not establish a production goal. Gradual declines in production can again be easily missed.

Another method employs a percentage rule. To identify problem wells, the monitoring system compares current production to the previous month's production but does not take action unless the downward variance exceeds, for instance, 10 %. This type of monitoring again employs too short a time period and also does not establish a production goal. The 10 % example above would allow a well to decline 5 % each month over a period of time and have a significant production loss without tripping the percentage limit.

The most refined method is a sophisticated computerized system used by some large independents and majors. This system utilizes production goals to compare with current producing rates. These systems collect and report vast quantities of information requiring so much time that the program is not always executed effectively. If the report is too burdensome, the goal becomes completing the report rather than identifying and acting upon the decreases in production. The monitoring program can work to identify a problem, but often lacks the follow-through in the implementation stage. This method may be impractical for the small, independent producer.

The first three methods identify large decreases in production, but often miss smaller decreases which can lead to significant losses in revenue. The last method, while in theory is workable, can be too burdensome for independents with small staffs to implement.

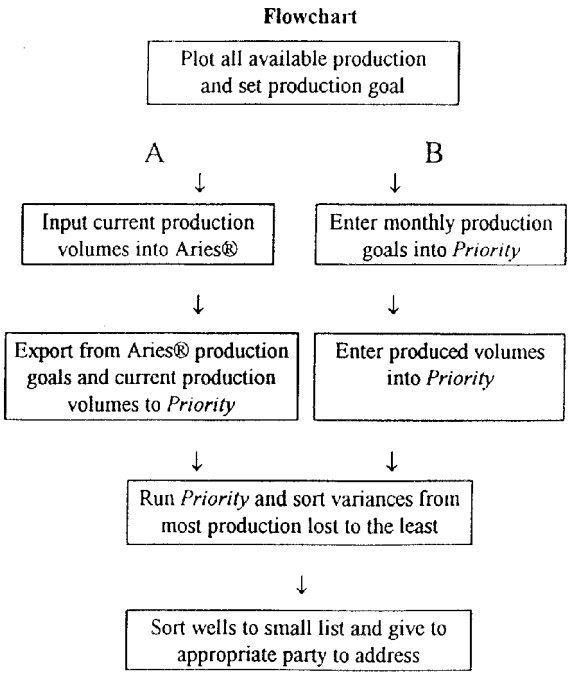
An Easier To Use Monitoring Method

Priority is a simplified software application that addresses the shortfall of the historical monitoring methods by comparing actual production volumes to production goals. The software uses actual measured production volumes as soon as they are available, to identify wells that fall short of these goals. This allows the user to prioritize the production deficits and provides the needed information to the field.

In this study, production histories were reviewed and analyzed to establish a reasonable forecast for each well. Production goals were set using Aries® software. This step made production input and forecasting relatively easy. *Priority* can utilize forecast information from forecasting programs or forecasts taken from simple hand plots of tabular information. In either case, a graphical presentation of the production history is recommended for forecasting purposes.

Prorated sales volumes have historically been plotted and were initially utilized for production comparisons. Integration volumes were eventually utilized to shorten the time between when a decrease in production is detected and the problem is addressed.

The program using the Aries® reverse-evaluation software follows path A in the Flowchart. Spreadsheet programs follow path B in the Flowchart.



Using a spreadsheet program, the wells with established production should have forecasted rates adjusted quarterly, newer wells should be adjusted monthly.

After the production data is imported, *Priority* permits the data to be sorted by negative variance and then printed out by area or pumper. An example of the printout is shown in Table 1.

A number of the wells in the study group experienced abnormal production declines detected by the program. These wells appear to have been reasonably well produced by different operators over the years, but decreases in production were still undetected. Review of the 250 well study group indicates the vast majority of the wells have experienced some underproduction for at least a period of one year during their lives.

The production histories have been included for three wells and are presented in figures 1, 2 and 3. In all three examples, the stabilized production declines were interrupted by decreases in production which went undetected or uncorrected for several years. Using *Priority*, the decreases were detected and corrective measures were implemented, which allowed the wells to be returned to expected production rates. The shaded portion below the projected performance time for each well represents the amount of underproduction. The H. Anderson No. 1 underproduced 11,658 mcf from 1989 to 1997. This represents revenue of $29,145 (at $2.50 per mcf). The A. Carter No. 1 underproduced 28,785 mcf from 1983 to 1997 representing revenue of $71,963.

The E. Wilson No. 1 underproduced 9421 mcf from 1994 to 1997 representing revenue of $23,553.

The program was implemented in the middle of 1996. During a five month production period at the end of 1996 and the beginning of 1997, a total production for the 250 wells increased by approximately 5 ½ % over the same period in 1995 and 1996. It should be noted that the nominal decline for these wells is approximately 6 % per year. Small operators with similar opportunities can realize substantial economic benefit by simply investing a few hours each month to run the *Priority* Program.

Conclusions

The *Priority* program is a simplistic management tool that enables users to identify problems and maximize production with a minimal time investment. *Priority* effectively identifies wells with production rates that vary from forecasted production goals. The program continues to remind the user of wells being underproduced until the problem is corrected or the production goal is changed. The examples provided demonstrate that users can gain significant economic benefit from this program with a small investment of their time.

PRODUCTION MONITORING SYSTEM
Evaluation for Production Month of: May 1997 INTEGRATED

WELL ID	WELL NAME	PUMPER	PIPELINE	PRODUCING METHOD	ACTUAL PROD.		FORECASTED PROD.		PROD. VARIANCE	
					(MCFM)	(BOPM)	(MCFM)	(BOPM)	(MCFM)	(BOPM)
2316355	GLASS #2	GG	A303	R	779		1041	1	-262	-1
2572961	KERR P. #1	GG	6033	R	15		262	0	-247	0
2572852	RIDENOUR G. #1	GG	A303	R	43		262	0	-219	0
2572683	LORENTZ #1	GG	A303	R	49		188	0	-139	0
2572613	GASSER #1	GG	A303		169		306	4	-137	-4
2573150	ANDERSON-MIZER #1	GG	A303	R	0	0	123	0	-123	0
2572936	SULZENER UNIT #1	GG	A303	R	12		124	0	-112	0
2572614	BUEHLER #1	GG	A291	S	91		179	0	-88	0
2573002	HANNI M., #1	GG	6033	R	62		118	0	-56	0
2573060	GANT UNIT #1	GG	A303	R	117		157	1	-40	-1
2572620	JOHN #1	GG	A303	R	137		161	0	-24	0
2573056	WAYNE FARMS #1	GG	A303	R	56		80	0	-24	0
2572950	BROWN G. #1	GG	A302	R	88		101	0	-13	0
2572646	EMIG #1	GG	5344	R	206		218	1	-12	-1

Table 1

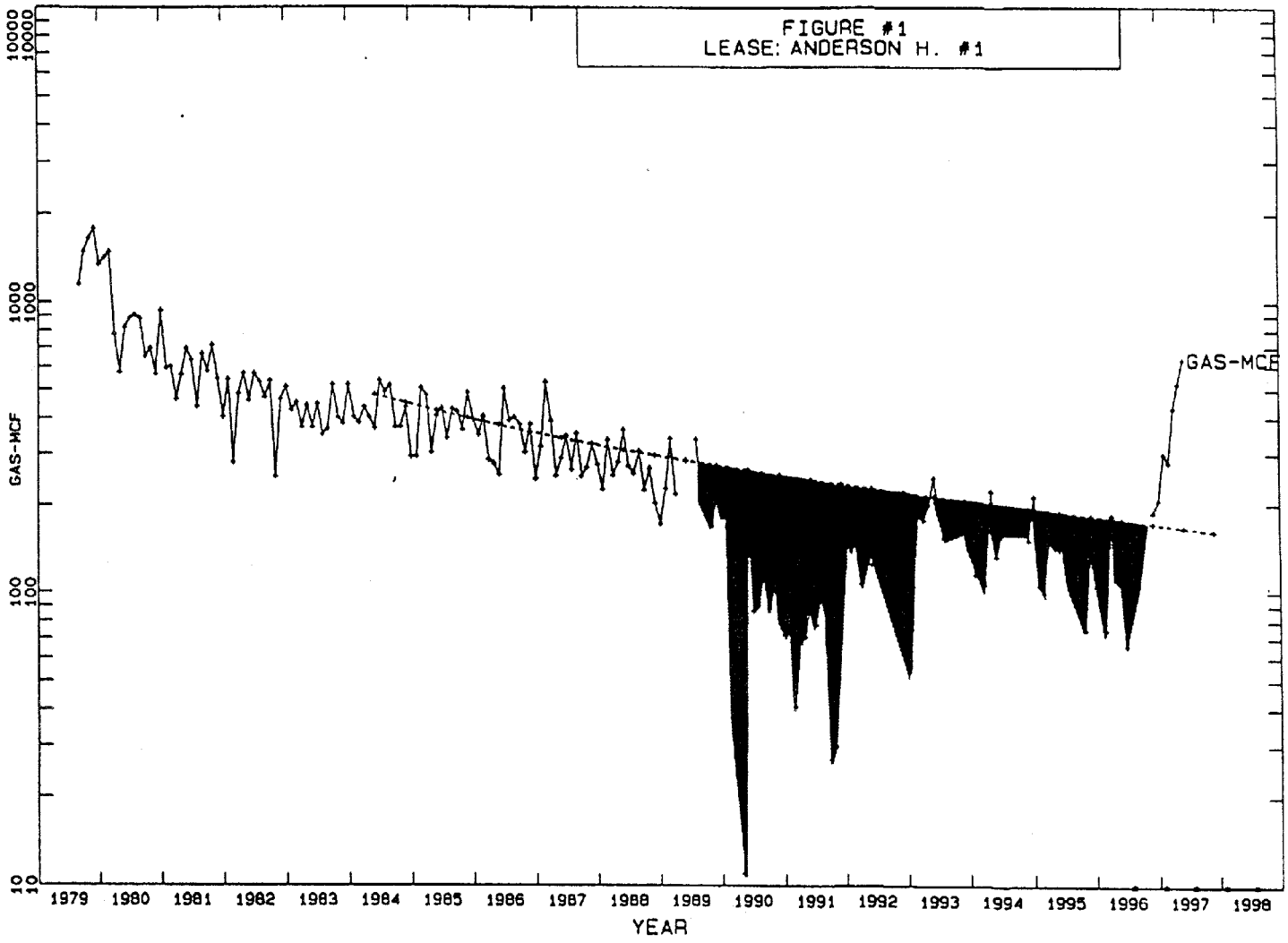


FIGURE #1
LEASE: ANDERSON H. #1
GAS-MCF
10000
1000
100
10
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
YEAR

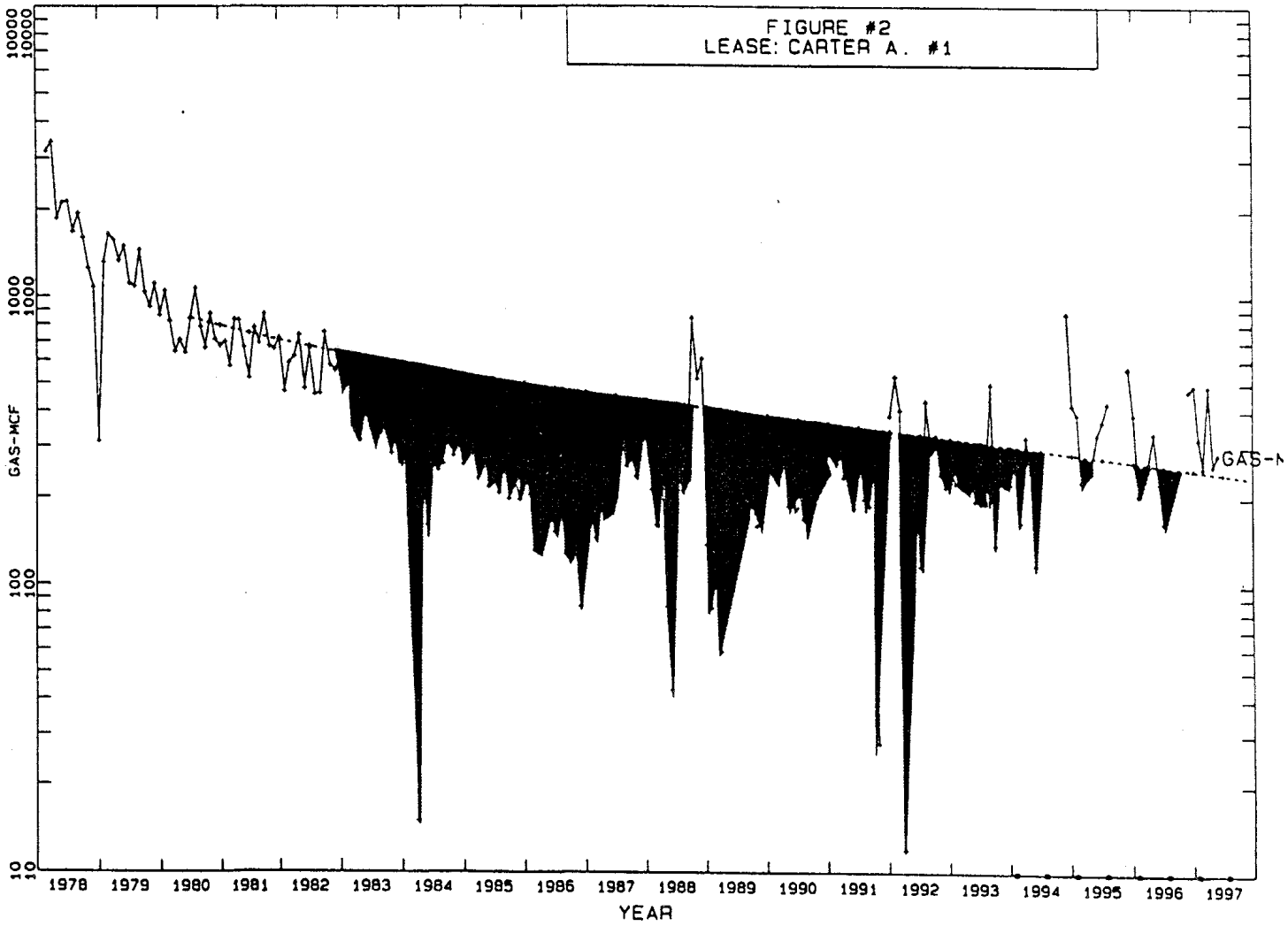


FIGURE #2
LEASE: CARTER A. #1
GAS-MCF
10000
1000
100
10
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
YEAR
GAS-M

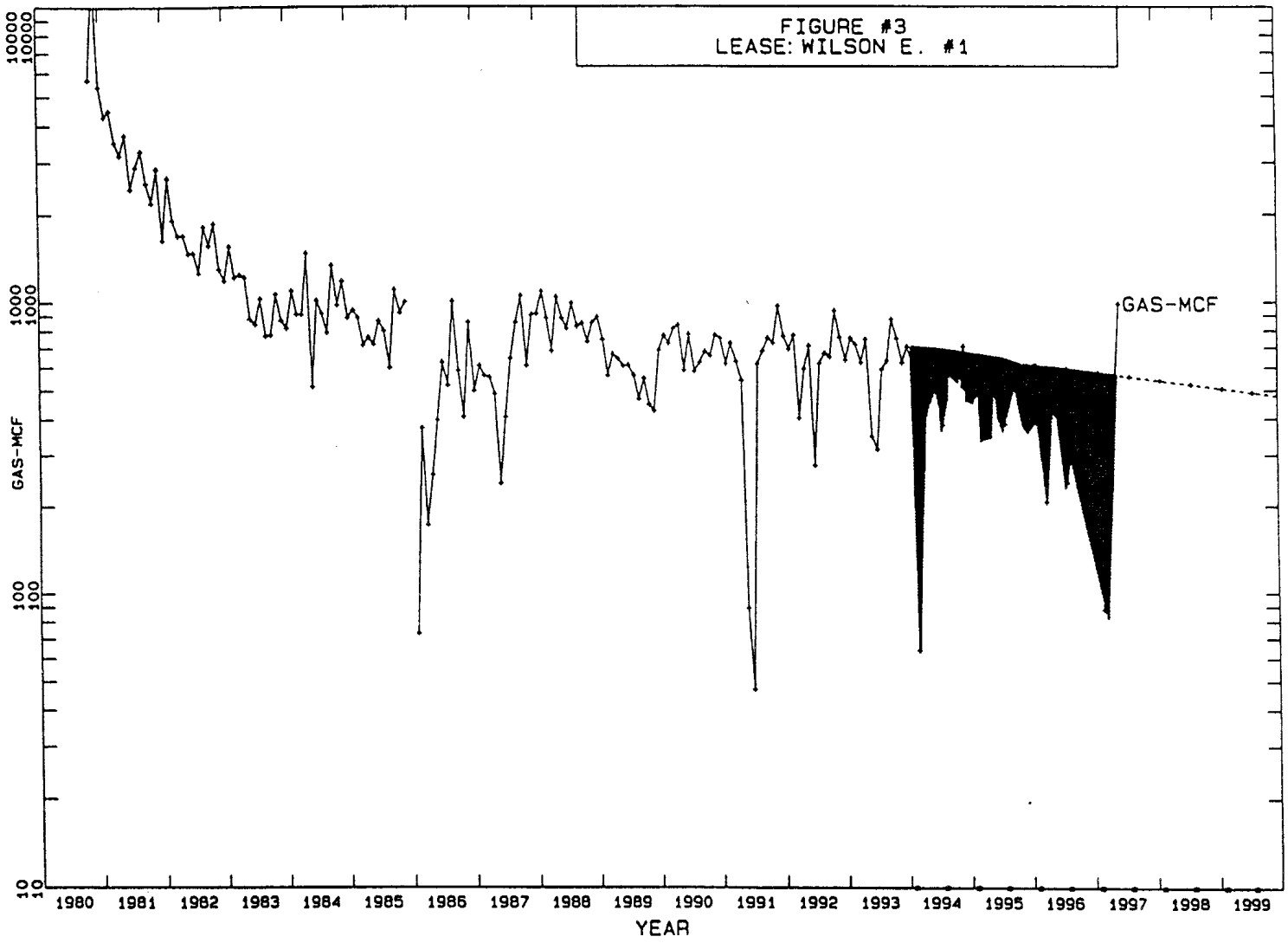


FIGURE #3
LEASE: WILSON E. #1
GAS-MCF
GAS-MCF
10000
1000
100
10
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
YEAR