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Field Laboratory in the Osage Reservation – Determination of Status of Oil & Gas Operations

(Task 3. Development of a Mineral Resource Information Management System)

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ABSTRACT

Microsoft EXCEL and Lotus 1-2-3 spreadsheets have been programmed to perform calculations as reservoir data is entered. These programs were developed by BDM-Oklahoma, Inc. personnel for use in the Field Laboratory in the Osage Reservation project. This spreadsheet will also assist Native American Tribe members in evaluation of the petroleum resource on the Osage Mineral Estate, Osage County, Oklahoma and independent operators to evaluate petroleum reservoirs on and off of the Osage Mineral Estate.

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TASK 3
DEVELOPMENT OF A MINERAL RESOURCE INFORMATION MANAGEMENT SYSTEM

1.0 INTRODUCTION

A comprehensive information management system is under development describing mineral resources exploration and production operations and facilities on the Osage Mineral Reservation. The information management system has been designed to facilitate entry, updating, retrieval, and analysis of operational data related to current and historical mineral resource exploitation and production operations. Required data fields and formats have been established, and along with initial data collection and entry. Protocols are being developed to ensure data reliability. The information retrieval system developed will allow easy data access and reporting at all levels. A user's guide will be developed under this task and stored information will be summarized in the final report.

1.2 STATUS OF TASK 3

Task 3 in the Field Laboratory in the Osage Reservation project, is to develop a minerals management plan for the Osage Mineral Estate located in Osage County, Oklahoma. Managing the minerals on the Estate includes developing a method to evaluate the petroleum resource remaining in the reservoirs. A format on a Microsoft EXCEL spreadsheet was developed and programmed by BDM-Oklahoma, Inc. personnel to perform calculations as data is entered. The objective for developing the programmed spreadsheet is to make the process of analyzing petroleum reservoirs faster and easier for a first look. This spreadsheet provides Native American Tribal members and small independent operators a method to evaluate the petroleum resource on the Osage Mineral Estate or on leases in areas outside the estate. A computer disk with the reservoir analysis software and an example accompany this report.

1.2.1 Using the Spreadsheet for Reservoir Analysis

The reservoir analysis spreadsheet has been designed to calculate subsea depths of the top and base of formations/reservoirs, water and oil saturation (Sw & So) from resistivity and porosity log picks, volumetric reserve calculations of original oil in place (OOIP), remaining oil in place (ROIP), and fractional oil produced per well and for the reservoir. In the spreadsheet 200 rows are programmed for these calculations.

When the user has entered all of the reservoir data available, data needed to calculate oil reserves can then be averaged. To average a column of numbers in MS EXCEL the user should highlight an empty space at the base of the column of numbers. Then pull down the insert menu, open function, highlight average, press the finish button, and highlight the column of numbers that you want to average. When all of the reservoir characteristics are averaged the formula programmed into the spreadsheet will automatically calculate oil reserves, etc.

On the accompanying computer disk there is a document entitled RESANALY.XLS that is a MS EXCEL spreadsheet and a Lotus 1-2-3 spreadsheet entitled RESANALY.WK3. These spreadsheets are programmed to perform the calculations described in Table 1. By saving the reservoir analysis spreadsheet as a re-named document the user is able to keep the "blank" template for analyzing other reservoirs or fields. On the same computer disk there are 2 documents that show examples of how the program is used to perform the calculations described in Table 1, they are entitled EXAMPLE.XLS and EXAMPLE.WK3. These spreadsheets have been saved in both EXCEL and Lotus formats in order for users of the respective systems to easily use the format that they are familiar with.

With approval from the Department of Energy (DOE) and BDM-Oklahoma, Inc. a disk with the programmed spreadsheets and the example can be distributed to Native American Tribe members evaluating petroleum resources or to small independent operators upon request. The remainder of this report is a users guide for the use of this spreadsheet.

2.0 SUMMARY

A Microsoft EXCEL spreadsheet was developed and programmed by BDM-Oklahoma, Inc. personnel to perform calculations as data is entered. The objective for developing the programmed spreadsheet was to make the process of analyzing petroleum reservoirs faster and easier for a first look. This spreadsheet provides Native American Tribal members and small independent operators a method to evaluate the petroleum resource on the Osage Mineral Estate or on leases in areas outside the estate. A computer disk with the reservoir analysis software and an example accompany this report.

TABLE 1

DESCRIPTION OF RESERVOIR ANALYSIS WORKSHEET

COLUMN	FORMULA	DESCRIPTION
A	None	Operator
B	None	Location - Section - Township - Range or other designation of choice by the user
C	None	Well Number
D	None	Elevation
E	None	Reservoir or Formation name
F	None	Reservoir/Formation Top measured depth (MD)
G	=D2-F2	Reservoir/Formation Top subsea depth (SS) - calculated by formula
H	None	Reservoir/Formation Base measured depth (MD)
I	=H2-F2	Reservoir/Formation Thickness - calculated by formula
J	None	Gas Cap (net feet)
K	None	Net Oil Pay (feet)
L	None	Average Porosity (%) as a decimal (e.g. 0.15)
M	None	Average Resistivity of Pay Zone From Resistivity Log (Rt)
N	None	Perforations or Pay Zone Shot Open hole with Nitroglycerin (e.g. 1525'-1550' or Shot 1525;-1550' w/150 qt.)
O	None	Driller's Log Top (DL Top) of Reservoir/Formation
P	None	Driller's Log Base (DL Base) of Reservoir/Formation
Q	None	Lithology (e.g. SS-sandstone, LS-limestone, Dol-dolomite)
R	None	Initial Production (IP) - Barrels of Oil Per Day (BOPD)
S	None	Resistivity of Reservoir Water (Rw) - The Oklahoma City Society of Petroleum Engineers publishes a book of measured Rw values by formation by county, Section-Township-Range.
T	=IF(L2="unknown","unknown",SQRT(((1/(L2*0.01*L2*0.01)*(S2))/M2)))/0.01	Reservoir Water Saturation (Sw) calculated with the Archie formula programmed into Column T of the spreadsheet
U	=IF(T2="unknown","unknown",100-T2)	Reservoir Oil Saturation (So) as a percent calculated by subtracting the calculated Sw from 100.
V	None	Cumulative Oil Production for: lease, field, well, etc.
W	=IF(Z2=0,"unknown",IF(MIN(L2)=0,"unknown",7758.4*Z2*IF(L2=0,0.24,L2*0.01)*MIN(K2)*IF(U2>0,U2*0.01,0.6)))	Calculated Estimated Original Oil In Place (OOIP) by using a volumetric formula. NOTE: the porosity will default to 0.24 (24%) if the porosity of the reservoir is not known. This can be changed in the formula if the user would like another default number for porosity if porosity of the reservoir is unknown. See *IF(L2=0,0.24,L2*0.01.
X	=IF(W2="unknown","unknown",IF(V2=0,"unknown",W2-V2))	Calculated Estimated Remaining Oil In Place (ROIP) by subtracting the cumulative oil production from the calculated OOIP in Column W.
Y	=IF(W2="unknown","unknown",V2/W2)	Calculated Fractional Oil Recovery by dividing the Cumulative Oil Production in Column V by the Calculated Estimated OOIP in Column W.
Z	None	Area (acres) for: well, field, reservoir, etc.
AA	None	Number of Wells for: reservoir, field, etc.
AB	=V2/AA2	Average Oil Recovery Per Well (Rec/Well): Cumulative Oil Production divided by Number of Wells in the: Reservoir, Field, Fault Block, etc.
AC	=D2-H2	Subsea Base of Reservoir/Formation.
AD	None	Oil and/or gas shows from well records for each well.
AE	None	Completion Date for each well.
AF	None	Depth of Production Casing.