DOE/BC/14987-13
(OSTI ID: 14183)

IMPROVED OIL RECOVERY IN MISSISSIPPIAN CARBONATE RESERVOIRS OF KANSAS -- NEAR TERM -- CLASS 2

Quarterly Technical Progress Report
October 1, 1997-December 31, 1997

By
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Don W. Green
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Report Issue Date: April 14, 1998

Performed Under Contract No. DE-FC22-94BC14987

University of Kansas
Center for Research Inc.
Lawrence, Kansas

DOE/BC/14987-13
Distribution Category UC-122

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November 1999

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14183

TITLE: IMPROVED OIL RECOVERY IN MISSISSIPPIAN CARBONATE RESERVOIRS OF KANSAS -- NEAR TERM -- CLASS 2

Cooperative Agreement No.: DE-FC22-94BC14987-13

Contractor Name and Address: The University of Kansas Center for Research Inc.

Date of Report: April 14, 1998

Award Date: September 16, 1994

DOE Cost of Project: $ 3,169,252 (Budget Period 2 05/16/97 -- 05/15/99)

Principal Investigators: Timothy R. Carr (Program Manager)
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Dan Ferguson

Reporting Period: October 1, 1997 -- December 31,1997

OBJECTIVES

The objective of this project is to demonstrate incremental reserves from Osagian and Meramecian (Mississippian) dolomite reservoirs in western Kansas through application of reservoir characterization to identify areas of unrecovered mobile oil. The project addresses producibility problems in two fields: Specific reservoirs target the Schaben Field in Ness County, Kansas, and the Bindley Field in Hodgeman County, Kansas. The producibility problems to be addressed include inadequate reservoir characterization, drilling and completion design problems, non-optimum recovery efficiency. The results of this project will be disseminated through various technology transfer activities.

At the Schaben demonstration site, the Kansas team will conduct a field project to demonstrate better approaches to identify bypassed oil within and between reservoir units. The approach will include:

- Advanced integrated reservoir description and characterization, including integration of existing data, and drilling, logging, coring and testing three new wells through the reservoir intervals. Advanced reservoir techniques will include high-resolution core description, petrophysical analysis of pore system attributes, and geostatistical analysis and 3D visualization of interwell heterogeneity.
- Computer applications will be used to manage, map, and describe the reservoir. Computer simulations will be used to design better recovery processes, and identify potential incremental reserves.
- Comparison of the reservoir geology and field performance of the Schaben Field with the previously described by slightly younger Bindley Field in adjacent Hodgeman, County.
- Drilling of new wells between older wells (infill drilling) to contact missed zones;
- Demonstration of improved reservoir management techniques, and of incremental recovery through potential deepening and recompletion of existing wells and targeted infill drilling.

SUMMARY OF TECHNICAL PROGRESS BUDGET PERIOD 2

Progress is reported for the period from 1 October 1997 to 31 December 1997. Work in this quarter concentrated on demonstrating the incremental recovery of additional mobile oil through targeted infill drilling (Task 2.1), developing technology transfer course materials, and preparing material for profession presentations and publication. A significant number of infill wells using locations identified through the reservoir characterization and simulations were drilled and completed. Work on horizontal well potential has contributed to at least 6 wells in various Mississippian reservoirs of Ness and Hodgeman counties.

Task 2.1 DEMONSTRATION OF RESERVOIR MANAGEMENT STRATEGY

During late 1996 and 1997, a total of fourteen infill locations were drilled or recompleted at the Schaben Demonstration Site based on the results of the reservoir management strategy developed in Budget Period 1(Table 1). Observed results are based on relatively short-term production tests provided by the operators. These wells will be monitored and reevaluated as longer-term production data becomes available. However, results to date show generally favorable outcomes in line with predicted results, and show the value of reservoir description and simulation. Monitoring of production rates and fluid levels will continue along with local modifications to the reservoir model. Operators within the Schaben Demonstration Site are planning at seven additional infill wells in 1998. The reservoir description and simulation was used to select and predict the outcomes of these proposed wells. All the major operators in the field are using the reservoir management strategy developed in Budget Period 1.

Task 2.2 TECHNOLOGY TRANSFER

Technology transfer is an ongoing process that includes access to information through the Internet, almost daily inquires and formal presentations. Two short courses, using materials and results derived from the Class 2 project, were developed and presented under the auspices of the Petroleum Technology Transfer Council (PTTC). The courses presented at the Kansas Geological Survey in Lawrence, Kansas and were directed at Mid-continent

operators. All the courses were well received and attended by consultants, independent operators and major companies. The two courses, related to the Class 2 project, were entitled **"Well-log Analysis on a PC using the PfEFFER Speadsheet Program"** and **"Reservoir Simulation on a PC using USDOE Boast 3 and Computer Mapping Packages"**. We are in discussion with the PTTC and AAPG to develop a national course.

Three extended abstracts covering a variety of topics have been accepted for the 1998 AAPG Annual Meeting in Salt Lake City Utah (Franseen and others; Guy and others, and Gerlach and others).

We continue to work with a number of Kansas operators on application of the technologies developed as part of the Class 2 project. We are providing access to the digital data and results from the project through an on-line (Internet) accessible format.

REFERENCES

(Accepted) Franseen, E.K., Carr, T.R., Guy, W.J., and Beaty, S.D., Significance of Depositional and Early Diagenetic Controls on Architecture of a Karstic-Overprinted Mississippian (Osagian) Reservoir, Schaben Field, Ness County, Kansas: 1998 AAPG Meeting, Salt Lake City, Utah.

(Accepted d), Guy, W.J., Byrnes, A.P., Doveton, J.H., and Franseen, E.K., submitted, Influence of Lithology and Pore Geometry on NMR Prediction of Permeability and Effective Porosity in Mississippian Carbonates, Kansas: 1998 AAPG Meeting, Salt Lake City, Utah.

(Accepted), Gerlach, P, and S. Bhattacharya, T. R. Carr, Application of Cost-Effective PC-based Reservoir Simulation and Management - Schaben Field (Mississippian), Ness County, Kansas

Table 1.—List of infill locations drilled or recompleted in the demonstration area. The majority of locations were selected based on the reservoir description and simulation results. All planned locations are based on the results of the reservoir description and simulation.

Well Name/Yr	Operator	API	Status	Location
1996				
4 BP Twin	Ritchie	15-135-23864	941'FOP	30-19S-21W, NW-NW-NE
2 P Lyle Schaben	Ritchie	15-135-23925	59' FOP	31-19S-21W, NE-NE-NE
1997				
2-30 Moore	American W	15-135-23800	<25 BOPD, little water	30-19S-21W, SE-NE-SE
6 DP Moore	Ritchie	15-135-24006	60 BOPD, 100 BW, 241' FOP	30-19S-21W, NE-NW-NW
3 AP Humburg	Ritchie	15-135-24013	70 BOPD, 130 BW, 33' FOP	25-19S-22W, NW-SE-SE
4 Humburg	Pickrell	15-135-24010	70 BOPD, 130 BW, 1347' FOP	25-19S-22W, NE-NW-SE
3 Borger	Pickrell	15-135-23998	40 BOPD, 40 BW, 1426' FOP	25-19S-22W, SW-NE-NE
7 Rein AP Ritchie		15-135-24031	70 BOPD, 80 BW, 530' FOP	29-19S-21W, SW-NW-SW
5 DP Moore	Ritchie	15-135-23973		30-19S-21W, NE-NE-NW
4 CP Moore	Ritchie	15-135-24030		30-19S-21W, NW-NE-SW
4 Borger	American W	15-135-24007	Plugged	25-19S-22W, SE-NW-NE
3-30 Moore	American W	15-135-23801	<25 BOPD, little water	30-19S-21W, NW-SE-NE
1-30 Moore	American W	15-135-23799	<25 BOPD, little water	30-19S-21W, NW-SW-SW
3 Borger	American W	15-135-23969	250' FOP	25-19S-22W, SE-SW-NE
1998 – Planned				
3 BCP Moore				
7 DP Moore	Ritchie	15-135-24034		30-19S-21W, NW-SE-NW
8 DP Moore	Ritchie	15-135-24033		30-19S-21W, NW-SW-NW
1 ERB	Ritchie	15-135-24036		32-19S-21W, NW-NW-NW
2X Humburg	Mid Continent R	15-135-24015		25-19S-22W, NW-NE-SE
4 Borger	American W	15-135-24007		25-19S-22W, SE-NW-NE
4AP Borger	Ritchie	15-135-24035		25-19S-22W, SE-NE-NW