

Disclaimer:

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

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

Cooperative Agreement No.: DE-FC22-93BC14987

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

Date of Report: November 8, 1996

Award Date: September 18, 1994

DOE Cost of Project: \$ 3,169,252 (Budget Period 1 09/18/94 -- 09/17/96)

Principal Investigators: Timothy R. Carr (Program Manager)
Don W. Green
G. Paul Willhite

Project Manager: Chandra Nautiyal, Bartlesville Project Office

Reporting Period: July 1, 1996 -- September 30,1996

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

Progress is reported for the period from 1 July 1996 to 30 September 1996. Work in this quarter has continued to concentrate on initiation of the reservoir simulation (Task 1.2), and technology transfer efforts (Task 1.3).

Task I.1 -- Acquisition and Consolidation of Available Data (Target Completion Date: 4/2/95). Delayed Completion (3/31/96).

This task is complete except for the continuing addition of production data from the demonstration site.

Task I.2 -- Reservoir Characterization (Target Completion Date: 3/3/96) Delayed Completion (10/15/96).

The geologic reservoir characterization for the Schaben Field is complete and has been presented at several national and regional meetings. Much of the geologic and production data, including maps, cross-sections and core analyses, is available on-line at the reservoir, lease and well levels. The Uniform Resource Locator {URL} is <http://www.kgs.ukans.edu/DPA/Schaben/schabenMain.html>).

A reservoir simulation study is underway for the Schaben Field. The initial area of study is Sec. 30-T19S-R21W. This is one of the most prolific producing areas within the Schaben Field. The study is being performed using a Silicon Graphics workstation with the Western Atlas VIP Executive simulation software. The VIP simulator is a conventional black oil simulator, equipped with a graphics interface. The objectives of the simulation are: 1) the characterization and distribution of the various reservoir parameters; 2) develop a material

balance model which will history match production to date; and 3) use the model to investigate and predict different enhanced oil recovery processes in an effort to optimize oil recovery.

The geological model provided digitized contour maps for the top of the Mississippian, bottom of the Mississippian, net pay interval, porosity, permeability, water saturation and individual well data. An initial simulation grid was developed over the area of interest. Two files were developed in a format compatible with the VIP software. The initialization file contains all the rock and fluid parameters, as well as the grid generated data. The recurrent file consists of the history of the wells that includes location, date of completion, perforation intervals, wellbore radius, skin factor, stimulation history, production history, pressure constraints and any other information related to individual wells. The initial model has been run for Sec. 30 and consists of a single layer reservoir. We are in the process of adding a second layer to simulate the underlying water aquifer. Reservoir parameters will be modified to obtain a history match with past production.

When the reservoir simulation is complete we can evaluate the results, make appropriate modifications to the geologic model, develop reservoir management techniques, and evaluate the potential for deepening and recompletion of existing wells and targeted infill drilling.

Task I.3 -- Technology Transfer (Target Completion Date: 8/4/96).

Technology transfer is an ongoing process that includes access to information through the Internet, almost daily inquires and formal presentations. The manuscript on the pseudoseismic approach as demonstrated at Schaben Field will be part of the publication related to the Gulf Coast SEPM conference entitled "Stratigraphic Analysis Utilizing Advanced Geophysical, Wireline and Borehole Technology for Petroleum Exploration and Production". An invited talk is scheduled at the San Joaquin Geological Society (Bakersfield, CA; December 10) on application of pseudoseismic and PFEFFER to reservoir description.

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