

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

Cooperative Agreement Number DE-FC22-93BC14987

The University of Kansas Center for Research Inc.

April 1, 1995

Budget Period #1 Duration from 09/18/94 - 09/17/96

Budget Period #2 Duration from 09/18/96 - 09/17/98

DOE Estimate Cost of Project \$ 3,169,252

Program Manager
Tim Carr
University of Kansas
Lawrence, Kansas

Principal Investigators
Tim Carr
Don W. Green
G. Paul Willhite

Co-Investigators
L. Schoeling, R. Reynolds

DOE Project Officer
Chandra Nautiyal
Bartlesville Project Office

Reporting Period 01/01/95 - 03/31/95
(2nd Quarterly Report)

**"U.S./DOE PATENT CLEARANCE IS NOT REQUIRED
PRIOR TO PUBLICATION OF THIS DOCUMENT"**

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.

Project Status

The project began in September of 1994, and will run through 1998.

Project Description

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.

The project is an effort to make Kansas producers more aware of potentially useful technologies and to demonstrate in actual oil field operations how to apply them. For many producers, especially independents, such information is important for continued production. A major emphasis of the Kansas project will be collaboration of University scientists and engineers with the independent producers and service companies operating in the state. An extensive technology transfer effort will be undertaken to inform other operators of the results of the project. In addition to traditional technology transfer methods (e.g., reports; trade, professional, and technical publications; workshops; and seminars) a public domain relational database and computerized display package will be made available through the Internet and other means of digital access.

Summary of Technical Progress

General Overview.--Progress is reported for the period from 1 January 1995 to 1 April 1995. The bulk of work to date has concentrated on Task 1.1. Some preliminary work on reservoir characterization (Task 1.2) has been completed, and related technology transfer has been initiated.

Task I.1 - Acquisition and Consolidation of Available Data (Target Completion Date: 4/2/95). Delayed Completion (6/1/95).

Summary of work in last quarter.--All acquisition and consolidation of geologic and digital log data are complete and all data have been loaded into a database management and analysis system. Work is not complete, but is progressing on the addition of production data, and a student assistant has been hired to assist in this task. Commercial oil sales data by lease are readily available for the field. Operators in the field have been contacted for more detailed production data and most operators have supplied production information for their wells. As the production data is assembled additional sources will be investigated (e.g., Kansas Corporation Commission).

As a result of permitting and scheduling problems, the three new wells with modern log suites and core data were not drilled in the first quarter. It appears that these problems have been cleared up and the wells should be drilling within the month. Discussion is under way on running, at a greatly reduced price, a magnetic resonance imaging log (MRI) in at least one of the three wells. The MRI device is not commonly run in Kansas and is still largely experimental in carbonate reservoirs. The MRI device is largely unknown to

Kansas independents, but has the potential to identify sections of the Schaben and other reservoirs that are prime candidates for additional oil recovery.

Summary of planned work for next quarter.-- This task has been delayed, but should be complete before the end of the next quarter. The delay in drilling the wells has been partially beneficial in that we have had time to integrate other geologic and engineering data, and to discuss acquisition of new logging data (i.e., MRI).

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

Summary of work in last quarter.--Petrophysical analysis is continuing and we are making use of newly developed analysis package (PfeFFER). PfeFFER stands for "Petrofacies Evaluation of Formations for Engineering Reservoirs". The program is being developed at the Kansas Geological Survey, and the Schaben Field data has provided a good test of the package. The program will be readily available to the small independent (i.e., PC-based), and requires only rudimentary computer expertise (use of EXCEL). Preliminary results indicate that the reservoir is highly vertically stratified, of variable lithology (limestone, dolomite, and chert), and has high BWV (Bulk Water Volume). PfeFFER may provide a cost effective tool for identifying sections of the reservoir that are prime candidates for additional oil recovery and improved reservoir description. Several preliminary descriptive reservoir products are now available (e.g., cross-sections, and structure maps).

Summary of planned work for next quarter.--Three wells will be drilled, cored, logged, and tested during the coming quarter. Analysis of data from these wells along with development of a descriptive reservoir model will continue. The availability of production data will provide the ability to undertake preliminary engineering analyses (i.e., mass balance, volumetrics, etc.). We will be working over the next quarter to develop a 3-D geologic visualization of the Schaben Field.

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

Summary of work in last quarter.-- Again this is very early in the project and the technology available to be transferred is limited. However, related work on the PfeFFER program has involved transfer of related technology to a dozen Kansas oil operators. We continue to develop our on-line server and feed information to be posted on the Internet,. We are working to publicize this site.

Summary of planned work for next quarter.--We will continue to work with Kansas operators on application of the technologies developed as part of the Class II project.