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

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FOREWORD

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ABSTRACT

This annual report describes progress during the third year of the project entitled “Improved Oil Recovery in Mississippian Carbonate Reservoirs in Kansas”. This project funded under the Department of Energy’s Class 2 program targets improving the reservoir performance of mature oil fields located in shallow shelf carbonate reservoirs. The focus of this project is development and demonstration of cost-effective reservoir description and management technologies to extend the economic life of mature reservoirs in Kansas and the mid-continent. The project introduced a number of potentially useful technologies, and demonstrated these technologies in actual oil field operations. Advanced technology was tailored specifically to the scale appropriate to the operations of Kansas producers. An extensive technology transfer effort is ongoing. Traditional technology transfer methods (e.g., publications and workshops) are supplemented with a public domain relational database and an online package of project results that is available through the Internet. The goal is to provide the independent complete access to project data, project results and project technology on their desktop.

Included in this report is a summary of significant project results at the demonstration site (Schaben Field, Ness County, Kansas). The value of cost-effective techniques for reservoir characterization and simulation at Schaben Field were demonstrated to independent operators. All major operators at Schaben have used results of the reservoir management strategy to locate and drill additional infill locations. At the Schaben Demonstration Site, the additional locations resulted in incremental production increases of 200 BOPD from a smaller number of wells.

EXECUTIVE SUMMARY

The majority of Kansas production is operated by the small independent oil and gas producer (90% of the 3,000 Kansas producers have less than 20 employees). The independent producer does not have the extensive resources and the ready access to a research lab to develop and test advanced technologies. For the Kansas oil and gas industry, access to new technology remains critical to sustained production and increased economic viability. A major emphasis of the Kansas project was collaboration of University of Kansas scientists and engineers with Kansas independent producers and service companies. The goal was to develop and modify cost-effective new technologies and to accelerate adaptation and evaluation of these technologies.

The demonstration project was conducted in cooperation with Ritchie Exploration, Inc. of Wichita, which operates leases that were the focus of the demonstration. However, a number of major operators in the Schaben Field contributed data to the project, and tested and adopted project results. Schaben Field (1963 discovery) is located in Ness County on the western flank of the Central Kansas uplift, and is typical of Mississippian production in Kansas. Prior to project initiation, cumulative field production was 9.1 million barrels of oil, and daily production was 326 BOPD from 51 wells prior. In Kansas, the majority of Mississippian production occurs at or near the top just below a regional unconformity. Production from Mississippian reservoirs accounts for approximately 43% of total annual production, and cumulative production exceeds 1 billion barrels. Today, independent producers, operating many of these reservoirs and production units, deal with high water cuts and low recovery factors that place continued operations at or near economic limits.

Common problems in Kansas reservoirs that affect producibility include; old and missing data, inadequate reservoir characterization, drilling and completion design problems, and non-optimal primary recovery. The value of cost-effective techniques for reservoir characterization and simulation at Schaben Field were demonstrated to independent operators. All major operators at Schaben have used results of the reservoir management strategy to locate and drill additional infill locations. At the Schaben Demonstration Site, the additional locations resulted in incremental production increases of 200 BOPD from a smaller number of wells.

Integrated geologic reservoir characterization provided the basis for development of a quantitative reservoir model. Descriptive reservoir characterization entailed integration and creative application of existing vintage data, drilling and coring three new wells. Core analysis (including NMR), petrophysical analysis, calibration of logs and core data integrated with existing data into a computerized 3D visualization. Procedures and computer code were developed to load and display available well logs using workstations for improved 3D visualization. Geologic, engineering and production data were brought into a common set of relational databases, and is available on-line at reservoir, lease and well levels.

One aspect of the project involved development of a low-cost PC-based petrophysical analysis package (PfeFFER) that works as part of a spreadsheet, and is a practical tool for the real-time, interactive log analysis. The US DOE Boast 3 Reservoir Simulation Package was modified to work at the full-field scale with commonly available, spreadsheet programs as pre- and post-processors. The result was a full field reservoir simulation model and management tool that the independent producer can run on a desktop PC using freeware and a spreadsheet.

Project design, methodologies, data, and results are disseminated to independent operators through focused technology transfer activities. These activities include development of cost-effective technologies, traditional publication; workshops and seminars; and public access

through the Internet. In addition to traditional workshops, electronic courses covering important technologies are available. All technologies used have been adapted to be cost-effective for independent operators of mature fields. Technologies include petrophysical analysis (PfeFFER), visualization (Pseudoseismic), core analysis using NMR, numerical simulation on a PC, and Internet technology transfer. The value of these technologies for independent operators has been demonstrated. All major operators at Schaben have adopted the results of the reservoir management strategy developed as part of the study, and have located and drilled approximately 20 infill locations. Overall results of the incremental wells are very favorable. The procedures continued to be transferred to other independent operators through publication, presentations, hands-on computer workshops and Internet access.