DOE/BC/14987--8

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.

July 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

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Reporting Period 04/01/95 - 06/30/95
(3rd Quarterly Report)

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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 April 1995 to 30 June 1995. Work in this quarter has concentrated on reservoir characterization (Task 1.2), with the initiation of technology transfer (Task 1.3). Difficulties still remain in the drilling of the final two wells. 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 1.1 - Acquisition and Consolidation of Available Data (Target Completion Date: 4/2/95). Delayed Completion (9/30/95).

Summary of work in last quarter.--Acquisition and consolidation of existing geologic and digital log data were complete last quarter. As reservoir analysis progresses, minor quality problems with the digital data are uncovered (e.g., spurious data within a digital log curve). These errors are corrected either manually or sent back to the digitizing contractor. Work is complete on the acquisition of a production data. We will continue to investigate additional sources of production and productivity data (e.g., Kansas Corporation Commission).

After protracted permitting and scheduling problems, the first of three new wells with modern log suites and core data was drilled during the first quarter. The #4 Moore "B-P" Twin was spudded on 4/25 and completed on 6/13. Daily drilling and completion reports are attached. An excellent core was recovered and described. The core has lead to the development of a new geologic reservoir model for the Schaben Field. The Ritchie Exploration as operator is pushing to expedite the permitting and drilling of the remaining two wells. Subject to hole conditions and tool availability we are still working on running a magnetic resonance imaging log (MRI) in at least one of the remaining wells.

Summary of planned work for next quarter.-- This task has been delayed by a contentious operator and his use of the permitting process to delay the drilling of the wells. The remaining two wells should be drilled this quarter.

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

Summary of work in last quarter.--The biggest breakthrough was in development of the ability to bin, load, and display well log data from Schaben Field as a 3D "pseudoseismic" volume. The preliminary results were briefly presented at the DOE contractor's meeting. The presentation lead to several contacts concerning possible cooperative work with other DOE contractors. At Schaben we are using the "Pseudoseismic" approach to recognize and map small faults and stratigraphic geometries within the reservoir units.

The core recovered from the #4 Moore "B-P" Twin has resulted in a modification of our view of the Schaben reservoir and the Mississippian reservoirs of Kansas, in general. If the multi-tiered karst model is valid, numerous vertically and laterally segregated reservoir compartments would be expected. We will continue to work to provide additional data that confirms or modifies this model.

Work continues on petrophysical analysis making use of newly developed analysis package (PfeFFER). PfeFFER stands for "Petrofacies Evaluation of Formations for Engineering Reservoirs".

Engineering analysis and simulation has picked up with the additional of a dedicated research assistant.

Overall, our geologic understanding of the Schaben reservoir has increased significantly over the last quarter.

Summary of planned work for next quarter.-- Analysis of data from the remaining new wells along with development of a descriptive reservoir model will continue. Engineering analysis and initial simulation efforts will be underway. The 3D geologic analysis of the Schaben Field should be nearly complete.

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

Summary of work in last quarter.-- Technology transfer is beginning to ramp up. The presentation at the DOE contractor's conference resulted in several contacts concerning possible cooperative work with other DOE contractors. These contacts and discussions center on application of the "pseudoseismic" approach to other projects. An open-file report on the "pseudoseismic" approach is available over the Internet (<http://crude1.kgs.ukans.edu/publication/carr.html>). An abstract on the Schaben was submitted to the Platform Carbonates Workshop to be held in Norman, Oklahoma (3/96).

Summary of planned work for next quarter.--Presentations will be prepared for the Oklahoma conference and the AAPG national meeting. We also plan to highlight the Schaben project at the Kansas Geological Survey's booth at the national AAPG meeting. A scientific paper is being prepared on the "pseudoseismic approach". We will continue our work with Kansas operators on application of the technologies developed as part of the Class II project.

RITCHIE EXPLORATION, INC.

125 N. Market - Suite 1000

Wichita, Kansas 67202-1775

316-267-4375 FAX 316-267-3026

#4 Moore "B-P" Twin
425' FNL & 2215' FEL
Section 30-19S-21W
Ness County, Kansas
1993 Production Package
API# 15-135-23,864
Duke Rig 1

FINAL REPORT

Field: B. Mathiesen
Office: J. Christian

Ref. Well: REI's #4 Moore "B-P", 150' W of NW NE, Sec. 30-19S-21W
Elevation: 2292' G.L. 2300' K.B.

DRILLING REPORT

SAMPLE TOPS			Ref. Well	ELECTRIC LOG TOPS			Ref. Well
Anhydrite	1510' (+ 790)	+1		Anhydrite	1509' (+ 791)	+2	
B/Anhy	1540' (+ 760)	+4		B/Anhy	1540' (+ 760)	+4	
Heebner	3763' (-1463)	+1		Heebner	3760' (-1460)	+4	
Lansing	3812' (-1512)	+2		Lansing	3809' (-1509)	+5	
B/KC	4122' (-1822)	+1		B/KC	4116' (-1816)	+7	
Pawnee	4228' (-1928)	flat		Pawnee	4223' (-1923)	+5	
Fort Scott	4306' (-2006)	+3		Fort Scott	4302' (-2002)	+7	
Cher shale	4322' (-2022)	+4		Cher shale	4320' (-2020)	+6	
Mississippi	4391' (-2091)	-10		Mississippi	4386' (-2086)	-5	
Osage	4404' (-2104)	-7		Osage	4401' (-2101)	-4	
RTD	4453' (-2153)			LTD	4446' (-2146)		
				True LTD	4450' (-2150)		

4-25-95 Spud at 1:30 p.m. Ran 7 joints (304.74') of 23# 8 5/8" surface casing set at 315' with 185 sacks 60/40 pozmix, 2% gel, 3% CC. Cement circulated. Complete at 8:00 p.m.

4-26-95 Drilling at 560'.

4-27-95 Drilling at 1910'.

4-28-95 Drilling at 2790'.

4-29-95 Drilling at 3400'.

4-30-95 Drilling at 3970'.

5-1-95 DST #1 from 4282' to 4322' (Fort Scott). Recovered 5' mud, no show of oil.
IFP:26-26#/30"; ISIP:28#/30";
FFP:26-26#/30"; FSIP:26#/30".

5-2-95 Depth - 4370'. Preparing to core Mississippian formation. Cut 9.5' of core. Core barrel jammed. Came out of hole. Recovered 9' of shale and chert rubble. Depth 4380'.

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- 5-3-95 Ran back in with core tool. Cut 3.75' tool torquing, thought pieces of rotary bit may be in hole. Came out of hole with core tool and ran rotary bit. Drilled to 4390'. Circulated hole clean. Cut 14' and core jammed. TD 4404'. Recovered 1' conglomerate shale and chert and 9.5' of shaley dolomite with some vug type porosity bleeding oil and 3.5' of green unconsolidated shale.
- 5-4-95 Cored 4' and core jammed. TD 4408'. Recovered 6" chert with some dolomite. Going in hole with core tool. Cored 10' and core jammed. TD 4418'. Full recovery Dolomite and chert with thin green shale laminations bleeding oil in spots.
- 5-5-95 Cored 25' and core jammed. TD 4443'. Full recovery Dolomite and chert with good oil staining and bleeding oil in spots. Cored 9.5' and core jammed. Rotary total depth 4453'. Recovered 7' of dolomite and chert with less staining and few fractures bleeding oil.
- 5-6-95 Attempted to run electric log. Would not go to bottom. Reconditioned hole and ran Dual Induction Log. Attempted to run Dual Porosity and Micro Caliper Log. Tool stuck in hole, called fisherman.
- 5-7-95 Recovered logging tool.
- 5-8-95 Ran 104 joints 14# new 5 1/2" production casing set at 4452' with 140 sacks Standard, 5% Calseal, 18% salt, and 3/4% Halad 322. 15 sacks in the rathole and 10 sacks in the mousehole. Plug down at 3:45 a.m. Float held. Baker port collar at 1466'. Waiting on completion.

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316-267-4375 FAX 316-267-3026

#4 Moore "B-P" Twin
425' FNL & 2215' FEL
Section 30-19S-21W
Ness County, Kansas
1993 Production Package
Field: B. Dills
Office: B. Mathiesen
Elevation: 2292' G.L. 2300' K.B.

FINAL REPORT

History:

Set 8 5/8" surface casing at 315' with 185 sacks. Set new 5 1/2", 14# production casing at 4452' with 140 sacks of standard, 5% Calseal, 18% salt, and 3/4% Halad. Baker port collar at 1466'. Distance from KB to Bradenhead = 9.8'. Length of shoe joint = 32.92'.

COMPLETION REPORT

- 5-19-95 MIRU double drum. Ran port collar opener and tubing. Found port collar at 1466'. Pressured casing to 1000#. Opened port collar and cemented with 257 sacks 65/35 poz, 6% gel, and 1/4# Flocele. Cement circulated. No KCC man on location. Received verbal permission from Richard Lacey with KCC. Casing pressured OK. Washed out, ran five joints and washed out. Pulled tubing and opener. SDOWE.
- 5-22-95 Ran 4 7/8" bit and tubing. Hit insert at 4416'. Drilled wiper plug, insert, and 24' of cement. TD at 4440'. Circulated hole clean. Started out of hole with tubing and bit because of bad weather. Got 25 joints out, cellar caving in. SDON.
- 5-25-95 Backhoe filled in cellar. Finished pulling tubing and bit. SDON.
- 5-30-95 Rigged up BPB Wireline. Logged well. SDON.
- 6-1-95 Swabbed 5 1/2" casing down to 2800'. SDON.
- 6-2-95 Finished swabbing down. Swabbed down to 4433' and loaded hole with 10 barrels lease water. Perforated from 4401' to 4403' with 3 SSB per foot. Swabbed down to 4385' and recovered 7.09 barrels. Swab tested from 4385':

Hour	Recovered
30 min	2.92 bbls, 100% water
1 hour	1.23 bbls, 100% water

SDOWE.

6-3-95 Fluid level at 3925', 475' of fillup. Swabbed down, oil with trace of water on bottom. Swabbed down to 4385' recovered 10.85 barrels oil. Swab tested from 4385':

Hour	Recovered
30 min	Dry
1 hour	0.41 bbls, dirty water w/trace oil
30 min	Dry
2 hours	0.25 bbls, 16% oil
3 hours	5' fluid, dirty water
4 hours	5' fluid, dirty water

SDON.

6-5-95 Fluid level at 4250', 150' of fillup. Swabbed down to 4385', all oil. Ran 4 7/8" bit and tubing, cut 4.5'. Cement to 4444.5', 4.5' of cement still in shoe joint. Pulled tubing and bit. Swabbed down to 4025'. Perforated 18' below insert collars at 4428.5' to 4431.5', three shots per foot, 10 shots SSB. TD at 4439'. Swabbed down to 4385' and recovered nine barrels with show of oil. SDON.

6-7-95 Fluid level at 3450' from surface, 950' of fillup. Swabbed down to 4400', 105' oil on top. Recovered 24.63 barrels on swab down. Swab tested from 4400':

Hour	Recovered
30 min	0.83 bbls, show of oil

Tested from 4439:

1 hour	1.67 bbls, show of oil
30 min	1.25 bbls, show of oil
2 hours	0.83 bbls, show of oil

Ran 8' sub, packer, and tubing. Set packer at 4424'. Swabbed down, fluid level at 3850', 575' of fillup. Swabbed down to 4424' and recovered 3.50 barrels, show of oil. Swab tested from 4424':

Hour	Recovered
30 min	0.83 bbls, 100% water
1 hour	0.83 bbls, 100% water

6-8-95 Fluid level at 2050' from surface, 2375' fillup, 100% water. Pulled tubing and packer. Ran Baker cement retainer and set at 4429', 15.5' from TD. Took injection rate: 1/2 barrel per minute at 800#. Mixed 50 sacks common cement and squeezed perforations at 4434'-4437', 16 sacks in formation 1000#. Pulled out retainer and washed cement out of tubing. SDON.

6-9-95 Swabbed down to 4000'. Perforated 4412' to 4417' (log) 3 SPF, 16 shots. Checked top of cement retainer at 4423' (log) 4429' (tubing tally). Ran packer and tubing. Set packer at 4407'. Swabbed down to 4403' and recovered 1.50 barrels. Swab tested:

Hour	Recovered
30 min	Dry
1 hour	0.50 bbls, muddy water

SDOWE.

6-12-95 Fluid level at 2700' from surface, 1710' fillup, 150' oil on top, 8.5%. Swabbed down to 4400' and recovered 10.02 bbls. Swab tested from 4400':

Hour	Recovered
30 min	Dry
1 hour	Dry
2 hours	0.83 bbls, 11% oil
3 hours	Dry

Acidized with 250 gallons 7.5% INS double FE. Feeding 200# at 1/4 barrel per minute. With 2.5 barrels acid in, 0# at 1/4 barrels per minute. Treated at that rate. ISIP 0#. Instant vacuum. Total load 32.5 barrels. Let set 15 minutes. Swabbed down, fluid level at 475'. Swabbed down to 4400' and recovered 32.98 barrels. Last pull show of oil. Tested four pulls per hour from 4400':

Hour	Recovered
1	16.28 bbls, 23% oil
2	14.20 bbls, 23% oil
3	15.44 bbls, 23% oil
4	14.20 bbls, 23% oil

SDON.

6-13-95 Fluid level at 1500' from surface, 2900' of fillup, 425' oil on top. Pulled tubing and packer. Ran 11' mud anchor set at 4417; 5 1/2" X 2 1/2" anchor catcher set at 4403'; 1.10' seating nipple set at 4402'; 141 joints of 2 7/8" tubing; 6', 6', 8' X 2 7/8" tubing sub. Set anchor with 18,000 over. SDON.

6-14-95 Ran 2 1/2" X 2" X 14' RWT pump with 4' plunger and double valve, 4 - sinker bars, 100 - 3/4" rods, 72 - 7/8" rods, 8' & 6' pony rods, and 1 1/4" X 22' polish rod with 10' liner. RDMO.

6-19-95 Laid lead line and hooked up wellhead.

6-21-95 Set pumping unit. Laid electric line. Set motor. Put well on production.