2nd Quarter, Fiscal Year 1996

**Post Waterflood CO₂ Miscible Flood in Light Oil
Fluvial - Dominated Deltaic Reservoirs.**

DE - FC22 - 93BC14960

Texaco Exploration & production Inc.

April 30, 1996

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Government Award for Current Fiscal Year

\$ 995,000.00

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Post Waterflood CO₂ Miscible Flood in Light Oil
Fluvial-Dominated Deltaic Reservoirs

"DE - FC22 - 93BC14960"
Technical Progress Report

Second Quarter, 1996

Executive Summary.

Texaco terminated the CO₂ purchase agreement with Cardox due to the declining production from the project during 1995. This decision was supported by the DOE and the Exploration and Production Technology Department (EPTD) who developed the model to simulate reservoir performance. Texaco is planning to continue recycling produced CO₂ to recover the remaining 400 MBO from the Marg Area 1 reservoir. Currently one well is remaining on production Kuhn #15R after the second producing well Kuhn #38 sanded up. Changing the water and CO₂ injection patterns should improve the sweep efficiency and restore production from other existing wells.

Second Quarter 1996, Objectives.

- * Make a decision on continuing CO₂ purchases

Texaco terminated the CO₂ purchase agreement with Cardox due to the decline in production during 1995, and after exploring various alternatives to restore production from the project. Purchases of new CO₂ was not necessary since it did not contribute to the recovery of new reserves from the project, and the stored CO₂ in the reservoir was sufficient to recover the remaining reserves through recycling. The Current purchased CO₂ utilization factor is in fact higher than the originally estimated (2.8 MCF/ BO vs. 2.5 MCF/BO). This evaluation was based on performance predictions by a compositional reservoir model built by EPTD, and the overall project economics. The decision was communicated timely to the DOE to obtain their support.

- * Complete the reservoir model.

EPTD built a compositional model to evaluate the project performance and improve the decision making process for project operations. The model included history matching of primary and secondary production and early CO₂ flooding, in addition to various production runs.

The reservoir model (COMP III by SSI) integrated the results of the Geologic model to improve the reservoir description. The SP curves from the well logs were used to determine the shale content and derive the shale corrected porosity. The porosity was utilized to calculate the permeability based on porosity/permeability transform. A four layers model that better represented the heterogeneity of the reservoir, and provided a flow path for the CO₂ to breakthrough into the upper portion of the reservoir. It also provided a more accurate view of the areal extent of the reservoir by eliminating the area to the south of the reservoir where Kuhn #6 is located, and reduced the total area of the reservoir by about 31% due to a localized shale-out.

EPTD modified the fault connections in the geologic model to isolate the main fault block, and utilized the model to perform a history match and make prediction runs. The emphasis was placed on obtaining a total fluid match as opposed to individual well match. The individual well performance was improved by producing the wells out to a point in time where the oil rates matched with the current values. this allowed the model to forecast production rates that are aligned with the current production rates. Prediction runs were made to evaluate the need for changing the injection pattern and to quantify the incremental oil that could be obtained with additional CO₂ purchases.

The results indicated that the new geologic description of the reservoir allows for an improved performance prediction and a reasonable estimates of oil recovery based upon two years performance history of the CO₂ flood. However it requires additional modification to fully match well performance. The following highlights the model results which can also be reviewed in more detail in the attached appendix A:

- * The OOIP in the main fault block of the reservoir is 7 MMBO.
- * The remaining recoverable oil reserves are in the range of 400 to 500 MBO.
- * Incremental recovery due to additional CO₂ purchases is limited. The cost of purchasing new CO₂ is not economically justifiable.

- * Continue monitoring and optimizing the reservoir performance.

Based on the reservoir model Texaco converted Kuhn #42 to a CO₂ injection well to improve the reservoir sweep efficiency and sweep a new area of the reservoir that has not been affected yet by CO₂ injection. Currently the well is injecting CO₂ at a rate of 1823 MCFD. Wells Kuhn #17 and Marg Area #1H are injecting water to maintain reservoir pressure and counter balance the reservoir total fluid withdrawal. Stark #10 well is continuing to inject CO₂ in the northern section of the reservoir. Production from well Kuhn #15R remains stable at an average rate of 125 BOPD, and it is anticipated to improve as the CO₂ injected in well Kuhn #42 reaches the well later this year. The second producing well Kuhn #38 sanded up after producing from an open hole Gravel pack system for about 1 year. The pressure in the reservoir is stable based on the surface CO₂ injection pressure, however, the injection rate is slightly higher than the withdrawal rate which should help increase the reservoir pressure and therefore improve the production rate.

Discussion of Results - Field Operations.

The following is a list of the most recent well tests taken during the month of March of 1996, for the producing and injection wells:

Producers:	Kuhn #15R,	137 BOPD,	82 % BS&W,	840 PSI,	22 CK.
	Kuhn # 38,	24 BOPD,	90% BS&W,	1100 PSI,	19 CK.

Injectors:	Kuhn #42,	1823 MCFD,	1181 PSI,
	Stark #10,	1040 MCFD,	1182 PSI.
	Kuhn #17,	967 BOPD,	1780 PSI.
	Marg Area 1H,	823 BOPD,	1780 PSI.

The Financial Status Report, Management Summary, Milestone Schedule and Federal Transaction Report are included on pages 7 through 11.

Discussion of Results - Technology Transfer.

As a part of its commitment to transferring the technology to the industry, Texaco presented a paper at the April 1996 SPE/ DOE Symposium on IOR in Tulsa, Oklahoma. The paper addressed the progress of the CO₂ flood at Port Neches and a new analytical method to select, design and predict the performance of new CO₂ floods in sandstone reservoirs.

Second Quarter 1996, Objectives.

- * Continue to monitor and optimize reservoir performance.
- * evaluate the effectiveness of the reservoir model.

PORT NECHES CO2 PROJECT ALLOCATED PRODUCTION

PORT NECHES
MARG AREA 1
FIELD
1"=600'

LESTAN SCLAVON
A-431

H.J. KUHN
267 AC
TR 1