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**FIELD VERIFICATION OF CO<sub>2</sub>-FOAM**

**DOE Grant No. DE-FG21-89MC26031**

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Funding for FY 1993: \$465,000**

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**Reporting Period: July 1 to September 30, 1993**

**MASTER**

## OBJECTIVES

The objectives of this cooperative industry-university-government project are to (1) transfer promising laboratory research to a field demonstration test, (2) provide research support to design and implement the test, and (3) evaluate the use of foam for mobility control and fluid diversion in a field CO<sub>2</sub> flood.

## SUMMARY OF TECHNICAL PROGRESS

The East Vacuum Grayburg/San Andres Unit (EVGSAU), operated by Phillips Petroleum Company (PPCo), is the site selected for a comprehensive evaluation of the use of foam for improving the effectiveness of a CO<sub>2</sub> flood. The Petroleum Recovery Research Center (PRRC), a division of the New Mexico Institute of Mining and Technology (NMIMT), is providing laboratory and research support for the project. The project is jointly funded by the EVGSAU Working Interest Owners (WIO), the U.S. Department of Energy (DOE), and the State of New Mexico. A Joint Project Advisory Team (JPAT) composed of WIO technical representatives from several major oil companies provides input, review, and guidance for the project. The four-year project began in late 1989, and is now in the final year. During this quarter, a no-cost extension of the project was granted by DOE for a period of six months.

The favorable production responses resulting from the first foam injection test are described in our previous progress reports. Based on that favorable response, a second foam test was initiated during the last quarter in the same injection well used for the first foam test. However, at some period after the initiation of the second foam test on May 21, 1993, a facilities problem was discovered at the field site. Normal injection operations involved the blending of about one-third produced gas (containing 70-75%

CO<sub>2</sub>) with about two-thirds purchased CO<sub>2</sub>. Because of the high temperatures observed in June to July, and the corresponding higher injection pressures, a greater than normal volume of produced gas was being injected. This condition resulted in a lower hydrostatic gradient and a somewhat higher surface injection pressure. Because it would be difficult to distinguish the pressure response due to the foam injection from the pressure increases caused by the change in injected gas composition, the decision was reached to abort the second foam test until a stabilized baseline could be re-established.

Following the JPAT meeting on June 30 and July 1, 1993 in Socorro, a smaller working group of the JPAT met in Odessa on July 26 and 27 to evaluate results of the foam test. The nature of the facilities problem was unknown and not discussed at the JPAT meeting, but it was discussed at the subgroup meeting in late July. The recommendation of the subgroup was to establish a mini-baseline by injecting CO<sub>2</sub> until a baseline injectivity is reached followed by about six to eight weeks of water and six to eight weeks of CO<sub>2</sub> before re-initiating the second foam test. The baseline injectivity with CO<sub>2</sub> stabilized in mid-September, and water injection began on October 1, 1993.

The subgroup has proposed an alternative foam generation scheme to the JPAT. After an analysis of the injection well profile results, the subgroup is proposing that near wellbore diversion might be more effective if a large surfactant slug was injected into the higher permeability zones and then followed by continuous CO<sub>2</sub> injection rather than using a rapid SAG process. Details of the second foam test will be decided by the JPAT during the next quarter.

During this quarter, the application of the simulated annealing method for inverse reservoir modeling at the EVGSAU pilot was presented<sup>1</sup> at the Annual SPE Meeting. Results of all the reservoir simulation runs will be compiled during the next quarter in preparation for completion of the final report.

## REFERENCES

1. Sultan, A.J., Ouenes, A., and Weiss, W.W.: "Reservoir Description by Inverse Modeling: Application to EVGSAU Field," *Proc.*, 1993 Annual Technical Conference and Exhibition of the SPE, Houston, Oct. 3-6, 637-652.

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