

Waterflood Developments In The Texas Panhandle

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ABSTRACT

The Panhandle field has produced more than 950 million barrels of oil from approximately 200,000 acres; currently there are more than 11,000 producing oil wells. This recovery has been obtained primarily by solution gas drive. Approximately 20 per cent of the field has been subjected to gas injection and it has been successful in several areas.

The first pilot waterflood project was initiated in 1944. Most of the earlier attempts to waterflood failed to increase the oil production. Not until 1955 was any degree of success obtained in pilot waterflood operations. Since 1955 approximately 15 pilot waterflood projects have been initiated. Results from five of these projects have been very encouraging. Although some of the other projects have not performed as predicted, the short time that they have been in operation is insufficient to provide a complete evaluation.

Waterflooding in the Panhandle field is in its infancy, with less than one per cent of the field subject to any waterflood operations. Extrapolation of the available data to apply to the entire field is impractical, as later developments could easily change the picture considerably. The only definite conclusion obtained from the numerous pilot waterflood projects is that considerable variation in results can be expected in this field. Additional projects should be selected with extreme care as many will probably not recover the development costs from increased production.

INTRODUCTION

The Panhandle field covers more than 200,000 acres in five counties of the Texas Panhandle. Currently there are more than 11,000 active producing oil wells in this field. Cumulative production to January 1, 1960, exceeds 950 million barrels. The Panhandle field has produced more oil than the field in California that has been reported as the second largest field in the United States.

Production is from dolomites of Permian age and granite wash of Pennsylvanian age. Depth of these zones varies from 2,200 feet on the eastern end to 3,300 feet on the western end of the field. Initial development during the 1920's was of the more prolific Granite Wash and Arkosic Dolomite formations. Development of the better dolomite areas took place during the early 30's. Considerable development of the marginal areas has taken place since the introduction of sand oil treating methods in the early 1950's.

RECOVERY MECHANISM

Although the Panhandle oil field is located adjacent to the Panhandle gas fields, gas cap expansion has not been a big factor in the recovery of oil. Very low permeability along the boundary of the oil field and gas withdrawals from the gas field have reduced the effectiveness of gas cap expansion as a primary recovery mechanism. With the possible exception of the old Borger field there has been no effective water drive in the Panhandle field. Apparent-

ly, most of the oil produced from the Panhandle field has been by solution gas expansion.

Gas Injection

Several cooperative gas injections have been formed in the Panhandle field. All of these projects have been dispersed gas, pattern, gas injection projects. Many of these projects have been economically successful. The largest, and perhaps the most successful of these projects is the West Pampa Repressuring Assn., which was organized in 1944.

Production from the wells in this project totals more than 90 million barrels. Failure of some smaller gas injection projects to retard the production decline can probably be attributed to either a fracture system existing in the reservoir, or insufficient gas injection to offset withdrawals due to production.

WATER INJECTION

The first attempt to increase oil production by the injection of water in the Panhandle field was made by Magnolia Petroleum Co. on a 390 acre lease west of Stinnett. Water injection into this one-well pilot water flood was commenced in March, 1944. Water injection operations were discontinued after the injection of 675,000 barrels of water with no appreciable effect on the offset producing wells. Magnolia initiated another one-well pilot waterflood on a 320 acre lease five miles south of Lefors in October, 1945. This project was abandoned after the injection of approximately 700,000 barrels of water.

The first sizable water injection project in the Panhandle field was a cooperative venture of Gulf Oil Corp. and Stekoll Petroleum Co., north of Borger. This project was a pattern flood with nine water input wells over an area of approximately 200 acres. Water injection commenced in October, 1946, and in 1952, injection operations were discontinued on most of the project. In 1955, water injection ceased in the entire project. The injection of almost four million barrels of water failed to increase oil production appreciably.

Results of these initial projects were certainly discouraging and very few operators would consider waterflooding their leases. However, declining primary production rates to very low levels influenced three operators to initiate pilot water flood operations on a small scale in 1955. Two of these projects have caused operators to take a "second look" at waterflood in the Panhandle field.

Successful Projects

The first of these projects was initiated by Kewanee Oil Co. on the Morse lease 13 miles east of Lefors. Water injection commenced in July, 1955, into two water input wells, one on regular ten acre pattern and the other a ten acre "five-spot" well. A substantial increase in production from the four producing wells offsetting the "five-spot" input well was obtained in May, 1956. Increased oil production from this pilot flood area has exceeded

5,000 barrels per acre. This project has been expanded to include 36 water input wells with a flood area of approximately 540 acres.

Another of these projects was Pan American Petroleum Corp.'s Ware lease, northwest of Skellytown. Water injection was commenced into six wells drilled on regular ten acre spacing in August, 1955. Two "five-spot" producing wells were drilled in the center of these injection wells. After approximately 15 months of water injection, a substantial increase in production was obtained. Increased oil production from this 20 acre pilot area has amounted to approximately 2,000 barrels per acre. Operations of this project have been curtailed pending arrangement of cooperative agreements with offset operators.

Huber also initiated a pilot waterflood project during 1955, on their Mayfield A lease north of Stinnett. One producing well was converted to a water input well initially. Four additional wells have been converted to water input service during the past two years. This project has produced some increased oil due to water injection.

During 1957 Kewanee initiated two one-input waterflood projects on small leases. The project on the Vida lease, west of Skellytown, was the first project in which water was injected into the Arkosic Dolomite. Although this project has produced some additional oil due to water injection, its principal significance has been in demonstrating that water can be injected into the Arkosic Dolomite at moderate pressure. The project on the Saunders lease, east of Lefors, was the first attempt to inject water into the Granite Wash formation. The estimated gas space developed during primary depletion has not been entirely replaced by injected water; therefore, no benefit has been received from this project to date.

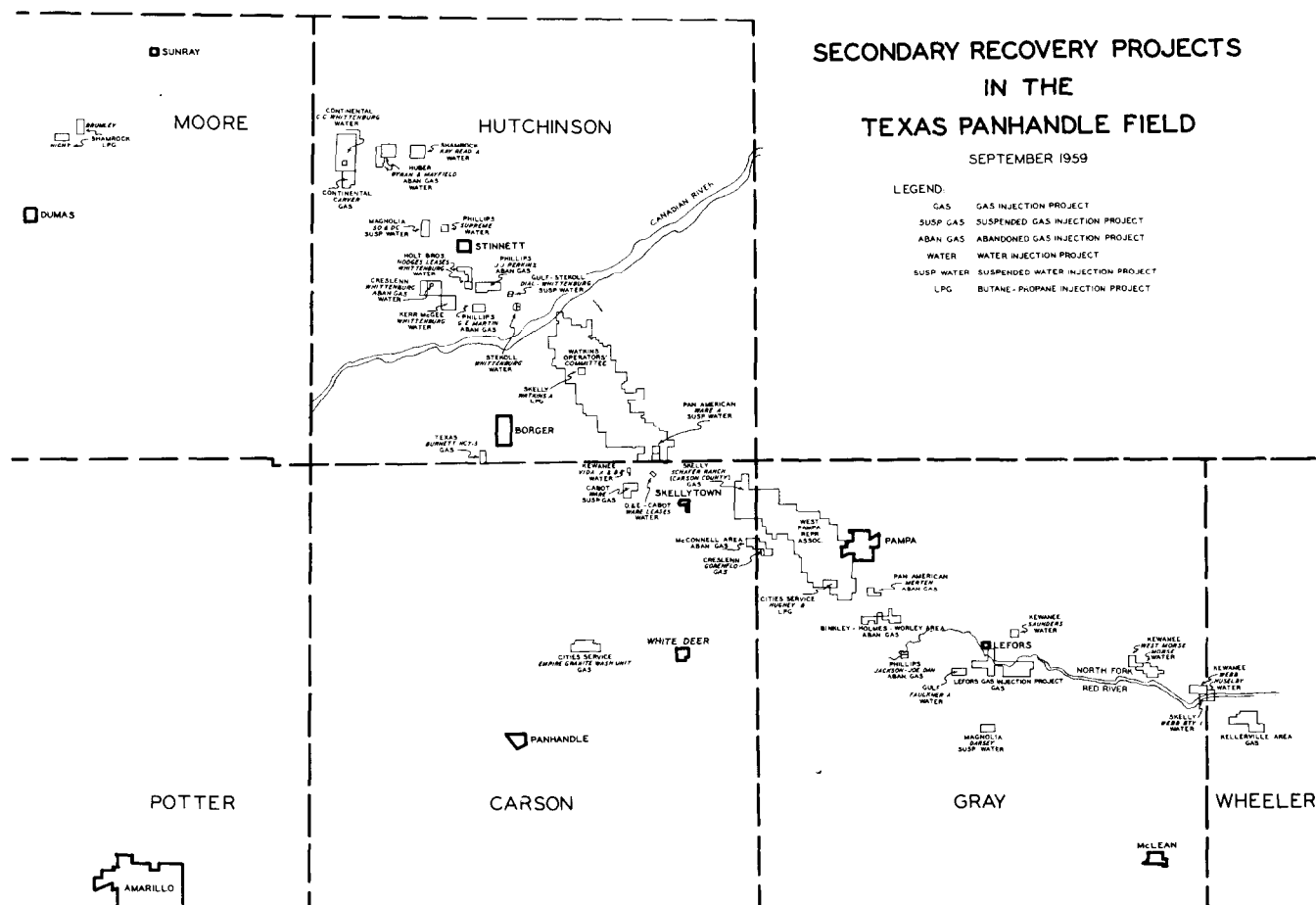
During the past two years ten separate water injection projects were initiated in the Panhandle field. These projects are all in the early stages of operations and very little can be done in evaluating them at the present time. Three of the most significant of these projects are discussed briefly.

Three Cases

Perhaps the most significant of these projects is the one initiated by Gulf Oil Corp. on their Faulkner lease, west of Lefors. Water injection commenced into three water input wells during January, 1959. This project produces from the Granite Wash formation and is being watched very closely by other operators with Granite Wash leases in the field. No results have been obtained on this project but, of course, nothing was expected at this early date.

Phillips Petroleum Co. started injecting water into the Brown Dolomite on their Supreme lease, near Stinnett. This was a one input well project on a 160 acre lease. The significance of this project is that a substantial increase in production was obtained in an area near two previous failures.

Kewanee Oil Co., with cooperation along lease lines from Skelly Oil Co., developed a waterflood project on their Webb leases, east of Lefors, during 1959. This project covers approximately 400 acres with 42 water input wells drilled on ten acre "five-spot" pattern. This is the largest area in the Panhandle field developed for waterflooding at one time. To date, performance of this project has been very satisfactory and indications are that it will be a very successful waterflood project.



Other operators engaged in waterflooding in the Panhandle field include Continental Oil Co., Cresleen Oil Co., Kerr-Magee, Shamrock and Holt Brothers. Several additional projects are scheduled for initiation during 1960.

CONCLUSIONS

The operators in the Panhandle field are entering the first stages of waterflood development with many pilot waterflood projects. These vary not only in injection pattern, size and operations, but also varied formations are being flooded. Conclusions made from the earlier pro-

jects were very discouraging but some later developments have presented a slightly better outlook for at least portions of the field. Results from the many projects operating at present will certainly aid in evaluating other projects in the Panhandle field. Additional projects should be selected with great care since some may never recover development costs. Additional information regarding connate water saturation, residual oil saturation after primary depletion, and the existence of fracture systems in the reservoir rock is needed before any accuracy can be obtained in predicting waterflood behavior in the Panhandle field.