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A CASE HISTORY

SUCCESSFUL PREVENTION OF $CaCO_3$ SCALE BY DOWNHOLE INHIBITOR SQUEEZES IN A GULF COAST WELL, GLADYS McCALL NO. 1, CAMERON PARISH, LA

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ABSTRACT

The DOE Gulf Coast geopressured-geothermal well sites, now operated by Eaton Operating Company, have experienced severe $CaCO_3$ scale problems in the past.

In order to control downhole scale formation associated with large volume, high temperature, brine production, two basic types of reservoir materials are recognized; 1) those which are cemented with calcite, and 2) those which are cemented with silica. Some novel concepts of simplified inhibitor squeezes have been used to design treatment programs for both types of formations. It has generally been suggested that proper inhibitor emplacement in silica cemented formations is the more difficult of the two. For silica cemented formations, an inhibitor squeeze procedure which took advantage of the formation brine chemistry and natural dispersional mixing processes was designed and field tested in the DOE Gladys McCall design well in Cameron Parish, Louisiana, U.S.A. (two squeezes). This well is completed over a 300 foot interval in the lower Miocene at a depth of approximately 15,100 feet (sand zone #8). Initial reservoir temperature and pressure were 290° F and 12,783 psia. Essentially, the last squeeze contained: 1) a 50 barrel lead spacer; 2) 100 barrels of 3% wt/wt pH adjusted inhibitor; and 3) 900 barrels of overflush. Considerable attention was given to the water quality and handling protocols of the squeeze fluids. This treatment will be discussed in detail. The injection rate was from 3 to 6 barrels/minute with minimal rise in surface pressure. Approximately 13 million barrels of brine have been produced from sand zone #8 since the last inhibitor squeeze without scale formation in the production tubing (18,430,000 Bbl. total, both squeezes).

The inhibitor concentration has been monitored by a new ultrasensitive analytical procedure for phosphonate. The concentration quickly dropped to about 0.15 mg/l (close to theoretical predictions) and has remained at that level for 18 months of continuous production at 10,0000 to 30,000 barrels per day. Laboratory simulation of inhibitor squeezes using intact cores has identified factors which control the rate of inhibitor retention and release in calcite-cemented sandstones. The effects of temperature, pH, salt concentration and type, and flow rate have been examined during inhibitor injection and flowback. As a consequence, the proposed squeeze design for the DOE Pleasant Bayou No. 2 design well, near Alvin, Texas, U.S.A., has been greatly simplified.