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Field Application of Phenol Formaldehyde Gel in Oil Reservoir Matrix for Water Shut-off Purposes

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Abstract

A few wells from a major western India on-shore oil field are either on the verge of being shut in or have already been abandoned due to excessive water-cut (WCT) levels. Low injectivity and extreme temperatures (149°C) make it difficult for water shut-off by conventional polymer gel injection. A water-thin monomer-based in situ gelation system has been developed and successfully tried in one of the wells that ceased production due to 100% WCT. The average production of 420 barrel of oil per day (BOPD) with less than 1% WCT, in the first year of production back in 1996, has declined to less than 8 BOPD (with 98% WCT) prior to shut-in in year 2002. A rise in the oil-water contact level in combination with a coning effect was diagnosed as a possible cause of the high WCT, which was later controlled by a newly developed gelant treatment. In fact, the average post-treatment production for the first 3 months was nearly 200 BOPD. Thereafter,

production gradually stabilized in the neighborhood of 115 BOPD with a WCT of 48%. Cheap chemicals and a fast treatment method have resulted in a payback time span of 5 days and made an additional profit of U.S. $0.6 M. The water shut-off job resulted in an impressive commercial success; technical success, however, was less than satisfactory due to the fact that, in spite of using a water-thin monomeric solution, only 40% of the designed volume could be injected due to low injectivity resulting in an abnormal pressure build-up. In addition to the gel development and treatment experiences, this article describes in detail the results of further lab investigations carried out to identify the possible reasons causing injection failure.

Keywords:

field application | gel | oil reservoir | phenol formaldehyde | water shut-off

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Related Research Data

Permeability Modification Using Sulfomethylated Resorcinol-Formaldehyde Gel System
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