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Analysis of acid returns improves efficiency of acid stimulation: a case history

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Abstract

Techniques are demonstrated to evaluate acid stimulation treatments based on chemical analysis of the return fluids. The techniques can provide information about the source of formation damage, the amount and type of scale in the casing, the efficiency of the acid treatment, and the amount of iron control chemicals required for similar treatments. As an example, these methods were used for the acid stimulation treatment of a typical seawater injection well (Well A) in a large carbonate reservoir in Saudi Arabia. Over a 2-day period, more than 50 field samples were collected. More than 700 chemical analyses were eventually made on these samples. Analysis of the casing pickle fluids showed that 235 kg of iron from corrosion products, as well as a significant amount of acid-insoluble iron carbide, Fe_3C, was produced. Measurement of iron (II) and iron (III) concentrations showed that the iron corrosion products in the casing contained mostly iron oxides such as rust or mill scale. The pickle treatment prevented the injection of this material into the formation around the wellbore. Otherwise, the main acid treatment would have flushed all of this material into the reservoir and reduced injectivity. Analysis of the matrix acid flowback samples showed that iron control chemical concentrations in the acid could be reduced with significant cost savings. The extent of acid dilution and the amount of unreacted acid were also determined. The results showed that 125 kg of calcium sulfate was dissolved from the near-wellbore region during flowback. Acid stimulation of Well A increased the injectivity index (II) of the well from 0.12 to 0.21 m^3/day/kPa (5 to 9 bbl/day/psi), an increase of 75%. The acid stimulation was successful and the evaluation methods provided useful information to improve the success of future treatments.

Keywords: injection well; stimulation; formation damage; iron control chemicals; pickling acid

1. Introduction

The seawater injection system for a large carbonate field in Saudi Arabia has more than 400 km of pipeline and can supply 0.67 million m^3/day (4.2 million barrels per day) of treated seawater. In this

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