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Glass Reinforced Epoxy Casing: Lessons Learned After Cementing and Completion of 70 Wells

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Abstract

The use of Glass Reinforced Epoxy (GRE) casing has increased significantly during the last decade, primarily on secondary recovery water injector wells. Corrosion resistance is this material main advantage when compared to steel. Almost one hundred wells have been completed in the Neuquén basin, Argentina, during the past five years.

This paper presents the experience obtained after cementing and completion of 70 GRE cased wells. Improvements on cement slurry mix designs, mud cleaning preflushes systems and best practices to ensure successful stimulation conditions (acids and fractures) are provided.

The work is supported by a laboratory study focused on the GRE casing to cement bonding performance evaluation and a finite element numerical simulation analysis of the down-hole service conditions achieved during stimulation jobs. This study considered the influence of GRE, cement and rock mechanical properties, the mud-cake removal conditions, as well as different bonding conditions. A comparison between GRE and steel cased wells is presented.

Cementing results were improved by casing centralization, increasing the preflushes aggressiveness and using low density slurries. Bonding experimental results showed that original GRE external coating attempts against cement bonding strength.

The numerical simulations show that when GRE casings are subjected to high internal pressures, its elastic behavior (Young modulus ten times lower than steel) generates overloading on the cement annulus. This condition could generate cracks that will propagate along the annulus creating communications paths between close perforated zones during stimulations treatments. This situation is even worst when poor formation mud-cake removal takes place.

Introduction

Puesto Hernandez is a mature oil field located in the Argentina's Neuquen basin. This field has been under secondary recovery since 1978. Current regulations in Argentina specify that all production water must be re-injected. The production water of this field is highly corrosive and tends to cause scaling. Casing corrosion and scaling have become a great problem over the last few years, increasing maintenance costs, causing severe injectivity reduction and even complete well losses.

Different tubular materials, including GRE, epoxy and polyethylene-coated steel, were evaluated. Among the best of these materials rated, GRE casings have proven to be an effective solution to corrosion and scaling problems.

The use of GRE tubulars in the oil and gas industry has shown a significant increase in the last decade worldwide. Proofs of this are many papers published in the SPE library (Peralta, 2006, Bowers, 1972, Maki, 1988, Ross, 2001). In a recent publication, Peralta et. al (2006) has described the operational aspects taken into account when cementing and completing these types of wells. The present paper is a follow-up of this work summarizing the lessons learned after cementing and completing 70 GRE cased wells mainly in Puesto Hernandez field.

Hydraulic communication between close perforated zones during stimulation was one of the main inconvenients detected. This problem became frequent during the last stages of this project, after introducing several modifications on the well completion methodology. The possible causes for communication failures were:

- **Poor mud cake removal.** One of the possible causes for communication between perforations during stimulation treatments is the inefficient formation mud-cake removal. This aspect was studied in detail by means of different laboratory test methods, using mud samples obtained from the field.