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## Successful Application of Glass Reinforced Epoxy (GRE) Casing in Hydraulically Fractured Water Injection Wells

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### Abstract

This paper describes the successful application of Glass Reinforced Epoxy (GRE) casing in 1,100-m water injection wells in Puesto Hernandez field, Argentina.

Prior to running 5 1/2-in. casing, thorough testing was carried out to evaluate the actual performance during frac treatments using a surface-mounted model. Other tests were designed and carried out to evaluate casing behavior during running, cementing and perforating operations.

Operational aspects, such as the effect of buoyancy, cement logging and downhole tools are addressed, as well as solutions and proposed approaches to remaining problems.

To date, four wells have been completed with this technique. Results indicate that casing, tools and operational techniques are appropriate and represent an innovative, sound alternative to reduce maintenance costs associated with scaling and corrosion.

### Introduction

Casing corrosion and scaling in saltwater injection wells in Puesto Hernandez field, located in Argentina's Neuquen basin, have become a greater problem over the last few years. Increased maintenance costs, severe injectivity reduction and even lost wells have been a direct result of casing corrosion and scaling. Fiberglass-reinforced epoxy (GRE) had been successfully used in tubing and pipelines in this and others fields, so this material was considered as an alternative for mitigating the problems experienced in injection wells casings. These wells require hydraulic fracturing to achieve desirable injection levels, so a test was conducted to evaluate whether the GRE casing could hold up to proppant. After the tests confirmed favorable results, four injector wells were drilled in Puesto Hernandez in 2004 using 5 1/2-in. GRE casing.

### History

Current regulations in Argentina state that all production water must be reinjected. As usual, in this field production water is highly corrosive and tends to cause scaling. It was necessary, therefore, to develop new tubular materials that could resist such deterioration. Tubing was the first component replaced in Puesto Hernandez injection wells. A number of material and design alternatives, including GRE, epoxy and polyethylene-coated steel, were evaluated. Some materials proved better than others over time, and their performance was related to well characteristics. Among the best of these materials rated GRE, despite its limited mechanical properties. Therefore, it was decided to focus on GRE casing.

Use of this material has been reported, but its application is not widespread. Evaluation of cement behind GRE casing is sometimes discussed in the literature.<sup>1,2,5</sup> It has been used in the Neuquen basin only for 2 3/8-, 2 7/8- and 3 1/2-in. casing in single-bore completions, particularly for recasing wells having corroded, worn-out casing.

### Testing of GRE casing

#### Stage I

The objective of the first stage was to evaluate the internal wear caused by erosion during fracturing. The tests were conducted in a surface-mounted pumping model, which had two 5 1/2-in. casing pipes (**Figure 1**). A sub having diameter smaller than the casing (3 1/2-in.) was attached to the fluid inflow end to simulate the turbulence effects caused by a stimulation packer or casing saver, when used. Three simulated frac jobs, resembling jobs in real wells, were pumped with the following parameters:

- Pressure: 940 psi
- Mean flow rate: 30 bpm
- Proppant: 2 / 4 / 6 lpg
- Fracturing fluid: 25 lbm/1000 gal linear gel
- Volume of pumped gel: 6200 gal
- Frac sand: 16/30
- Pumped sand: 240 sacks

ID measurements were taken prior to and immediately after pumping operations in order to estimate the wear over the casing walls. In all cases, three ID measurements per station were taken at 0°, 60° and 120°. Following field data