Case Studies:
Cement Integrity Swellable Elastomers

Cement Integrity equipment with elastomer(s) mounted on or along a casing/tubing

There are two types of cement integrity applications, micro-annulus and full-bore. If the client is concerned with a micro-annulus forming after the cement job, a minimal OD packer is recommended which will seal off without affecting Equivalent Circulation Density (ECD). If there are concerns about total losses of cement then a full bore swellable packer can be placed above the planned Top of Cement (TOC) to provide a backup to the cement. At times, clients anticipate issues with the cement job and use the swellable packers as a replacement to cementing.

Case History 1

A client in Russia experienced problems with cement of variable quality which resulted in poor zonal isolation, premature water breakthrough and sub-optimal well performance resulting wells being shut-in. The cost of shutting in a well due to poor isolation was $24k per day. The solution was to run SwellFix multi-element packers as a back-up to cement. Where losses occurred, the packer provided a reactive element that adapted to changes in the well and grew out to the formation providing zone isolation.

Well Data

Location: Russia
Well Type: Oil Producer
Installation Date: 2007

SwellFix Packers being installed prior to cementing
The predicted water cut from logging was 31.6%. It can be seen from the CBL data in purple on the right-hand side of the log that the quality of the cement job was good. The actual water cut in this application was less than 1%.

The result was reduced water cut and improved well performance.

CBL and log data for well WS-1182-K07-01

The predicted water cut from logging was 3.4%. It can be seen from the CBL data in purple on the right-hand side of the log that the quality of the cement job was doubtful above and below the perforated interval. The actual water cut in this application was less than 1%.

CBL and log data for well WS-1069-K05-01

The predicted water cut from logging was 3.4%. It can be seen from the CBL data in purple on the right-hand side of the log that the quality of the cement job was doubtful above and below the perforated interval. The actual water cut in this application was less than 1%.
**Case History 2**

A client in Romania had previous issues in the field with poor quality cement and had major concerns in terms of gas at surface and HSE exposure. Previous wells were required to be shut-in prior to performing a squeeze job.

**Well Data**

<table>
<thead>
<tr>
<th>Location</th>
<th>Romania</th>
</tr>
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<tbody>
<tr>
<td>Well Type</td>
<td>Gas producer</td>
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<tr>
<td>Installation Date</td>
<td>2009</td>
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</tbody>
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Tendeka’s solution was to run 9-5/8” combination oil and water SwellFix sleeves designed to seal inside the 13-3/8” shoe within 8 days. The result was a reduction in annulus pressure until day 8 when there was zero pressure in the annulus and the well was brought back online.

The result was that installing swellables, even in wells with CBL data indicating cement of variable quality, limits gas at surface, annulus pressure and water production. Cost savings are associated with eliminating the need to perform a cement squeeze.

**Case History 3**

A client in the North Sea experienced significant losses during drilling which peaked at 1600 barrels per hour. After multiple cement jobs and multiple LCM jobs, the losses stabilised at around 400bph. There was still 600m of open hole to be drilled.

**Well Data**

<table>
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<tr>
<th>Location</th>
<th>North Sea</th>
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<tr>
<td>Well Type</td>
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<td>Installation Date</td>
<td>2008</td>
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The solution was to run SwellFix multi-element packers with a combination of slow and fast swelling water swells and oil swells. The packers were custom built and ready to run within 7 days of the losses first being noted. The OD was optimised to run with cement and losses reduced from 400bpd to zero within 4 days allowing drilling to commence.

**Case History 4**

A client in Australia anticipated well integrity issues in a field in the East Timor Sea. They had a requirement to prevent annular flow inside the 30” conductor and 20” casing annulus without using cement. The swellables solution requested was to be the world’s first 20” slip-on suitable for swelling in a water environment and at low temperature (50°C).

**Well Data**

- **Location:** East Timore Sea
- **Well Type:** Oil producer
- **Installation Date:** 2010

The solution was to run two 20” SwellRight Sleeves with a 27” OD to seal inside the conductor. The installation was simple with a significant reduction in rig time by eliminating the cement. The result was major cost savings, zero annular flow and enhanced well integrity.

First 20” swellable sleeves installed to replace cement
Case History 5

A client in the UK North Sea had declining production in their wells and a requirement to carry out a workover in a cost-effective manner. The need for zonal isolation meant that large bores would be required for cementing and the cost of a conventional sidetrack would be prohibitive. The only way the economics could work was if Through Tubing Rotary Drilling (TTRD) was used, which would require a much smaller hole. Multiple swellables were proposed to allow zonal isolation without the need for cement.

The solution was to wrap a small amount of rubber on to 2-7/8” client owned pipe to swell into a 3.96” open hole. The result was a successful TTRD campaign with SwellFix Packers for zonal isolation. Future isolation of zones was still easily achievable which may have not been the case if a poor cement job was performed. The cost of the sidetrack was reduced by 65% and the client had increased production due to flow from both the mother bore and the sidetrack.

Well Data

<table>
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