CASE STUDY

# Form-A-Squeeze Pill Seals Induced Fractures, Eliminates Lost Circulation

"During drilling of the exploration interval, the Form-A-Squeeze* pill was successful in eliminating our losses on the offshore exploration well. This allowed continuous drilling to meet our objectives."

Richard McCartney, Senior Project Engineer

## Well Information:

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| Location | Offshore Caspian Shah Deniz exploration well |
| Spud | January, 2006 |
| Interval drilled | 6½-in. hole from 6515 m (21,375 ft) to 6822 m (22,382 ft) |
| Disposal method | Zero discharge operation |
| Bottomhole temperature | 215°F |
| Density required | 2.12 SG (17.7 lb/gal) |
| Mud weight | 2.12 SG (17.7 lb/gal) |
| Pay zones | Not available |
| Zones to be sealed | 6700-6780 m (21,982-22,244 ft) |
| Casing size | 9⅝-in./7⅝-in. liner |
| Casing shoe depth | 9⅝-in. at 5402 m, 7⅝-in. liner at 6515 m |
| Total well depth (TD) | 6822 m (22,382 ft) |
| Water depth | 414 m (1358 ft) |

## The Situation

While drilling an exploration interval on a Shah Deniz exploration well, it was required to increase the fluid density to 2.16 SG (17.9 lb/gal) as a result of increasing pore pressure trends. Despite a formation integrity test of 2.28 SG (19.0 lb/gal) at 6660 m (21,654 ft), the well began to take fluid with an equivalent circulating density (ECD) of 2.23 SG (18.6 lb/gal). Loss rates varied between 40 and 70 bbl/hr. Several conventional LCM pills were pumped, reducing the loss rate to 25 bbl/hr. While continuing to drill, the fluid density was decreased to 2.13 SG (17.8 lb/gal), which reduced the ECD to an estimated 2.21 SG (18.4 lb/gal). The losses decreased to less than 10 bbl/hr. and drilling continued. When the loss rate began to increase to 30 bbl/hr at 6770 m (22,211 ft), the fluid density was again lowered to 2.11 SG (17.6 lb/gal). The losses decreased to less than 1 bbl/hr. While drilling at 6803 m (22,320 ft), an increase in the pore pressure trend was observed, and it was believed that there was virtually no overbalance on the well. The fluid density was raised to 2.12 SG (17.7 lb/gal), and drilling continued. The loss rate increased to 15 bbl/hr, and it was decided to pump a Form-A-Squeeze pill.

## The Solution

M-I SWACO recommended pumping a Form-A-Squeeze pill over the entire open hole interval, which required less than 50 bbl in total volume, and to squeeze the material into the induced fractures. A 65-bbl Form-A-Squeeze pill was mixed in the slugging pit using synthetic-base fluid and Form-A-Squeeze lost circulation material and weighted up with barite. 55 bbl of the Form-A-Squeeze pill was spotted into the open hole. The drill string was slowly pulled, and a squeeze (above 500 psi) was applied and maintained on the formation for 1 hr.

## The Results

No further mud losses occurred on the well after having pumped the Form-A-Squeeze pill. Immediately following the pumping, the drill string was tripped out, and an open hole logging program was carried out successfully. Drilling continued to a depth of 6917 m (22,694 ft), without any further downhole losses, despite having to increase the fluid density to 2.14 SG (17.9 lb/gal) (near to the mud weight where losses occurred).

## The Details

After the decision had been made to pump the Form-A-Squeeze pill, the slugging pit was used for mixing. The formulation was built to specifications set forth in the Form-A-Squeeze mixing and displacement procedures. 65 bbl of 2.12 SG (17.7 lb/gal) Form-A-Squeeze pill was prepared in approximately 6 hr. The drillstring was placed at 6780 m (22,244 ft) (about 5 m (16 ft) below the suspected loss zone). 55 bbl of the pill was spotted using the rig pumps, and was displaced into the open hole. Due to the small hole size, it was decided to pump out the drillstring with slow pump rates, to maintain the ECD effect on the hole, and to avoid swabbing. The string was pulled out by pumping 25 strokes/stand of drill pipe, and the string was pulled to a depth of 6100 m (20,013 ft). The well was shut in and the squeeze commenced, pumping 0.5 bbl of mud every 2 min., using the cement unit. 21 bbl of fluid was squeezed away, while the squeeze pressure was monitored. Pressure was held on the formation for 1 hr. The estimated ECD equivalent held on the formation was 2.24 SG (18.7 lb/gal). The drillstring was then run back to bottom, and washed only over the zone from 6770-6775 m (22,211-22,228 ft). The hole was circulated clean, with zero losses recorded from this point onward. The drillstring was then tripped to carry out logging operations. No further downhole losses were observed when drilling ahead to the interval TD at 6917 m (22,694 ft) with a fluid density of 2.14 SG (17.9 lb/gal).

**Questions? We'll be glad to answer them.**

If you'd like to know more about the Form-A-Squeeze product and how it's performing for our other customers, please call the Alpine Specialty Chemicals or M-I SWACO office nearest you.

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