

# New routes to better recovery

Unconventional techniques known as managed-pressure drilling (MPD) and underbalanced drilling (UBD) are key tools for squeezing more oil and gas out of depleted reservoirs – one of the NPD's top priorities.

Nick Terdre

"MPD could be the most significant contributor to improved oil recovery (IOR) from existing fields," says Odd Tjelta, chief engineer for field developments at the NPD. "It's impossible to put numbers on the extra volumes we could get out, but the benefit is potentially very great."

Colleagues at the Petroleum Safety Authority Norway (PSA) agree. "Depletion is increasing all over the NCS – everyone will get to the point where they have to figure out a new way of drilling," says principal engineer Monica Ovesen. "Maybe these are the tools."

In September, the NPD and PSA joined forces in presenting their message to the industry during the Norwegian Petroleum Society's drilling and well technology conference at Kristiansand in southern Norway.

"We want to focus attention on the increasing challenges to do with depletion," says Ms Ovesen. Mr Tjelta adds, "We want oil companies to assess whether these techniques have value for them."

## Into the frame

As depletion advances, conventional drilling in most reservoirs becomes ever less effective because it damages the reservoir formation. This is when MPD and, at a later stage, UBD come into the frame by making it possible to continue drilling production and injection wells.

In conventional or overbalanced drilling, the pressure created by the weight of the mud circulating in the borehole is significantly greater than it is in the reservoir. That prevents hydrocarbons from entering the well during the drilling phase.

But applying this method in a depleted reservoir means that the pressurised mud is pushed out of the

borehole into the surrounding formation, leading to lost circulation and making further drilling difficult or impossible.

MPD involves drilling with just a slight mud overpressure. Unlike the conventional approach, the mud is contained in a closed system with its pressure controlled by a choke at the top of the well. Additional equipment has to be installed on the platform to do this.

In a depleted reservoir, the pressure is liable to vary unpredictably from zone to zone, Ms Ovesen notes. So it is important to be able to adjust or manage pressure in the borehole. Careful regulation ensures on the one hand that the formation is not damaged and on the other that no hydrocarbons enter the well.

UBD is applied when the formation has become too unstable for MPD. By underbalancing pressure in the well, the risk of damaging the formation is minimised at the cost of allowing hydrocarbons to enter the well. They circulate with the mud and must be separated from it when they come to the surface.

## Challenges

Both MPD and UBD have been extensively used around the world, and have proved their worth for IOR. But applying these approaches on platforms in the North Sea involves additional challenges.

Accommodating the extra equipment and piping is difficult and expensive on platforms with little spare space and often limited capacity to take the extra weight. Personnel also need special training, since these techniques differ considerably from the conventional drilling methods they are used to.

The big Norwegian fields devel-

oped in the earlier years are already at an advanced stage of depletion. High pressure and temperature fields such as Kvitebjørn and Kristin are also depleting at a rapid rate, says Mr Tjelta.

Although cost and safety represent big challenges, Ms Ovesen maintains that neither is a show-stopper for MPD and UBD. She says the PSA believes safety can be satisfactorily managed.

"In some ways, MPD is safer than conventional drilling because the closed system gives better control over the pressure in the well," she points out.

Handling hydrocarbons at the surface while drilling underbalanced is an issue with crucial safety implications, but Ms Ovesen is confident that efficient solutions can be developed.

## Planning

She also believes that cost-effective means of deploying these techniques are best found by incorporating them into a company's long-term planning. In her view, doing this when considering an upgrade to extend an installation's working life could substantially reduce the cost of adopting MPD and UBD.

Taking the requirements for these techniques into consideration when planning new developments could save the companies from large bills in the future, since modifications are expensive.

To get the most out of MPD and UBD, Mr Tjelta suggests they should be implemented through the integrated operation (IO) approach, with real-time data transfer between land and offshore, and between operator and service companies.

"I believe MPD operations represent an area where IO really shows its worth," he says. ❄



*BIG POTENTIAL. Managed-pressure drilling could make an important contribution to improved recovery from existing fields, according to the NPD and the PSA. (Photo: Harald Pettersen, Statoil)*

## Leading the way

Only one operator on the NCS has accumulated significant experience with MPD – Statoil.

"We see the need to have MPD in our toolbox, both for older fields and in high pressure and temperature (HPHT) fields where depletion occurs rapidly," says Uno Rognlie, the group's vice president for drilling technology.

"We've started work on mapping which fields will need it and surveying what the platform requirements are going to be."

Statoil's Technology & New Energy business area, where Mr Rognlie is

employed, works with all the assets involved in MPD projects. A dedicated group is led by Inger Kjellevoll, the leading advisor on this technique.

Several MPD wells drilled from Gullfaks C and on Kvitebjørn have made a significant contribution to IOR. Three were drilled very successfully on Kvitebjørn using the world's most highly automated MPD system, says Ms Kjellevoll.

Now Statoil is preparing to extend MPD to the other Gullfaks platforms and to Oseberg C, and evaluating its use on the Snorre, Statfjord and Njord fields.

Over the next couple of years, it also plans to drill a couple of MPD wells on the Kristin HPHT field from a mobile rig. This involves a number of issues not faced on fixed platforms, says Ms Kjellevoll, particularly heave motion.

Similar challenges apply on Njord, which is a floating production platform with drilling capability. A project is under way to qualify the necessary technology.

UBD is on the agenda as a future requirement. "When we see a need for it, we'll prepare for it," says Mr Rognlie. ❄