



## Wellbore History

### GENERAL

Well 35/11-4 was designed to drill at a site located in block 35/11 which is situated on the eastern flank of the Viking Graben and northwest of the Horda Platform. The regional structural generally trends north-south, with some north-northeast components. Planned TD was 3317 m, which was prognosed to be near top Triassic. The primary objective for 35/11-4 was the Middle Jurassic Brent Group. Reservoirs were expected in the Tarbert, Ness, Etive and Oseberg formations. Secondary targets were possible sand development of Sognefjord Formation sand in the Late Jurassic as well as Paleocene sand mounds.

### OPERATIONS AND RESULTS

Wildcat well 35/11-4 was spudded with the dynamically positioned semi-submersible installation Yatzy on 18 August 1990 and drilled to TD at 3127 m in the Early Jurassic Statfjord Formation. Yatzy was the first dynamically positioned drilling unit used offshore Norway and 35/11-4 was the rig's first well. This implied significant rig time spent on testing and down time due to failure of first-time equipment. At a depth of 2072 m one decided to sidetrack the well from 1700 m in order obtain cores from the hydrocarbon bearing zones of the Sognefjord formation. This led to a maximum deviation of 5.7 deg at 1765 m. The well was drilled with seawater and viscous pills down to 1009 m and with KCl/polymer mud from 1009 m to TD.

The Lower Eocene consisted of a continuous argillaceous sequence and no reservoir rocks were penetrated. At 1647 m good reservoir quality sandstones were found in the Paleocene Lista Formation but they were not hydrocarbon bearing. Poor shows were observed in limestones of the Cretaceous Shetland Group. A total of four hydrocarbon-bearing zones were discovered in the Jurassic: in the Sognefjord Formation in the original hole and in the Sognefjord, Fensfjord Formations and Brent Group in the sidetrack hole. Mud log shows were recorded in most of the sandstone intervals from 1984 meters to the OWC in the Rannoch Formation at 2687 meters. The log evaluation indicated possible residual hydrocarbon from the OWC down to 2712 meters in the Oseberg Formation, mud logs indicated weak to poor shows over the same interval.

Open hole logging, FMT pressure testing and FMT sampling proved movable hydrocarbons. The Upper Sognefjord Formation contained 11.4 meters of gas on top of 5.4 meters of oil with OWC at 2005 meters. The Lower Sognefjord Formation contained 14.6 meters of oil on water with OWC at 2050.5 meters. The Fensfjord contained 5.4 meters of oil in micaceous sandstones. FMT pressure data defined OWC in the Fensfjord at 2310 meters. Sandstones in the Brent Group contain 18.6 meters of gas on oil and 17.1 meters of oil on water. The GOC and OWC were found at 2670 and 2687 meters respectively.

Reservoir quality of the sandstones is generally good though some are micaceous. In places the sandstones are very micaceous and the permeability is low. The micaceous zones may even act as barriers to the vertical migration of hydrocarbons particularly in the Sognefjord Formation. This may be one explanation for the separate hydrocarbon accumulations in the formation.

Eight cores were cut in the Late and Middle Jurassic reservoirs; five in the Sognefjord Formation (108 m cut with 95% recovery) and three in the Fensfjord Formation (41.5 m cut with 98% recovery). FMT fluid samples were recovered from 1995 meters in the original hole (gas) and from 2000 m, 2038 m, 2290 m, and 2678 m in the sidetrack hole (all oil). A gas/condensate sample was recovered at 2634.5 m. A total of 125 sidewall cores were attempted and 100 were recovered.

The well was suspended on 29 December 1990 as an oil and gas discovery.

### TESTING

Drill stem testing was planned for a re-entry in 1991.

## LITHOSTRATIGRAPHY & HISTORY FOR WELL: 35/11-4