

Challenges Associated with Planning, Drilling, and Evaluating an xHPHT Ultra-Deep Gas Well: Lessons Learned from Will K, High Island Area, US Gulf of Mexico

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Industry is testing a new gas play targeting ultra-deep structures on the Gulf of Mexico Shelf. Depths to these objectives typically exceed 25,000 feet. The extreme high temperatures and pressures (xHPHT) encountered in Deep Gas wells make them especially challenging. BP's integrated well team successfully planned, drilled, and evaluated Will K, reaching a total depth of 28,404'.

Well planning began with pore pressure and temperature predictions, critical to casing, mud, and cement design. Pore pressure prediction relied on relatively low resolution seismic velocities uncalibrated at depth. Temperature prediction was based on shallow nearby well control and basin modeling. The well plan led to the largest casing design in the Gulf of Mexico (8 strings, total weight 8 million pounds, 9-1/2" hole at TD).

BP successfully executed the well plan, and as predicted, encountered shallow geopressure, two separate salt welds, extreme pressures and temperatures, and a significant pressure regression at TD. When conditions exceeded PWD/LWD capabilities, pore pressure prediction while drilling defaulted to traditional tools such as d-exponent, shale density, gas analysis and cuttings morphology. Emerging technology such as Managed Pressure Drilling helped test the sensitivities of wellbore conditions and allowed for real-time pressure management.

Will K demonstrates that Deep Gas wells can be safely and successfully drilled and evaluated. BP collected basic wireline logs, reservoir pressures and a heads-up core. Improvements in evaluation tools are required to better understand and categorize reservoirs in xHPHT environments.