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Reducing Reservoir Uncertainty During Appraisal and Development - Novel Applications of a new Wireless Reservoir Monitoring Technology in Santos Basin Pre-Salt

Abstract

Uncertainties in reservoir connectivity and compartmentalization risk are important considerations when thinking about any new field appraisal or development options. Having a better understanding of reservoir connectivity provides benefits in determining the appropriate drainage strategy and optimizing the field development plan. By the application of a new wireless reservoir monitoring technology, based on electromagnetic (EM) communications, it is now possible to monitor the reservoir pressure and temperature response during the long term suspension of development or appraisal wells. Accurate reservoir data can now be reliably collected in the period prior to a completion string being run, or a Xmas tree being installed on the well.

Petrobras is conducting an active programme of drilling and well testing evaluation in the Pre-Salt Santos Basin area, with the objective of maximizing the collection of reservoir data that can be used to prove the reservoir models. An opportunity was identified to utilize this wireless monitoring technology in some newly drilled development wells that were to be suspended for an extended period of up to 3 years. The primary monitoring objective was to gather dynamic reservoir pressure data that could be used to identify interference effects resulting from production or injection events in the adjacent field area. Any evidence of interference will serve to prove reservoir connectivity with the adjacent well assets.

A secondary monitoring objective was to record a long term pressure build-up, beyond the end of a Drill Stem Test (DST), to check for the presence of any reservoir boundaries located far from the wellbore.

Case histories are presented for 2 installations of the wireless technology in the Brazilian deepwater pre-salt environment. The first case history presents the installation of a wireless gauge system that successfully transmitted high quality pressure and temperature data to a subsea receiver for a period of 873 days until the receiver's recovery from the seabed. The results show clear evidence of inter-well interference resulting from production in both near and far located wells. With certain producing wells being located at least 12km away from the observation well, this demonstrates that there was excellent reservoir connectivity across the field.

The second case history was targeted at monitoring for interference effects resulting from an extended well test being performed on a well located 15km away. At the time of authoring this paper the survey has been on-going for 341 days and whilst there is no evidence of connectivity, the long term pressure build-up monitoring beyond the end of the DST has provided useful data.

For both case histories the data collected has proved very useful in reducing uncertainty during the early stages of field development.