Benefits of Gas Zone Evaluation Combining Dual Wait-time NMR and Density Data

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Accurate estimates of porosity and fluid saturations are critical for the proper evaluation of a gas reservoir. These properties and several *in situ* gas characteristics are determined by combining data from a dual wait-time (DTW) nuclear magnetic resonance (NMR) log and a density log.

The combined density and dual wait-time technique (DDTW) is applicable to reservoirs where the pore-filling fluid can be described as one liquid phase and one gas phase. The low proton density of the gas phase causes a reduction in NMR signal strength resulting in underestimation of the apparent porosity. The amount of polarization for different wait-times depends on the specific spin-lattice relaxation time of each fluid and may cause additional NMR porosity underestimation. The density log, however, delivers a porosity that is overestimated because of the presence of a gas phase. Mathematical description of these effects with the aid of two correlations for gas properties establishes the new deterministic method.

DDTW primarily yields the total porosity, ϕ, and the flushed zone gas saturation, $S_{g,xo}$. Other derived properties are the *in situ* gas density, ρ_g, as well as the two NMR-related properties hydrogen index, HI_g, and spin-lattice relaxation time, T_{1g}. Field examples illustrate the method, and results from other measurements validate the new technique.