

RECONCILIATION OF CORE AND LOG RESIDUAL OIL SATURATION THROUGH APPLICATION OF IN-SITU SATURATION MONITORING

B. Trewin and S. Morrison*

Core Laboratories Advanced Technology Centre, Aberdeen, UK
*Sun Oil Britain Limited, UK

ABSTRACT The residual oil saturation (S_{or}) of a North Sea sandstone reservoir has been measured by two different techniques. Log analysis of a zone swept by vertical water flow from the aquifer yielded a range of values. Carefully performed core analysis using in-situ saturation monitoring has provided an independent check on residual oil saturation. By examining petrophysical parameters, taking saturation hysteresis into account, reconciliation of log and core S_{or} has been achieved. Application of the results using a Land-type^{1,2} approach to describe dependence of S_{or} on initial oil saturation (S_{oi}) furnishes high quality input data for reserves calculations and numerical reservoir simulation. In-situ monitoring of oil and water saturation within core samples was achieved through measuring the attenuation of X-rays. Water saturation (S_w) measurements accurate to 1-2 saturation units were obtained in 2mm contiguous slices down the length of the core over a 30 second scanning period. This detailed, real time saturation profile measurement can identify uneven and therefore unrepresentative initial water saturation (S_{wi}) and S_{or} profiles. The technique can also identify instability in the flood front due to rock heterogeneities or viscous fingering. Since S_w measurement is made in-situ, it is inherently less prone to the errors suffered by traditional volumetric techniques. The accuracy of this residual oil saturation measurement therefore gives confidence in the values obtained and shows consistency with log-derived S_{or} .