# A RELATIONSHIP BETWEEN CRITICAL AND IRREDUCIBLE WATER SATURATIONS

by
O. A. Harris, Jr.
Texaco USA, New Orleans, LA

Irreducible water saturation is the minimum interstitial water saturation existing above the water transition zone. Critical water saturation is the upper limit for formation water saturation above which a specific sample will produce a significant percentage of water with hydrocarbons. For many years, critical water saturation has been estimated from routine porosity and permeability data. However, there is no published data to estimate irreducible water saturation from critical water saturation.

In general, the critical water saturation increases linearly with irreducible water saturation. The proposed relationship is used to estimate either water saturation if the other one is known. With the two water saturations estimated, improved water saturation analyses can be made as well as better watercut predictions.

Other applications include resistivity reconstruction from core porosity and formation water resistivity. Formation resistivity can be reconstructed from irreducible water saturation for verification of assumed cementation and saturation exponents used in the ''Archie'' equation for evaluating high-resistivity formations. Reconstructed resistivity provides a valuable tool for analyzing thin-bedded or low-resistivity formations.