Application of Geostatistical Methods to Reservoir Characterization: An Example from the West Coalinga Field, San Joaquin Basin, California

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Sedimentologic and sequence-stratigraphic interpretations from outcrop, core, and log data were applied to develop an architectural framework for constructing 3-D geologic realizations of the Temblor Formation (Miocene) heavy oil sands at the West Coalinga field. An area of the field was evaluated utilizing reservoir rock properties, large-scale facies tracts, and small-scale lithofacies groups to better understand interwell heterogeneity, uncertainty, and risk.

Statistical trends of reservoir rock properties were evaluated using a cluster analysis approach. This technique provided five grouped lithofacies for input into 50 stochastic realizations and property distributions applying the geostatistical method of sequential indicator simulation. Normalized distributions of reservoir rock properties and semivariogram sensitivities were completed to better understand the distribution of variability. Core permeability and porosity were biased to the lithofacies groups to create each of the 50 realizations.

The geostatistical realizations of porosity and permeability, incorporating lithofacies groups and bounding surfaces, provided input into a numerical steam-flood simulation. The resulting simulation displayed the effects of model upscaling, decimation, evaluation of geologic model type, and the applicability of geostatistical modeling.