Reservoir Characterization and Facies Architecture of the Chesterian Clore Formation (Upper Mississippian) at Mumford Hills Field, Southwestern Indiana

Polly Root[1], M. Parke[2], M. Khadhrawi[1], L. Pratt[1]

[1]Indiana University, Department of Geological Sciences, 1001 East Tenth Street, Bloomington, IN 47405
[2]Layne Hydro, 320 West Eighth Street, Showers Plaza Suite 201, Bloomington, IN 47404

Chesterian sands are the primary petroleum reservoirs undergoing line-drive water and CO_2 injections at Mumford Hills Field in Southwestern Indiana. Refinement of facies correlation and a new petrophysical model of the Clore has resulted in improved characterization and understanding of the reservoir. The mixed carbonate-siliciclastic Clore Formation was deposited along the shallow marine shoreline of the Illinois Basin with fluvial influence from the ancient Michigan River during the Upper Mississippian. Vertically, the Clore is comprised of three subunits (basal packstone and wackestone, middle fine to very-fine grained sandstone with interbedded shales, and upper wackestone and packstone with shaly interbeds), reflecting one of several high-frequency transgressive-regressive intervals. The central Mount Pleasant Sandstone member is composed of tidally-dominated elongated ribbons with occasional lenticular channel beds, as observed in outcrops in Southern Illinois and confirmed in wireline log correlations. Stratigraphic closure is defined by gradual interval thinning and decreased sand content, with sand pinching out into low-porosity mudstones to the eastern and western edges of the field. Fifteen wells within the Mumford Hills Field provided wireline geophysical logs (SP, resistivity, and some gamma ray), and core data (porosity, permeability, water saturation, and oil saturation). Porosity and permeability were measured from complete core, with values ranging from 3.1-26.6% (average 19.7%) and 0.8-750 mD (average 157 mD). New geologic and petrophysical models have correlated the subsurface porosity and permeability with depositional environments to better understand the sand distribution and reservoir quality for the Clore Formation in Indiana. These petroleum reservoir calculations may provide a more comprehensive inventory for accurate estimations of CO_2 sequestration potential and increased oil production at Mumford Hills.