Reservoir Characterization for Enhanced Oil Recovery in Middle Mississippian Cypress Sandstones at Lawrence Field, Illinois

Seyler, Beverly [1]; Grube, John [1]; Huff, Bryan G.[1]; Blakley, Curt S.[1]; Johanek, Philip [1] (1) Illinois State Geological Survey, Champaign, IL.

Detailed reservoir characterization studies of Cypress Sandstone reservoirs at Lawrence Field, a near giant 400 million barrel producer, are being conducted in conjunction with a Department of Energy contract. Cypress Sandstone reservoirs in most Illinois Basin fields are complexly compartmentalized. Designing Enhanced Oil Recovery programs that take these complexities into consideration increase the potential for commercial success. Identification of flow units and knowledge of permeability barriers and potential thief zones is important for implementing EOR projects. The Cypress Sandstone at Lawrence Field was subdivided into separate sandstone lenses that have been mapped in detail. Cypress Sandstone reservoirs commonly consist of multiple stacked ten foot thick lenses of porous and permeable sandstone separated by thin intervals of impermeable siltstone or shale. Cores were described and features that were potential permeability barriers were identified on geophysical logs and used to correlate and map flow units and barriers.

Interpretation of sedimentary structures observed in core includes tidal couplets, flaser bedding, and herringbone crossbedding suggesting deposition by tidal processes. Two good quality reservoir facies were identified in core. The most common reservoir facies consisted of ripple laminated, well sorted, very fine to extremely fine grained sandstone with good porosity and permeability of 18 percent and 150 md., respectively. The facies with the best reservoir qualities is less common and consists of mottled, bioturbated, poorly sorted, fine to very fine grained sandstone with excellent porosity of 20 percent or greater and permeability of approximately 300md. Petrographic examination of reservoir samples shows that the sandstone has intergranular and secondary porosity caused by dissolution of feldspar grains. X- ray diffraction and SEM/EDX results show that the clay mineral suite in pores varies by facies and consists primarily of kaolinite in the poorly sorted facies and of iron rich chlorite and illite in the ripple bedded facies.