

Paper Number	99794-MS
Title	Injection Strategies To Overcome Gravity Segregation in Simultaneous Gas and Liquid Injection Into Homogeneous Reservoirs
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Source	SPE/DOE Symposium on Improved Oil Recovery, 22-26 April, Tulsa, Oklahoma, USA
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Abstract

We earlier presented a proof for the model of Stone (1982) for gravity segregation in steady-state, horizontal gas-liquid flow in homogeneous porous media using only the standard assumptions of the method of characteristics. We extend this method here to cases of co-injection of gas and liquid over only a portion of the formation interval, injection of water above gas over the entire formation interval, and injection of water and gas in separate zones well separated from each other.

If gas and liquid are injected at fixed total volumetric rates, the horizontal distance to the point of complete segregation is the same, whether gas and liquid are co-injected over all or any portion of the formation interval. The volume of reservoir swept by gas may be affected by these different injection strategies, however, and is not directly predicted by our model. At fixed injection pressure, the deepest penetration of mixed gas and water is expected when fluids are co-injected along the entire formation interval.

At fixed total injection rate, injection of water above gas gives deeper penetration before complete segregation than does co-injection, but again exactly where the two fluids are injected does not affect the distance to the point of segregation. At fixed injection pressure, injection of liquid above gas is predicted to give much deeper penetration before complete segregation. When injection pressure is limited, the best strategy for simultaneous injection of both phases would be to inject gas at the bottom of the reservoir and liquid over the rest of the reservoir height, with the ratio of the injection intervals adjusted to maximize overall injectivity.

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