

Liquid Lifting from Deviated and Horizontal Tight-Shale Gas Wells

Lead Organization: Colorado School of Mines
Key Contact: Richard Christiansen
(303) 273-3965, rchristi@mines.edu
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Objectives. Measure and correlate (1) critical flow rates for lifting liquids from deviated and horizontal gas wells, and (2) extent of production impairment by water blocks in very low permeability formations.

Motivation. Deviated and horizontal wells with induced fractures are used increasingly for exploiting gas from very low permeability formations where much of U.S. gas reserves reside. To efficiently produce from these gas-bearing formations, accumulations of water and hydrocarbon liquids in wells must be avoided or minimized because accumulated liquid decreases productivity by increasing bottom-hole pressure and by blocking flow of gas from the formations – water blocks can be severe for very low permeability formations.

Specific Directions. The three tasks proposed below describe briefly the specific directions for this study.

1. *Quantify Critical Flow Rates.* Use the flow loop in the High Bay Lab at CSM to measure critical flow rates for tubing orientations from vertical to horizontal. Compare measured critical flow rates to existing correlations. Modify or develop new correlations as needed to describe data.
2. *Quantify Water Blocks.* Use the Relative Permeability Apparatus at TerraTek in Salt Lake City to measure the extent of production impairment by water blocks in very low permeability media. Correlate results with other rock properties.
3. *Liquid-Lifting Short Course.* Continue one-day short courses on lifting liquids from gas wells using the CSM Flow Loop for hands-on demonstrations. Add demonstrations for deviated wells and water blocks.