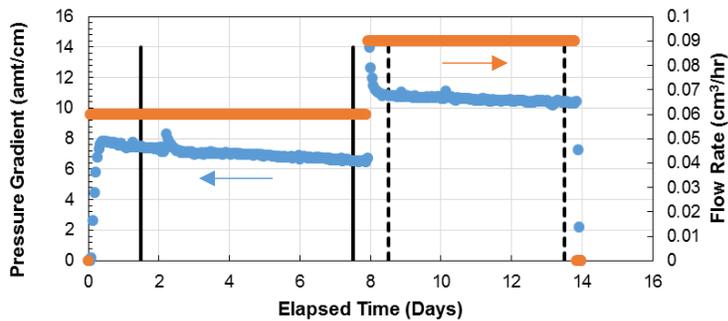### Steady State Permeability Measurement Data

Figure 2: Data from the first steady state permeability test over 14 days. Blue Points are the pressure gradient and orange points are flowrate. Vertical black lines denote steady state region. Steady state was reached quickly justifying using one-week sample runs on subsequent samples.

A major advantage of measuring permeability at steady state with liquids was that compressibility and slippage were negligible allowing straightforward interpretations of pressure drop data.

Validation studies of this procedure found the steady state permeability method is accurate on one inch core plugs down to 10nD with greater than 95% reproducibility.

Pressure drop data from the measurements were inspected for quality and plotted in relation to flow rate with linear trend lines typically having correlation coefficients greater than 0.98. Figure 3 is an example plot showing the linear regression of pressure data. The measurements found that permeability values ranged from 30nD to 600nD with the majority of values clustering around 100-200nD.

> *"Validation studies of the steady state permeability method on unconventional reservoir rock found it reliable down to 10nD with reproducibility greater than 95%."*

Discussion

Steady-state permeability measurements were performed on one-inch diameter unconventional reservoir core plugs and a validation study proved the accuracy of the results. It was necessary plugs be screened with

Micro-CT to eliminate samples with cracks or barriers to flow. Samples reached steady state fairly quickly; multiple point permeability measurements took about one week. Permeability ranged from 30-600nD for the selected samples.

Variations of this measurement are also available. Permeability can be measured with differing net confining stresses. Effluent from the sample can also be collected for geochemical analysis. The liquid used to measure permeability is not limited to decane, brine and dead oil from the field can also be used so long as there is equipment incompatibility.
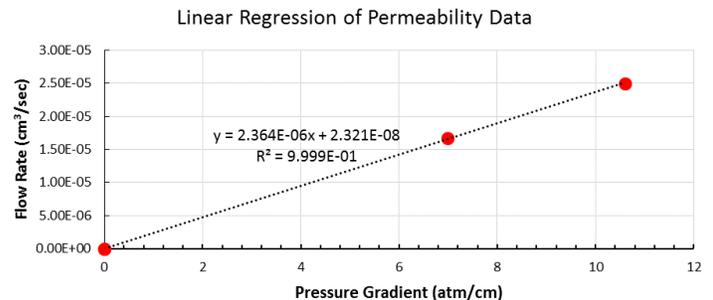

Figure 3: Example linear regression of permeability data from this study. Calculated permeability was 320nD.

References
(1) Chhatre, S. S. et al. *Petrophysics* **2015**, *56* (2), 116–124.
(2) McPhee, C. et al. I. *Dev. Pet. Sci.* **2015**, *64*.