



## **Marcellus Shale Post-frac Flowback Waters – Where is All the Salt Coming from and What are the Implications?**

M.E. Blauch, Superior Well Services, Inc.; R.R. Myers, T. R. Moore; B.A. Lipinski, Exco - North Coast Energy, Inc.; N.A. Houston, Superior Well Services, Inc.

This paper was presented at the 2009 SPE Eastern Regional Meeting held in Charleston, West Virginia, USA, 23–25 September 2009.

### Abstract

One of the most prominent unexplained phenomena observed in the Marcellus and some other shale plays is the concentration of dissolved salts in produced waters after hydraulic stimulation. In this paper, we present both geochemical and lithologic laboratory and field data to address the salt question. Is salt being dissolved from the shale, or are deep saline aquifers being breached during hydraulic fracturing? What evidence do we have to support or refute either theory?

To address these questions, over 100 flowback analyses were collected over 18 months from both the southwestern and northeastern regions of the Marcellus Shale play. These data incorporate both cation and anion water analyses in either a full or partial determination of the cation and anion balance. Detailed inorganic geochemical and mineralogical analyses of shale samples were integrated to help determine the presence or absence of physical evidence of minerals that may be the root cause for high salinity. If present in the shale, is halite dissolution desirable from a formation stimulation perspective? If so, is this gain a worthwhile trade when balanced against the costs of returned load water handling and reuse or disposal? This paper provides interpretations at both the regional and local scales to try to explain basal variations observed in the data. It discusses implications of the phenomenon of high saline frac flowback fluids, along with methods being used to mitigate environmental problems associated with the post-frac flowback water geochemistry.