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geoConvention 2013

Effects of Unconventional Gas Development on Groundwater: A Call for Total Dissolved Gas Pressure Field Measurements

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Summary

One of the primary public concerns with new development of shale and other unconventional gas resources is potential contamination of shallow groundwater with natural gas (largely methane). Natural gas contamination of shallow groundwater can result from leaky gas production wellbores (e.g. Stein et al., 2003; Van Stempvoort et al., 2005). However, there is also concern that hydraulic fracturing may enhance natural gas migration from deep formations to shallow groundwater (see Jackson et al., this issue, for further details). Measurements of groundwater gases will be needed to appropriately address these concerns. Field measurement of total dissolved gas pressure (P_{TDG}) can provide useful information during investigations of the effects of natural gas development on groundwater, but it is not being widely used. We make the case here that P_{TDG} has a critical role as we endeavour to collect accurate and objective data for assessing the impacts of shale gas development. .

Introduction

The P_{TDG} equals the sum of groundwater gas partial pressures. So, for water equilibrated with the atmosphere, P_{TDG} = barometric pressure (P_{ATM}). Processes such as microbial respiration will reduce P_{TDG} (e.g. less soluble O_2 consumed, more soluble CO_2 produced). Gas-producing processes, such as methanogenesis or dissolution of natural gas (e.g. gas phase potentially mobilized from deeper depths), can result in gas-charged groundwater ($P_{TDG} > P_{ATM}$). Thus, P_{TDG} is especially relevant to unconventional gas investigations.

Theory and/or Method

Estimation of *in situ* P_{TDG} can be conducted using a few different set ups depending on the monitoring well characteristics. Continuous data collection lends this approach to monitoring before, during, and after periods of interest. The P_{TDG} can be compared to pore water pressure to evaluate the likelihood that un-dissolved (or free) gas is present in the subsurface. Failure to estimate *in situ* P_{TDG} can lead to significant underestimations of gas concentraitons.

Conclusions

Total dissolved gas pressure is an under-utilized tool that can provide a ‘master variable’ to measure and understand un-dissolved (or free) gases in groundwater.

References

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