

## Geochemical and Isotopic Variations in Waters of an Area of Accelerating Shale Gas Development

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The main concern associated with Marcellus shale gas development is that water quality of surface waters and fresh water aquifers can be compromised during gas well drilling, stimulation and improper disposal practices. However, in shale development areas of West Virginia, the frac flowback waters can have similar chemical constituents found in some saline formations and coal mine waters originating from several thousand acres of abandoned coal mines in this region. Therefore, to better assess any detrimental effect on water quality there is need to understand the natural temporal and spatial variations in the geochemical parameters of the surface waters and groundwaters in the area.

This study documents geochemistry of 32 USGS groundwater and surface water monitoring sites in West Virginia. Groundwater sampling locations were chosen to represent different formation aquifers and differing well depths. The formation aquifers include the Beekmantown Group, Conemaugh Formation, Helderberg Group, Kanawha Formation, Mahantango Formation, Mauch Chunk Formation, Monongahela Formation, Pocahontas Formation, Pottsville Formation, and Stonehenge Formation. Surface water sampling sites were chosen in close proximity to the groundwater sampling location. To understand the spatial geochemical variation data has been compiled for these groundwater and surface water monitoring sites from the USGS database. Preliminary analysis of this geochemical data shows highly variable chemistry within surface water sites locally and statewide. Samples will be collected from these sites during the summer and winter season of 2011 to correspond with peak and base flow conditions. Hydrochemical data will be analyzed in conjunction with isotopes, including cations and anions, as well as discharge, pH, dissolved oxygen, conductivity, temperature, and ORP. We hypothesize that the stable isotope signatures of oxygen, hydrogen, carbon, and sulfur of the different water sources i.e. frac flowback waters associated with Marcellus shale gas development, coal mine waters, surface waters, and waters in shallow and deep fresh water/saline aquifers are likely to be very different. Hence, stable isotope variations can be used in conjunction with the routine geochemical parameters to understand the impact of Marcellus shale gas development on the water quality of surface and groundwater aquifers of the area.