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Chemistry of Newark Basin Sediments in Context of Vulnerability to a CO_2 Leak

Carbon Dioxide sequestration is being proposed in the Newark Basin area as a mitigation option for increased CO_2 gases in the atmosphere. However, little is known of the consequences of a potential CO_2 leakage from a subsurface storage site into overlying Newark Basin aquifers. Increased water acidity is correlated with increased metal mobilization rates from surrounding sediments. Little is known of what trace metals reside in the formations of the Newark Basin tapped by drinking water wells. This study aims at filling this gap by measuring bulk metal concentrations from drill cuttings and cores collected in the Newark Basin. A test well at the northeastern edge of the Basin in palisades, NY was deepened and 314 separate cuttings samples were collected. The color and lithology of these cuttings were determined and the depth was adjusted by comparisons with optical and geophysical logs. X-ray fluorescence (XRF) analysis on powdered samples and inductively coupled plasma mass spectrometry (ICP-MS) analysis on completely digested samples were done on select samples from the cuttings to test for major and trace metals. XRF measurements were also performed on core segments of the Lockatong, Stockton and Passaic formations. Arsenic levels ranged from less than 5 ppm to as high as 135 ppm, manganese from 123 ppm and 2200 ppm. Uranium concentrations were detected above the 5 ppm detection limit in 59 of 210 samples. Metal concentrations were very variable along small depth intervals; hence autocorrelation lengths were determined to optimize sampling strategies for future studies. The presence of elevated concentrations of these metals implied that there is potential for mobilization in the case of CO_2 leakage from respective reservoirs, which would lead to public health concerns. Considerations should be given to these levels of metals when selecting samples and sites for laboratory and field experiments to study the mobilization of metals by elevated CO2 concentrations in groundwater.