Environmental Tracers as Early Detectors of Groundwater Contamination Due to Hydraulic Fracturing

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Hydraulic fracturing ("hydro-fracking" or "fracking") is the process of drilling horizontally into the earth and injecting highly pressurized water to create fractures in shale to release gas. Fracking has been increasing as a form of unconventional natural gas production globally. Natural gas is often considered to be a bridge fuel, due to its lower greenhouse gas potential. This process occurs deep in the earth, miles away from groundwater, but contamination from the fluid injected or from the infrastructure used can be a source of pollution in groundwater. This project looks to identify tracers that can detect and identify contaminated groundwater. A project was created to recreate a groundwater system to determine how tracers would interact with contaminated water moving through sandstone. The system involved pumping a solution--comprised of groundwater from a region close to the rock column, fracking fluid from a fracking site, benzene, methanol, and six tracers (perfluoromethylcyclobutane, perfluormethylcyclohexane, perfluoroethylcyclohexane, sodium fluorescein, sulfur hexafluoride, and blue dye) through a rock column and measuring the outflow for the presence of tracers and contamination. Previous experiments found sulfur hexafluoride to be successful as a tracer and perfluorocarbon tracers to be not successful. Preliminary results show similar results as before--sulfur hexafluoride is measurable when contaminated water arrives through the system and perfluorocarbon tracers are not. Preliminary results also indicate the rock column is absorbing or blocking the perfluorocarbon tracers, as they are measurable without the rock column. Comparing concentration of the contaminants and concentration of the successful tracers are the next steps of the project. The contamination measured will be bromide, chlorine, lithium, iron and uranium. After having measured the concentration of these inorganic pollutants, a comparison can be made to the concentration of the tracers to help determine the success of the tracers. Understanding how tracers interact with rock, water and contamination in groundwater aquifers will allow us to detect pollution in drinking water earlier and will help us to tag pollution to specific sources.