

Maryland-Delaware-District of Columbia
Water Science Center
Seminar Series

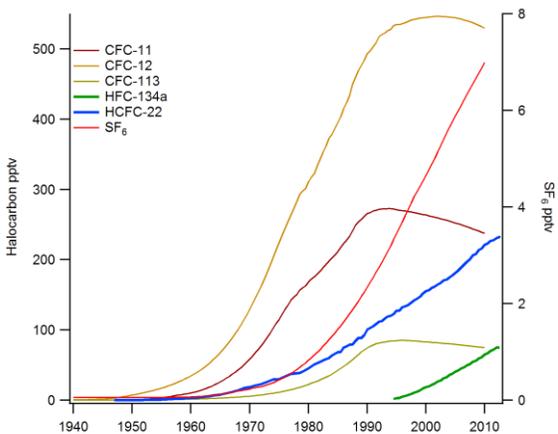
Wednesday, February 26, 2014 11:00-12:00

Exploring Hydrofluorocarbons as Groundwater Age Tracers

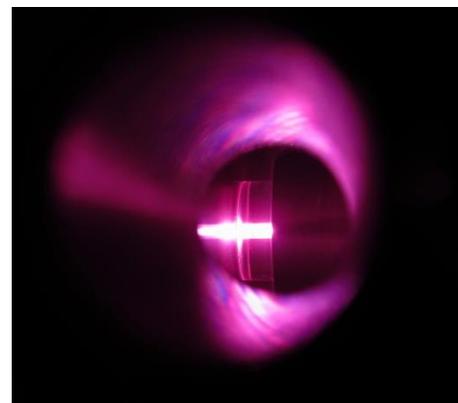
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Groundwater dating tracers are an essential tool for analyzing hydrologic conditions in groundwater systems. Commonly used tracers for dating post-1940's groundwater include sulfur hexafluoride (SF₆), chlorofluorocarbons (CFCs), ³H-³He, and other isotopic tracers (⁸⁵Kr, δ²H and δ¹⁸O isotopes, etc.). Each tracer carries a corresponding set of advantages and limitations imposed by field, analytical, and interpretive methods. Increasing the number available tracers is appealing, particularly if they possess inert chemical properties and unique temporal emission histories from other tracers.



Among the likely candidates identified are HCFC-22 and HFC-134a. Both compounds have unique atmospheric histories and chemical properties compared to other tracers, making them appealing for inclusion lumped parameter mixing models and in situations where SF₆ or the CFCs are present in elevated concentrations from non-atmospheric sources such that they cannot be used for dating purposes. To measure these compounds we developed an analytical method that uses an atomic emission detector (GC-AED) in place of an ECD. In contrast to the ECD,



the AED is a universally sensitive, highly linear, elementally specific detector, with sensitivities reaching into the low pico-gram range. The GC-AED system is capable of detecting concentrations ≈200 fM (HCFC-22) and ≈100 fM (HFC-134a), corresponding to piston flow ages of 54 and 18 yr, respectively, with a typical uncertainty of ≈1 yr. Preliminary comparisons with CFC and SF₆ analyses showed general agreement between the techniques (within a few years), but larger studies show broad disagreement between traditional dating methods and the H(C)FCs, indicating they are generally subject to loss processes, and may not be suitable for use as groundwater age tracers.

Presentation also available remotely via Webex: <https://usgs.webex.com/>

For directions to the USGS MD-DE-DC WSC: <http://md.water.usgs.gov/directions/baltimore.html>.