

## Groundwater, bubbles, energy and radioactivity

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### Summary

Although geoscientists have been long aware of free phase gas (FPG, or bubbles) in the groundwater zone, its study is relatively new. Fortunately, it borrows easily from other areas, including chemistry, groundwater, and petroleum science.

This talk will outline the need to understand free phase groundwater gases (with a focus on the energy industry) and discuss the challenges inherent in their sampling and analysis before covering the relevant high school geochemistry you may not have needed recently in groundwater context.

Our currently understanding of fugitive methane gas emissions around oil and gas wells with integrity issues will be presented, along with a discussion of the challenges and opportunities for sampling, analysis, and continuous monitoring of groundwater gases. A conceptual model for visualizing buoyant transport of free phase gases will be introduced and discussed.

Finally, the geologic source(s) and transport of the radioactive, gas-forming element radon will be considered. Despite its short (~3.8 day) half-life, radon is endemic in shallow groundwater and soil gas. It has been given the adjectives of 'pathfinder', 'tracer', and 'hitchhiker' gas, in addition to 'earthquake precursor'. Radon is endemic in groundwater and soil gas, and travels into indoor air where it presents a significant public health risk. Although geologic correlations between indoor radon have been weak at best, recent data suggest homes on groundwater supplies are at greater risk.