

## **Using stable isotope geochemistry to identify sources of fugitive gas at shale gas wells: Examples from Western Canada**

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Increasing commercial success of horizontal drilling and hydraulic fracturing has been matched by heightened societal concerns for the safety of the environment. Mature shale gases worldwide are characterized by otherwise rare isotopic reversals and/or “rollovers” that are now routinely used in exploration and production of shale gas, but these same isotopic reversals are also definitive forensic fingerprints. Consensus is developing that problem gases at well sites need not come from the targeted, fractured, formations but may originate from shallower gas bearing zones due to poor wellbore integrity. Gas in an aquifer or soil may have migrated along a poorly cemented or damaged wellbore. The specific source depths of the problem gases collected at surface can be deduced by comparing their methane, ethane, propane and butane  $\delta^{13}\text{C}$  values to nearby gas isotope mud logs. Examples of how this isotopic approach has identified the source depth of stray gases in soils, well cellars, and various casings at, multiply-fractured, multipad, horizontal wells from the Horn River and Montney plays will be discussed. It will be shown that problem gases can originate from various depths, at different wellbores, even if on the same well pad.