Geophysical Research Abstracts
Vol. 17, EGU2015-6958-2, 2015
EGU General Assembly 2015

Environmental baseline conditions for impact assessment of unconventional gas exploitation: the G-Baseline project

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A major scientific challenge and an indispensible prerequisite for environmental impact assessment in the context of unconventional gas development is the determination of the baseline conditions against which potential environmental impacts on shallow freshwater resources can be accurately and quantitatively tested. Groundwater and surface water resources overlying the low-permeability hydrocarbon host rocks containing shale gas may be impacted to different extents by naturally occurring saline fluids and by natural gas emanations. Baseline assessments in areas of previous conventional hydrocarbon production may also reveal anthropogenic impacts from these activities not related to unconventional gas development. Once unconventional gas exploitation has started, the baseline may be irrevocably lost by the intricate superposition of geogenic and potential anthropogenic contamination by stray gas, formation waters and chemicals used during hydraulic fracturing. The objective of the Franco-Canadian NSERC-ANR project G-Baseline is to develop an innovative and comprehensive methodology of geochemical and isotopic characterization of the environmental baseline for water and gas samples from all three essential zones: (1) the production zone, including flowback waters, (2) the intermediate zone comprised of overlying formations, and (3) shallow aquifers and surface water systems where contamination may result from diverse natural or human impacts. The outcome will be the establishment of a methodology based on innovative tracer and monitoring techniques, including traditional and non-traditional isotopes (C, H, O, S, B, Sr, Cl, Br, N, U, Li, Cu, Zn, CSIA...) for detecting, quantifying and modeling of potential leakage of stray gas and of saline formation water mixed with flowback fluids into fresh groundwater resources and surface waters taking into account the pathways and mechanisms of fluid and gas migration. Here we present an outline of the project as well as first results from chemical and isotopic analyses on gas, fluid and solid samples collected during a baseline monitoring program at the Carbon Management Canada field research site in south-eastern Alberta, Canada.