

The occurrence of methane and other hydrocarbon gases in private water supply wells in the vicinity of the Stoney Creek oil and natural gas field, New Brunswick, Canada

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As part of the Gas Seepage Project, 42 private water supply wells within a 10-km radius of the Stoney Creek oil and natural gas (ONG) field near Moncton, New Brunswick, were sampled. Along with field parameter measurements, water samples were collected for inorganic ions, dissolved hydrocarbon gases, and stable isotopes of water, methane and ethane. The results for dissolved gases will be the focus of this presentation.

Methane was detected in 34 (81%) of the wells, with concentrations ranging from 0.0005 to 36 mg/L. Two wells had methane concentrations above 28 mg/L, while all other sampled wells had methane concentrations <10 mg/L. The median concentration in the water wells around the Stoney Creek ONG field, 0.03 mg/L, is significantly higher ($p < 0.001$) than the median concentration, 0.005 mg/L, in other areas of southeastern New Brunswick that do not have the same history of extensive ONG resource development. There is no correlation between methane concentration and distance to an ONG well. The two wells with the highest methane concentrations also had detectable ethane and propane, while butane, pentene, pentane and hexane were observed in one of those wells. The two wells are located east of the Petitcodiac River, approximately 2 km from the Stoney Creek ONG field. However, the ONG-bearing Horton Group bedrock of the Maritimes Brunswick Basin approaches the ground surface in the area of those wells.

The methane concentration was >0.1 mg/L in 12 (29%) of the wells and those wells were resampled for the determination of the isotopic composition of methane, and ethane, if possible. The $\delta^{13}\text{C}$ -methane and $\delta^2\text{H}$ -methane values are indicative of a range of biogenic, mixed biogenic/thermogenic, or atmospheric signatures, and the molecular ratios ($C_1/(C_2+C_3)$) combined with the $\delta^{13}\text{C}$ -methane values from samples with detectable ethane or propane point to biogenic or mixed signatures. Three samples had high enough ethane concentrations for isotopic analyses. Comparison between the $\delta^{13}\text{C}$ -methane and $\delta^{13}\text{C}$ -ethane values suggest a mix of biogenic and thermogenic methane but not microbial oxidation of the methane. Given the spatial distribution of methane concentrations – considered against both distance to ONG wells and bedrock geology – as well as the isotopic composition of the dissolved gases, we cannot determine definitely if groundwater methane concentrations in the area result from the presence of natural hydrocarbon-bearing bedrock in the vicinity of the wells or the presence of stray gas related to the ONG field.