Methane emissions from abandoned oil and gas wells at the Stoney Creek oilfield, New Brunswick, Canada

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Emissions from oil and gas operations are understood to originate from active oil and gas operations, but not much concern is given to abandoned infrastructure. Improperly abandoned wells can provide pathways for hydrocarbon gases like methane (CH_4) to migrate upwards into groundwaters, and the atmosphere. Atmospheric methane emissions have long been recognized as a significant contributor to the greenhouse effect, with a global warming potential 28–34 times greater than CO_2 on a 100-year horizon. Most atmospheric emissions from oil and gas activity occur in the western provinces, but New Brunswick is home to one of the oldest oilfields in the world. Approximately 168 oil and gas wells have been spudded at the Stoney Creek oil field in New Brunswick since 1909, most of which have since been decommissioned. To identify methane emissions from legacy infrastructure in this field, we sampled atmospheric and shallow soil gases around abandoned well sites in the Stoney Creek oilfield over a period of three weeks in late August to early September 2017. Shallow soil gases were sampled using a static flux chamber methodology, with an array of chambers sampled in triplicate at a total of 12 well-pads and 4 control sites. Additional sampling on individual well-pads was done using a backpack-mounted gas analyzer to identify elevated CH_4 concentrations (if present) and potential release mechanisms. Since we could not visit all historic well sites, we also conducted regional gas surveys using a vehicle-based sampling system to record methane and other gas concentrations at >1Hz while driving. Plumes of thermogenic gases (as indicated by $\delta^{13}C$-CH_4 and C_2H_6 tracers) were subjected to emission rate calculations using an Inverse Gaussian Plume Dispersion model. In general, we did measure elevated methane in the region. Regional surveys indicated that abandoned sites were likely emitting at a frequency near 20% (5 out of 27 sites surveyed), but at average emission rates of only 2.1 (± 1.7) kg of CH_4 per day. At only 1 of the 12 legacy well-sites we visited did we record soil CH_4 gas migration fluxes in excess of control sites, but emissions were very small and averaged only 25 (± 32) g of CH_4 per day. This study represents the first of its kind in regards to CH_4 emission detection from abandoned oil and gas wells in the Atlantic provinces, and provides valuable information to help understand methane emission risks associated with onshore oil and gas activity.

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