Geologic characterization and historical context for the Gas Seepage Project (GaSP) study areas in the Maritimes Basin, Canada

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Fossil fuel sites are susceptible to the release of methane, a potent greenhouse gas (GHG), at any stage of the extractive sites lifetime. As a response to recent international climate change agreements, Canada has committed to reducing methane from upstream oil and gas industries by 40–45% from 2012 levels by the year 2025. The Gas Seepage Project's (GaSP) primary goal is to investigate and evaluate potential methane emissions associated with historic (legacy) hydrocarbon extraction sites (oil and natural gas wells, and coal mines) in Atlantic Canada. GaSP is the first multi-phase methane mitigation initiative to be conducted in Atlantic Canada with the aim to use a multidisciplinary, holistic approach to evaluate and provide an inventory of methane emissions from legacy fossil fuel extraction sites.

Geologic characterization and the historical context of the sites are necessary to build a foundation for understanding factors that influence methane gas accumulation, abundance, migration potential, approaches to future site mitigation, as well as the anthropogenic influences upon methane generation and migration. Most of developments within the Maritimes Basin were constructed prior to modern environmental regulations. Coal resources throughout Cape Breton Island and in counties north of the Cobequid-Chedabucto Fault System were mined in Nova Scotia for over two hundred years. The Nova Scotia Department of Natural Resources has recorded more than 1900 abandoned coal mine openings in the province and the total is likely higher. The Cumberland, Stellarton, and Sydney basins host most of the coalfields and were a focus of this study. Site characterization involved compiling geologic maps, infrastructure and historical production data of coal mining, and oil and gas development, incorporated into a geologic report and assembled onto a spatial platform using Arc Geologic Information System (GIS) 10.3 software. Examination of the structure, stratigraphy, coal composition, oil and natural gas occurrences, identified key geologic components controlling methane migration pathways for modelling potential trends and relationships. These are all significant for the other task components of GaSP for the analysis of methane emission trends and the investigation of the magnitude of emission rates to both geologic and anthropogenic structural influences (i.e., faults, and mine adits), and the resource composition type (i.e., gas and coal types).

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