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Fate and transport of antibiotic resistance genes in Arctic tundra wetlands receiving municipal wastewater

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Fate and transport of antibiotic resistance genes in Arctic tundra wetlands receiving municipal wastewater

Theme 1. Environmental protection

Session Name 1.5 Sanitation in small Arctic communities

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Abstract text In the Canadian Arctic, municipal wastewater is commonly discharged into tundra wetlands, where ancillary treatment has been observed to occur. Antibiotic resistant bacteria and the antibiotic resistance genes (ARGs) they contain can be present in municipal wastewater and there is limited knowledge on ARGs in wastewater in arctic environments. The objective was to assess the fate of ARGs in arctic tundra wetland ecosystems impacted by municipal wastewater sources. The two wetlands were located in the Inuit communities of Sanikiluaq (56°33'N, 079°13'W) and Naujaat (66°31'N, 086°14'W) in Nunavut, Canada. Genomic DNA was extracted from both soil and water during the spring freshet

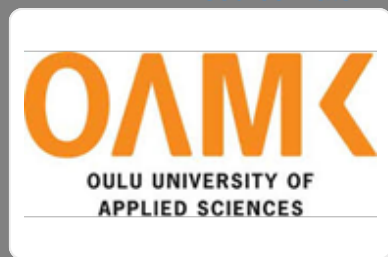
Arctic community of Cambridge Bay, Nunavut

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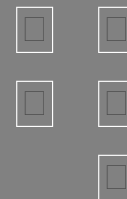
and late summer in the wetlands, and a suite of nine clinically relevant ARGs (sul1, sul2, mecA, vanA, qnrS, ermB, tetO, blaTEM, blaCTX-M), and an integron gene (int1) were analyzed using quantitative polymerase chain reaction (qPCR). Hydrological and water quality measurements were also conducted. Gene targets were consistently present in the wastewater, and throughout both wetlands, with the exception of vanA and mecA. ARGs were higher during the spring freshet, as a result of short hydraulic retention times (HRTs) (<2 days). ARG concentrations at the marine receiving environments returned to near baseline in Sanikiluaq; however, elevated concentrations persisted in Naujaat. Elevated ARGs in wetland soils suggested that they may act as a long term storage reservoir for ARGs. Hydrological conditions had a large impact on the spatial distribution and levels of ARGs in the arctic environment.

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