TITLE: Approaches to Emerging Contaminants of Concern in Small, Rural and Remote Environment – Environmental Challenges and Nature-Based Solutions under Climate Change

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The treatment of contaminated effluents in small, rural and remote communities, particularly in cold climate regions, is one of the greatest challenges for scientists and engineers working toward building climate resilient and adaptable communities. These communities must often partially or completely rely on open biological treatment systems to manage their effluent streams. In the next decade, increasingly efficient treatment systems, designed to operate under temperate conditions, will be required to meet increasingly stringent effluent discharge guidelines and minimize detrimental effects on receiving environments. The following scientific question needs to be addressed: can nature-based solutions be effectively integrated in resilient and adaptable eco-engineered treatment systems located in small, remote or isolated areas to enhance the mitigation of persistent organic and/or metal contaminants? Although used extensively, concerns associated with the long-term performance and functional reliability, robustness and adaptability of these systems compared to conventional, but less sustainable, treatment systems have been raised. However, these challenges may be largely addressed by the implementation of carefully designed and integrated biological processes in eco-engineered systems. Critical factors limiting the widespread adoption of eco-engineered treatment technologies have been the lack of a standardized understanding of varying water chemistry and climate change effects on treatment process mechanisms within these systems, and a more robust basis of comparison within and between systems as they evolve with time. Hence, a focus must be placed on better understanding the dynamic interactions influencing the performance, enabling the development of a toolkit that would lead to more robust design guidelines that follow an evidence-based approach. This could also be a great benefit to the Canadian mining, oil and gas and other heavy industries who are often located in remote or isolated sites, and produce large volumes of processing effluents that require subsequent treatment prior to water reuse or discharge to receiving environments.