Developing an in-situ risk management strategy for enhancing natural recovery of highly contaminated gold mine tailings impacted wetlands

EEV (Emily) Chapman, David Lewis, Heidi Gavel, Jenna Campbell, Liam Hill, Bradley Knockwood, and Linda M Campbell

Environmental Science, Saint Mary's University, Halifax, Nova Scotia, Canada

Historical gold mining in Nova Scotia took place between 1860-1940 in 64 gold mining districts. Initially the gold was extracted through mercury (Hg) amalgamation. From that process, the mining waste (tailings) contained high concentrations of Hg, and naturally occurring elevated concentrations of arsenic (As), and were usually deposited in low-lying wetland areas close to the mine. Over 150 years later, contaminated tailings are still present in these wetland areas. Although wetlands are slowly recovering, at many sites the sediment is still toxic to sensitive invertebrates and plants. Even if plants and insects are able to survive the high contaminant concentrations at these sites, mercury is biomagnifying in the food chain, with potential multi generational ecological impacts. Traditional risk management such as dredging and isolation caps would destroy the wetlands and would not be the best option for recovery for all sites. To address this problem, in 2020, Saint Mary's University entered into a 5-year project funded by Atlantic Mining Nova Scotia with a goal to develop an in-situ risk management strategy for enhancing natural recovery of highly contaminated gold mine tailing impacted wetlands. This multidisciplinary project is investigating reactive capping treatments that will reduce the ecological risks of As and Hg in these wetlands without destroying the wetland area in the process. It will involve several carefully-spaced experiments that will become increasingly more environmentally realistic with each step; starting with reactive amendment development and reactivity studies in small test vessels, moving through ecotoxicity testing with a range of organisms and contaminant speciation testing in beaker-, column-, and pail-sized test vessels under different redox conditions, to ecologically and environmentally realistic field testing in larger plots. The overall project outline, together with conclusions from selected tests completed for the first 2 years of the project will be presented.