Defining the Applicable Depth for the Ecological Direct Soil Contact Pathway

Sarah Thacker, InnoTech Alberta

Unnecessary remediation and vegetation disturbance may occur based on the assumption that the ecological direct soil contact pathway (i.e., exposure pathway to plants and invertebrates) applies at depths down to 3.0 m. This pathway currently cannot be eliminated above 3.0 m; however, it is presumed that ecological exposure to chemicals of potential concern (COPC) will not occur beneath the biologically active and/or rooting zone. At present, sufficient justification is not available for establishing the true depth of the biologically active and/or rooting zone, and in turn the depth at which the ecological direct soil contact pathway should apply.

In 2018, Millennium EMS Solutions Ltd., in collaboration with InnoTech Alberta, initiated a project to develop a scientifically defensible depth at which the ecological direct soil contact pathway applies. Phase 1 of the project included a comprehensive literature analysis. The current phase, Phase 2, is a greenhouse study, with the objective to validate effective rooting depth by confirming the effects of a COPC on above- and below-ground plant health when found at various depths within the soil profile. Outcomes of Phase 2 will help determine at which soil depths remediation will result in reduced risk to plants and soil invertebrates.

The experiment was set up in a sunken greenhouse at InnoTech's research facility in Vegreville, AB. Sodium chloride (NaCl) was selected as a COPC surrogate and alfalfa as a representative vegetation species. Alfalfa was grown in two-metre tall columns in either uncontaminated material or contaminated material (spiked with NaCl to 14.5 dS/m) at varying depths below the surface. There were seven treatments, each with ten replicates. The experiment ran for approximately one year with seven aboveground biomass harvests. At the end of the experiment, columns were cut open to assess roots. Data on aboveground biomass, rooting depth, and root distribution around salinity interfaces will be presented. While aboveground biomass tended not to be strongly impacted by salinity, there was a clear effect of salinity on roots. Recommendations will be made regarding the applicable depth of the ecological direct soil contact pathway. This project highlights how innovative experimental design can produce clear and relevant results that help improve remediation practices in the province.

Sarah Thacker

Sarah Thacker is an environmental scientist working as a researcher in the Environmental Impacts team at InnoTech Alberta. Sarah completed her BSc in Land Reclamation in 2016, and her MSc in Soil Science from the University of Alberta in 2018. Sarah's area of expertise is plant-soil interactions—she enjoys combining her knowledge of both plants and soil to advance applied research in Alberta. At InnoTech, Sarah has managed a variety of lab, greenhouse, and field scale projects. Sarah has worked on many projects evaluating the impacts of soil contaminants (including salt) on plants.

Ian Mitchell

Ian Mitchell has degrees in ecology, environmental engineering and toxicology, and 25 years of experience focused on risk assessment and environmental guideline development. He has contributed to the development of soil, groundwater and vapour guidelines both federally and provincially. Ian's current focus is on the advancement of practices for contaminated sites management and liability reduction.