



Recent Research Results for Selenium and Sulphate Ecotoxicology and Methods for Livestock Risk

Viktoria Winter, Equilibrium Environmental Inc

Selenium (Se) soil quality guidelines are being reassessed with the most recent toxicity data. The ameliorating effect of sulphate (SO_4) was further investigated with the higher Se concentration range in coarse and fine soils and five plant species: alfalfa (*Medicago sativa*), barley (*Hordeum vulgare*), cucumber (*Cucumis sativus*), northern wheatgrass (*Elymus lanceolatus*), and red fescue (*Festuca rubra*). These species were tested under various Se and SO_4 combinations. Benchmark Dose Software (BMDS) was used to build the dose-response curve and estimate representative toxicological endpoints. Endpoints were plotted to derive a Species Sensitivity Distribution (SSD) as a function of soil texture and SO_4 concentration. The 25th percentile from each SSD was used for ecological guidelines, where Se toxicity depends on SO_4 concentration in soil. To assess potential livestock risk, the proposed guidelines will be tested for bioaccumulation. Select agricultural and native plants will be grown to maturity in applicable Se and SO_4 concentrations. Plant tissue will be collected in the various growth stage and analyzed for Se and SO_4 . These long-term bioaccumulation tests will confirm if the new Se guidelines are protective for the grazing animals. The reassessed soil guidelines would improve environmental performance through decreasing greenhouse gas emission (by decreased remediation volumes). In addition, they would improve conservation efforts and reduce instances where remediation would generally be required because of guideline exceedances, although Se may not pose unacceptable risk to the environment or human health. This research was made possible through funding provided by the Petroleum Technology Alliance Canada (PTAC).

Viktoria Winter

Ms. Winter is a senior environmental scientist/ toxicologist at Equilibrium Environmental Inc., a professional biologist in Alberta, and a professional agrologist in B.C. Ms. Winter received a B.Sc. from Agricultural and Environmental Science at McGill University in 2007. In 2011, she obtained the Master of Environmental Toxicology degree from Simon Fraser University. Ms. Winter has 15 years of experience in ecotoxicology studies and environmental industry. Her skillset includes toxicology, human health and ecological risk assessment, research in support of environmental toxicology, and numerous field investigations. She has worked on sites impacted by various industrial operations including upstream oil and gas, pesticide and fertilizers applications. Environmental toxicology experience included developing and validating of a new egg-injection protocol and multi-generational study of PBDE exposure in small songbirds, plant and invertebrate toxicity testing for petroleum hydrocarbon impacted soils, and plant toxicity testing for selenium. Ms. Winter worked on the data gap analyses in ecotoxicology, bioavailability and bioaccessibility, phytoremediation and plant tolerance potential studies (TPH, lead, selenium), and on the weight-of-evidence approach to redefine provincial ecological soil selenium guidelines.