

**1. Title:** Metal toxicity thresholds for important reclamation plant species of the Rocky Mountains

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**4. Project Period:** 11/01/2003 - 10/31/2005 (2 years)

**5. Project Cost:** \$231,679 (\$183,922 Rocky Mountain Regional HSRC; \$47,756 Cost Share)

**6. Project Summary:** The proposed project will establish heavy metal toxicity thresholds for numerous grass, forb and shrub species that are commonly used in reclamation activities in the Rocky Mountains. This information is currently not available and, as a result, ecological risk assessments must rely on toxicity thresholds established for agronomic species. These crop plants have very different physiological characteristics and sensitivity levels than native species used in the reclamation of sites contaminated with metals. As a result, risk assessors have the potential for classifying sites as phytotoxic to native species and calling for intensive remediation activities that may not be necessary. The objective of this work is to provide a better estimate of soil metal toxicity thresholds and uptake factors for four metals and a large number of native plant species (and a few commonly used introduced species). These threshold values could be used by those in the reclamation industry to more accurately assess risks associated with soil metal contamination, and to better match revegetation plant species to site conditions.

**a. Objectives:** The objective of this work is to provide a better estimate of soil metal toxicity thresholds for four metals and a large number of native plant species (and a few commonly used introduced species). These threshold values would be used by those in the reclamation industry (government regulators and private entities) to more accurately assess risks associated with soil metal contamination, and to better match revegetation plant species to site conditions.

**b. Approach:** The proposed project will involve large greenhouse screening studies. Plants of numerous reclamation species will be grown in sand culture and exposed to various concentrations of metals that are characteristic of the most hazardous mine sites in the Rocky Mountains. From these studies, we will determine five measures of toxicity: 1) The germination  $LC_{50}$  (the concentration of metal that reduces germination by 50% relative to controls), 2) The 60-day  $LC_{50}$  (the concentration of metal that kills 50% of the seedlings by 60 days), 3) The 60-day  $EC_{50}$  (the concentration of metal that reduces seedling biomass accumulation by 50% after 60 days), 4) The  $PT_{50}$ -shoot (the shoot metal concentration corresponding to a 50% seedling biomass reduction) and 5) The  $PT_{50}$ -root (the root metal concentration corresponding to a 50% seedling biomass reduction). In addition, metal uptake factors will be determined.

**c. Expected Results:** These studies will establish metal toxicity thresholds for numerous reclamation plant species. This will have Regional, National and Global benefits. Our published threshold values and uptake factors could be used in risk assessments where agronomic species data are inappropriately used in place of data for native species. In addition, the proposed study will identify plant species and genera that will be suited for reclamation projects involving metal-contaminated soils. This knowledge will lower reclamation costs by reducing planting failures.