Contribution in the production of contaminants by oxidized mine tailings after reclamation with oxygen-barrier covers

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The production of acid mine drainage (AMD) can occur when sulfidic tailings exist in contact with oxygen and water. In humid climates, oxygen barrier covers are frequently placed over tailings to control the production of AMD and its associated contaminants. Previously, most studies have focused on relatively fresh or unweathered tailings. Two techniques have been frequently investigated: monolayer covers with an elevated water table (EWT) and geomembrane covers. Few studies have investigated the application of these techniques in the context of previously oxidized tailings.

In this study, laboratory columns were set up with tailings from two abandoned mine sites: Mine Principale (Québec) and Long Lake (Ontario). Control and reclaimed columns were set up for each site and each column contains oxidized and unoxidized tailings. For the Mine Principale tailings, a monolayer cover with an EWT was tested. For the Long Lake tailings, a sand cover was installed for the first six months of the test, after which an air-tight geomembrane was installed.

The control columns produced AMD with high concentrations of Fe (1000-3500 mg/L) and tens of mg/L Co, Ni, and Zn. The control Long Lake tailings also leached hundreads of mg/L As. Metal concentrations in the control leachates were often more than one order of magnitude higher than those in the reclaimed leachates. The pH of the reclaimed Mine Principale column increased slowly after nine months to near-neutral values. The sand cover was not efficient at controlling the production of AMD from the Long Lake tailings. After installing the geomembrane over the Long Lake tailings, the pore water quality varied over depth and time and has not yet stabilized.

The hydrogeochemical behavior of these columns will be reproduced through reactive transport modeling to better identify the nature and the impacts of the contaminant-generating processes in oxidized tailings.