Assessment of using mine tailings and waste rock in waster balance covers

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Abstract. The focus of this study was to evaluate hydrologic performance of mixed mine tailings and waste rock in water balance cover systems. Water balance covers are designed to minimize percolation and oxygen ingress into underlying waste via moisture retention while also providing resistance against slope failure and erosion of cover materials. A series of water-balance simulations were conducted using a variably saturated one-dimensional numerical model to assess hydrologic characteristics for an operating municipal solid waste (MSW) landfill in Missoula, Montana. The actual water balance cover was designed with 1.22-m-thick storage layer consisting of the native soil (silty sand) and a 0.15-m-thick topsoil layer. Comparisons were developed between an actual water balance cover and the following theoretical scenarios: (1) cover systems with storage layers composed of (i) copper, (ii) gold, (iii) coal, and (iv) oil sand tailings; (2) constant thickness mine tailings storage layers with waste rock inclusions; and (3) re-designed storage layer thickness composed of tailings and waste rock to yield comparable percolation rate to covers with no waste rock. Percolation rate ranged between 0.0 and 3.2 mm/yr for pure mine tailings water balance covers, which was comparable to predictions for the actual cover. Addition of waste rock inclusions increased percolation in all cases due to reduced storage capacity. Re-designed covers composed of tailings and waste rock yielded thicker storage layers, but comparable percolation rates to water balance covers with no waste rock inclusions.