FATE AND TRANSPORT OF METAL AND SEDIMENT IN SURFACE WATER[1]

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Abstract. This effort focuses on surface water and sediment transport, with an emphasis on the fate and transport of metals in rivers from mining wastes. The main objectives of this project are to: (1) improve and develop computer modeling tools for the simulation of erosion and sedimentation of sediment and metals in surface waters; and (2) develop methodology for evaluating impacts from sediment and metals on watersheds. The CASC2D-SED numerical model is used as a basic framework to simulate metals transport and fate. This model is directly coupled with GIS-based site characterization data and remote sensing sources. Physical characterization of waste rock piles such as degree of erosion, slope stability, distance from surface water, proximity to a drainage channel, presence of vegetation on mine waste and presence of a kill zone are taken into account in the model. CASC2D-SED allows the simulation of an unlimited number of soil and metal particle types from different source areas (e.g. different waste piles and uncontaminated areas) and the total delivery of solids is computed as the sum of all particle types simulated. The simulation of heavy metals transport during a rainfall event is visualized as an animated sequence of raster grids. At the end of the simulation, spatial variability of deposited or scoured volumes is shown for each metal as a raster grid.

The CASC2D-SED model is applied to the EPA California Gulch Superfund site, Colorado. Raster data sets collected on the site consist of a Digital Elevation Model (DEM), land use / land cover map, soil type map, digital orthophoto quadrangles, and AVIRIS mineral map. AVIRIS images are used to map the spatial distribution of minerals associated with the sources of acid rock drainage and heavy metal contamination. The main benefit of this research includes an improved understanding and representation of metals transport and fate in mine waste impacted hillslopes and streams. The results of this study provide remediation managers with a tool to examine the contribution of individual contaminated areas to the total impairment of a site in terms of heavy metals transport.

Additional Key Words: CASC2D-SED, AVIRIS, GIS, DEM