Occurrence and Transport of Selected Constituents in Streams in the Vicinity of the Stibnite Mining Area of Idaho

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The U.S. Geological Survey has operated a network of 5 stream gages in the Stibnite mining area near Yellow Pine, Idaho since September 2011 in cooperation with the Idaho Department of Lands and Midas Gold. Stream gages were located to evaluate trace metal loading and transport in the East Fork of the South Fork (EFSF) of the Salmon River and some tributaries. Water temperature, specific conductance, and pH were continuously measured, and discrete water-quality samples were collected 5-7 times annually at each stream gage. Discharge and water-quality data were used in the USGS LOAD ESTimation model (LOADEST) to estimate daily, monthly, and annual loads and flow-weighted concentrations for selected constituents. LOADEST results showed large increases in arsenic and antimony loads in discrete reaches in the EFSF of the Salmon River with relatively small increases in discharge. Arsenic and antimony exist primarily in the dissolved phase (less than 0.45 micron) in water samples from the study area, indicating groundwater as a likely source. Hysteresis in transport of suspended sediment and suspended sediment-associated constituents (e.g., aluminum and mercury) resulted in load estimates that were biased low on the ascending limb of the hydrograph and biased high on the descending limb of the hydrograph. LOADEST models for suspended sediment, aluminum, and mercury may be improved by including an additional explanatory regression variable to account for hysteresis. Mercury was detected in 40-50 percent of samples collected from the EFSF of the Salmon River and 100 percent of samples collected from Sugar Creek, a tributary to the EFSF of the Salmon River that contains a former cinnabar mine within its watershed. Regression models relating continuous values of specific conductance and/or discharge with constituent concentrations were statistically significant at some stream gages. These surrogate models may be used to estimate real-time concentrations and loads of arsenic, antimony, and total mercury.