Environmental Impacts of Hardrock Mining in Eastern Washington

Metals contamination resulting from hardrock mining can continue for hundreds or thousands of years following the cessation of mining operations. Acid mine drainage still occurs from hardrock mines in Europe that were worked by ancient Romans prior to A.D. 476. In the United States, more than 500,000 inactive and abandoned mines are estimated to exist in 32 states. Thousands of abandoned mines in eastern Washington are located in sensitive mountain watersheds. In Okanogan County, alone, there are more than 150 sites threatening human health and the environment. Acid mine drainage and heavy metals from abandoned mines in this area are affecting communities of aquatic invertebrates, fish, mammals, riparian vegetation, and domestic water supplies. Mine contaminants affect the biological, recreational, industrial, and municipal use of larger rivers many miles downstream from mining. A University of Washington study sponsored by the Bonneville Power Administration Fish and Wildlife Program and theUniversity of Washington's Center for Streamside Studies is examining the watershed scale response of stream habitat to to abandoned mine waste, the dispersion of metals, and their effects on biota in the Methow River Basin. The results of the study, to be completed in 2003, will be used to shape a remediation plan that addresses specific groundwater, surfacewater, soil, vegetation, and visual impacts.

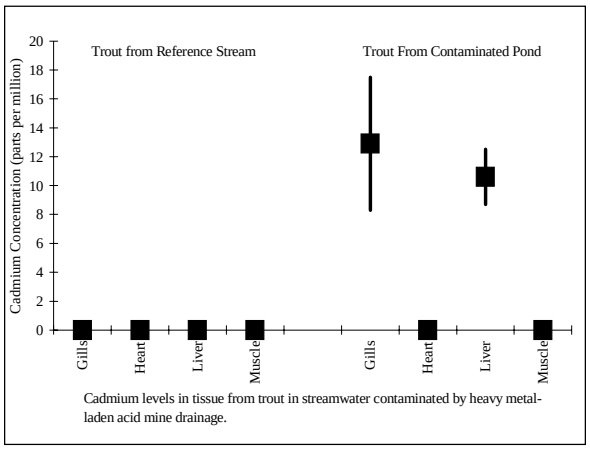
Background

Contamination of Water. Water is contaminated when it comes into contact with solid mining waste remaining after mining has ceased. Rain and snow fall on the waste rock and tailings. The runoff contains metallic sulfides from the ore that oxidize, dissolve, and release heavy metals. Acid mine drainage and metals contamination is the greatest concern, but the leaching of chemicals from the milling and concentration process, most notably cyanide, can also be a serious problem. Water contaminated with metal sulfides and chemical additives are often discharged into surface waters that seep into the groundwater. Domestic water from wells located near abandoned mill sites has been found to contain heavy metals at levels that exceed drinking water criteria.

Biological Hazards. Using the principles of epidemiology, strong relationships have been established between elevated levels of heavy metals and the condition of invertebrate communities in impacted creeks. Elevated concentrations of cadmium, copper, selenium, and zinc in streamwater and sediments have reduced species diversity and abundance in these aquatic communities. Contaminated headwater streams are significant hazards to the environment and threaten juvenile salmonids, including bull trout, native steelhead, and chinook salmon, which may use the lower portion of contaminated tributaries as rearing habitat.

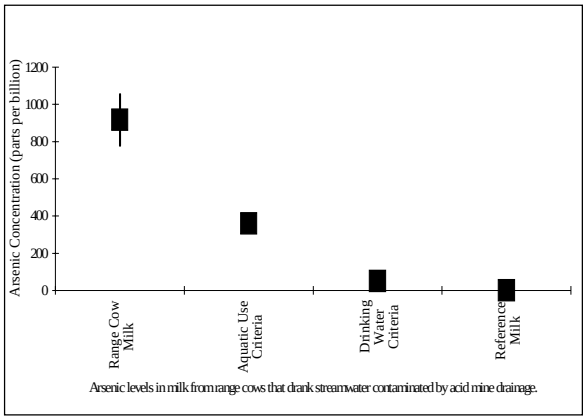
An abandoned mine site near a headwater tributary of the Methow River in Okanogan County, WA.

A mine portal discharging acidic heavy metal-laden water that contaminates a stream near Twisp, WA.



Cadmium levels in tissue from trout in streamwater contaminated by heavy metal-laden acid mine drainage.

Trout. Excessive mortality and the accumulation of cadmium and zinc occur in rainbow trout exposed to metal concentrations exceeding natural background levels. Resident trout in farm ponds fed by water contaminated by metals fromabandoned mines concentrate cadmium and zinc in their gill and liver tissues.



Arsenic levels in milk from range cows that drank streamwater contaminated by acid mine drainage.

Lactating Mammals. Lactating beef cows grazing on abandoned mine lands and drinking from creeks contaminated by acid mine drainage concentrate heavy metals in their milk. Arsenic, nickel, selenium, and zinc are found at concentrations that exceed reference samples as well as Washington State's criteria for aquatic life.

P*lants.* Analysis of core samples show that Douglas-fir trees growing on soils contaminated by mine waste are concentrating zinc. Manganese, zinc, iron, and aluminum also accumulated in needles and leaves of Douglas-fir, ponderosa pine, and aspen.

Methow River Basin (Okanogan County, WA) Study

Mine drainage from the abandoned mine produced acidic,
effect on the quality of water in a tributary of the Methow River. Water samples in the stream, which provides spawning habitat for juvenile salmonids including native steelhead and chinook salmon, were assayed for total metals. Respiration chambers that measured oxygen consumption were used to estimate the metabolic activity and relative algal densities on rocks in streams. Study findings included:

- Water samples from below the mine exceeded Washington State's criteria for aquatic use and have the potential to adversely affect both public health and organisms dependent on those waters.
- The density and diversity of stream insects was less below the mine than above, reflecting the toxic impacts of mine waste on sensitive stream organisms.
- Algae, which are tolerant of mine waste contaminants, proliferate in the absence of stream insects.
- Precipitates of calcite, reslting from the impacts of mine waste on soils and groundwater, occur several miles downstream from historic mining operations.

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