

## **Pathways for mobilization and fisheries impacts of mercury from the Cinnabar mine site, Idaho, USA**

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Abandoned mercury mine sites present multiple pathways for the release of mercury to aquatic ecosystems. Subsurface tunnels expose groundwater to ore-bearing minerals including cinnabar and metacinnabar. The formation of the bioaccumulating neurotoxin methylmercury remains limited in the fractured rock aquifer associated with the Cinnabar mine site in Idaho. Once the mercury-enriched water emerges in adit overflows and seeps, the flow path goes through discrete areas of dense wetland vegetation that are rich in organic matter and provide a substrate for microbial consortiums to form methylmercury. Ore processing tailings remain on site, and act as an additional source of mercury, arsenic, and other toxic trace metals. Crushing and roasting increase both surface area for water-rock interactions and the solubility of the mercury in the heat-treated rock. The solubilized mercury is flushed from the pore spaces in the tailings pile during spring snowmelt, producing an annual pulse of elevated mercury concentration stream water at a gage site on Sugar Creek, eight kilometers downstream from the mine site. Fish collected along stream reaches between the mine site and gaging station show differences downstream in community structure, as well as differences in length and mass within the same age group of Bull trout consistent with measured mercury and methylmercury concentrations. Tissue mercury concentrations are elevated for the Bull trout collected downstream from the mine site relative to fish collected in background sites within the same watershed. Muscle tissue samples from a Chinook salmon collected in Sugar Creek had similar mercury concentrations to the Bull trout. However, it is not possible to determine how much mercury in the salmon tissue was reflecting the initial year of feeding in Sugar Creek relative to the bulk of the fish's life cycle in the Pacific Ocean.

