Correlating Arsenic Bioaccessibility & Bioavailability through *In Vivo* Rat Exposures

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Toxic metal(loid)s such as arsenic pose environmental hazards to human and organismal health in many locations throughout Southern California where mine tailings are located near residences and ecosystems. However, the relationships between the geochemical/physical properties of airborne dust particles and the bioaccessibility of potentially harmful elements in the particles have not yet been clearly established. The bioavailability of inhaled arsenic is largely dependent upon two factors: the size and solubility of the arsenic-bearing particle. The size of the particles dictates how far into the lungs and other tissues the potential arsenic-containing particles will be lodged, while the solubility determines how rapidly and completely the arsenic is absorbed into the bloodstream and through the other organs.

To characterize arsenic bioaccessibility and bioavailability of mine tailings samples in the respirable (i.e. ≤10 μm) size range, rats were exposed through a nose-only inhalation procedure to an acute dose (1000 μg/m^3) of airborne particles from processed mine tailings and unprocessed waste rock from the Marigold East gold mine in California for 3 hours, then sacrificed immediately after exposure and after 1 and 7 days post-exposure, with results compared with an unexposed control group. Arsenic concentrations were measured in the urine, feces, blood, and a range of tissues.

Results from the feces and urine analyses showed an initial sharp increase in arsenic in the first day post-exposure, a decrease to background arsenic levels by day 3-4, and then a gradual increase in arsenic through day 7. The tissue data show comparable trends but to varying degrees based on the absolute percentages of arsenic present within them. Together the results suggest that arsenic is released from the mine wastes in two stages: 1) a rapid release of highly soluble, surface-bound arsenic; and 2) a slower release of less-soluble, particle-bound arsenic. The mine tailings demonstrate higher bioavailability than the waste rock, consistent with *in vitro* solubility studies, suggesting that processing of the ore produces more soluble arsenic phases. The findings generated by this experiment are potentially transferable to other environmentally-contaminated regions where fine-grained dusts and their associated contaminants have the potential to be mobilized and inhaled, increasing hazardous exposure to residents and visitors.