

The contemporary dust lead exposure risk and its potential influence on children health in an Australian mining community

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Broken Hill in New South Wales, Australia, contains one of the world's largest lead ore bodies, which has been mined continuously for more than 130 years. The operations have left behind a legacy of widespread lead contamination and have caused persistent elevated blood lead problems in children. However, there remains ongoing dispute amongst geologists and environmental experts as to the primary source of the environment lead — naturally occurring, legacy contamination or contemporary emissions and depositions. This research addresses this problem by examining spatial and temporal samples of contemporary dust deposits for their lead concentration, bioavailability, mineral content and surface morphology.

Dust samples were collected monthly from six sites across Broken Hill. The preliminary results show that dust lead loading at the two sites closest to the local mining operations (average 205 $\mu\text{g}/\text{m}^2/\text{day}$ and 213 $\mu\text{g}/\text{m}^2/\text{day}$, respectively) are approximately double those furthest from mining operations at the edge of the city. The same sites also have higher lead bioavailability, average of 74 % 70 %, respectively, compared to the more distant sites that had an average of 64 %.

Scanning Electron Microscope (SEM) images show that galena (PbS) particles (grain size ranging 10-50 μm) collected close to operating mines in Broken Hill are angular and have not undergone weathering processes. By contrast, galena (PbS) particles of the distant dust samples are subrounded and finer (grain size < 10 μm).

The elevated dust lead loading observed around the local mining operations and the morphological characteristics of galena particles indicate that the current mining operations are the predominant source of the contemporary dust lead contamination and blood lead exposures in Broken Hill. The high bioavailability of dust lead deposits in Broken Hill demonstrates there remains a high risk from the emissions of the current operations to children's health.