

Legacy mine tailings in urban areas: Assessing heavy metal exposure from street dust

SANDRA CORTÉS^{1,2,4}, GUILLERMO ARCE¹, CINTHYA LEIVA¹, LUIS MUÑOZ³, SANTIAGO GUTIÉRREZ¹, PABLO MOYA², ALEJANDRA VEGA², PABLO PASTÉN^{1,2*}

¹ Pontificia Universidad Católica de Chile, Santiago, 7820436, Chile (*correspondence: ppasten@ing.puc.cl)

² Centro de Desarrollo Urbano Sustentable, Santiago, 7520245, Chile

³ Comisión Chilena de Energía Nuclear, Santiago, 7600713, Chile

⁴ Advanced Centre for Chronic Disease (ACCDiS), 8330077, Chile

Mining residues in urban and periurban areas may become a threat to public health when metal-rich fine particles are mobilized by wind and water, affecting streets, housing, buildings, and parks. More than 220 Mton of copper tailings were deposited into the Chañaral bay, forming a ~5 km beach by the arid city of Chañaral in the Atacama Desert, Northern Chile. Lacking containment, the fine material was prone to transport to nearby urban areas, exposing inhabitants to toxic metals.

We used street dust to characterize metal enrichment in Chañaral. Samples (n=66) were collected using a uniform grid to capture spatial variability. Samples were digested and measured for As, Mn, Ni, Pb and Zn using ICP-MS. The exposure of population to metals was assessed by metal concentrations in urine samples measured by ICP-MS. These samples can be used to assess potential health effects and distinguish heavy metal intake from environmental and dietary sources. Urine samples (n=159) and personal responses to a questionnaire were collected concurrently with street dust sampling.

Concentrations of As and Cu in street dust up to 105 and 7,468 mg/kg were found, respectively, showing a decreasing trend with the distance from the mine tailings. This suggests that the tailings are exposing those living closer to higher concentrations. Some urine samples presented up to 91.1 ng mL⁻¹ of As (inorganic As and its metabolites), but no statistically significant correlation with the As concentration on nearby street dust samples was found. Further analyses on bioavailability of metals in street dust samples are ongoing to elucidate the relation between As in street dust and urine samples, as well as assessing the potential health effect through health risk assessment methods.

Acknowledgements: FONDAP-CONICYT 15110020, FONDAP-CONICYT 15130011 and Pastoral UC-VRI 2017.