

Urban geochemistry to inform public policy and residential soil quality guidelines for toxic metals in mining cities

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Human exposure to toxic metals raises significant concerns in urban areas located near active and legacy mining-related operations and their residues. High or unknown background concentrations, absent soil quality guidelines, and poor urban planning configure a complex human and environmental health problem. Urban geochemical studies may input critical information to public policy, regulatory approaches, and remediation addressing metal pollution in mining areas.

This work compares the occurrence of toxic metals in soil, street dust in six model cities in Chile, a country largely known by its historical and current mining activity. The cities (Chañaral, Copiapó, La Serena, Andacollo, Santiago and Coronel) vary in size, population -from 10,000 to over 6 million-, geographical location (arid and semiarid climate, except for Coronel), and proximity to ore extraction, ore processing, other industries, or the residues from ore processing. In Copiapó, mapping of toxic metal enrichment factors allowed the identification of critical pollutants and specific sources and drivers of pollution, while preliminary risk assessments connected with the implications for human health.

Results from these efforts have been purposely communicated to the community, regulators, and law makers through outreach activities and documents. Not only a new framework law for soil protection is currently discussed in the Chilean congress, soil quality guidelines are also under discussion by environmental regulators. Some results were also useful for decision making in emergency response, like the mudslides affecting urban areas in the Atacama region.

The outcome of urban geochemical studies and risk assessments may also point to other solutions complementing the regulatory approach. For example, they help in (i) defining criteria within current urban planning instruments for risk areas where residential use is not safe, and (ii) prioritizing efforts to immobilize toxic metals from critical sources, like mine tailings deposits. Finally, geochemists should work within interdisciplinary groups with lawyers, engineers, urban planners, epidemiologists, and communicators to further the impact of urban geochemical studies on public policy and to facilitate community engagement in their studies.