

# Highly soluble arsenic from contaminated soil explains arsenic contamination in groundwater in central Mexico

PROF. NADIA MARTINEZ-VILLEGAS, PHD, JEJANNY  
LUCERO HERNÁNDEZ MARTÍNEZ AND ABRIL  
MUNGUÍA LARA

IPICYT

Presenting Author: [nadia.martinez@ipicyt.edu.mx](mailto:nadia.martinez@ipicyt.edu.mx)

Arsenic concentrations ranging from 1 to 160 mg/L in shallow groundwater in central Mexico were attributed to metal arsenate dissolution in soils contaminated by historical metallurgical activities. The extent of their solubility and leaching remains, however, unclear. For this reason, the objective of this study was to determine the solubility of arsenic from contaminated soil samples and the extent of its leaching. For doing so, 355 surface and vertical soil samples were collected across 38.8 ha to determine total and soluble arsenic concentrations as well as soil mineralogy, pH, and electrical conductivity. We found that total arsenic concentrations reached up to 117,870.0 mg/kg, mainly due to the presence of lead arsenate ( $\text{Pb}_2\text{As}_2\text{O}_7$ ), lead arsenate hydroxide ( $\text{Pb}_5(\text{AsOH}_4)\text{OH}$ ), potassium hydrogen arsenate ( $\text{K}_8\text{H}_2\text{As}_4\text{O}_{15}$ ), and pharmacolite ( $\text{CaHAsO}_4 \cdot 2\text{H}_2\text{O}$ ), while soluble arsenic accounted for up to 50% of total arsenic. Furthermore, soluble arsenic was found to be a function of total arsenic, which explained the extremely high concentrations of arsenic in the aquifer. Surface arsenic contamination was found all across the 38.8 ha, while vertical arsenic contamination reached, at least, 3.2 m below soil surface. At some soil sampling points, arsenic leaching reached the shallow water table and revealed arsenic accumulation in the capillary fringe. Lastly, mean soil pH and electrical conductivity were 7.8 and 3.3 dS/m, respectively, typical of calcareous environments. Results from this study highlight the likelihood of high arsenic solubility and leaching in metal arsenate contaminated soils in historic metallurgical sites and calcareous environments and the urgent importance of arsenic stabilization.