

# ENVIRONMENTAL TOXICITY OF GLASSWORKS LANDFILL SOILS

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## Abstract

Following over 200 years of industrialization, soil contamination is a widespread problem in many countries. Contaminants, especially heavy metals and persistent organic compounds, can still be found at high concentrations decades after the emissions have ceased. One important part of this industrial heritage is the heavy metal contamination of soil and landfills around glass factories, with complex relationships between contaminants, the natural hydrogeochemical environment and biota. In southeastern Sweden lies the so called “Kingdom of Crystal”, with a long tradition of artistic glass production and elevated concentrations of a range of metals found in soil and landfills of the glassworks sites. Because high total concentrations may not always translate into a high mobility, bioavailability, and toxicity, research on biological effects has been deemed necessary to delineate the severity of contamination.

For the present study, soil samples from landfills and control areas were collected at five glassworks in the Kingdom of Crystal (Bergdala, Målerås, Kosta, Johansfors and Orrefors). *Each landfill site was heavily contaminated with various metals. As, Ba, Cd, Pb, Sb and Zn were the major contaminants, exceeding the guideline values of Swedish legislation.* Total concentrations were found in the range 64-7800 mg As kg<sup>-1</sup>, 30- 600 mg Ba kg<sup>-1</sup>, 0.16- 3 mg Cd kg<sup>-1</sup>, 160-38000 mg Pb kg<sup>-1</sup>, 0.40-56 mg Sb kg<sup>-1</sup>, and 45-1100 mg Zn kg<sup>-1</sup>. To test for biotoxicity, a battery of tests with species of varying sensitivities and exposure pathways were applied. Evaluation of *plant toxicity to Lepidium sativum demonstrated the lack of difference between biomass production between the soils from contaminated landfill sites and control areas. Similarly,* elutriates from both metal contaminated and reference soils implied low toxicity to the photobacterium *Vibrio fischeri*. However, significant reduction in the numbers and biomass of enchytraeids was observed in the landfill sites of Bergdala, Kosta, Johansfors and Orrefors. Also the numbers of nematodes tended to be reduced in landfill sites. Altogether, the obtained results provide a better understanding of the complex historical contamination by evaluating biological responses at different levels.

## Keywords

Metal contamination, Glass industry, Biototoxicity, Heavy metals