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Estimating the uncertainty from sampling in pollution crime investigation: the importance of metrology in the forensic interpretation of environmental data.

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Highlights

- Metrology tools were used in a forensic pollution investigation.
- Metal determinations in leachate and sediment were performed in double split design.
- Measurement uncertainties, including sampling, were estimated.
- The sampling uncertainty was the most important component of the combined uncertainty.
- The uncertainty from sampling is key to the interpretation of environmental forensic analyses.

Abstract

The forensic interpretation of environmental analytical data is usually challenging due to the high geospatial variability of these data. The measurements' uncertainty includes contributions from the sampling and from the sample handling and preparation processes. These contributions are often disregarded in analytical techniques results' quality assurance. A pollution crime investigation case was used to carry out a methodology able to address these uncertainties in two different environmental compartments, freshwater sediments and landfill leachate. The methodology used to estimate the uncertainty was the duplicate method (that replicates predefined steps of the measurement procedure in order to assess its precision) and the parameters used to investigate the pollution were metals (Cr, Cu, Ni, and Zn) in the leachate, the suspect source, and in the sediment, the possible sink. The metal analysis results were compared to statutory limits and it was demonstrated that Cr and Ni concentrations in sediment samples exceeded the threshold levels at all sites downstream the pollution sources,

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