

## Definition of areas of probable risk to human health posed by As, Cd and Pb in soils of the surrounding area of an abandoned Pintor mine (Portugal).

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The Pintor mine explored an As-sulphide deposit and was abandoned without any environmental assessment study or remediation actions. At the study area the main land uses are housing, agriculture and forestry. In particular, the Pintor-residential area is being constructed on the land of the abandoned mine, a fact that raises some concern about the potential risk to human health posed by potentially harmful elements (PHE) in the soils. Therefore, this study aims to identify areas of probable risk to public health, especially for the inhabitants of the Pintor residential area.

A total of 132 soil samples were collected and sieved into two fractions (<2 mm and <150 µm). Near total concentrations of As, Cd and Pb were determined by ICP-MS, after an acid digestion with aqua regia. The soluble fraction of As in the soil was obtained using 1 M NH<sub>4</sub> Acetate, pH 4.5. The results show that the soils of the study area have high concentrations of As, Cd and Pb, three of the most dangerous elements so far classified as PHE to human health.

In order to assess the probable risk posed by these elements in the soil, total concentrations are compared with the Soil Guideline Value (SGV) established for the United Kingdom [1].

In order to identify geographical areas of probable risk to human health, surface maps were interpolated

by ordinary kriging for the finest soil size fraction, which has a higher probability of being ingested since it easily adheres to the hands.

The results show that, using the SGV as threshold, all the area under study is classified as an area of probable risk. Moreover, As fractions in labile soil phases reach values as high as 4714 mg/kg. Since exposure through soil ingestion is probable in and around the residential area, where arsenic is in more labile soil phases, it is prudent to consider that this PHE in the soil represents a probable risk to human health. Yet, Cd and Pb are also PHE of concern since have concentrations above the SGV near the residential area, which increases the probability of exposure through soil ingestion (mainly for children that play in the outdoor) and the risk for human health. The health risk posed by As, Cd and Pb in the solid-phase is site specific and dependent on the bioaccessibility of the elements (major factor limiting their bioavailability). It is therefore desirable to carry out bioaccessibility testing in the samples within the area already identified as that of higher probable risk.

### References

[1] DEFRA (2002). Soil guideline values for chromium, lead, arsenic, nickel, cadmium and selenium. Environment Agency, Bristol, UK.

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