

---

# Newcastle Allotments Lead Biomonitoring Study: an investigation into the relationship between the blood lead concentration of gardeners and the solid phase partitioning and bioaccessibility of soil lead.

Jane Entwistle\*<sup>†1</sup>, Patrick Amaibi<sup>2</sup>, Lindsay Bramwell<sup>3</sup>, Mark Cave<sup>4</sup>, John Dean<sup>2</sup>, Michael Deary<sup>1</sup>, Jackie Morton<sup>5</sup>, and Joanna Wragg<sup>4</sup>

<sup>1</sup>Department of Geography, Faculty of Engineering and Environment – Northumbria University, Newcastle upon Tyne, NE1 8ST, United Kingdom

<sup>2</sup>Department of Life Sciences – Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, NE1 8ST, United Kingdom

<sup>3</sup>Institute of Health and Society – Newcastle University, Newcastle upon Tyne, NE1 7RU, United Kingdom

<sup>4</sup>British Geological Survey (BGS) – Keyworth, Nottingham, NG12 5GG, United Kingdom

<sup>5</sup>Health and Safety Laboratory – Buxton,, United Kingdom

## Abstract

Many urban allotments in Newcastle have soil lead concentrations > 10 times higher than the current UK guideline values. The aim of this study was to investigate the relationship between the blood lead concentration of gardeners and the total, solid-phase partitioning and oral bioaccessibility of soil lead.

Three allotment sites were identified (BR, TS and MS) and gardeners and their non-gardening neighbours were recruited. Soil and produce samples were collected and participants provided blood samples. Percentage bioaccessibilities (and mean total soil lead), ranged from 32%–72% at BR (665 mg/kg), 33%–62% at TS (722 mg/kg) and 63%–76% at MS (481 mg/kg). The produce samples are currently awaiting analysis. The extent to which the soil lead is available for plant uptake, and the bioaccessibilities, can however be understood in terms of the solid-phase partitioning of the lead following application of the Chemometric Identification of Substrates and Element Distribution protocol (Cave et al., 2004). The CISED extraction identifies the main acid soluble substrates in the soil and the fractionation of the lead between them. This information is used in conjunction with soil properties to provide a holistic overview of the factors controlling the mobility of lead in the three allotment sites. Our work highlights the need to better model exposure within urban allotments if we are to provide a robust, relevant and applicable soil screening value for soil lead at such sites, as despite both the high total lead concentrations, and the high observed bioaccessibilities, no significantly raised blood lead concentrations were observed. This is essential if we are to provide confidence to regulators, who must decide on the suitability of a site, but also to the residents who want confidence that both physical/social gardening activities and the consumption of their homegrown produce is a greater benefit than risk to health.

---

\*Speaker

<sup>†</sup>Corresponding author: jane.entwistle@northumbria.ac.uk

**Keywords:** Blood lead, oral bioaccessibility, sequential extraction, soil, urban gardens