Newcastle Allotments Lead Biomonitoring Study: Modelling blood Pb in coal ash amended urban soils

J. A. ENTWISTLE[1*], L. BRAMWELL[2], J. MORTON[3] AND T. PLESS-MULLOLI[2]

[1] Dept. of Geography & Environmental Sciences, Northumbria University, Newcastle-upon-Tyne, UK. (*correspondence: jane.entwistle@northumbria.ac.uk)
[2] Institute of Health and Society, Newcastle University, Newcastle-upon-Tyne, UK.
[3] Health and Safety Laboratory, Buxton, UK.

Considerable uncertainty exists in the exposure modelling of Pb in urban allotment gardens. Elevated soil Pb exists on many allotments across NE England, due in part to the long tradition of adding hearth ash as a soil amendment. The aim of the study was to determine the relationship between concentrations of Pb in allotment garden soils, produce and the blood Pb concentration of gardeners to improve exposure assessment at such sites and give greater confidence to regulators.

Study participants were recruited from across three allotments and 31 individual plots were investigated; aqua-regia extractable soil Pb ranged from 58 - 1300 mg/kg (n=284) and soil Pb bioaccessibilities (n=20) ranged from 32% - 76%. Participants (gardeners (n=44) and non-allotment gardening controls (n=29)) provided saliva and blood samples, home-grown produce, home tap water samples, home dust samples, atmospheric deposition samples and completed a questionnaire on potential Pb exposure factors (e.g. produce consumption rates, outdoor exposure duration and frequency, age, gender, occupation).

Blood Pb levels ranged from 0.6 - 11.4 μg/dL. Accounting for confounding factors, a significant correlation with blood Pb concentration was only observed for age (female). Even at soil Pb concentrations >10 times over the current UK soil screening value for allotments of 80 mg/kg, blood Pb concentrations were below 5 μg/dL. Our work highlights the need to better model exposure within urban allotments if we are to provide a robust, relevant and applicable soil Pb screening value at such sites.