Introducing the human health impact of contaminated land (from allotment land use)

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Introduction
In the UK, there is an increasing demand for allotment plots, which increases the pressure to re-use urban or brownfield land as allotments. Therefore, it is important that the actual risks posed to human health from allotment land use are clearly understood. However, the current exposure models (e.g., CLEA) used in contaminated land risk assessment are highly conservative, which leads to over-estimation of actual exposures. Consequently, this may lead to unnecessary remedial work being undertaken at a substantial cost to businesses and taxpayers, or possibly cause brownfield sites to remain derelict if developers are unable to meet the remediation costs.

This study aims to develop a better understanding of the actual levels of human exposure to soil-bound metal contaminants (using allotments), in order to promote sustainable contaminated land management.

Key objectives
• To develop a better understanding of actual levels of human exposure to soil-bound contaminants.
• To provide a platform for a more sustainable approach to the management of contaminated land.

Methodology
• Recruitment of volunteers, collection of allotment samples (soil and vegetables/fruits), moist-wipe samples from hands while volunteer is working at the allotment, air-born dust sampling at selected allotments, and collecting biological samples.
• Laboratory analysis of samples for selected metals (As, Cd, Cr, Pb, Ni).
• Producing a human physiologically-based pharmacokinetic (PBPK) model, which will be implemented using computer software MATLAB.
• Ethical approval for the study has been obtained from the university REC.

Biological monitoring
Human biological monitoring is a recognized tool in assessing human exposure to environmental pollutants [3]. It involves the assessment of an individual’s exposure to a hazardous agent through the measurement of a biomarker which results from exposure to the agent.

Participants are asked to provide samples of their urine and blood (optional). The pilot study phase of biological monitoring is currently on-going, but the main study is scheduled from mid-2015, following refinement of study procedures based on pilot study findings.

PBPK modelling
A PBPK model is a quantitative description of the absorption, distribution, metabolism and excretion (ADME) of chemicals in the body [2], and is well recognised as a framework for simulating and predicting the fate of substances in the body [3].

Figure 1 is a sketch of a simplified PBPK model (for As, Cd, Cr, Pb) using key body tissues, which includes the main points within the host following metal ingestion as determined from the literature. The model will be implemented using the software package MATLAB.

Industrial relevance of the project
Results from this study will be used to improve our understanding of the risk posed to human health from soil-bound metal contaminants. This will subsequently lead to a more sustainable management of contaminated land and supports the creation of sustainable built environments.

Study Volunteers Required – can you help?
I would like to recruit adult volunteers (18 years and above) who have allotments and consume produce from their allotments; and any adults in their households who also consume produce from the allotments, to participate in the main study scheduled from mid-2015.

If you would like to help with the study, or if you know anyone who may be able to help, please contact me using the details given below. Likewise, for more information about the project, please contact me. Thank you.

References

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