

Assessment of Soil Quality and Human Health from Organic Contaminants in Materials Commonly Spread on Land (Scotland)

Spreading organic materials to land as soil amendments can supply nutrients and organic matter and has the potential to improve soil quality. It also promotes the sustainable use of materials that are considered wastes under some circumstances. The spreading of these materials to land is controlled by regulations, which ensure that the benefits are realised, and that any potential risks to either the environment or human health are minimised.

There may be cases where the levels of chemicals in soil amendments from some sources present potential risks to human health or the environment, despite regulations being in place. This project was aimed at identifying chemicals in soil amendments that might be spread to land in Scotland and their likely concentrations, and gathering together environmental and human health related effects data, as well as behaviour and fate information. This information was then used to perform an assessment of the potential risks to identify the form, magnitude, and characteristics of risks from chemicals present in organic wastes applied to land in different parts of Scotland.



Animal manures represent the bulk of soil amendments going to land in Scotland (over 95%) and, due to their numbers and larger size, the majority of this comes from cattle rather than poultry, pigs or sheep. Other important sources of chemicals from the use of organic soil amendments are processed sewage sludge, produced by municipal sewage treatment plants, and the products of certain processes which are exempt from waste management licensing, such as off-specification composts, anaerobic digestates and paper manufacture by-products.

An initial screening risk assessment of 80 chemicals identified from the literature was performed to produce a priority list of 8-10 chemicals which presented the greatest potential environmental and human health risks. The chemicals investigated in detail were:

- Tetracycline,
- Ivermectin,
- Triclosan,
- Benzo-a-pyrene,
- Galaxolide (HHCB),
- Polybrominated diphenylethers,
- Polychlorinated biphenyls (PCBs)
- Dioxins and dioxin-like PCBs

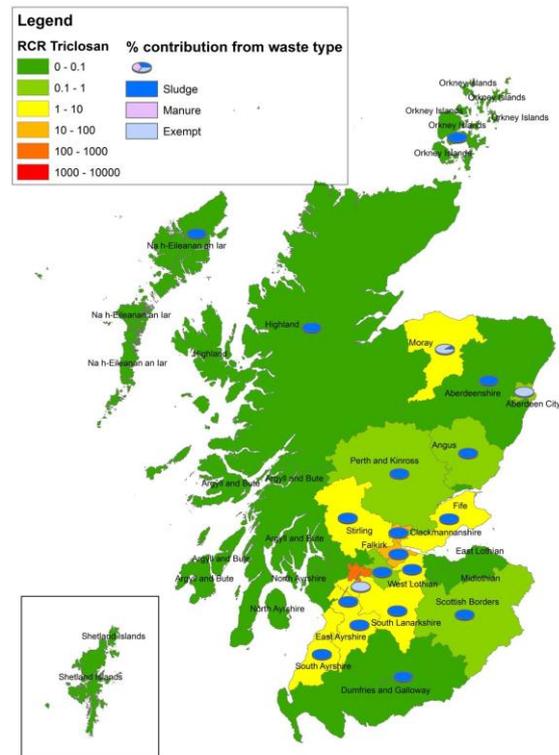
The exposures of all of these chemicals were modelled to assess potential risks from organic material spreading across Scotland. These assessments demonstrated that the greatest potential risks for human health and soil quality mostly occurred in Central Scotland. This was true for both contaminants mainly associated with slurries and manures (e.g.

tetracycline) and contaminants mainly associated with sewage sludge and industrial by-products (e.g. triclosan), probably because this area contains the highest densities of both farm animal and human populations, so manure and waste production is high, leading to higher spreading rates. However, an accurate likelihood of impact on soil quality or human health cannot be determined for most organic contaminants, largely because concentrations in materials spread to land are uncertain and are probably highly variable.

Some chemicals identified in soil amendments as potentially presenting an environmental risk, such as nonylphenol, phenol and linear alkylbenzene sulphonate (LAS), have relatively short half-lives in soils. This is because they are biodegradable and means that they would be unlikely to accumulate in soils over time. Biodegradable chemicals present a lower risk than those that remain in the soil for long periods, and accumulate through repeated application of the soil amendments.

Quantitative risk assessment for human health was undertaken for dietary exposure resulting from the presence of contaminants in soil amendments applied to agricultural land. This focused on dioxins, and considered their potential to be present at low levels in soil amendments and to transfer and accumulate through the food chain. The results of the assessment indicated that there was no risk to health expected from the use of the soil amendments.

Refinement of the risk assessments for two of the chemicals (HHCB, and ivermectin) demonstrated that the uncertainties in results could be greatly reduced by using measured (instead of estimated) data for the concentrations of chemicals in the soil amendments, and taking the organic carbon content of the receiving soil into account.



Finally, a feasibility study was undertaken to determine the capability of commercial laboratories to analyse organic materials for the priority chemicals that were identified. The results from this exercise demonstrated the paucity of commercial laboratories with the skills or experience to determine the concentrations of these types of determinands, with only two of ten laboratories filing a positive return. Neither of the laboratories which provided a positive response were able to analyse for the complete list of chemicals which were identified as priorities.