science summary

Environment Agency

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UK Soil & Herbage Pollutant Survey: project summary

Science summary: SC000027

The Environment Agency is today publishing the results of a major survey of contaminant levels in soil and herbage in England, Scotland, Wales and Northern Ireland. The 27 month survey presents valuable information about a range of pollutants including PCBs, dioxins, polycyclic aromatic hydrocarbons and trace metals in soils and herbage. For many contaminants, the survey provides the first coherent picture of their concentrations across the UK. The results provide a reliable baseline against which intensive local surveys and future national surveys can be assessed, and will help the Environment Agency and others to monitor and remedy pollution events more efficiently.

Samples of soil and herbage taken from 122 rural, 28 urban and 50 industrial locations were analysed for metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) and dioxins. All the contaminants studied are regarded as persistent in soil; metals because they are strongly retained by soil particles; the organic compounds (PCBs, PAHs and dioxins) because their breakdown to carbon dioxide by soil micro-organisms takes years or even decades.

The results in UKSHS show that, for all the metals studied (and arsenic), concentrations in industrial soils are significantly higher than in rural areas. Concentrations of copper, lead, mercury, nickel, tin and zinc are higher in urban soils compared with rural soils, probably reflecting the presence of significant industrial activity in urban areas in recent times. Herbage concentrations of chromium, copper, lead, nickel, titanium and zinc are higher in urban and industrial areas compared with rural areas.

Differences in metal concentrations across the four countries of the UKSHS are partly because of the complex underlying geology in the UK and partly because of differing human inputs. For example, high concentrations of titanium in rural and urban soils from Northern Ireland and Scotland reflect the occurrence of titanium-rich basaltic rocks in these areas rather than man-made pollution.

The UKSHS results for PCBs indicate that the concentrations of PCBs in soil have fallen approximately 800-fold since restrictions on their production were introduced in the mid-1970s. However concentrations of PCBs in soils and herbage in urban and industrial areas are still approximately 1.5 times those in rural areas, suggesting PCB sources remain in these areas. Identifying the source of PCBs from total concentrations in soil and the pattern of individual PCBs is difficult because characteristic ‘fingerprints’ or ‘source signatures’ tend to change during aerial transport and subsequent degradation in soil. However, the total concentrations and the pattern of individual PCBs suggest they probably enter the UK environment as a result of leakage or volatilisation from sources such as transformers or PCB-containing building materials.

Of the three groups of persistent organic pollutants studied in UKSHS, the urban and industrial footprint of PAHs is the most marked. Concentrations of total PAHs and benzo(a)pyrene in urban and industrial soils are approximately 5–7 times those in rural areas, whilst concentrations in herbage are 2–5 times those in rural areas. Concentrations of total PAHs and benzo(a)pyrene are lower in rural soils and herbage in Scotland compared with England. Concentrations of total PAHs in rural herbage in Northern Ireland are approximately twice those in England. Increased contributions from acenapthene and anthracene to the total PAH concentrations in Northern Ireland suggest coal burning as a possible cause.

The pattern of PAHs determined in the UKSHS is broadly consistent with recent inventory estimates that traffic and domestic fuel combustion are now the main sources of PAHs in the UK environment. One PAH, benzo(ghi)perylene, which is often asociated with traffic, has a significantly higher contribution to total PAH concentrations in urban and industrial areas than in rural

areas, possibly reflecting the importance of traffic in built-up and industrial locations.

The dioxin data in UKSHS illustrate how comparisons between concentrations in soil and herbage can be useful. Dioxins persist in soil, so soil concentrations reflect inputs over a number of decades. However herbage is much shorter-lived, so dioxins in the plants growing on the soil more closely reflect current atmospheric conditions. Over the UK, concentrations of dioxins in urban and industrial soils are 2–3 times those in rural areas, presumably reflecting historically significant sources in those areas.. In contrast, dioxin concentrations in herbage from urban and industrial sites (when expressed as toxic equivalents) are lower than those in rural areas. Along with the concentration patterns of individual dioxins, this suggests that, overall, industrial processes are no longer a significant source of dioxins, although inevitably there may be individual exceptions.

Other studies have indicated an increase in soil dioxin concentrations between 1850 and 1980 presumably corresponding to the increased industrialisation of Britain. However the UKSHS data suggest that concentrations have dropped by around 70 per cent since then. The size of the decline is surprising and suggests that we may have over-estimated the persistence of dioxins in soil. Less surprising is the drop in dioxin herbage concentrations, which almost certainly reflects the significant reductions in dioxin emissions since 1990.

This summary relates to information from Science Project SC000027 reported in detail in the following output(s):-

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Report 1: Introduction & summary
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Report 6: Intensive sampling and spatial variability in UK soils
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Report 7: Environmental concentrations of heavy metals in UK soil and herbage
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Report 8: Environmental concentrations of polychlorinated biphenyls (PCBs) in UK soil and herbage
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Report 9: Environmental concentrations of polycyclic aromatic hydrocarbons in UK soil and herbage
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Report 10: Environmental concentrations of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in UK soil and herbage
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