

Executive Summary

The Dublin SURGE (Soil Urban Geochemistry) Project aims to create a baseline dataset of heavy metals and persistent organic pollutants (POPs) in Dublin topsoils for the first time. Most cities have well-established monitoring systems for the environmental quality of air and water, while soils as an environmental medium have received comparatively little attention. In urban areas, human activities over time can alter soil's natural chemical and physical properties through the addition of chemical contaminants, waste matter and the disturbance of soil through excavation and landscaping. This project provides information on soil chemistry in the urban environment relevant to the protection of human health, compliance with environmental legislation, land-use planning and urban regeneration.

A total of 1058 samples were taken in topsoil (0-10cm depth) in the greater Dublin area in October and November 2009. Sample locations were chosen randomly to give an overview of baseline conditions in the city. All samples were analysed for 31 inorganic elements including heavy metals.

Results for heavy metals indicate that the concentrations of lead, copper, zinc and mercury are strongly influenced by human activities. The concentrations of these metals are elevated in the docklands, inner city and heavy industry areas. Sources of heavy metals in these areas include historic industry such as metal and chemical works, coal burning in homes and industry, reuse of contaminated soil and modern traffic. Lead concentrations are considered high in inner city locations, a trend which can be attributed to the historic use of leaded paint and petrol in addition to the sources described above.

Concentrations of other inorganic elements in topsoil in the greater Dublin area show patterns which are strongly related to regional bedrock parent material (limestones in the Dublin basin region and the Leinster granites in southern Co. Dublin).

Of the 1058 samples taken, a subset of 194 samples were also analysed for the following persistent organic pollutants:

- Polycyclic aromatic hydrocarbons (PAHs) and
- Polychlorinated bipheyls (PCBs).

Persistent organic pollutants are chemicals which do not readily break down in soil, air or water and they can be taken up by plants, animals and humans through the food chain. Therefore they are a cause of concern for human health and the environment. PAHs are sourced mainly from human activities, namely the combustion of organic matter and fossil fuels in domestic fires, industry and vehicle engines. PAHs are known to cause adverse

human health effects such as dermatitis and bronchitis and they are classed as potential human carcinogens. PCBs are man-made chemicals which were synthesised from the 1930s to the 1980s for use in electrical equipment and building materials. PCBs are classed as potential human carcinogens and potential human endocrine disruptors (affecting the reproductive and hormonal systems). Humans can be exposed to PAHs and PCBs in soil by gardening or playing in contaminated soil, eating food grown in contaminated soil or by inhaling contaminated soil dust which is brought into the home on the wind or on shoes or clothes.

PAHs were detected across the city, with maximum concentrations occurring in the city centre. Concentrations decline towards the outer suburbs. This trend reflects historical sources of domestic coal burning, industrial emissions and modern traffic which are associated with city centre locations. PAH compositions indicated that most PAHs in soils may be attributed to historical coal combustion. Other potential sources of PAH concentrations in Dublin soils include contaminated fill materials in reclaimed land, bonfires, creosote treated wood and recycled tyre products.

Results for PCBs in soil indicate isolated, low level detections of PCBs in Dublin, mainly in the city centre. The PCB compositions in soils indicate that contamination is probably associated with historical industrial sources and old paint rather than modern, active sources.

Advances in environmental protection have been made in recent decades in Dublin with the bituminous coal burning ban, the regulation and licensing of industry and remediation of many inner city contaminated sites through redevelopment. Although traffic volumes have increased over the years and vehicle emissions are now the main pressure on Dublin's air quality, vehicle engines are becoming cleaner. These factors are reducing heavy metal and PAHs emissions which can impact on topsoil quality. However active measures are required to ensure good land management practices in relation to the reuse of contaminated soil and dealing with contaminated soils.

Ireland does not yet have dedicated contaminated land guidance to help landowners assess the potential risks from contaminated land to human health and the environment. Other countries have successfully established guidance and regulation through collaboration of environmental experts, health authorities and regulators. It is recommended that a contaminated land guidance and regulatory regime is put in place for Ireland, in order to prevent deterioration of Ireland's soil resource, especially in public areas where people can come into contact with urban soil.