

Contaminated land

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The Department for Environment, Food and Rural Affairs (Defra) says:

England has a substantial legacy of chemical contaminants in soil, much of it caused by industrial and domestic pollution. Land contamination can pose a threat to the environment and the health of humans, animals and plants. Policy in this area addresses:

- *Measures to find and deal with existing contaminated land.*
- *Measures to prevent more contaminated land being created. These include policy and legislation on pollution, waste, water and chemicals¹.*

Most soils contain small quantities of contaminants, often caused by natural geological changes. In these cases, the risks to human health and the environment are low. However, some land contains levels of contaminants that may pose unacceptable levels of risk. This land is 'contaminated land' in the legal sense.

Soil contamination falls into four categories:

- atmospheric deposition (pollutant gases and particulates);
- agriculture (fertilizers and pesticides that 'escape' and get into surface and groundwater);
- waste management and recycling including sewage sludge (metal ion and organic compound contamination);
- industry, mining and historic land contamination (metal ion and organic compound contamination).



Figure 1 Leaching from land-fill sites is one source of soil contamination.

Metal contamination

A number of metal ions are micronutrients essential for the healthy growth of plants. However, very high concentrations of some of these may harm the plants. Zinc is an example.

Further, soil may contain metals that are not nutrients, and some may be toxic to the plant or animals that feed on the plant. These harmful metals are often referred to as 'heavy metal pollutants'. They include:

chromium, Cr	cobalt, Co	nickel, Ni	copper, Cu	zinc, Zn
arsenic, As	selenium, Se	silver, Ag	cadmium, Cd	tin, Sn
antimony, Sb	mercury, Hg	thallium, Tl	lead, Pb	uranium, U

Notes: A heavy metal is one with a relatively high density, typically greater than 5 g cm^{-3} , or with a high relative atomic mass. Arsenic and selenium are often called 'semi-metals' because their properties are somewhere between those of metals and those of non-metals.

¹ <http://www.defra.gov.uk/environment/quality/land/>

Some contaminating metals of particular concern and examples of their sources:

Lead	plumbing, petrol, paint	Arsenic	wood preservatives
Mercury	pesticides, mining	Zinc	electroplating, sludge
Cadmium	phosphorus fertilisers, sludge		

Some examples

- Leaching of metals from disused mines into surface and groundwater has happened in parts of England and Wales, especially in South and West Wales, and Northern England. The main pollutants are iron, zinc, lead, cadmium, manganese and copper.
- Prolonged use of copper-based fungicides in parts of New Zealand has led to combined soil, surface water and ground water copper concentrations of up to 8000 mg kg⁻¹.
- During the California gold rush mercury was used to extract gold (there are mercury deposits in the Coast Ranges). Erosion of mine tailings has led to mercury pollution of San Francisco Bay.
- In the Amazon Basin, gold is extracted by small scale, low technology mining (garimpo) operations. Commonly, but illegally, mercury is used to extract the gold. Quantities of mercury compounds build up in the soil because of its high organic content. Deforestation by burning releases volatile toxic mercury.



Figure 2 Thirty-five years after it closed a disused iron ore mine turned this Teesside beck orange.

Organic compounds

The most common sources of organic pollutants in soil are petroleum products, solvents and pesticides.

Dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenols (PCBs) are compounds that pose a threat to human health.

DDT was the first chlorinated insecticide to be synthesised. It kills, for example, malaria-carrying mosquitoes. The use of DDT was banned by the World Health Organization (WHO) in 1976, but in 2006 WHO reversed this decision and endorsed its use for malaria control.

PCBs are good electrical insulators and were used in many electrical appliances. The Environment Agency says:

There are 209 different PCB compounds. Manufacturers used PCBs in a wide variety of products because they are: chemically inert; stable at high temperatures; flame resistant. PCBs pose a threat to the environment because of their toxicity, persistence and tendency to bio-accumulate, i.e. once they are in the environment or in animals or humans it is very difficult to get rid of them.

PCBs were banned by governments around the world during the late 1970s.

Both DDT and PCBs are examples of persistent organic pollutants – organic compounds resistant to environmental degradation. As a result they remain unchanged in soil for generations.

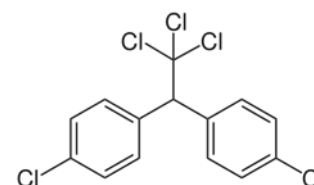


Figure 3 Molecular structure of DDT.

Finding out

How is contaminated land 'cleaned up'?