Contamination

Contamination of soil, water and air by the toxic biological and chemical byproducts of human activities has been a feature of our environment ever since the industrial revolution and, in some cases, since civilization itself began.

Awareness of the risks posed by contamination has climbed sharply in the last half century, as science has demonstrated its effects on the health and safety of our water, food supplies and environment as well as on the health of individuals.

These range from well-understood cases of poisoning due to substances such as arsenic, cadmium, lead, certain pesticides or chemical compounds to a mounting suspicion that some chronic diseases seen in society today may in part be attributable to the community's low-level exposure over time to a 'cocktail' of contaminants.

Most productive human activities that concentrate raw materials and generate waste are capable of causing contamination – and this needs to be dealt with, sooner rather than later.

Contamination may also occur naturally, as a result of concentrations of toxic elements in particular soils, rocks or water bodies

Extent of contamination

Contamination affects every country in the world, whether or not it is industrialised, and probably affects every individual.

The industrial nations have a legacy of contamination extending back for 200 years resulting mainly from mineral processing, heavy manufacturing, fertiliser and pesticide use. This occurs in soils and water at sites where, or close to where, these industries have operated. Most citizens of these countries are probably exposed to some degree, as blood tests confirm.

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However volatile organic compounds which have entered the global circulation of atmosphere and water have also been found in wildlife and humans in remote places such as the Arctic, far from any possible industrial source, suggesting that the entire human is exposed to this form of pollution.

Worldwide the number of contaminated industrial sites is thought to number 5-10 million. In Asia alone there are estimated to be between 3-5 million sites and the number is undoubtedly growing due to recent economic development. Most of these sites are in urban areas with people living close by, eating food from their soils or relying on groundwater which may contain the contaminants.

Australia has many potentially contaminated sites. These include former factories and tanneries, fuel dumps and chemical stores, service stations, munitions plants, farm livestock dips, timber treatment plants, oil and chemical refineries, landfills and the sediments of rivers, estuaries and coastlines where waste has in the past been piped for disposal.

Natural contamination

An example of hazardous natural contamination exists in more than 20 countries worldwide where arsenic is a problem in groundwater. The source of the arsenic is usually soils of volcanic origin naturally rich in this metal, which is then mobilized into groundwater which can be used for household purposes, irrigating crops or for livestock. In some countries coal mining and use of poor quality coal have also led to poisoning outbreaks.

The worst case of arsenic contamination is in Bangladesh where 35–77 million people are thought to be exposed and tens of thousands of cases of poisoning have been documented.

Types of contamination

Contamination has a wide variety of forms, but is chiefly:

- inorganic, such as mercury, chromium, arsenic, selenium, fluorine, cadmium, lead, nickel and copper
- radionuclides including uranium
- asbestos
- organic, consisting of chemical groups such as Persistent Organic Pollutants (POPs), Polychloro biphenyls (PCBs), Polyaromatic hydrocarbons (PAHs), carcinogens such as benzene etc.
- biological, by disease-causing organisms.

Bioavailability and risk assessment

In recent years scientists have recognised that the presence of a contaminant does not automatically mean there is a risk to people.

The contaminant must first be bioavailable, meaning that it is capable of being taken up by humans through drinking water, by inhaling dust, through the skin or by eating contaminated plants or animals.

Most organic contaminants break down in the soil over time into harmless fractions, so any risk tends to diminish. This process can be artificially accelerated to make sites safe.

Inorganic compounds like metals have different species some of which are less toxic than others. These metals also tend to bind with other materials in the soil over time, becoming less available to humans and the food chain.

The concept of risk assessment depends on scientifically assessing the extent of bioavailability of various toxic substances in a soil and, based on risk found, the development of a clean-up plan which minimises this. For details, see CRC CARE Fact Sheet 2 – Risk Assessment.

Clean up – a growing business

Awareness of the extent of hazards to human and environmental health from contamination has prompted global interest in better ways to assess and deal with it.

Remediation is becoming a big business worldwide, worth an estimated $US20-40 billion. Germany, for example, plans to spend $US2.5 billion in the next five years on remediating old sites. Hungary puts its clean-up bill at $2 billion, South Korea and Switzerland at $3 billion apiece. In Australia the cost of remediating known and potential sites is estimated at $US3-4 billion. The cost of remediating dioxin-contaminated sediments in Sydney Harbour alone has been estimated at around $A2 billion.

CRC CARE is at the forefront in developing new technologies and partnerships for risk assessment and remediation. For further details see CRC CARE Fact Sheets 2 and 3, Risk Assessment and Remediation.

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CRC CARE is a partnership of organisations providing research, technologies and knowledge in assessing, preventing and remediating contamination of soil, water and air.

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