



The risk to human health

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The British Geological Survey has been involved in landfill research for over twenty five years. Currently the Department for International Development (formerly the Overseas Development Administration) is supporting landfill research into human health risk in newly industrialised countries and sites are being studied in Thailand, Mexico and Jordan. A feature of these countries is that waste disposal is often unregulated and very few waste disposal sites are engineered for containment and treatment of the fluids leaching from the site (leachates). Furthermore the waste tends to have a very high component of organic matter and frequently contains hazardous (e.g. medical) and industrial wastes. When waste degrades, a highly mineralised solution of inorganic and organic components, is generated. Heavy metals can be important, e.g. leachate from the Leon Guanajuato landfill, Mexico, has very high chromium content due to the disposal of tannery wastes. Solvents, petroleum compounds, phenols and aromatic hydrocarbons are also detected in many leachates derived from mixed domestic / industrial wastes.

Landfills

Lack of engineering controls permits leachate migration off site and the possible contamination of shallow aquifers which are often the only source of potable water supply. To look at the human health risks associated with leachate release, the Merida Municipal Waste Disposal site in Mexico has been studied. The site is characterised by Pliocene and Miocene limestones forming a regional platform, six to seven metres above sea level. The water table is at about 1.5 metres above sea level and shallow groundwater abstraction from hand dug wells is common.

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Risk assessment work involves characterising the hazard then determining the pathway to the receptor and its likely response to the hazard. In the context of waste disposal our concern is with the toxic hazard of leachate contamination of groundwater. This is usually evaluated within some form of regulatory framework or by comparison with a guideline value.

As a means of assessing the biological hazard associated with sewage disposal at the site, a programme of on-site sampling and the culture of heat tolerant coliform

bacteria was carried out. The results indicated that the leachate may be a source of pathogenic contamination. All of the water supply wells tested were found to be contaminated by these bacteria and sewage is the indicated source. There also appears to be a high background level of faecal contamination, which may be related to the general urban contamination migrating from beneath the city of Merida itself.

In order to evaluate the hazards the leachate chemistry was determined and a study of the groundwater chemistry surrounding the site was made. This involved sampling leachate seepages, purpose built monitoring wells and the shallow, hand dug wells used for groundwater abstraction. By contouring the distribution of specific compounds it is possible to define a contaminant plume. Chloride gives a reliable indication of the extent of the contaminant plume as it does not degrade. Dilution and biodegradation of organic matter occur within the plume as it migrates down gradient and the impact of the waste site is not evident beyond about one kilometre. Point risk assessments have been conducted and give a clear signal that unacceptable toxic and carcinogenic risks are present from organic contaminants in the groundwater close to the landfill.



Sampling groundwater at a purpose built monitoring well.