ECG Environmental Briefs

Asbestos in soils (ECGEB No 5)

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The UK along with other industrialised nations has a legacy of land that is contaminated with materials from previous use or from naturally occurring sources. This Environmental Brief outlines asbestos in soil, the risks and assessment methodologies available.

In the UK, asbestos was extensively used in buildings and other products in the 20th century. In 1970, strict regulations were introduced to regulate the use of asbestos in the workplace and to limit employees' exposure to it. There are three main mineral types: amosite (brown) and crocidolite (blue), use of which was banned in 1985, and chrysotile (white), use of which was banned in 1999 in the UK.

There is a background concentration of airborne asbestos fibres in the environment due to historic usage and waste disposal. Asbestos in buildings is strictly regulated in the UK (e.g. through the Control of Asbestos Regulations 2012) with surveys, registers and removal methodologies. In contrast, the presence of asbestos in soil is usually only discovered during site investigation work prior to redevelopment of a site or if the site is deemed potentially "Contaminated Land".

Chrysotile, white asbestos, empirical formula $Mg_3(Si_2O_5)(OH)_4$. Image credit: Shutterstock

Asbestos can be present in the environment as free fibres or bound in a matrix as an asbestos-containing material (ACM). Naturally-occurring asbestos is not commonly found in UK soils; it is therefore most likely that manmade ground (such as ash, demolition materials, and spoil) is the primary source, and it is likely to be commonplace within the soil matrix at brownfield sites. Asbestos usually occurs discretely in an impacted area and will not undergo biodegradation over time to form less harmful materials (i.e. it is very persistent), although ACMs can be physically degraded over time. It can migrate through physical disturbance, resulting in possible release of its dangerous fibres.

Asbestos toxicology mainly affects humans rather than being a risk to the environment. Asbestos fibres that are not in the air cannot be inhaled and hence do not pose a significant risk to health until they become airborne, can be inhaled, and are retained in the lungs. Inhalation of asbestos fibres can produce a range of lung-associated diseases, including asbestosis, lung cancer, and mesothelioma. The latter two diseases are considered to be the primary diseases of concern at asbestos exposure levels in the environment.

Assessment methodologies

UK: Asbestos on contaminated sites, ICRCL, 1990

This guidance was published in 1990 in the UK by ICRCL (1) based on contemporary research; it reported that soils containing as little as 0.001% free asbestos fibres could liberate significant airborne free fibre concentrations. Although 0.001% has been considered a screening value by some risk assessment practitioners since the 1990s, recent guidance by CIRIA (C733) on asbestos in soil indicates that 0.001% is not a level below which ICRCL considered risks to be acceptable.

UK: Asbestos in soil and made ground (C733), 2014

In March 2014, UK guidance on asbestos in soil was published by CIRIA (2). This guidance has stated that screening values for asbestos in soil such as 0.1% and 0.001% should not be used in the UK and that an appropriate generic screening value cannot be derived at present without a policy decision because of the limited understanding of the soil-to-air fibre release relationship for asbestos. The risk assessment for asbestos is a function of the composition and quantity of fibres released from the soil, the exposure scenario, and the critical receptor. The CIRIA guidance has proposed

adopting exposure risk assessment models that predict the lung cancer and mesothelioma risks associated with exposure to airborne asbestos.

Netherlands: RIVM (2003)

Dutch intervention values (3, 4) are used as generic soil standards (Tier 0) to trigger remediation. A tiered approach to assess the risk from asbestos in soil considers site specific circumstances at each tier, with less conservatism relative to the previous tier. An intervention value for asbestos was derived at 0.01% w/w fibre equivalents for friable and bound asbestos, and 0.1% w/w fibre equivalents for bound asbestos assessed to be in "good condition" (not seriously weathered or eroded).

Australia: Guidelines on the assessment, remediation and management of asbestos contaminated sites in Western Australia, May 2009

In 2009, guideline values for asbestos-containing materials in soils were derived for the following categories (5): asbestos-containing material (ACM – non-friable matrix material); fibrous asbestos (FA – friable and fibrous material); and asbestos fines (AF – sub-7mm material including free fibre).

The guideline values are as follows:

- 0.001% weight for weight (w/w) asbestos for FA and AF (all site uses)
- 0.01% w/w asbestos for ACM (residential use, childcare centres etc.)
- 0.04 % w/w asbestos for ACM (residential, minimal soil access, e.g. residences having fully and permanently paved yard space)
- 0.02% w/w asbestos for ACM (parks, public open spaces, playing fields etc.)
- 0.05 % w/w asbestos for ACM (commercial and industrial sites).

These criteria can be used as soil clean-up goals, or site-specific goals can be developed. Asbestos buried deeper than 3 metres below ground level is not usually regarded as contamination provided it is not likely to be disturbed.

The examples from the Netherlands and Australia show that generic screening values are available overseas. However, UK practitioners and regulators of contaminated land are left in a situation where there is an increased awareness of asbestos-related risk and liability on sites, yet there are no authoritative UK-generic screening values for asbestos in soil.

Remediation

If asbestos in soil presents a potentially unacceptable risk to human health, the most likely remediation strategy is to remove the ACMs that are present or encountered during remediation, although these works may inadvertently expose workers and/or members of the public to asbestos fibres through disturbance. The exposure of site workers during any excavation, storage, treatment, placement, or disposal of asbestos should be assessed and managed in accordance with the regulations. The damping down of soils before and during remediation can significantly reduce the release of airborne fibres.

Chemical, thermal and biological treatment techniques that are applicable to organic contaminants such as benzene are ineffective on asbestos as it does not burn; it is biologically inert and chemically unreactive. In the presence of contaminants other than asbestos, the likely preferred option will be one that mitigates both the risks from asbestos and from the other contaminants.

Where asbestos is the single or primary contaminant in soil, the remedial options include leaving the asbestos in-situ and undisturbed with or without a capping layer comprising uncontaminated soil; re-use of asbestos in soil; treatment of asbestos in soil e.g. separating asbestos pieces from the soil through hand-picking or solidification/stabilisation of the soil; or off-site waste disposal of asbestos in soil to a suitably licensed landfill.

Acronyms

ICRCL Inter-Departmental Committee on the Redevelopment of Contaminated Land
CIRIA Construction Industry Research And Information Association
ACM Asbestos-containing material

References

1. Asbestos on Contaminated Sites, ICRCL (1990); http://www.eugris.info/envdocs/ICRCL64_85.pdf
2. Asbestos in soil and made ground: a guide to understanding and managing risks, C733, CIRIA (2014).
3. F. A. Swartjes and P. Tromp (2008), A tiered approach for the assessment of the human health risks of asbestos in soils, *Soil and Sediment Contamination* , **17**(2), 137–149.
4. Assessment of the risks of soil contamination with asbestos, RIVM Report 711701034 (2003).
5. Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia, 2009; http://www.public.health.wa.gov.au/3/1144/2/