Asbestos in soil and made ground: a guide to understanding and managing risks

P Nathanail  Land Quality Management Ltd
and University of Nottingham
A Jones  Institute of Occupational Medicine
R Ogden  Land Quality Management Ltd
A Robertson  Institute of Occupational Medicine
Asbestos in soil and made ground: a guide to understanding and managing risks
Nathanail, C P, Jones, A, Ogden, R, Robertson, A

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<td>This guide provides coherent information for clients, landowners or developers and their advisors, regulators and other stakeholders on the safe investigation, assessment and remediation of soil and made ground containing, or suspected of containing, free asbestos fibres or asbestos-containing materials. It contains a digest of contemporary information and guidance with the aim of raising current good practice.</td>
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Front cover: Amlanos mine, Troodos, Cyprus. From the archives of Jules Chr. Parisinos 1924–2009 (courtesy Marina Parisinou)
Summary

The term ‘asbestos’ relates to several fibrous minerals regulated under UK law that are known to cause serious health effects (including mesothelioma and lung cancer) when inhaled. Asbestos containing materials (ACMs) were widely used in construction, and it is difficult (and sometimes not possible) to ensure that all asbestos is removed before demolition. Building rubble is liable to contain ACM, and may contain free fibres. ACM fragments in rubble or soil can be difficult to detect by the naked eye whereas free fibres in rubble or soil are generally not visible.

The Control of Asbestos Regulations (CAR) 2012 requires actions to ensure the protection of workers and general public from asbestos exposures resulting from work activities. However, current case law suggests that landowners and developers could find themselves liable for claims under the Compensation Act 2006 in the future, even if CAR and planning requirements have been satisfied. In order to avoid such claims, adequate attention needs to be paid to potential risks from asbestos-containing soils (ACSs) during all redevelopment.

The concentration of airborne fibres released is influenced by many factors including asbestos type, ACM type and condition/state, depth, distribution and concentration in soil, soil type, and soil moisture content. There is limited data on the release of airborne fibres from soils in real world environments, but soil moisture content has a particularly significant impact. Increasing amounts of fibres are likely to be released over time as ACMs deteriorate. Friable ACMs (e.g. lagging and asbestos insulating board) release fibres much more easily, and are likely to deteriorate faster, than firmly bound materials (e.g. asbestos cement), which may take a very long time to degrade, if undisturbed.

In principle, the general tiered approach to the assessment and management of potential risks posed by ACSs is the same as that for any other contaminant. However, the unique nature of asbestos means that different methods of analysis, exposure estimation and risk estimation are required. Importantly, soil and air analysis methods may need to be more detailed than those currently commonly used to demonstrate compliance with CAR.

This guide identifies several key areas of uncertainty in current understanding, and recommendations are made for future research and policy making in order to address them. However, due to these uncertainties, the characterisation and assessment of potential risks is not straightforward, with similar difficulties also being encountered in other developed countries. This guide recommends a ‘lines of evidence’ approach whereby more than one method is used to estimate the airborne fibre concentrations likely to be generated from soils at the site. Except at low-risk sites, measuring soil concentrations alone is unlikely to be sufficient. Based on the estimated airborne concentrations, cumulative exposures can be estimated for exposure scenarios relevant to the site under assessment, and existing exposure-risk models are available to indicate the level of risk such exposures may pose. Asbestos in soil thresholds cited for other purposes (such as the hazardous waste threshold and the detection limit mentioned in ICRCL, 1990) should not be used for the assessment of risk.

The requirements of CAR 2012 and other relevant legislation (e.g. relating to waste and the carriage of dangerous goods) need to be complied with throughout. Due to high public awareness of the dangers of asbestos, effective risk communication will also be required at many affected sites.
Acknowledgments

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Authors

Paul Nathanail MA(Cantab) MSc DIC PhD EuroGeol CGeol SILC
Paul Nathanail is professor of engineering geology at the University of Nottingham and managing director of Land Quality Management Ltd. He runs the Nottingham e-learning Masters course in contaminated land management. He is a chartered geologist and Specialist in Land Condition (SiLC). The pioneering work of LQM in developing generic assessment criteria for substances for which no SGV was available revolutionised generic quantitative risk assessment under the planning regime. The LQM/CIEH Dose Response Roadmaps have since been developed to assist local authorities in evaluating whether or not sites pose a significant possibility of significant harm.

Alan Jones BSc (Hons) MPhil PhD
Alan Jones is a senior consultant at IOM. He has been involved in health and safety research at IOM for over 30 years, and has assisted or led many studies relating to asbestos. He has worked with a wide variety of clients, including UK Government departments, HSE, Defra, local authorities, US NIOSH, UK and international companies. Alan is currently associated with expert witness work (concerning asbestos litigation) and provides advice on asbestos in soils and also incidents involving exposures to asbestos. Alan has written over 100 published papers and reports.

Richard Ogden BSc (Hons) PhD
Richard Ogden is a senior environmental scientist at Land Quality Management Ltd, and has over 10 years’ experience in the field of contaminated land assessment and remediation. He gained a degree in biochemistry and marine biology and went on to study the genetic and molecular bottlenecks in the biological remediation of BTEX, PAHs and PCBs at the University of Wales, Bangor. Richard is a member of the team responsible for the development of the LQM/CIEH Dose Response Roadmaps and both first and second editions of the LQM/CIEH GAC.

Alastair Robertson BSc (Hons) PhD
Alastair Robertson has recently retired from his post as a senior consultant at IOM. He was involved in IOM’s research and consultancy relating to health at work and in the general environment for almost 40 years. He was a member of IOM’s Board of Management for 18 years and was in charge of IOM’s consultancy and services work for 10 years. His experience in asbestos in soils extends over 25 years, working more recently on major, ground-breaking projects for both public and private sector clients.

Project steering group

Rachael Adams Ministry of Defence (MoD)
Bill Baker Independent consultant (representing Chartered Institute of Environmental Health
Chris Barrett Arup
Jane Beckmann  Health and Safety Executive (HSE)
Adam Binney  Network Rail
Seamus Lefroy Brooks  LBH Wembley Geotechnical and Environmental (also representing Association of Geotechnical and Geoenvironmental Specialists)
Stuart Chandler  Peter Brett Associates
James Clay  Campbell Reith Hill LLP
Hazel Davidson  DETS
Claire Dickinson  AECOM (chair)
Frank Evans  National Grid
Matt Hussey  OAMP (formerly Tyser)
Paul Gribble  ALcontrol Laboratories
Matt Griggs  Redhills
Simon Hay  Arcadis
Ian Heasman  Taylor Wimpey (also representing Soil and Groundwater Technology Association
Phil Hellier  Chemtest
Ursula Lawrence  Crossrail
Ian Martin  Environment Agency
David Robinson  Transport for London
Phil Rozier  Lucion Environmental Ltd
Carl Slater  Waterman
Chris Vincett  Hydrock
Paula Whittell  Independent (formerly Berrymans Lace Mawer)
George Wilkinson  Akzonobel
Rebecca Williams  SNIFFER

Project managers
Chris Chiverrell  Project director
Joanne Kwan  Project manager

Other contributors
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This guide represents the views of the authors who are grateful for all the comments and suggestions received from the people and organisations listed. However, the authors acknowledge that the information presented in this guide does not reflect all the views expressed.
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Glossary

**Asbestiform**
Having the form or structure of asbestos. It implies a particular kind of fibrosity in which fibres have high tensile strength and flexibility (from Merriam-Webster online dictionary).

**Asbestos cement**
“Material which is predominantly a mixture of cement and chrysotile and which when in a dry state absorbs less than 30% water by weight” (CAR 2012).

**Asbestos coating**
A surface coating which contains asbestos for fire protection, heat insulation or sound insulation but does not include textured decorative coatings (CAR 2012).

**Asbestos insulating board**
“Any flat sheet, tile or building board consisting of a mixture of asbestos and other material except:
(a) asbestos cement
(b) any article of bitumen, plastic, resin or rubber which contains asbestos, and the thermal or acoustic properties of the article are incidental to its main purpose” (CAR 2012).

**Asbestos insulation**
“Any material containing asbestos which is used for thermal, acoustic or other insulation purposes (including fire protection) except:
(a) asbestos cement, asbestos coating or asbestos insulating board
(b) any article of bitumen, plastic, resin or rubber which contains asbestos and the thermal and acoustic properties of that article are incidental to its main purpose” (CAR 2012).

**Asbestos-containing material (ACM)**
Any material that contains asbestos above trace quantities.

**Aspect ratio**
The ratio of the length of a fibre to its diameter.

**Bonded ACM**
Material where the asbestos fibres are contained in a matrix, such as resins or cement (locked into a matrix, eg asbestos cement, vinyl tiles). If in reasonable condition, the release of respirable fibres from bonded ACMs in soils is likely to be low. HSE (2010) (Appendix 2) gives a table of ACMs in buildings, listed in order of ease of fibre release.

**Brownfield site**
A site that has been affected by former uses of the site or surrounding land, is derelict or underused, is mainly in fully or partly developed urban areas, requires intervention to bring it back to beneficial use, and may have real or perceived contamination problems.

**Cement-bonded asbestos**
Collective term for materials containing asbestos in a cement matrix, including high density (eg asbestos cement) and low density (eg asbestos insulating board) materials.

**Cohort**
A designated group of people followed or traced over a period of time.

**Conceptual site model**
A diagrammatic and tabular representation of the characteristics of the site shows the possible relationships between contaminants, pathways and receptors as well as relevant uncertainties.

**Control limit**
“A concentration of asbestos fibres in the atmosphere when measured in accordance with the 1997 WHO recommended method, or by a method giving equivalent results to that method approved by the HSE of 0.1 f/ml of air (100,000 fibres/m3) averaged over a continuous period of 4 hours” (CAR 2012).
### Abbreviations and acronyms

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<td>ABS</td>
<td>Activity-based sampling</td>
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<tr>
<td>AC</td>
<td>Asbestos cement (see Glossary)</td>
</tr>
<tr>
<td>ACM</td>
<td>Asbestos-containing material</td>
</tr>
<tr>
<td>ACOP</td>
<td>Approved code of practice</td>
</tr>
<tr>
<td>ACS</td>
<td>Asbestos-containing soil</td>
</tr>
<tr>
<td>AIB</td>
<td>Asbestos Insulating Board</td>
</tr>
<tr>
<td>AGS</td>
<td>Association of Geotechnical and Geoenvironmental Specialists</td>
</tr>
<tr>
<td>AIMS</td>
<td>Asbestos In Materials Scheme (quality assurance scheme)</td>
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<tr>
<td>ART</td>
<td>Advanced Reach Tool</td>
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<tr>
<td>ASM</td>
<td>Asbestos source material</td>
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<tr>
<td>ATAC</td>
<td>Asbestos Testing and Consultancy</td>
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<tr>
<td>ATSDR</td>
<td>US Agency for Toxic Substances and Disease Registry</td>
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<tr>
<td>BAT</td>
<td>Best available technology</td>
</tr>
<tr>
<td>BOHS</td>
<td>British Occupational Hygiene Society</td>
</tr>
<tr>
<td>BREF</td>
<td>BAT reference documents</td>
</tr>
<tr>
<td>CAR</td>
<td>Control of Asbestos Regulations 2012</td>
</tr>
<tr>
<td>CAS</td>
<td>Asbestos-containing soil</td>
</tr>
<tr>
<td>CDM</td>
<td>The Construction (Design and Management) Regulations 2007</td>
</tr>
<tr>
<td>CERCLA</td>
<td>Comprehensive Environmental Response, Compensation, and Liability Act 1980 (‘Superfund’)</td>
</tr>
<tr>
<td>CIEH</td>
<td>Chartered Institute of Environmental Health</td>
</tr>
<tr>
<td>CL:AIRE</td>
<td>Contaminated Land: Applications in Real Environments</td>
</tr>
<tr>
<td>CLEA</td>
<td>Contaminated Land Exposure Assessment model</td>
</tr>
<tr>
<td>CLR</td>
<td>Contaminated Land Research reports</td>
</tr>
<tr>
<td>CSM</td>
<td>Conceptual site model</td>
</tr>
<tr>
<td>Defra</td>
<td>Department for Environment, Food and Rural Affairs</td>
</tr>
<tr>
<td>DETR</td>
<td>Department of the Environment, Transport and the Regions</td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Environment</td>
</tr>
<tr>
<td>ED</td>
<td>Electron diffraction</td>
</tr>
<tr>
<td>EDR</td>
<td>Environmental Damage (Prevention and Remediation) Regulations 2009</td>
</tr>
<tr>
<td>EDXA</td>
<td>Energy dispersive x-ray analysis</td>
</tr>
<tr>
<td>ELCR</td>
<td>Excess lifetime cancer risk</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Act 1990</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>GAC</td>
<td>Generic Assessment Criteria</td>
</tr>
<tr>
<td>HEI</td>
<td>Health Effects Institute</td>
</tr>
<tr>
<td>HPA</td>
<td>Health Protection Agency (now Public Health England)</td>
</tr>
<tr>
<td>HSE</td>
<td>Health and Safety Executive</td>
</tr>
<tr>
<td>HSL</td>
<td>Health and Safety Laboratory</td>
</tr>
</tbody>
</table>
1 Introduction

Asbestos is a natural fibrous material. It is known to cause serious illnesses, including lung cancer and mesothelioma. Once thought to be safe, it was widely used for many decades in the UK as a durable, fire-proof and cost-effective material. Historical waste management and demolition practice has resulted in asbestos-containing materials (ACMs) being potentially present in the soil or made ground at any brownfield site. ACMs may have been buried on site intact, broken up and mixed with other demolition wastes, and also potentially imported on site as a contaminant in recycled aggregates/made ground materials. Asbestos cement wastes were also used to improve paths and farm tracks on otherwise greenfield sites.

As the health effects became known, legal controls to protect the health and safety of workers and the public developed. For example, Regulation 16 of the Control of Asbestos Regulations 2012 (CAR) imposes a duty on every employer to “prevent or, where this is not reasonably practicable, reduce to the lowest level reasonably practicable the spread of asbestos from any place where work under his control is carried out”. Other current relevant legislation includes the Construction (Design & Management) Regulations 2007 (CDM) and the Health and Safety at Work Act 1974 (HSWA). These also extend to asbestos found during site reconnaissance visits, ground investigations and other similar activities.

The numbers of deaths from asbestos-related diseases in the UK has risen in recent decades – mesothelioma is no longer a rare form of cancer in the UK. There continues to be unintentional exposure to asbestos in the UK, especially in the construction and building maintenance sectors. To try to prevent such exposure, publicity campaigns (notably the HSE Hidden Killer campaign, see Useful websites) have raised awareness among workers and there continues to be a need to ensure that all workers are alerted to the hazards, including those posed by asbestos-containing soils (ACSs). However, such publicity has resulted in widespread fear of asbestos among the public such that the mere presence of asbestos can result in disproportionate alarm. Consequently, taking account of the risks perceived by workers and the public is important when dealing with ACSs.

Land contamination is considered in risk-based land management frameworks embedded in a wide range of legislation that seeks to protect human health and the environment. The starting point of any risk assessment is the legal context within which the assessment is being carried out coupled with the conceptual site model (CSM) of exposure (SNIFFER, 2007). The Environment Agency (2004) provides a step-wise approach to carrying out risk assessment and remediation.

Although there is considerable guidance on investigating, assessing, and managing occupational exposure to asbestos, there is limited guidance on assessing and managing environmental or non-occupational risks from asbestos in the ground in the context of, for example, common law, planning or Part 2A of the Environmental Protection Act 1990. In addition to addressing non-occupational risks, there is also a need to sign-post existing occupational guidance documents/requirements on asbestos for those undertaking ground investigations.

Recent changes to the Part 2A regime in England and Wales and a review of the regime in Scotland make it timely to provide guidance on risk assessment under Part 2A. Recent court rulings have refined the understanding of liability under the tort of negligence and have implications on risk assessment aimed at ensuring new development is suitable for use.

In compiling this guide, national and international guidance and practice, as well as the limited scientific literature and available case studies, have been reviewed in order to form a defensible evidence base. This review has also allowed the identification of critical gaps and uncertainties in the present understanding of the risks posed by asbestos in soil and made ground.
1.1 **AIM**

The aim of this guide is to improve the confidence in and performance of risk assessment and risk management on sites that contain soils or made ground potentially contaminated by asbestos.

1.2 **OBJECTIVES**

The overall objectives of this guide are to help practitioners:

- understand the risks to health posed by asbestos that may be buried in the ground or dispersed within soils and made ground
- know how to comply with relevant legislation when managing sites where asbestos may be present in the ground or soil, including the Part 2A and planning regimes, the Control of Asbestos Regulations 2012, relevant codes of practice, duty of care, and hazardous waste obligations
- know how to comply with the civil liabilities in negligence and nuisance
- plan effectively for dealing with the possibility of asbestos in any field investigation including advice for desk studies and preliminary site surveys
- know what options are available if asbestos is discovered on-site
- know what to look for and the requirements for laboratory testing including a discussion of ACM and the identification/quantification of asbestos fibres in soil and made ground
- understand how the tiered approach to the risk assessment applies to asbestos taking into account the legislative context
- know and assess the advantages and limitations of various remediation approaches through different project scenarios
- understand the importance of multi-disciplinary teams to the investigation, assessment and remediation of sites affected by asbestos
- know how and when to appoint and manage specialists and how to ensure that they will follow good practice
- specify and record adequate monitoring
- keep verification reports and records of asbestos known to be present in specific media and locations.

1.3 **STRUCTURE OF THE GUIDE**

This guide consists of two main parts:

**Part 1 (Chapters 3 to 9)** contains essential background information and forms the basis for Part 2

**Part 2 (Chapters 10 to 17)** contains more practical information on the methods and procedures used in the assessment and management of affected sites.

In order to understand the relevance of the methods and procedures and to appreciate the sources of uncertainty involved in Part 2, it is important that readers have a thorough understanding of Part 1.

Each chapter starts by stating what it aims to achieve and concludes with a summary of the key findings.

Chapter 2 comprises a short summary of requirements for the assessment and management of risks from ACSs. This is intended to help clients, landowners or developers appreciate the technical and legal issues associated with ACSs and to increase their awareness of what is involved in the appropriate investigation, assessment, remediation and management of asbestos in soil. However, it is not intended as an alternative for consultants and other professionals to reading the detailed guidance contained in Parts 1 and 2.
Part 1
Chapter 3 describes the relevant legislation

Chapter 4 outlines the legal and mineralogical definitions of asbestos and the range of products containing asbestos.

Chapter 5 describes the effects on human health of asbestos inhalation.

Chapter 6 summarises the types and potential magnitude of exposures to inhalable asbestos in the UK.

Chapter 7 summarises practices in other countries.

Chapter 8 addresses compliance with CAR 2012: risk assessments, licensing and training.

Chapter 9 reviews the release of airborne fibres from asbestos in soil.

Part 2
Chapter 10 outlines the requirements for preliminary risk assessment, including the role of the conceptual site model.

Chapter 11 describes the sampling and analysis of soils containing asbestos.

Chapter 12 describes air monitoring and the analysis of asbestos in air.

Chapter 13 describes the process of exposure assessment and how potential airborne fibre concentrations may be estimated.

Chapter 14 describes the process of risk estimation and risk evaluation under specific legal regimes.

Chapter 15 summarises management and remediation options.

Chapter 16 discusses good practice approaches to communicating the potential risks to the public and other stakeholders of identifying asbestos in soils at a site.

Chapter 17 identifies issues to consider when appointing specialists.

Chapter 18 draws general conclusions about current understanding and gaps in knowledge of asbestos in soil and made ground, including recommendations for future work.

1.4 WHAT ARE ‘SOIL’ AND ‘MADE GROUND’?

Within this guide ‘soil’ is used to mean both naturally occurring and man-made unbound mixtures of solid particles of varying size and composition at various moisture levels. Man-made soils are generally referred to as ‘made ground’ and when engineered to a specification are referred to as ‘fill’.

Made ground has been artificially deposited on the former, natural ground surface. It includes engineered fill (such as road, rail, reservoir and screening embankments), flood defences, spoil (waste) heaps, coastal reclamation fill, offshore dumping grounds, constructional fill (eg bunds, landrise), and infilling of excavated voids, such as pits, quarries, opencast sites (Rosenbaum et al, 2003). Associated terms include ‘landscaped ground’ where remodelling of the original ground surface obscures the boundary between excavated and infilled ground. Basements, old tanks, gas holder bases and other voids were commonly used to dispose of demolition and other debris on clearing a site. In the 1970s such spaces were often specifically used to dispose of asbestos-contaminated materials.
1.5 LEGAL CONTEXT

The approach taken to the characterisation and assessment of risks relating to ACSs will be heavily influenced by the legal context. Existing developments are likely to be assessed under Part 2A of the Environmental Protection Act 1990 (see Section 3.3.2). For land to be declared as contaminated under this regime, local authorities need to show either that significant harm is being caused or that there is a significant possibility of significant harm (SPOSH). In the planning process for new developments (see Section 3.3.1), if soil contamination is identified as an issue, responsibility for securing a safe development rests with the developer and/or landowner. Under both contexts, the local authority acts as the primary regulator with reference to land contamination either via environmental health officers or specialist contaminated land officers.

Unless otherwise stated the discussion in this guide focuses on the situation as it pertains to England after April 2012. Specific reference is made to the situation in Scotland, Wales and Northern Ireland.

It should be noted that planning and Part 2A legislation differ between the four countries of the UK. The Control of Asbestos Regulations 2012 apply in England, Wales and Scotland, and in Northern Ireland the Control of Asbestos Regulations (Northern Ireland) 2012 apply.

Civil law (here contract and tort) requires work to be done as accurately as is reasonably possible and also imposes duties to take reasonable care of those who might be affected by works, which includes practitioners, contractors, the public, developers, landowners and other stakeholders.

Standards for what is an acceptable asbestos exposure have become more stringent over the past 50 years. For example, a quantitative occupational exposure limit for asbestos was first introduced into the UK in 1960. That limit has, in effect, become 300-times more stringent over the past 50 years. Given the ongoing concern surrounding asbestos and the incidence of asbestos-related disease, it is also possible that the acceptable criteria for asbestos in soils will progressively tighten in the future.

It is possible that criteria used to define SPOSH under Part 2A may change during the probable lifetime of developments that are currently being constructed. As additional remediation of ACSs post-development is generally hugely expensive, developers may wish to adopt a precautionary approach (additional voluntary remediation) to the assessment and remediation of ACSs during any development.

1.6 UNITS OF MEASUREMENT

A variety of different units are used within the literature cited in this guide relating to asbestos concentrations in soil and air. Within this guide values have been cited in the same units as the source. Where the reader needs to make comparisons, units can be easily inter-converted as shown in Table 1.1. The concentration of asbestos in soil and made ground is expressed in terms of the weight of asbestos per unit weight of soil calculated on a dry weight basis. It is usually reported as a percentage by weight but can also be expressed in mg/kg. The concentration of asbestos in air is usually reported in terms of the number of fibres per unit volume in units of fibres per millilitre of air or fibres per cubic metre of air (Table 1.1). In this guide units of f/ml are used unless the source document does otherwise.
Table 1.1  Conversion between standard units used for soil concentrations (milligrams per kilogram soil (mg/kg) and percentage asbestos by weight (%)) and air concentrations (fibres per millilitre (f/ml) and fibres per cubic metre (f/m³))

<table>
<thead>
<tr>
<th>mg/kg</th>
<th>%</th>
<th>f/m³</th>
<th>f/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 000</td>
<td>1%</td>
<td>1</td>
<td>0.000001</td>
</tr>
<tr>
<td>1000</td>
<td>0.1%</td>
<td>10</td>
<td>0.00001</td>
</tr>
<tr>
<td>100</td>
<td>0.01%</td>
<td>100</td>
<td>0.0001</td>
</tr>
<tr>
<td>10</td>
<td>0.001%</td>
<td>1000</td>
<td>0.01</td>
</tr>
<tr>
<td>1</td>
<td>0.0001%</td>
<td>10 000</td>
<td>0.1</td>
</tr>
<tr>
<td>0.1</td>
<td>0.00001%</td>
<td>100 000</td>
<td>1</td>
</tr>
<tr>
<td>0.01</td>
<td>0.000001%</td>
<td>1 000 000</td>
<td>1</td>
</tr>
</tbody>
</table>

Note
Fibres per millilitre (f/ml) and fibres per cubic centimetre (f/cc; f/cm³) are synonymous.

The health risks from airborne asbestos are usually associated with cumulative exposures, which are representative of the accumulated fibre burden inhaled into the lungs. Cumulative exposures are usually estimated as the product of the airborne fibre concentration (usually in f/ml) and the period of exposure (eg in hours or years) and reported as f/ml.hours or f/ml.years. The calculation of cumulative exposures is described in detail in Chapter 13.

1.7 FUNCTION AND LIMITATIONS OF THE GUIDE

This guide provides coherent information for clients, landowners or developers and their advisors, regulators and other stakeholders on the safe investigation, assessment and remediation of soil and made ground containing, or suspected of containing, free asbestos fibres or ACMs.

It may be used by clients to inform procurement and by professional advisors in demonstrating adherence to good practice. Chapter 2 has been written specifically with clients in mind. It contains a distillation of the key messages of the whole guide.

Phrases such as ‘risk assessment’ and ‘assess the risk’ have multiple interpretations within this guide. The authors have tried to discriminate between ‘health and safety risk assessments’ required under occupational health and safety legislation (such as HSWA and CAR) and ‘soil risk assessments’ needed under development control, Part 2A or other environmental legislation. Both are equally important with respect to the aims of this guide. However, where the distinction is not explicit, the reader will need to infer the appropriate context.

This guide is intended to be read and referred to by practitioners and their clients, landowners or developers, by regulators, policy makers, project managers and other stakeholders. It contains a digest of contemporary information and guidance with the aim of raising current good practice. CIRIA guides are widely recognised as being authoritative and robust but they are only to be used as guidance and have no legal standing per se.

The guide does not seek to be the code of practice being developed by the EIC-CL:ARE Joint Industry Working Group on Asbestos in Soil, Made Ground and Construction & Demolition Materials.

This guide does not include detailed comment on all legal source material – the law changes over time. Also, it should be used only as a starting point when evaluating legal duties and responsibilities, and further research will be necessary.

This guide is up-to-date at the time of writing (2014), however the user should check for any changes in regulations or statutory guidance as well as keeping track of scientific and technical developments.
Part 1

Understanding the risks of asbestos in soil and made ground
3 Legislation relating to asbestos in soil

Aim
This chapter is intended to provide an overview of UK legislation and recent case law concerning asbestos, asbestos in soil, worker protection and risk-based land management.

3.1 INTRODUCTION

This chapter provides an outline of the UK legislation, and recent case law, to guide the technical practitioner in general terms. It is intended to be read in conjunction with the legislative documents and guidance, and aims to signpost key issues that are important in dealing with asbestos-containing land. It does not contain the regulations that apply specifically to licensed asbestos contractors. Where such specialists are retained, readers should supply them with all relevant information that they hold and rely on their expertise. It is also necessary to ensure that appropriate health and safety risk assessments and method statements are prepared for the work and amended when situations change during the project.

A wide range of legislation applies to ACSs (Table 3.1), and this varies from country to country within the UK. Readers should refer to the primary and secondary legislation and any judgments that may become available as well as to relevant approved codes of practice (ACOPs) and guidance for full details of current legislation and/or seek professional advice. In addition to statutes, a range of civil and case law is applicable to ACSs. Readers should presume the law relates to England only unless stated otherwise. On a given site, different legal contexts can apply both consecutively and/or simultaneously. This brief commentary is intended to alert the reader to the issues that may need further consideration.

The following commentary is based on the law as it applies to England. Equivalent provisions apply in the other three countries unless explicitly stated. These provisions are listed in Table 3.1. The law changes over time, so it is important that the reader regularly checks for the most up-to-date legislation.

ACOPs have a special legal status. If employers are prosecuted for a breach of health and safety law, and it is proved that they have not followed the relevant provisions of the ACOP, a court can find them at fault unless they can show that they have complied with the law in some other way.

The HSWA 1974 gives the Secretary of State power to issue regulations on various relevant aspects. The two particularly pertinent to asbestos in soil and made ground are CAR 2012 and CDM 2007.
<table>
<thead>
<tr>
<th>Aspect</th>
<th>Relevant legislation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>England</td>
</tr>
<tr>
<td>Protection of workers and general public</td>
<td>Control of Asbestos Regulations 2012</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Health &amp; Safety at Work etc. Act 1974</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Construction (Design and Management) Regulations 2007</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Management of Health and Safety at Work Regulations 1999</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Common law of negligence or public nuisance</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Construction (Design and Management) Regulations (Northern Ireland) 2007</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Control of Asbestos Regulations (Northern Ireland) 2012</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Health and Safety at Work (Northern Ireland) Order 1978</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Management of Health and Safety at Work Regulations (Northern Ireland) 2000</td>
<td>✓</td>
</tr>
<tr>
<td>Who is liable for remediation costs?</td>
<td>Part 2A of the Environmental Protection Act 1990</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Environmental Damage (Prevention and Remediation) Regulations 2009 (as amended)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Those who are found liable in law for such costs either in breach of contract or under the common laws of negligence or public nuisance</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Part III of the Waste and Contaminated Land (Northern Ireland) Order 1997 (not yet enacted)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Part IIA of the Environmental Protection Act 1990</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>The Environmental Liability (Scotland) Regulations 2009</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Environmental Damage (Prevention and Remediation) Regulations 2009</td>
<td>✓</td>
</tr>
<tr>
<td>Who is liable for compensating mesothelioma victims?</td>
<td>Those found liable under common laws of negligence or public nuisance or breach of statutory duty</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>The Compensation Act 2006 provides that any liability for damages arising whether statutory or at common law is joint and several.</td>
<td>✓</td>
</tr>
<tr>
<td>Site investigation activities</td>
<td>In addition to all those applying to protection of workers and the general public:</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Construction (Design and Management) Regulations, 2007</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Construction (Design and Management) Regulations (Northern Ireland) 2007</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Those found liable in law for such costs either in breach of contract or under the common laws of negligence or public nuisance</td>
<td>✓</td>
</tr>
<tr>
<td>Disposal of ACSS and other asbestos wastes</td>
<td>In addition to all those applying to protection of workers and the general public:</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Hazardous Waste (England and Wales) 2005 and Hazardous Waste (Wales) Regulations 2005 and subsequent amendments (there have been several)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Control of Asbestos Regulations 2012</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Control of Asbestos Regulations (Northern Ireland) 2012</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>The Hazardous Waste Regulations (Northern Ireland) 2005 and subsequent amendments (there have been several)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Regulations relating to the definition transfer and disposal of wastes by Approved Asbestos Contractors</td>
<td>✓</td>
</tr>
</tbody>
</table>
3.1.1 Control of Asbestos Regulations 2012 (CAR 2012)

This section briefly highlights key points in CAR 2012 in relation to asbestos-containing land (Table 3.2). Readers should consult the relevant ACOP (HSE, 2013) for a full understanding of its requirements. The ACOP for CAR 2012 (HSE 2013) was published after the preparation of this guide, while the ACOP relating to CAR 2006 (HSE, 2008) was primarily referred to in the preparation of this guide.

CAR 2012 and CAR (Northern Ireland) 2012 set out several important duties that are likely to be relevant where land contains more than ‘trace’ asbestos content.

CAR apply to ‘premises’, which legally include both buildings and the land surrounding them. They also apply to work places in general including work outdoors and would be relevant to any work activity conducted on asbestos-containing land. Consequently, CAR is relevant to works at any site with ACSs (including walkovers, site investigations and remediation). CAR also apply to employers at commercial or industrial premises built on sites with ACSs. However, CAR is unlikely to be applicable to the protection of residents in properties built on such sites. The protection of such residents should be ensured through the planning and Part 2A contaminated land regimes.

CAR places many duties on the ‘employer’ with respect to employees and extends those duties, so far as is reasonably practicable, to other persons who may be affected by the work activity. This includes subcontractors, members of public and residents ‘adjacent’ to development sites during re-development works. Failure to pass on important information to sub-contractors in order to prevent their exposure to asbestos has been found to be a consequence of poor planning (HSE, 2012d).

CAR sets control limits (0.1 f/ml over four hours and 0.6 f/ml over 10 minutes) and a clearance indicator threshold (<0.01 f/ml) for the concentration of asbestos in air associated with work activities. However, employers are required to reduce exposures to asbestos to the lowest level reasonably practicable below the control limit. No limits are set with respect to concentrations in soils.
CAR requires that the known presence of asbestos at a ‘premises’ be recorded in an ‘asbestos register’, which is an important part of the asbestos management plan. Although not explicitly referred to by the HSE, this could include the known presence of asbestos in soil (discussed further in Section 15.7). It is also arguable that the presumption of asbestos where full inspection had not been possible, which applies under CAR, should also apply to the presence of asbestos in soil (see Regulation 5, Table 3.2).

Table 3.2 Commentary on selected parts of Control of Asbestos Regulations 2012

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CAR came into effect on 6 April 2012.</td>
</tr>
<tr>
<td>2</td>
<td>CAR defines asbestos as the fibrous silicate minerals as listed in Section 2.1 and the control limit as 0.1 fibres per cubic centimetre of air averaged over a continuous period of 4 hours. This limit is much higher than the background levels of asbestos discussed in Chapter 6. So, compliance with the control limit does not necessarily mean that adequate control of environmental pollution has been achieved. (Compliance with the control limit does not even mean that adequate control of workplace exposure has been achieved. Workplace exposure should be kept as low as reasonably practicable.) Monitoring to detect lower concentrations is needed to ensure developments are ‘safe’ under the planning system, but that is not addressed by CAR.</td>
</tr>
<tr>
<td>3</td>
<td>Defines the scope for notification under the Regulations and the key section is the following from Regulation 3: “(2) Regulations 9 (notification of work with asbestos), 18(1)(a) (designated areas) and 22 (health records and medical surveillance) do not apply where: (a) the exposure to asbestos of employees is sporadic and of low intensity; and (b) it is clear from the risk assessment that the exposure to asbestos of any employee will not exceed the control limit; and (c) the work involves: (i) short, non-continuous maintenance activities in which only non-friable materials are handled, or (ii) removal without deterioration of non-degraded materials in which the asbestos fibres are firmly linked in a matrix, or (iii) encapsulation or sealing of asbestos-containing materials which are in good condition, or (iv) air monitoring and control, and the collection and analysis of samples to ascertain whether a specific material contains asbestos”. Conditions (a), (b) and (c) all have to hold if the duties on notification, designated areas, health records and medical surveillance do not apply. The types of work mentioned within paragraph (c) are alternatives. The definition of what would be covered by non-friable materials (para. (c) (i)) may need to be considered in relation to the condition of ACMs found in the land. For example, asbestos cement would normally be considered a non-friable material but historically crushed asbestos cement (where there are fragments and dust from the asbestos cement) is in a condition such that fibres would be easily released and therefore would appear to be a friable material. The conditions in Regulation 3(2) (a), (b) and (c) have changed between CAR 2006 and CAR 2012. The wording is substantially more stringent in limiting the types of work activity that would meet the exemption. For example, paragraph (c)(iii) refers to “removal without deterioration of non-degraded materials” whereas the 2006 version did not mention ‘non-degraded’. It would be necessary to consider whether materials that have lain in soils would remain ‘non-degraded’. As degradation might depend on various factors (the type of ACM, the soil conditions and site activities), decisions may need to be site specific. However, AIB, lagging and loose insulation will almost certainly be defined as ‘degraded’ after years in the soil. Regulations 9, 18(1)(a) and 22 are likely to continue to apply to remediation of land containing large amounts of these materials (eg where the asbestos is driving the need for remediation or influencing how the remediation is being carried out). For strongly bound materials such as asbestos cement and bitumen, the extent of any degradation may be most readily demonstrated by the condition of materials found in the land. The CAR requirements make it quite likely that work undertaken to deal with ACSs may not be exempt under Regulation 3, particularly if it contains friable ACMs such as AIB, lagging and loose insulation.</td>
</tr>
<tr>
<td>4</td>
<td>Sets out several requirements on a duty holder (essentially anyone who has some control or say in what happens on that land) to ensure that exposure of workers and the public to asbestos is prevented. The essence of the requirements is that “in order to manage the risk from asbestos in non-domestic premises, the duty holder must ensure that a suitable and sufficient assessment is carried out as to whether asbestos is or is liable to be present in the premises.” The HSE does not believe the requirements under Regulation 4 were written with anything other than buildings in mind. If it is known that asbestos is present or there is a strong suspicion (eg it is the site of a former asbestos manufacturing activity, demolition of commercial and industrial buildings between, for example, 1940 and sometime around 2000, visual evidence of ACMs in the ground or asbestos being found during screening before analysis of other possible contaminants) then there could be grounds for owners surveying their land for the presence of asbestos.</td>
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Regulations 4, 5, 6, 7 and 10 will all apply to site investigation; redevelopment and remediation work on sites containing asbestos. If asbestos is identified as being present in soil, then there needs to be an adequate written plan to ensure that measures are taken to control the risks from that asbestos. A sufficient and suitable plan should be included in all site investigation plans where the former land use suggests asbestos may be present.

Requires that before undertaking works (which might disturb asbestos, if present), an employer:

(a) “must ... have carried out a suitable and sufficient assessment as to whether asbestos, what type of asbestos, contained in what material and in what condition is present or is liable to be present in those premises; or

(b) if there is doubt as to whether asbestos is present in those premises, that employer:
   (i) assumes that asbestos is present, and that it is not chrysotile alone
   (ii) observes the applicable provisions of these Regulations.”

The presumption should apply that in terms of site investigation, where there is demolition or other construction-related material (e.g. recycled in-fill or fly-tipping), there is likely to be “a doubt as to whether asbestos is present” unless there is reliable information to the contrary.

In order to avoid disproportionate responses to this regulation, any brownfield site development could have a contingency plan saying what to do if suspicious material is found (whether asbestos, arsenic, aniline, unexploded ordnance or indeed any other hazardous material). Any asbestos encountered would then be dealt with under CAR.

Requires that an employer “must not carry out work which is liable to expose employees of that employer to asbestos unless that employer has:

(a) made a suitable and sufficient assessment of the risk created by that exposure to the health of those employees and of the steps that need to be taken to meet the requirements of these Regulations;

(b) recorded the significant findings of that risk assessment as soon as is practicable after the risk assessment is made; and

(c) implemented the steps referred to in sub-paragraph (a).”

There are further requirements regarding obtaining information to support a risk assessment, keeping records of such risk assessments and updating the assessments. The legal liabilities for consultants and subcontractors associated with exposing workers to asbestos, mean that it is essential that suitable and sufficient health and safety documentation (including method statements and risk assessments) is prepared, particularly if ACS may be present.

Regulation 7(1) requires that: “An employer must not undertake any work with asbestos without having prepared a suitable written plan of work detailing how that work is to be carried out.” The regulation specifies what must be in the plan and the need to work in accordance with the plan and record any subsequent changes to the plan.

Work that is more than very minimal, i.e. as described in exemptions set out Regulation 3(2), will need to be notified in advance to the appropriate enforcing authority (HSE or HSE NI). CAR extended the requirement for notification beyond licensed works (i.e. notifiable non-licensed work).

Sets out requirements that apply to licensed asbestos contractors. The definition of licensed work changed from the 2006 regulations, but the overall meaning appears essentially the same. The preliminaries to CAR specify that ‘licensable work with asbestos’ is “work:

(a) where the exposure to asbestos of employees is not sporadic and of low intensity; or

(b) in relation to which the risk assessment cannot clearly demonstrate that the control limit will not be exceeded; or

(c) on asbestos coating; or

(d) on asbestos insulating board or asbestos insulation for which the risk assessment
   (i) demonstrates that the work is not sporadic and of low intensity, or
   (ii) cannot clearly demonstrate that the control limit will not be exceeded, or
   (iii) demonstrates that the work is not short duration work.”

Requires every employer to ensure that the employer gives any employee [appropriate and] adequate information, instruction and training where that employee:

(a) is or is liable to be exposed to asbestos, or if that employee supervises such employees; and

(b) carries out work in connection with the employer’s duties under CAR, so that the employee can carry out that work effectively.
Sets out a duty on employers to prevent exposure to asbestos so far as is reasonably practicable and in any case minimise any exposure to asbestos and use respiratory protection (for employees) in addition to control exposure. Where exposure is likely to exceed the control limit, the respiratory protection must provide sufficient protection to reduce the actual received exposure to below the control limit and should minimise the exposure as far as reasonably practicable. The duty on exposure extends (beyond employees) to preventing exposure arising from a work activity to anyone (but does not extend to residents/occupants once development has been completed).

Covers the arrangements to deal with accidents, incidents and emergencies. Where an unplanned release of asbestos takes place, employers must ensure that immediate steps are taken to:

(a) mitigate the effects of the event, restore the situation to normal, and inform any person who may be affected; and

(b) ensure that only those responsible for carrying out repairs and other necessary work are permitted in the affected area and are provided with: appropriate respiratory protective equipment and protective clothing, and any necessary specialised safety equipment and plant, which must be used until the situation is restored to normal.

An important duty that will affect any land that contains asbestos is the duty to prevent or reduce the spread of asbestos: “Every employer must prevent or, where this is not reasonably practicable, reduce to the lowest level reasonably practicable the spread of asbestos from any place where work under the employer’s control is carried out.” These will cover spread in the air and inadvertent tracking of asbestos within and out of the site. Suitable working methods must be adopted and enforced.

There are further duties that define requirements for air monitoring, standards to be observed in air testing and site clearance certification, health records and medical surveillance. These will affect the undertaking of work on land containing asbestos.

Relates to the cleanliness of premises. There is often temporary accommodation on contaminated land sites. The CAR risk assessment should determine whether clean areas are required etc.

Regulation 22 provides for different requirements for medicals and health surveillance depending on whether the work is ‘licensable work with asbestos’ or not.

### Part 3 Prohibitions and related provisions

There is a requirement under Regulation 27 that any products containing asbestos (supplied under exemptions) must be labelled as containing asbestos. This appears to imply that any recycled soil products that contain asbestos may need to be labelled accordingly or at least labelled that no asbestos was detected above the relevant reporting limit.

### 3.1.2 Construction (Design and Management) Regulations 2007 (CDM)

The Construction (Design and Management) Regulations 2007 (CDM) are intended to improve health and safety in the construction industry. Most projects considering asbestos in soil or made ground will be part of a construction project and fall under the remit of CDM.

It is arguable that site investigations to inform a soil risk assessment under Part 2A are not part of a construction project and therefore fall outside the CDM Regulations. However, the principles are still valid and ought to be considered and applied in the majority of cases where the history of the site suggests that asbestos is present. Site investigations to inform the remediation design even under Part 2A would be part of a construction project (the remediation) and so CDM would apply.

CDM 2007 places legal duties on almost everyone involved in construction work. Those with legal duties are commonly known as ‘duty holders’:

- clients (including landowners and developers)
- CDM co-ordinators
- designers
- principal contractors
- contractors
- workers.

Generic advice on CDM is provided by the HSE (see Useful websites). Practical advice is also contained in the relevant ACOP.